DEPARTMENT OF PUBLIC UTILITIES
Solid Waste Disposal Division

February 13, 1992

Mr. Steve Smallwood, P.E.
FDER
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

REF: DER Flare Construction Permit AC 16-186047
Your Letter of June 3, 1991

Dear Mr. Smallwood:

We are nearing construction of our East Landfill closure and expect bids to be received Wednesday, February 26, 1992. As a part of that closure project, the contractor will be constructing a gas collection and flare system. We expect construction to begin in late March or early April, and be completed in early 1993.

We definitely concur with the second paragraph of your June 3 letter, and in fact, have designed our system, with a built-in gas access point, for connection to other future disposal methods. As designed, the system would burn the gas until appropriate alternate methods were found, constructed and made available. At that time, the blind flange could be removed from this point in our system, a pipeline installed to this new process facility, and the valve opened up for recovery of the landfill gas. We would retain the flare system as a back up disposal method.

The purpose of this letter is to request a one year extension to the construction permit. This permit now expires on February 15, 1992. We will have the system completed and operational by February 15, 1993.

Your favorable consideration and approval of this request would be appreciated. We look forward to commencing construction in approximately one month.

Sincerely,

W. C. Boyle

William C. Boyle
Manager

WCB:rsz

cc: Reading File
LOFS
M. Bair
G. Kuliyna
R. Robertson

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

February 21, 1992

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Mr. William C. Boyle, Manager
City of Jacksonville
Department of Public Utilities
Solid Waste Disposal Division
37-2 West 1st Street
Jacksonville, FL 32206

Dear Mr. Boyle:

RE: Flare Construction Permit AC 16-186047
East Landfill, Duval County

The Bureau of Air Regulation received your request to extend the above referenced air construction permit. On October 30, 1991, Rule 17-4.050(4)(o), F.A.C., (copy enclosed) was changed to require a $50 fee per permit to process extension requests; therefore, we will not be able to take action on your request until the fee is received. If you have any questions, please call Patty Adams at (904)488-1344.

Sincerely,

C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/pa

Enclosure

Department of Environmental Regulation

Routing and Transmittal Slip

To: (Name, Office, Location)

1. ~~Cindy~~ AI: DARM 494
2. Due: 2-28-92
3. Patty 2/21
4. An action item for a permit

Remarks: ~~attention~~ 7 days ~~instead of~~ 90 —. priority 1a''

Prepare response for SSm's Sig.

From: Judy Rogers

Date 2-21-92

Phone

PBS&J TRANSMITTAL

TO MR. TOM CASCIO DATE 11/10/92

BUREAU OF AIR QUALITY MNMT JOB NO. 07-421.05

FDER RE JACKSONVILLE EAST

TWIN TOWERS OFFICE BUILDING

TALLAHASSEE, FL 32301

RECEIVED
NOV 13 1992
Division of Air
Resources Management

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____
the following items:

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples

☐ Copy of Letter ☐ Change Order ☐ Specifications ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1			FLARE PACKAGE

THESE ARE TRANSMITTED As Checked Below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ For review and comment ☐ _____ ☐ _____

☐ For bids due _____ 19___

☐ Prints returned after loan to us

REMARKS PER OUR TELEPHONE CONVERSATION ON 10/14/92, HERE IS THE INFORMATION ON THE ENCLOSED FLARE FOR THE JACKSONVILLE LANDFILL PROJECT.

PLEASE CALL IF YOU HAVE ANY FURTHER QUESTIONS OR COMMENTS.

SIGNED Kane A Schmidt

DISTRIBUTION _____

FORM NO. CIS070.01

If enclosures are not as noted, kindly notify us at once

(407)647-7275

THE CITY OF JACKSONVILLE
DEPARTMENT OF PUBLIC UTILITIES
SOLID WASTE DISPOSAL DIVISION

EAST DUVAL SANITARY LANDFILL
AIR POLLUTION SOURCE
(LANDFILL GAS FLARE)
INFORMATION PACKAGE

Includes:
1. Original Submittal (August 1990)
2. Response to FDER's RAI (December 1991)
3. Misc. Supporting Documents from Manufacturer

November 10, 1992

Prepared For:

Department of Environmental Regulations
Bureau of Air Quality Management
Tallahassee, Florida

Prepared By:

Post, Buckley, Schuh & Jernigan, Inc.
Solid Waste Division
1560 Orange Avenue, Suite 700
Winter Park, Florida 3278

THE CITY OF JACKSONVILLE
DEPARTMENT OF PUBLIC UTILITIES
SOLID WASTE DISPOSAL DIVISION

EAST DUVAL SANITARY LANDFILL
APPLICATION TO CONSTRUCT
AIR POLLUTION SOURCE
(LANDFILL GAS FLARE)

THE CITY OF JACKSONVILLE

DEPARTMENT OF PUBLIC UTILITIES

SOLID WASTE DISPOSAL DIVISION

EAST DUVAL SANITARY LANDFILL

APPLICATION TO CONSTRUCT AIR POLLUTION SOURCE (LANDFILL GAS FLARE)

August 1990

Prepared by:

POST, BUCKLEY, SCHUH & JERNIGAN, INC.
Engineering - Planning - Architecture
6635 E. Colonial Drive
Orlando, Florida 32807

PBS&J
ENVIRONMENTAL LABORATORIES
6635 EAST COLONIAL DRIVE
ORLANDO, FLORIDA 32807
407/277-4443

August 27, 1990

Mr. Clair Fancy, P.E.
Bureau of Air Quality Management
Florida Department of Environmental Regulation
2600 Blair Stone Road
Twin Towers Office Building
Tallahassee, Florida 32301

Reference: East Duval Sanitary Landfill
Application to Construct Air Pollution
Source (Landfill Gas Flare)

Dear Mr. Fancy:

Pursuant to the requirement of specific condition Number 9 of the East Duval Sanitary Landfill Closure Permit Number SF16-155245, the City of Jacksonville, Solid Waste Disposal Division is pleased to submit four (4) copies of this Application to Construct Air Pollution Source (Landfill Gas Flare).

A check in the amount of $2,500 is enclosed as specified in Florida Administrative Code Rule 17-4.050.

If you have any questions or comments regarding this application, please do not hesitate to call.

Very truly yours,

PBS&J ENVIRONMENTAL LABORATORIES

Jerome J. Guidry, P.E.
Vice President

JJG:kf

cc: G. Threlkeld

DEPARTMENT OF ENVIRONMENTAL REGULATION

BEST AVAILABLE COPY

CENTRAL FLORIDA DISTRICT
3319 MAGUIRE BOULEVARD
SUITE 232
ORLANDO, FLORIDA 32803-3767

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Landfill Gas [X] New[1] [ ] Existing[1]

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

COMPANY NAME: City of Jacksonville COUNTY: Duval

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) Landfill Gas Flare

SOURCE LOCATION: Street 515 Girvin Road City Jacksonville, FL

UTM: East 454.95 km North 3355.57 km

Latitude 30 ° ~~18~~ 19 ' ~~40~~ 58 "N Longitude 81 ° 28 ' ~~30~~ 07 "W

APPLICANT NAME AND TITLE: George R. Knecht, P.E. Manager of Disposal

APPLICANT ADDRESS: Solid Waste Disposal Division, 1931 East Beaver Street Jacksonville, FL 32202

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

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

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. Furthe I agree to maintain and operate the pollution control source and pollution contro facilities in such a manner as to comply with the provision of Chapter 403, Floric Statutes, and all the rules and regulations of the department and revisions thereof. also understand that a permit, if granted by the department, will be non-transferabl and I will promptly notify the department upon sale or legal transfer of the permitte establishment.

*Attach letter of authorization

Signed: G. R. Knecht

George R. Knecht, P.E. Manager of Disposal
Name and Title (Please Type)

Date: 6/25/90 Telephone No. (904) 630-0973

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 hav been ~~designed~~/examined by me and found to be in conformity with modern engineerin principles applicable to the treatment and disposal of pollutants characterized in th permit application. There is reasonable assurance, in my professional judgment, tha

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

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 Jerome J. Guidry, P.E.

Post, Buckley, Schuh & Jernigan, Inc.
Name (Please Type)

6635 E. Colonial Drive, Orlando, Florida 32807
Company Name (Please Type)

Mailing Address (Please Type)

Florida Registration No. 32589 Date: Telephone No. (904) 277-4443

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 East Duval Sanitary Landfill will incorporate an active gas management system to collect and burn off, through the use of a flare, landfill gases. This project will result in full compliance with F.A.C. Rule 17-3, See Section IIA Attachment.

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

Start of Construction March, 1991 Completion of Construction June, 1991

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.)

Enclosed Ground Flare - $80,000.

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

East Duval Sanitary Landfill Closure

DER file No. SF16-155245

e. Requested permitted equipment operating time: hrs/day 24 ; days/wk 7 ; wks/yr 52 ;

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

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

1. Is this source in a non-attainment area for a particular pollutant? NO

   a. If yes, has "offset" been applied? N/A

   b. If yes, has "Lowest Achievable Emission Rate" been applied? N/A

   c. If yes, list non-attainment pollutants. N/A

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?_____

   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: N/A

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): N/A

2. Product Weight (lbs/hr): N/A

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	
CH4	55.4	242.7			See Section		
NOx	5.36	23.48			III C Attachment		
CO2	14,621	64,040					
CO	23.84	104.42					
N2	88,168	386,176					
O2	15,632	68,468					
H2O	7,188	31,483					

[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)
McGill Environmental Systems, Inc.		98% Expected		
Model EGF-60 (or equivalent)		Minimum Destruction		
		Efficiency		

E. Fuels N/A

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	

*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 N/A Maximum _____

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

N/A

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

Stack Height: 40 ft. Stack Diameter: 7.6 ft.

Gas Flow Rate: 120,060 ACFM 26,450 DSCFM Gas Exit Temperature: 1400°F Min. / 1800°F Normal / 2000°F Max. °F.

Water Vapor Content: 5.7% by weight of H_2O in flue gas % Velocity: 44 FPS

SECTION IV: INCINERATOR INFORMATION N/A

Type of Waste	Type 0 (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) _____

rief description of operating characteristics of control devices: _____

_____

_____

_____

_____

'lltimate disposal of any effluent other than that emitted from the stack (scrubber water, sh, etc.):

_____

_____

_____

_____

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

SECTION V: SUPPLEMENTAL REQUIREMENTS

lease 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

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
N/A	

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration
N/A	

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

Contaminant	Rate or Concentration
N/A	

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

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). N/A

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: Enclosed Ground Flare

2. Efficiency:[1] 98%+

3. Capital Cost: $80,000

4. Useful Life: 30+ years

5. Operating Cost: $5,000/year

6. Energy:[2] N/A

7. Maintenance Cost: $1,000/year

8. Manufacturer: McGill Environmental Systems, Inc. (or equivalent)

9. Other locations where employed on similar processes: N/A

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:

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 N/A

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

. 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)_____

. 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.

. Applicants Maximum Allowable Emission Data

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

. 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.

. 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.

PROJECT DESCRIPTION:

East Duval Sanitary Landfill Closure

TO WHOM IT MAY CONCERN:

This is notification that George R. Knecht, Manager of Disposal, has the authority to act on behalf of the City of Jacksonville as agent in applying for and obtaining site-related permits and approvals for the project described herein.

It is understood that this representation may be terminated by the undersigned at any time upon proper notice to the permitting agencies.

BY: _____ TITLE: _____

FOR: _____

_____

STATE OF FLORIDA,
COUNTY OF _____

I, the undersigned authority, hereby certify that the foregoing is a true and correct copy of the instrument presented to me by _____ as the original of such instrument.

WITNESS my hand and official seal, this ____ day of _____, 19___.

_____
Notary Public

My commission expires _____.

cla/58/016
22-092.00/3.0

Section II A Attachment

NATURE AND EXTENT OF THE PROJECT

The City of Jacksonville began solid waste disposal operations at the East Duval Sanitary Landfill (the East Landfill) in November, 1974. Materials accepted at the East Landfill include Class I waste (residential, commercial, and industrial wastes) as well as Class III waste (construction and demolition debris). Less than 3,000 combined tons of both dry and wet ash from a Carbonaceous Fuel Boiler were also received from the Mayport Naval Station for disposal at the East Landfill. Additionally, a clay lined special waste pit was opened for a short time in which small quantities of special wastes were disposed of. Operations at the East Landfill are on-going and the landfill is expected to reach its capacity within 1-2 years.

The East Landfill (see Figure 1 for location) consists of approximately 136 acres with the waste disposal area occupying approximately 71 acres. The East Landfill is expected to achieve a 132' final height (this is approximately 110' above existing ground elevation).

The City of Jacksonville has committed to install an active landfill gas collection and flaring system (see Figures 2 and 3). Landfill gases will be actively withdrawn from the landfill through a system of specially designed extraction wells. Gases will be collected by producing a negative pressure in the wells with a system of blowers. The wells will be manifolded together and routed to a flare system where the gas will be burned to oxidize potential odor causing constituents and destroy the potentially explosive gases. Moisture will be removed from the collection system through a system of condensate traps located

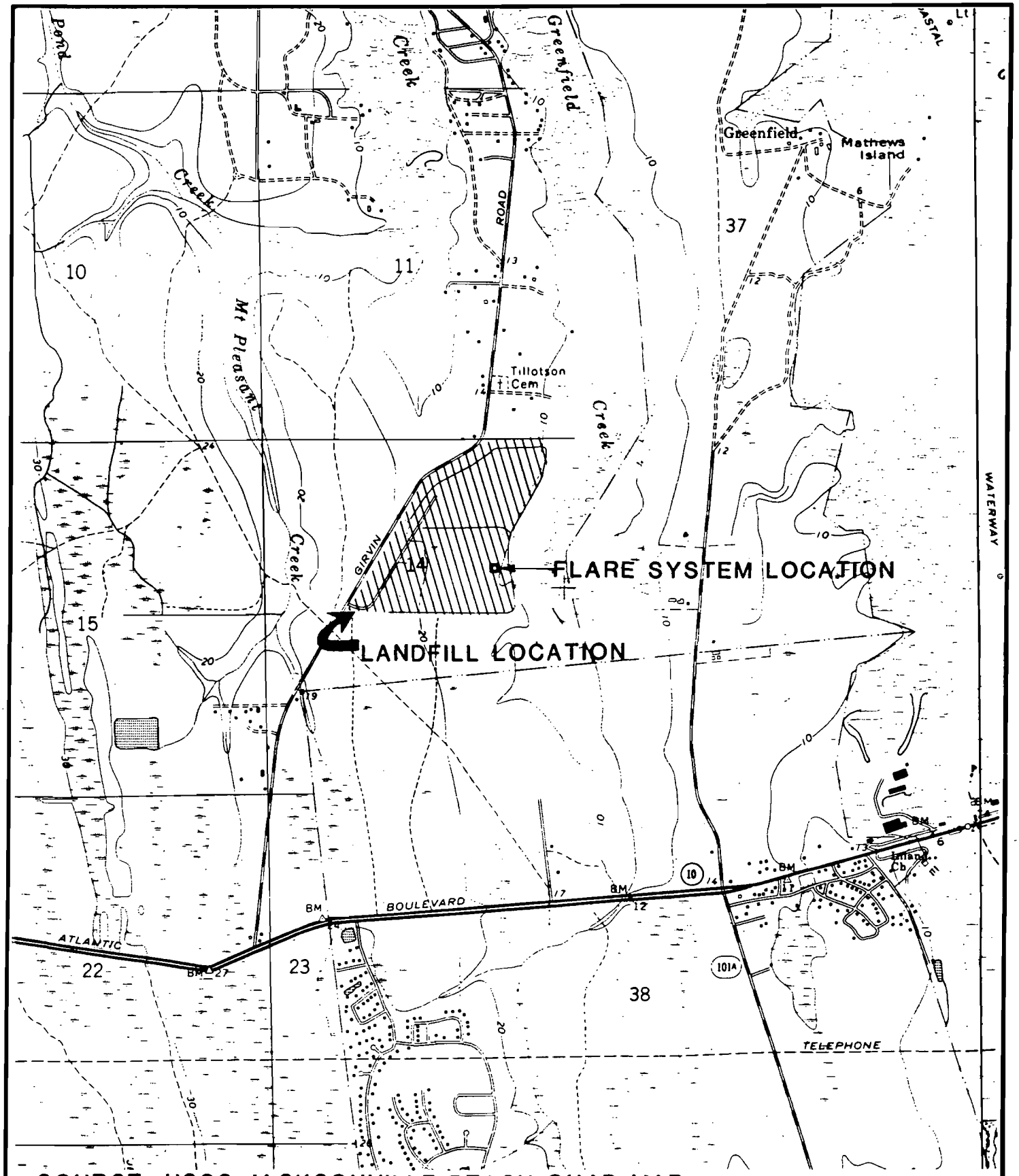
at low points of the collection pipe system and will be routed to an above ground condensate storage tank.

The blower system will be designed with three individual blower units connected in parallel between the well system manifold and the flare system. Two of the blower units will operate simultaneously under normal conditions, with the additional blower unit provided as stand-by for use during scheduled or unscheduled maintenance outages.

The McGill Environmental Systems, Inc. flare system (or equivalent) to be used will be an enclosed unit designed such that all combustion takes place in a refractory lined chamber. This will offer the greatest control of the combustion process, and no flame or lighting should be visible outside of the unit. A flame arrestor will be incorporated to prevent flame migration outside of the flare unit.

Sensors and alarms will be incorporated to monitor system performance. In the event of flame out or blower unit malfunction, responsible City personnel will be notified automatically, so that appropriate action will not be delayed.

While the City of Jacksonville currently plans to burn off the landfill gases with a flare system, the City may, at a later date, elect to sell the gas. The primary consideration by the City on this alternative (and any other alternatives to flaring the gas) will be odor control.



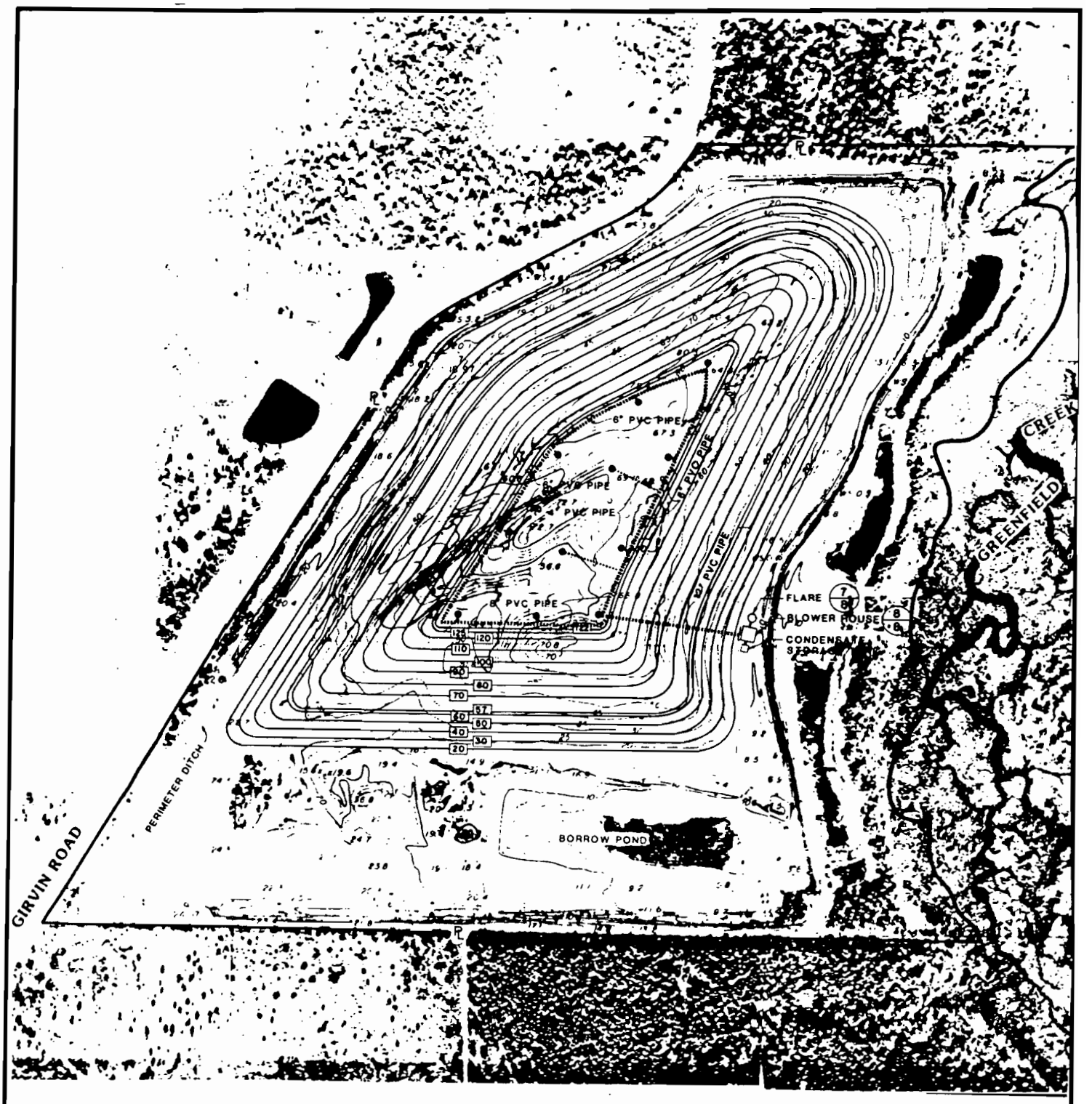
SOURCE: USGS JACKSONVILLE BEACH QUAD MAP
PHOTOREVISED 1981

PBS&J

EAST DUVAL SANITARY LANDFILL LOCATION MAP

FIGURE 1

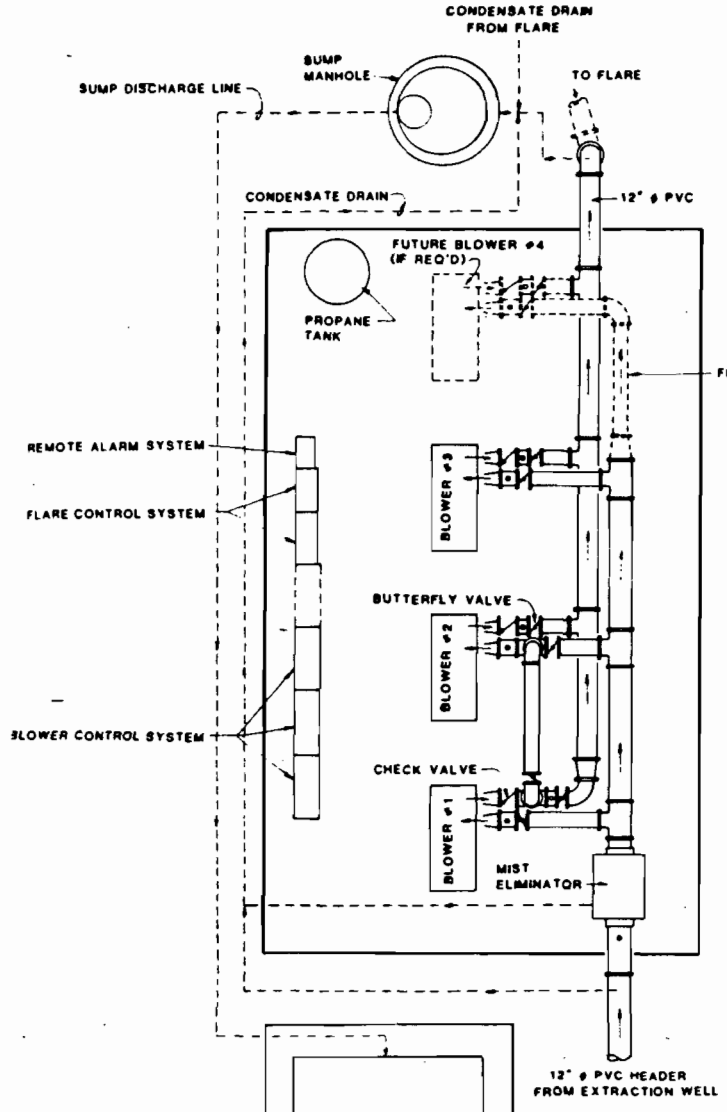
N69174



EAST DUVAL SANITARY LANDFILL
GAS MANAGEMENT FACILITY PLOT PLAN

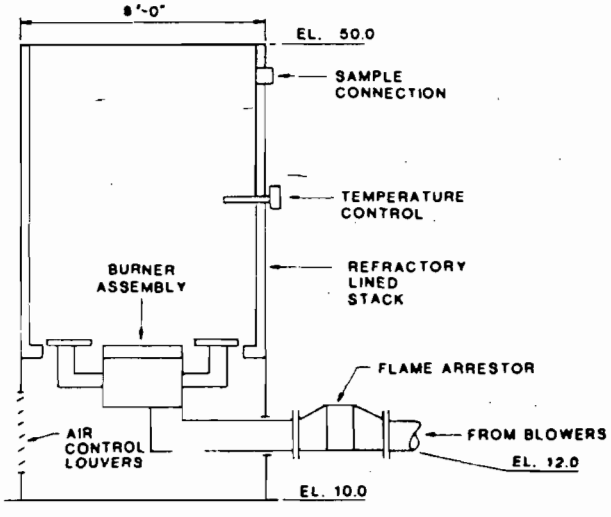
FIGURE 2

N69174



BLOWER HOUSE SCHEMATIC

N.T.S.



ENCLOSED FLARE SYSTEM PROFILE SCHEMATIC

N.T.S.

EAST DUVAL SANITARY LANDFILL - GAS MANAGEMENT FACILITY FLOW DIAGRAM

FIGURE 3

N69174

Section III C Attachment

AIRBORNE CONTAMINANTS EMITTED

The potential emissions of the landfill without the landfill cap (to contain the gas) and the active gas management system (to collect and burn the gas) are difficult to predict due to the varying nature and age of the garbage in the landfill. The attached landfill gas production model conservatively predicts a peak year average flow of approximately 2100 cfm. The composition of this gas can reasonably be expected to coincide with the values shown in Table 2-1, Typical Landfill Gas Composition at Various Sites. These are the potential emissions of the landfill without the landfill cap and active gas management system.

The emissions data for each contaminant in Section III C was provided by McGill Environmental Systems, Inc. based on an assumed 2100 cfm peak year average flow and an estimated 52% methane content.

KW/jdm/MISCII/018

22-092.00

East Landfill
City of Jacksonville
Jacksonville, Florida

LANDFILL GAS PRODUCTION MODEL
BASED ON THE PALOS VERDES KINETIC MODEL
VERSION 3.2 - MARCH 7, 1989

REFUSE QUANTITY & CHARACTERISTICS

ASSUMPTIONS:

TOTAL TONS OF REFUSE IN-PLACE=	3,720,500 TONS		FINAL MOISTURE CONTENT=	25%
REFUSE TEMPERATURE =	85 DEGREES F		YEARS LANDFILL WAS OPEN BEFORE CLOSURE =	0
INITIAL MOISTURE CONTENT =	35%		PERCENTAGE REDUCTION OF MOISTURE PER YEAR AFTER CLOSURE =	13%
METHANE CONTENT =	52%			
AVERAGE REFUSE THICKNESS =	100 FEET OR	30.5 METERS		
AVERAGE IN-PLACE DENSITY =	1200 LB/CY OR	711.7 KG/CM		

REFUSE COMPOSITION

DECOMPOSIBILITY CLASS	COMPONENT	% WET WEIGHT	% WATER	% DRY WEIGHT	% VOLATILE SOLIDS (dry wt.)	% VOLATILE SOLIDS BIODEGRAD. (dry wt.)	METHANE GAS PRODUCTION PER LB OF REFUSE (cf-CH4/lb) wet	by class	ADJUSTED FACTORS (cf-CH4/lb)
Readily	Food Waste	14%	63%	5%	60%	50%	0.131	0.131	0.146
Moderate	Garden Waste	12%	48%	6%	70%	35%	0.129	0.610	0.679
	Paper Waste	42%	20%	34%	85%	20%	0.481		
Slowly	Plastic/Rubber	5%	13%	4%	95%	2%	0.007	0.020	0.022
	Textiles	2%	16%	2%	94%	5%	0.007		
	Wood	2%	14%	2%	85%	5%	0.006		
Inert	Metal	9%	3%	9%	-	-			
	Glass/Ceramics	11%	2%	11%	-	-			
	Ash/Dirt/Rock	3%	8%	3%	-	-			
	TOTAL	100%		75%		Total	0.761	0.761	0.847

GAS GENERATION FACTORS

DECOMPATIBILITY CLASS	READILY	MODERATELY	SLOWLY
Total % Dry Weight	5%	40%	8%
Methane Yield Factor (cf/dry ton)	5,627	3,409	568
Half-Life (yrs)	2	5	20
Ult.-Life (yrs)	6	15	60
Lag-Time (yrs)	0.2	0.8	4.4

KINETIC FACTORS GENERATION

DECOMPOSIBILITY CLASS	Assumed Half-Life (yrs)	Assumed Ult.-Life (yrs)	k1 (yrs-1)	k2 (yrs-1)
Readily	2	6	1.956	0.978
Moderate	5	15	0.782	0.391
Slowly	20	60	0.196	0.098

RADIUS OF INFLUENCE

METHANE PRODUCTION RATE (r) =	0.0003 cf/lb/day or	20.4 ml/kg/day or
(Note: r designed at a peak = 2 x average)		143 cf-CH4/cy-yr
RADIUS OF INFLUENCE (ROI) ASSUMED=	200 FEET	
ROI: HORZ. RADIUS/LF DEPTH RATIO =	2	
RADIUS OF INFLUENCE THEORETICAL=	136 FEET	
VOLUME OF INFLUENCE =	310,436 CY	

DESIGN FACTORS

NO. OF WELLS IN RECOVERY FIELD=	11	
AVE. RECOVERY RATE =	70.0%	
WELL FLOW RATE (LFG) =	114 CFM OR	53.7 L/SEC
MAX. WITHDRAWAL RATE =	190 CFM/WELL	
AVE. WITHDRAWAL RATE =	81 CFM/WELL	
MIN. WELL SIZE FOR PASSIVE VENTS =	14 INCHES	
MIN. WELL SIZE FOR ACTIVE VENTS =	8 INCHES	
WELL SPACING=	346 FEET WELL TO WELL	
LFG SYSTEM DESIGN RECOVERY RATE =	1,252 CFM	1.80 MMcfd Recovered
LFG SYSTEM MAXIMUM RECOVERY RATE =	2,093 CFM	
MAXIMUM PRODUCTION =	2,846,238 CF-CH4/DAY	
AVERAGE PRODUCTION =	1,215,647 CF-CH4/DAY OVER 9 YEARS	

Time (yrs)	Moisture Content	Moisture Content Factor Per Year	Methane Content Factor Per Year	Average Factor	Adjusted Factors (cf-CH4/lb)			Methane Yield Factor (cf-CH4/lb)		
					Readily	Moderate	Slowly	Readily	Moderate	Slowly
0.0	35.0%	1.07	1.04	1.11	0.146	0.679	0.022	5627	3409	568
0.2	34.2%	1.05	1.04	1.09	0.143	0.667	0.022	5524	3347	558
0.4	33.3%	1.03	1.04	1.07	0.140	0.654	0.021	5421	3284	547
0.6	32.5%	1.01	1.04	1.05	0.138	0.642	0.021	5319	3222	537
0.8	31.7%	0.99	1.04	1.03	0.135	0.629	0.020	5216	3160	527
1.0	31.0%	0.97	1.04	1.01	0.132	0.617	0.020	5113	3098	516
1.2	30.2%	0.95	1.04	0.99	0.130	0.605	0.020	5010	3035	506
1.4	29.5%	0.93	1.04	0.97	0.127	0.592	0.019	4907	2973	495
1.6	28.8%	0.91	1.04	0.95	0.124	0.580	0.019	4805	2911	485
1.8	28.1%	0.89	1.04	0.93	0.122	0.567	0.018	4702	2848	475
2.0	27.4%	0.87	1.04	0.91	0.119	0.555	0.018	4599	2786	464
2.2	26.7%	0.86	1.04	0.89	0.116	0.543	0.018	4496	2724	454
2.4	26.1%	0.84	1.04	0.87	0.114	0.530	0.017	4393	2662	444
2.6	25.5%	0.82	1.04	0.85	0.111	0.518	0.017	4291	2599	433
2.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
3.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
3.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
3.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
3.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
3.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
4.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
4.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
4.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
4.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
4.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
5.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
5.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
5.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
5.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
5.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
6.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
6.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
6.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
6.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
6.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
7.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
7.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
7.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
7.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
7.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
8.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
8.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
8.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
8.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
8.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
9.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
9.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
9.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
9.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
9.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
10.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
10.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
10.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
10.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
10.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
11.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
11.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
11.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
11.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
11.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425

12.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
12.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
12.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
12.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
12.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
13.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
13.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
13.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
13.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
13.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
14.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
14.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
14.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
14.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
14.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
15.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
15.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
15.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
15.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
15.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
16.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
16.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
16.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
16.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
16.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
17.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
17.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
17.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
17.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
17.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
18.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
18.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
18.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
18.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
18.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
19.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
19.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
19.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
19.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
19.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
20.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
20.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
20.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
20.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
20.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
21.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
21.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
21.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
21.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
21.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
22.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
22.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
22.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
22.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
22.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
23.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
23.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
23.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
23.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
23.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
24.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
24.2	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
24.4	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
24.6	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
24.8	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425
25.0	25.0%	0.80	1.04	0.83	0.109	0.508	0.016	4212	2552	425

Time (yrs)	Moisture Content	Readily - CH4 Production cf	Readily - CH4 Production cum cf	Moderate - CH4 Production cf	Moderate - CH4 Production cum cf	Slowly - CH4 Production cf	Slowly - CH4 Production cum cf	Total - CH4 Production cf	Total - CH4 Production cum cf
0.0	35.0%	0	0	0	0	0	0	0	0
0.2	34.2%	5,096,978	5,096,978	8,402,652	8,402,652	64,151	64,151	13,563,781	13563781
0.4	33.3%	7,396,946	12,493,924	9,643,127	18,045,779	65,469	129,619	17,105,542	30669323
0.6	32.5%	10,730,896	23,224,820	11,062,753	29,108,532	66,790	196,409	21,860,438	52529761
0.8	31.7%	15,561,708	38,786,528	12,686,630	41,795,162	68,112	264,521	28,316,450	80846211
1.0	31.0%	22,558,479	61,345,007	14,543,222	56,338,384	69,434	333,955	37,171,135	118017346
1.2	30.2%	32,687,885	94,032,892	16,664,774	73,003,158	70,752	404,707	49,423,411	167440757
1.4	29.5%	47,345,747	141,378,640	19,087,779	92,090,937	72,065	476,772	66,505,592	233946349
1.6	28.8%	68,546,384	209,925,024	21,853,488	113,944,425	73,371	550,143	90,473,243	324419592
1.8	28.1%	99,194,888	309,119,912	25,008,481	138,952,906	74,665	624,808	124,278,034	448697626
2.0	27.4%	95,742,655	404,862,567	28,605,282	167,558,187	75,947	700,755	124,423,884	573121510
2.2	26.7%	76,973,296	481,835,863	32,703,042	200,261,229	77,212	777,967	109,753,549	682875059
2.4	26.1%	61,851,132	543,686,995	37,368,272	237,629,501	78,456	856,423	99,297,861	782172919
2.6	25.5%	49,672,661	593,359,657	42,675,645	280,305,146	79,678	936,101	92,427,983	874600903
2.8	25.0%	40,098,917	633,458,574	48,989,455	329,294,601	81,337	1,017,438	89,169,710	963770613
3.0	25.0%	32,974,950	666,433,524	57,287,703	386,582,304	84,582	1,102,020	90,347,235	1054117848
3.2	25.0%	27,116,626	693,550,150	66,991,578	453,573,882	87,957	1,189,977	94,196,161	1148314009
3.4	25.0%	22,299,090	715,849,240	78,339,178	531,913,060	91,466	1,281,443	100,729,734	1249043743
3.6	25.0%	18,337,437	734,186,677	91,608,930	623,521,990	95,115	1,376,557	110,041,482	1359085225
3.8	25.0%	15,079,611	749,266,289	107,126,425	730,648,415	98,909	1,475,467	122,304,945	1481390170
4.0	25.0%	12,400,570	761,666,859	125,272,404	855,920,819	102,856	1,578,322	137,775,829	1619166000
4.2	25.0%	10,197,487	771,864,345	146,492,102	**********	106,959	1,685,281	156,796,548	1775962547
4.4	25.0%	8,385,803	780,250,148	171,306,172	**********	111,226	1,796,508	179,803,201	1955765749
4.6	25.0%	6,895,982	787,146,130	200,323,459	**********	115,664	1,912,171	207,335,105	2163100854
4.8	25.0%	5,670,843	792,816,974	234,255,940	**********	120,278	2,032,449	240,047,061	2403147915
5.0	25.0%	4,663,362	797,480,336	273,936,190	**********	125,077	2,157,526	278,724,629	2681872544
5.2	25.0%	3,834,870	801,315,206	142,323,587	**********	130,067	2,287,593	146,288,523	2828161067
5.4	25.0%	3,153,568	804,468,773	131,612,603	**********	135,256	2,422,848	134,901,427	2963062494
5.6	25.0%	2,593,305	807,062,079	121,707,707	**********	140,652	2,563,500	124,441,664	3087504158
5.8	25.0%	2,132,579	809,194,658	112,548,233	**********	146,263	2,709,763	114,827,075	3202331233
6.0	25.0%	1,753,705	810,948,363	104,078,082	**********	152,098	2,861,862	105,983,886	3308315119
6.2	25.0%	1,442,142	812,390,506	96,245,377	**********	158,166	3,020,028	97,845,686	3406160805
6.4	25.0%	1,185,932	813,576,437	89,002,146	**********	164,477	3,184,505	90,352,554	3496513360
6.6	25.0%	975,239	814,551,676	82,304,026	**********	171,038	3,355,543	83,450,304	3579963663
6.8	25.0%	801,978	815,353,655	76,109,993	**********	177,862	3,533,405	77,089,833	3657053496
7.0	25.0%	659,499	816,013,154	70,382,110	**********	184,958	3,718,363	71,226,567	3728280063
7.2	25.0%	542,333	816,555,486	65,085,295	**********	192,337	3,910,700	65,819,965	3794100028
7.4	25.0%	445,982	817,001,468	60,187,108	**********	200,010	4,110,711	60,833,101	3854933128
7.6	25.0%	366,749	817,368,217	55,657,549	**********	207,990	4,318,701	56,232,288	3911165416
7.8	25.0%	301,592	817,669,809	51,468,875	**********	216,288	4,534,989	51,986,755	3963152172
8.0	25.0%	248,011	817,917,820	47,595,433	**********	224,917	4,759,905	48,068,361	4011220533
8.2	25.0%	203,950	818,121,770	44,013,497	**********	233,890	4,993,795	44,451,337	4055671869
8.4	25.0%	167,716	818,289,486	40,701,131	**********	243,221	5,237,016	41,112,068	4096783938
8.6	25.0%	137,920	818,427,406	37,638,047	**********	252,924	5,489,941	38,028,891	4134812829
8.8	25.0%	113,417	818,540,823	34,805,484	**********	263,015	5,752,956	35,181,916	4169994745
9.0	25.0%	93,267	818,634,090	32,186,094	**********	273,508	6,026,464	32,552,870	4202547614
9.2	25.0%	76,697	818,710,787	29,763,834	**********	284,420	6,310,884	30,124,952	4232672566
9.4	25.0%	63,071	818,773,859	27,523,869	**********	295,767	6,606,650	27,882,707	4260555273
9.6	25.0%	51,866	818,825,725	25,452,478	**********	307,567	6,914,217	25,811,911	4286367184
9.8	25.0%	42,652	818,868,376	23,536,977	**********	319,837	7,234,054	23,899,466	4310266650
10.0	25.0%	35,074	818,903,450	21,765,632	**********	332,597	7,566,652	22,133,303	4332399953
10.2	25.0%	28,843	818,932,293	20,127,595	**********	345,866	7,912,518	20,502,304	4352902257
10.4	25.0%	23,719	818,956,012	18,612,833	**********	359,665	8,272,183	18,996,216	4371898473
10.6	25.0%	19,505	818,975,517	17,212,069	**********	374,014	8,646,197	17,605,588	4389504061
10.8	25.0%	16,040	818,991,556	15,916,724	**********	388,935	9,035,132	16,321,699	4405825760
11.0	25.0%	13,190	819,004,746	14,718,863	**********	404,452	9,439,585	15,136,506	4420962265
11.2	25.0%	10,847	819,015,593	13,611,152	**********	420,588	9,860,173	14,042,586	4435004852
11.4	25.0%	8,920	819,024,513	12,586,804	**********	437,368	10,297,540	13,033,091	4448037943
11.6	25.0%	7,335	819,031,848	11,639,547	**********	454,817	10,752,357	12,101,699	4460139642
11.8	25.0%	6,032	819,037,879	10,763,578	**********	472,962	11,225,319	11,242,572	4471382214
12.0	25.0%	4,960	819,042,840	9,953,533	**********	491,831	11,717,149	10,450,324	4481832538

12.2	25.0%	4,079	819,046,919	9,204,451	**********	511,453	12,228,602	9,719,982	4491552520
12.4	25.0%	3,354	819,050,273	8,511,743	**********	531,857	12,760,459	9,046,954	4500599474
12.6	25.0%	2,758	819,053,031	7,871,166	**********	553,076	13,313,535	8,427,000	4509026475
12.8	25.0%	2,268	819,055,300	7,278,798	**********	575,141	13,888,676	7,856,208	4516882683
13.0	25.0%	1,865	819,057,165	6,731,011	**********	598,087	14,486,763	7,330,963	4524213645
13.2	25.0%	1,534	819,058,699	6,224,448	**********	621,948	15,108,711	6,847,930	4531061576
13.4	25.0%	1,261	819,059,960	5,756,009	**********	646,761	15,755,472	6,404,031	4537465607
13.6	25.0%	1,037	819,060,998	5,322,824	**********	672,564	16,428,035	5,996,424	4543462031
13.8	25.0%	853	819,061,851	4,922,239	**********	699,396	17,127,431	5,622,488	4549084519
14.0	25.0%	701	819,062,552	4,551,801	**********	727,299	17,854,729	5,279,801	4554364320
14.2	25.0%	577	819,063,129	4,209,242	**********	756,314	18,611,044	4,966,133	4559330453
14.4	25.0%	474	819,063,603	3,892,463	**********	786,488	19,397,532	4,679,425	4564009878
14.6	25.0%	390	819,063,994	3,599,524	**********	817,865	20,215,397	4,417,779	4568427658
14.8	25.0%	321	819,064,314	3,328,631	**********	850,494	21,065,892	4,179,446	4572607104
15.0	25.0%	264	819,064,578	3,078,125	**********	884,425	21,950,317	3,962,814	4576569919
15.2	25.0%	217	819,064,795	2,846,472	**********	919,710	22,870,027	3,766,399	4580336317
15.4	25.0%	178	819,064,973	2,632,252	**********	956,402	23,826,429	3,588,833	4583925150
15.6	25.0%	147	819,065,120	2,434,154	**********	994,558	24,820,988	3,428,859	4587354009
15.8	25.0%	121	819,065,241	2,250,965	**********	1,034,237	25,855,225	3,285,322	4590639331
16.0	25.0%	99	819,065,340	2,081,562	**********	1,075,498	26,930,723	3,157,159	4593796490
16.2	25.0%	82	819,065,422	1,924,908	**********	1,118,406	28,049,129	3,043,395	4596839885
16.4	25.0%	67	819,065,489	1,780,043	**********	1,163,025	29,212,154	2,943,135	4599783020
16.6	25.0%	55	819,065,544	1,646,081	**********	1,209,425	30,421,578	2,855,560	4602638581
16.8	25.0%	45	819,065,589	1,522,200	**********	1,257,675	31,679,253	2,779,920	4605418501
17.0	25.0%	37	819,065,627	1,407,642	**********	1,307,851	32,987,104	2,715,530	4608134032
17.2	25.0%	31	819,065,657	1,301,706	**********	1,360,028	34,347,132	2,661,765	4610795796
17.4	25.0%	25	819,065,682	1,203,742	**********	1,414,287	35,761,420	2,618,055	4613413851
17.6	25.0%	21	819,065,703	1,113,151	**********	1,470,711	37,232,130	2,583,883	4615997733
17.8	25.0%	17	819,065,720	1,029,378	**********	1,529,386	38,761,516	2,558,780	4618556514
18.0	25.0%	14	819,065,734	951,909	**********	1,590,401	40,351,917	2,542,324	4621098838
18.2	25.0%	12	819,065,746	880,270	**********	1,653,851	42,005,768	2,534,133	4623632970
18.4	25.0%	9	819,065,755	814,023	**********	1,719,832	43,725,601	2,533,864	4626166834
18.6	25.0%	8	819,065,763	752,761	**********	1,788,446	45,514,047	2,541,215	4628708049
18.8	25.0%	6	819,065,770	696,110	**********	1,859,797	47,373,843	2,555,913	4631263962
19.0	25.0%	5	819,065,775	643,722	**********	1,933,994	49,307,838	2,577,722	4633841684
19.2	25.0%	4	819,065,779	595,277	**********	2,011,152	51,318,990	2,606,433	4636448117
19.4	25.0%	4	819,065,783	550,477	**********	2,091,388	53,410,378	2,641,869	4639089985
19.6	25.0%	3	819,065,786	509,050	**********	2,174,825	55,585,203	2,683,877	4641773863
19.8	25.0%	2	819,065,788	470,740	**********	2,261,591	57,846,793	2,732,333	4644506195
20.0	25.0%	2	819,065,790	435,313	**********	1,210,864	59,057,657	1,646,178	4646152374
20.2	25.0%	2	819,065,792	402,552	**********	1,187,409	60,245,066	1,589,963	4647742336
20.4	25.0%	1	819,065,793	372,257	**********	1,164,409	61,409,475	1,536,667	4649279003
20.6	25.0%	1	819,065,794	344,241	**********	1,141,854	62,551,329	1,486,097	4650765100
20.8	25.0%	1	819,065,795	318,334	**********	1,119,736	63,671,065	1,438,072	4652203172
21.0	25.0%	1	819,065,796	294,377	**********	1,098,047	64,769,113	1,392,425	4653595597
21.2	25.0%	1	819,065,796	272,223	**********	1,076,778	65,845,890	1,349,001	4654944598
21.4	25.0%	1	819,065,797	251,736	**********	1,055,921	66,901,811	1,307,657	4656252255
21.6	25.0%	0	819,065,797	232,791	**********	1,035,467	67,937,278	1,268,259	4657520514
21.8	25.0%	0	819,065,798	215,272	**********	1,015,410	68,952,689	1,230,682	4658751196
22.0	25.0%	0	819,065,798	199,071	**********	995,742	69,948,430	1,194,813	4659946009
22.2	25.0%	0	819,065,798	184,089	**********	976,454	70,924,885	1,160,543	4661106552
22.4	25.0%	0	819,065,798	170,235	**********	957,540	71,882,425	1,127,775	4662234328
22.6	25.0%	0	819,065,798	157,423	**********	938,993	72,821,417	1,096,416	4663330744
22.8	25.0%	0	819,065,799	145,576	**********	920,804	73,742,222	1,066,380	4664397124
23.0	25.0%	0	819,065,799	134,620	**********	902,968	74,645,190	1,037,589	4665434713
23.2	25.0%	0	819,065,799	124,489	**********	885,478	75,530,667	1,009,967	4666444679
23.4	25.0%	0	819,065,799	115,120	**********	868,326	76,398,993	983,446	4667428125
23.6	25.0%	0	819,065,799	106,456	**********	851,506	77,250,500	957,963	4668386088
23.8	25.0%	0	819,065,799	98,445	**********	835,013	78,085,512	933,457	4669319546
24.0	25.0%	0	819,065,799	91,036	**********	818,838	78,904,351	909,874	4670229420
24.2	25.0%	0	819,065,799	84,185	**********	802,977	79,707,328	887,162	4671116583
24.4	25.0%	0	819,065,799	77,849	**********	787,424	80,494,752	865,273	4671981856
24.6	25.0%	0	819,065,799	71,990	**********	772,171	81,266,923	844,162	4672826018
24.8	25.0%	0	819,065,799	66,573	**********	757,214	82,024,138	823,787	4673649805
25.0	25.0%	0	819,065,799	61,563	**********	742,547	82,766,685	804,110	4674453914

ADJUSTED LFG RATES INCORPORATING LAG TIME

MAXIMUM PRODUCTION = 2,846,238 CF/DAY
AVERAGE PRODUCTION = 1,215,647 CF/DAY IN 9 YEARS
MAX. YEARLY MOVING AVERAGE = 2,867,334 CF/DAY

Time (yrs)	Readily (cf)	Moderate (cf)	Slowly (cf)	Total (cf)	Annual Total	
0.0	0	0	0	0		
0.2	0	0	0	0		
0.4	5,096,978	0	0	5,096,978		
0.6	7,396,946	0	0	7,396,946		
0.8	10,730,896	0	0	10,730,896		
1.0	15,561,708	8,402,652	0	23,964,360	47,189,180	9,437,836
1.2	22,558,479	9,643,127	0	32,201,606		15,878,157
1.4	32,687,885	11,062,753	0	43,750,638		23,608,889
1.6	47,345,747	12,686,630	0	60,032,377		34,135,975
1.8	68,546,384	14,543,222	0	83,089,606		48,607,717
2.0	99,194,888	16,664,774	0	115,859,662	334,933,889	66,986,778
2.2	95,742,655	19,087,779	0	114,830,434		83,512,544
2.4	76,973,296	21,853,488	0	98,826,784		94,527,773
2.6	61,851,132	25,008,481	0	86,859,613		99,893,220
2.8	49,672,661	28,605,282	0	78,277,943		98,930,887
3.0	40,098,917	32,703,042	0	72,801,959	451,596,733	90,319,347
3.2	32,974,950	37,368,272	0	70,343,222		81,421,904
3.4	27,116,626	42,675,645	0	69,792,270		75,615,001
3.6	22,299,090	48,989,455	0	71,288,545		72,500,788
3.8	18,337,437	57,287,703	0	75,625,141		71,970,227
4.0	15,079,611	66,991,578	0	82,071,190	369,120,368	73,824,074
4.2	12,400,570	78,339,178	0	90,739,748		77,903,379
4.4	10,197,487	91,608,930	0	101,806,417		84,306,208
4.6	8,385,803	107,126,425	64,151	115,576,378		93,163,775
4.8	6,895,982	125,272,404	65,469	132,233,855		104,485,517
5.0	5,670,843	146,492,102	66,790	152,229,735	592,586,133	118,517,227
5.2	4,663,362	171,306,172	68,112	176,037,646		135,576,806
5.4	3,834,870	200,323,459	69,434	204,227,763		156,061,076
5.6	3,153,568	234,255,940	70,752	237,480,259		180,441,852
5.8	2,593,305	273,936,190	72,065	276,601,561		209,315,393
6.0	2,132,579	142,323,587	73,371	144,529,537	1038876766	207,775,353
6.2	1,753,705	131,612,603	74,665	133,440,974		199,256,019
6.4	1,442,142	121,707,707	75,947	123,225,796		183,055,625
6.6	1,185,932	112,548,233	77,212	113,811,376		158,321,849
6.8	975,239	104,078,082	78,456	105,131,777		124,027,892
7.0	801,978	96,245,377	79,678	97,127,033	572,736,957	114,547,391
7.2	659,499	89,002,146	81,337	89,742,983		105,807,793
7.4	542,333	82,304,026	84,582	82,930,941		97,748,822
7.6	445,982	76,109,993	87,957	76,643,931		90,315,333
7.8	366,749	70,382,110	91,466	70,840,324		83,457,042
8.0	301,592	65,085,295	95,115	65,482,002	385,640,181	77,128,036
8.2	248,011	60,187,108	98,909	60,534,029		71,286,246
8.4	203,950	55,657,549	102,856	55,964,355		65,892,928
8.6	167,716	51,468,875	106,959	51,743,550		60,912,852
8.8	137,920	47,595,433	111,226	47,844,579		56,313,703
9.0	113,417	44,013,497	115,664	44,242,578	260,329,091	52,065,818
9.2	93,267	40,701,131	120,278	40,914,676		48,141,948
9.4	76,697	37,638,047	125,077	37,839,821		44,517,041
9.6	63,071	34,805,484	130,067	34,998,622		41,168,055
9.8	51,866	32,186,094	135,256	32,373,216		38,073,783
10.0	42,652	29,763,834	140,652	29,947,138	176,073,473	35,214,695
10.2	35,074	27,523,869	146,263	27,705,206		32,572,801
10.4	28,843	25,452,478	152,098	25,633,420		30,131,520
10.6	23,719	23,536,977	158,166	23,718,862		27,875,568
10.8	19,505	21,765,632	164,477	21,949,613		25,790,848
11.0	16,040	20,127,595	171,038	20,314,673	119,321,773	23,864,355

11.2	13,190	18,612,833	177,862	18,803,885	22,084,090
11.4	10,847	17,212,069	184,958	17,407,874	20,438,981
11.6	8,920	15,916,724	192,337	16,117,980	18,918,805
11.8	7,335	14,718,863	200,010	14,926,209	17,514,124
12.0	6,032	13,611,152	207,990	13,825,174	81,081,121 16,216,224
12.2	4,960	12,586,804	216,288	12,808,052	15,017,058
12.4	4,079	11,639,547	224,917	11,868,543	13,909,192
12.6	3,354	10,763,578	233,890	11,000,823	12,885,760
12.8	2,758	9,953,533	243,221	10,199,513	11,940,421
13.0	2,268	9,204,451	252,924	9,459,644	55,336,574 11,067,315
13.2	1,865	8,511,743	263,015	8,776,623	10,261,029
13.4	1,534	7,871,166	273,508	8,146,208	9,516,562
13.6	1,261	7,278,798	284,420	7,564,479	8,829,293
13.8	1,037	6,731,011	295,767	7,027,815	8,194,954
14.0	853	6,224,448	307,567	6,532,868	38,047,994 7,609,599
14.2	701	5,756,009	319,837	6,076,548	7,069,584
14.4	577	5,322,824	332,597	5,655,998	6,571,542
14.6	474	4,922,239	345,866	5,268,580	6,112,362
14.8	390	4,551,801	359,665	4,911,856	5,689,170
15.0	321	4,209,242	374,014	4,583,577	26,496,558 5,299,312
15.2	264	3,892,463	388,935	4,281,662	4,940,334
15.4	217	3,599,524	404,452	4,004,193	4,609,973
15.6	178	3,328,631	420,588	3,749,398	4,306,137
15.8	147	3,078,125	437,368	3,515,639	4,026,894
16.0	121	2,846,472	454,817	3,301,409	18,852,301 3,770,460
16.2	99	2,632,252	472,962	3,105,313	3,535,190
16.4	82	2,434,154	491,831	2,926,066	3,319,565
16.6	67	2,250,965	511,453	2,762,484	3,122,182
16.8	55	2,081,562	531,857	2,613,474	2,941,749
17.0	45	1,924,908	553,076	2,478,029	2,777,073
17.2	37	1,780,043	575,141	2,355,221	2,627,055
17.4	31	1,646,081	598,087	2,244,198	2,490,681
17.6	25	1,522,200	621,948	2,144,173	2,367,019
17.8	21	1,407,642	646,761	2,054,424	2,255,209
18.0	17	1,301,706	672,564	1,974,286	2,154,460
18.2	14	1,203,742	699,396	1,903,152	2,064,047
18.4	12	1,113,151	727,299	1,840,461	1,983,299
18.6	9	1,029,378	756,314	1,785,701	1,911,605
18.8	8	951,909	786,488	1,738,404	1,848,401
19.0	6	880,270	817,865	1,698,142	1,793,172
19.2	5	814,023	850,494	1,664,522	1,745,446
19.4	4	752,761	884,425	1,637,191	1,704,792
19.6	4	696,110	919,710	1,615,823	1,670,816
19.8	3	643,722	956,402	1,600,127	1,643,161
20.0	2	595,277	994,558	1,589,838	1,621,500
20.2	2	550,477	1,034,237	1,584,716	1,605,539
20.4	2	509,050	1,075,498	1,584,549	1,595,011
20.6	1	470,740	1,118,406	1,589,147	1,589,675
20.8	1	435,313	1,163,025	1,598,339	1,589,318
21.0	1	402,552	1,209,425	1,611,977	1,593,746
21.2	1	372,257	1,257,675	1,629,933	1,602,789
21.4	1	344,241	1,307,851	1,652,093	1,616,298
21.6	1	318,334	1,360,028	1,678,363	1,634,141
21.8	0	294,377	1,414,287	1,708,665	1,656,206
22.0	0	272,223	1,470,711	1,742,934	1,682,398
22.2	0	251,736	1,529,386	1,781,122	1,712,635
22.4	0	232,791	1,590,401	1,823,192	1,746,855
22.6	0	215,272	1,653,851	1,869,123	1,785,007
22.8	0	199,071	1,719,832	1,918,903	1,827,055
23.0	0	184,089	1,788,446	1,972,535	1,872,975
23.2	0	170,235	1,859,797	2,030,032	1,922,757
23.4	0	157,423	1,933,994	2,091,418	1,976,402
23.6	0	145,576	2,011,152	2,156,728	2,033,923
23.8	0	134,620	2,091,388	2,226,008	2,095,344
24.0	0	124,489	2,174,825	2,299,314	2,160,700
24.2	0	115,120	2,261,591	2,376,711	2,230,036

24.4	0	106,456	1,210,864	1,317,320	2,075,216
24.6	0	98,445	1,187,409	1,285,854	1,901,041
24.8	0	91,036	1,164,409	1,255,445	1,706,929
25.0	0	84,185	1,141,854	1,226,039	1,492,274

Table 2-1

TYPICAL LANDFILL GAS COMPOSITION AT VARIOUS SITES
(Component Percentage, Dry Volume Basis)

Compounds	Blanchet 1977	Ham et al 1977	Bray 1981	Cagliostro 1981	Elzy 1983
Methane	44.0	47.5	50.0	53.4	50.0
Carbon Dioxide	34.2	47.0	35.0	34.3	42.5
Nitrogen	20.8	3.7	13.0	6.2	5.4
Oxygen	1.0	0.8	1.7	0.05	0.2
Paraffin Hydrocarbons	-	0.1	-	0.17	-
Aromatic and Cyclic Hydrocarbons	-	0.2	-	-	-
Hydrogen	-	0.1	-	0.005	1.9
Hydrogen Sulfide	0.7	0.01	0.3	0.005	-
Carbon Monoxide	-	0.1	-	0.005	-
*Trace Compounds	-	0.5	-	-	-

*Trace compounds include: sulfur dioxide, benzene, toluene, methylene chloride, perchlorethylene, carbonyl sulfide, and vinyl chloride.

SOURCE: Final Report (August-July 1985); Landfill Gas: Resource Evaluation and Development - Gas Research Institute.

Response to FDER Comments
Dated October 2, 1990
Regarding the City of Jacksonville
East Duval Sanitary Landfill
Application to Construct Air
Pollution Source
(Landfill Gas Flare)
Application No. AC 16-186047

PBS&J
POST,
BUCKLEY,
SCHUH &
JERNIGAN, INC.

ENGINEERING
PLANNING
ARCHITECTURE

December 21, 1990

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

Re: Response to Request for Additional Information
East Duval Sanitary Landfill Flare
Construction Permit Application No. AC 16-186047

Dear Mr. Fancy:

Enclosed are responses to your letter of October 2, 1990 regarding the above referenced permit application.

For ease of review we have included your statement (in bold type) followed by our response. If you have any questions or need additional information, please contact me.

Very truly yours,

PBS&J ENVIRONMENTAL LABORATORIES

Jerome J. Guidry, P.E.
Vice President

JJG/jdm/MISC II 044

Encs.

cc: G. Knecht, City of Jacksonville
G. Threlkeld, PBS&J

22-087.00

EAST DUVAL SANITARY LANDFILL FLARE
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

The following are responses to Mr. C. H. Fancy's request for additional information dated October 2, 1990 (included in Attachment 1) regarding the East Duval Sanitary Landfill Application to construct Air Pollution source (Landfill Gas Flare), Application No. AC 16-186047.

1. **Complete Item B(1), Section III of the permit application (tons/day of Class I & III wastes this facility is designed to handle).**

   The East Duval Sanitary Landfill is currently accepting approximately 1,200 tons per day of municipal solid waste. There will not be any material accepted once the facility is closed, in which time the flare will be constructed. The landfill is expected to reach its capacity within 1 to 2 years. Upon closure, the landfill will contain approximately 6,207,000 cubic yards of municipal solid waste.

2. **Submit a calculation sheet for Item C, Section III, for all contaminants which must include H_2S emissions, along with Item H, Section III calculations.**

   Section III, Item C has been revised, and is included in Attachment 2. The estimated component qualities and stack information were provided by IT-McGill, a flare manufacturer. Any background data can be obtained by contacting Mr. Kyle Schotts at (918) 748-0700.

3. **The control device, according to Item D, Section III of the application is McGill Environmental Systems, Inc., Model EGF-60 Flare (or equivalent). When do you expect to finalize the type and model of flare that will be installed. Please submit a manufacturer's brochure including the design specification sheet.**

The type and model of flare will be finalized during the award of bid to perform the landfill closure construction. This will enable the City of Jacksonville to obtain the most cost effective flare unit. A copy of the manufacturers brochure including the design specification sheet is included in Attachment 3.

4. **Is this flare steam-assisted or air-assisted? What is the net heating value of the gas being combusted?**

The flare is neither steam nor air-assisted; it is a totally natural draft system. The net heating value of the gas being combusted ranges from 300 BTU/SCF to 520 BTU/SCF.

5. **How is the presence of the flare pilot flame, exit gas temperature and gas flow rate monitored?**

The flare pilot flame is sensed with a UV flame detector. The exit gas temperature is monitored with a thermocouple. The exit gas flow rate is not measured.

6. **According to Section II "A" Attachment, the East Landfill is expected to achieve a final height of 132 feet while the flare stack height is only 40 feet. Do you plan to install the flare stack at the highest elevation at the landfill?**

The top of the stack will not be installed at the highest elevation at the landfill. The flare will be installed on the east side of the landfill. The final elevation of the landfill is expected to be 132 feet National Geodetic Vertical Datum (NGVD), and the top of the stack is anticipated to be at elevation 51 NGVD.

7. **Submit a process flow diagram showing the location of all extraction wells in the collection system along with gas flow rates (ACFM) for each well that will be routed to the flare.**

A process flow diagram and a collection system layout with the location of all extraction wells in the collection system is shown in Attachment 4. The gas flow was estimated to be 150 CFM for each well.

ATTACHMENT 1

FDER REQUEST FOR ADDITIONAL INFORMATION

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Bob Martinez, Governor Dale Twachtmann, Secretary John Shearer, Assistant Secretary

October 2, 1990

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. George R. Knecht, P.E.
Manager of Disposal
City of Jacksonville
Solid Waste Disposal Division
1931 East Beaver Street
Jacksonville, Florida 32202

Re: Duval County - A.P.
City of Jacksonville, East Duval
Sanitary Landfill-Flare
AC 16-186047

Dear Mr. Knecht:

The Department has received a permit application to construct a flare at the above referenced facility on September 4, 1990 and deemed it incomplete. Please provide the following information:

1. Complete Item B(1), Section III of the permit application (tons/day of Class I & III wastes this facility is designed to handle).

2. Submit a calculation sheet for Item C, Section III, for all contaminants which must include H_2S emissions, along with item H, Section III calculations.

3. The control device, according to Item D, Section III of the application is McGill Environmental Systems, Inc. Model EGF-60 Flare (or equivalent). When do you expect to finalize the type and model of flare that will be installed. Please submit a manufacturer's brochure including the design specification sheet.

4. Is this flare steam-assisted or air-assisted? What is the net heating value of the gas being combusted?

5. How is the presence of the flare pilot flame, exit gas temperature and gas flow rate monitored?

6. According to Section II "A" Attachment, the East Landfill is expected to achieve a final height of 132 feet while the flare stack height is only 40 feet. Do you plan to install the flare stack at the highest elevation at the landfill?

7. Submit a process flow diagram showing the location of all extraction wells in the collection system along with gas flow rates (ACFM) for each well that will be routed to the flare.

Processing of this application will continue as soon as the above referenced information has been received.

If you have any questions, please contact Mr. Mirza P. Baig at (904) 488-1344.

Sincerely,

Barry D. Andrews

for C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/MB/plm

c: J. J. Guidry, P.E.
R. Roberson, BESD
A. Kutyna, Northeast District

ATTACHMENT 2

PAGE 4 OF 12 OF AIR POLLUTION SOURCE PERMIT
Revised December, 1990

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

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

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): N/A

2. Product Weight (lbs/hr): N/A

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	
N2	88,168	386,176			See Section		
O2	15,632,	68,468			III C Attachment		
CO2	14,621	64,040					
H20	7,188	31,483					
CH4	55.4	242.7					
CO	23.84	104.42					
NOX	5.36	23.48					
H2S	0.013	0.057					

[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).

ATTACHMENT 3

MANUFACTURER'S DESIGN SPECIFICATIONS

SECTION ONE - PROCESS SUMMARY

DESIGN BASIS

Gas Composition (Vol. %)

CH4	52% max.
CO2, Air, Inerts	48%
	100%
LHV	473 Btu/SCF
Temperature	100°F (45 - 120°F)
Mole Weight	29.46

Flare Gas

Type:	Landfill Gas
Max. Flow Rate:	2100 scfm
Waste Heat Release:	59.6 MMBtu/hr (Design Basis)
Min. Flow Rate:	10% of max. flow
Smokeless Flow:	100%
Pressure Drop:	12" WG

Unit Design

Operating Temp:	1600 - 2000°F (2100°F shutdown)
Retention Time:	1600°F .66 Seconds
	1800°F .69 Seconds
	2000°F .72 Seconds
Overall Unit Turndown:	6:1 (to hold 2000°F)
Flame Stability Turndown:	20:1 minimum
Fired Fuel Req'd:	None (pilot only)

UTILITIES

Pilot Gas	22 SCFH propane (intermittent)
Compressed Air	Not required
Electricity	460V/3Ph/60 Hz (McGill will step down to 110V for control usage.)

MECHANICAL DESIGN

Design Wind Speed	90 mph
Ambient Temp	-20 to 120°F
Electrical Area	Non-hazardous

FLAME STABILITY

Low methane concentrations may require auxiliary fuel to initiate combustion and maintain temperature.

Flashback will not occur if the landfill gas 02 level is 6% or less.

SECTION TWO - EQUIPMENT DESCRIPTION

ITEM I - ENCLOSED FLARE SYSTEM

A. Enclosed Flare Stack

One McGill Landfill Gas Flare System, with:

.. 2" layer A.P. Green (or equal) ceramic fiber refractory on Inconel pins and keepers. (2600°F hot face refractory).

.. A-36 carbon steel shell (1/4" nom.).

.. Stainless steel gas burner(s) with flame stabilizers for high temperature corrosion resistance.

.. 12" flanged flare gas inlet.

.. One (1) pilot assembly designed for 60,000 Btu/hr propane with electric spark ignitor. The pilot only operates during start-up.

.. Heavy duty, galvanized, opposed blade combustion air dampers. Opposed blade design provides a 6:1 air turndown control. Galvanized finish and stainless steel press-fit bearings ensure smooth, long term operation.

.. Four 3" NPT sample ports at 90° located 1/2 diameter from the top for accurate emission testing.

.. Inorganic zinc primer coat for superior corrosion protection and 600°F temperature resistance.

.. Continuous base plate for high wind stability.

.. Lift lugs to assist in erection.

B. Control System Operation

The following is a brief outline of the control system start-up and operating sequence:

System start-up would begin with a timed air purge cycle to evacuate any fugitive hydrocarbons from the flare enclosure. After purge is completed, the pilot will be lit. Upon proving the pilot flame by the flame scanner, the landfill gas valve will be opened and the landfill gas blower (by others) will be started allowing landfill gas to flow to the flare enclosure. This allows use of the landfill gas for system warm-up.

Upon proving a flame on the pilot, the system will continue its warm-up sequence. The landfill gas valve will be opened allowing normal operation of the unit.

After the landfill gas valve has been opened, the pilot gas will then shut off to limit propane gas usage. If a flame is still sensed on the main burner the system will continue operation, if not it will shutdown on flame failure.

The unit temperature is set by adjusting the air dampers (manually or optional automatic). Opening the dampers will reduce the flue gas temperature by adding quench air. In the manual system, the operating temperature is set at 1800-2000°F at the maximum design flow and will fluctuate between 600-2100°F at variable gas flows.

Due to the presence of an open flame, the ground flare should be located in a "non-hazardous" electrical area.

C. Base Case Control Features - Manual Operation

.. Manually operated combustion air dampers to control the operating temperature.

.. High temperature shutdown switch with panel mounted temperature indicator.

.. Pilot gas control system including pressure regulator, fail-closed shutdown valves, manual block valve and pressure indicator.

.. Ignition system including ignition transformer, pilot spark electrode and ignition timer.

.. Flame safeguard controls including self-checking flame scanner and panel mounted flame relay.

.. Purge air blower with pressure proved switch and motor starter.

.. All high voltage (440/220V) items are enclosed in a separate panel for electrical safety including:

Main power supply disconnect.

Power transformer. Client will supply 220-460V/3Ph/60 Hz electricity. McGill will stepdown to 110V/1 Ph for use as required.

Motor starter for client's landfill gas blower motor. (Client to specify horsepower).

Amp meter for waste gas blower motor (200% scale).

.. "Manual-Off-Auto" blower selector switch.

.. The following indicating lights:

a. Panel Power ON
b. Purging
c. Purge Complete
d. Pilot Gas ON
e. Flame Proved
f. High Stack Temperature (SD)
g Flame Failure (SD)

.. Contacts for control room monitoring of the system.

.. 15A convenience outlet (duplex) with weatherproof cover.

.. 100W high pressure sodium security light with manual switch and photocell (shipped loose).

.. Additional relays, timers, controllers, etc. required for system operation.

.. The appropriate items will be enclosed in a weatherproof (NEMA 4) panel.

.. Controls and valving are prepiped and wired onto a support rack.

The control system will be given a functional test simulating actual operation in our shop to ensure that it is properly wired and will perform as designed.

Units can be operated in the manual mode which requires an operator at the flare to start and restart the system using a pushbutton sequence. If the units shutdown for any reason, operator assisted restart is required.

The flare operating temperature is set by manually adjusting the air dampers.

The base case is recommended for sites with stable gas flow and constant electrical supply.

OPTION I: AUTOMATIC START/RESTART

In the automatic mode, the unit will automatically start when power is applied. If the unit shuts down for any reason except high stack temperature, the auto mode will allow the unit to attempt to purge and restart for a specified time period. A remote signal is sent if the unit fails to restart.

OPTION II: INLET FLAME ARRESTOR

Varec 12" flame arrestor (or equal). Aluminum housing and aluminum internals. Internal elements can be cleaned without removing the flame arrestor body from the pipe.

OPTION III: INLET BLOCK VALVE WITH PNEUMATIC ACTUATOR

12" Pliaxseal high performance butterfly valve, ANSI 150# with carbon steel body, 316 stainless steel disk, PTFE seal with Bettis pneumatic, fail-closed actuator, 3-way solenoid valve, speed control valves and Bettis Auxiliary switches. (Nitrogen bottles supplied by others).

Although nitrogen cylinders are required to be installed, the advantage of this option is that the actuator is a highly reliable standard industrial actuator that will have less maintenance than an electric fail-closed actuator.

OPTION V: AUTOMATIC TEMPERATURE CONTROL (AIR)

Flue gas temperature would be automatically controlled by adjusting the air flow into the unit. Lower waste gas flows or lower methane concentrations would automatically close the inlet air louvers. The control loop consists of a thermocouple and temperature indicator/controller and two electric operated actuators on the air louvers.

OTHER ENCLOSED FLARE OPTIONS

McGill will design the Enclosed Flare system to meet most requirements or restrictions that our client's may have. Following are a number of optional features provided on previous projects:

.. Temperature recorder for the flue gas. May be required for some local authorities.

.. Landfill gas blower with explosion-proof motor (Arrg. 8).

.. Caged access ladder to 30' elevation for access to thermocouples and flame scanner.

.. 360° platform for access to sample connections. McGill does not recommend this option due to the proximity to the hot exit flue gas.

.. Hinged manway (18") for access into the flare base. Normal access is through the air dampers, however, this option should be considered if automatic louvers are used.

.. Inconel mesh cover for the ceramic fiber refractory. The mesh provides additional mechanical strength. If the unit is not used for extended periods, the mesh will extend the refractory life.

.. Visual alarm beacon or audible alarm horn.

.. Automatic telephone dialing system (requires phone line at flare).

.. Finish coat of high temperature paint (aluminum color).

.. Service agreement for a McGill technician to periodically check the operating characteristics and safety shutdown points.

Safety Controls and Other Features

We are providing "self-checking" type flame scanners and relay system, which affords a fail-safe shutdown. Without this feature an unsafe failure mode may occur. A normal scanner may be substituted at a substantial cost deduct, but all liability resulting from such a change must be borne by the purchaser.

Heat Tracing

It is not necessary to heat trace the piping between the blower and the flare.

McGILL FLARE MANUFACTURING STANDARDS

Following is a summary of our fabrication standards as they apply to the supply of this equipment.

The McGill shop is qualified to meet ASME boiler and pressure vessel codes and maintains quality control documentation and welder's qualifications which are available for our client's review. Inspectors have access to our company and subcontractors upon short notice.

McGill regularly uses local subcontract shops to assist in fabrication and assembly of our products. These shops work under McGill direction and project management and will meet our fabrication quality control standards.

1. General Industry Standards

Welding - Gas Piping:	ASME IX	Electrical Wiring:	NEC
- Burners:	AWS	Pipe Flanges:	150 lb. ANSI
- Structural:	AWS	Pipe Threads:	NPT
Weld Inspection:	ASME V	Structural Design:	AISC A58.1
Drawing Dimensions:	English		

2. Nondestructive Testing

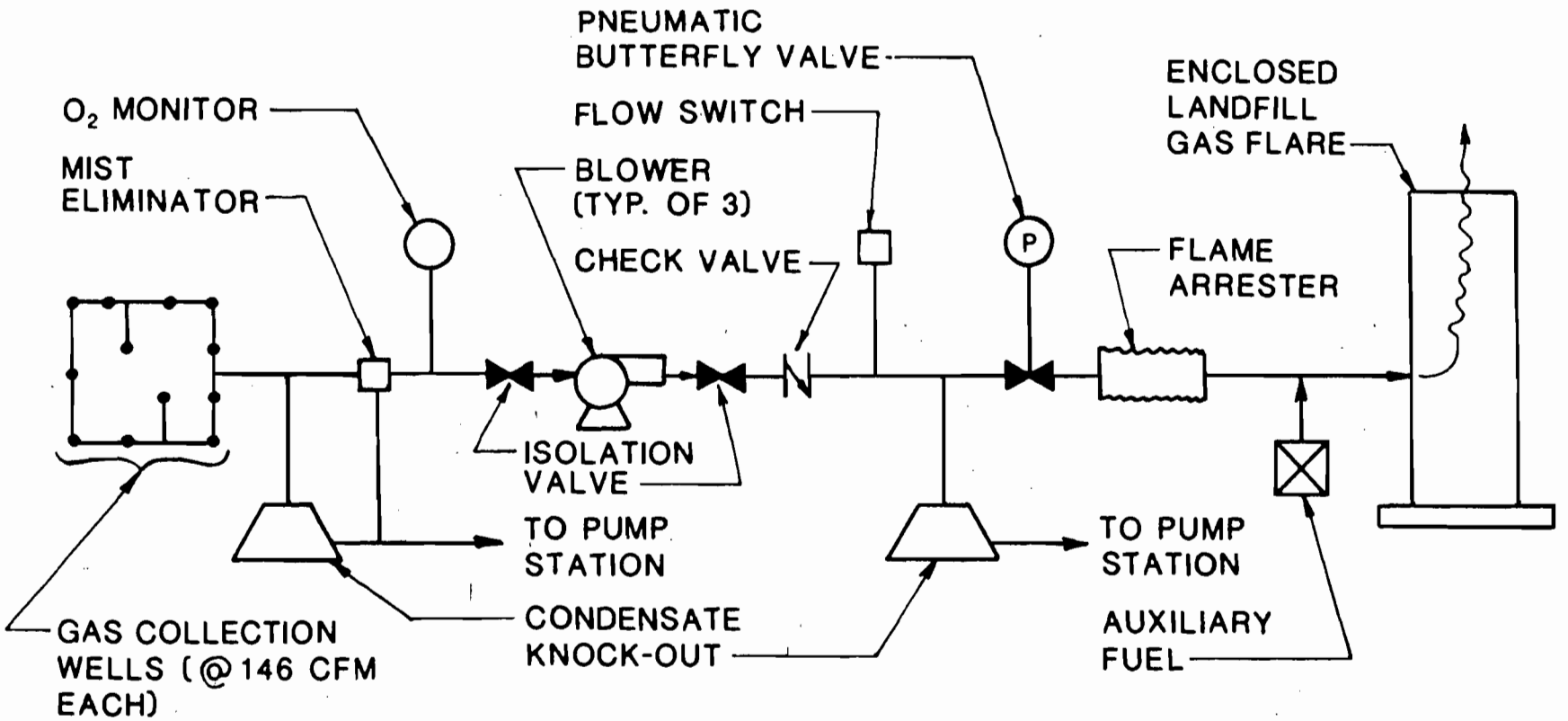
X	Dimensional Check:	All exterior and mounting dimensions
X	All Welds:	100% Visual Inspection
X	Ignition Transformers:	Functional Check
X	Control System:	Function Check

3. Quality Control Documentation

- X Welder Qualifications (on request)
- X Welding Procedures (on request)
- X Instrument Data Sheet/Catalog Sheet
- X Other Standard McGill Inspection Reports
- X Review Drawings (1R/3P)
- X As Built Drawings (1R/3P)
- X Operating & Maintenance Manual (3)

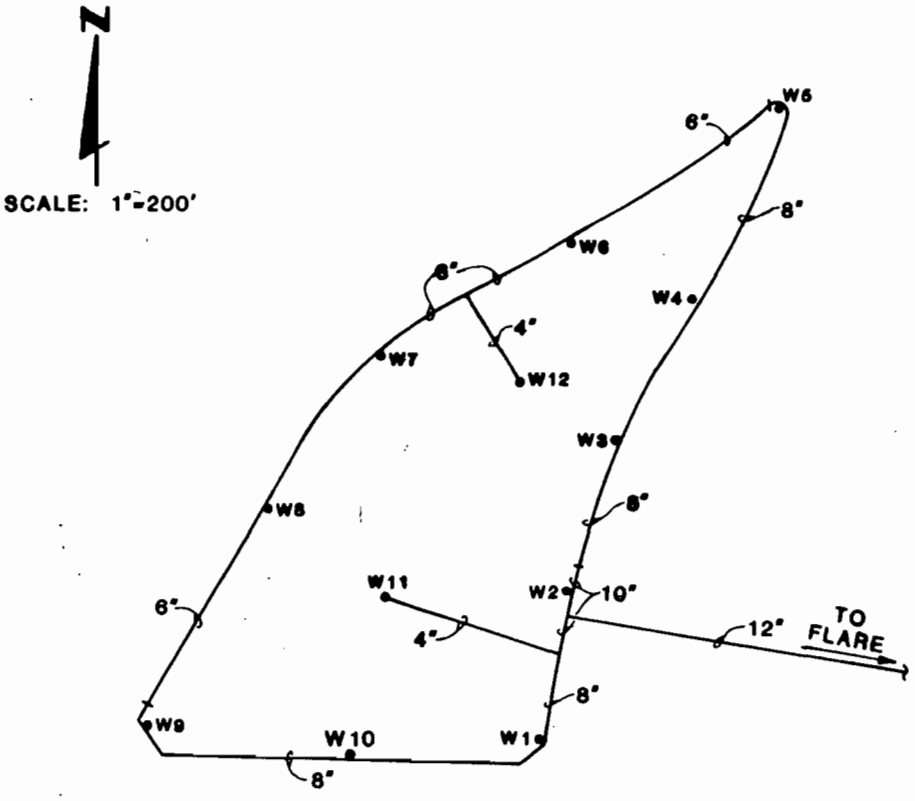
ATTACHMENT 4

GAS MANAGEMENT SYSTEM PLANS



EAST DUVAL LANDFILL GAS FLARE
PROCESS FLOW DIAGRAM

N49174



EAST LANDFILL
GAS COLLECTION PIPE LAYOUT

ASSUMPTIONS

Maximum Allowable Velocity (V):	40 FT/SEC
Maximum Gas Generation Rate per Well:	150 CFM
Perimeter Header Pipe Length:	3,300 LF

50/50 Split in Flow Rate Half-Way Around Perimeter Header System

CALCULATIONS

Cross Sectional Area (A) of 12" Pipe:	0.785 SF
Cross Sectional Area (A) of 10" Pipe:	0.545 SF
Cross Sectional Area (A) of 8" Pipe:	0.349 SF
Cross Sectional Area (A) of 6" Pipe:	0.196 SF
Cross Sectional Area (A) of 4" Pipe:	0.087 SF

Pipe Section From	Pipe Section To	Diameter (Inches)	Flow (Q=VA) (CFM)
W12	W12's Node	4	150
W12's Node	W6	6	150
W6	W5	6	300
W6	W5	8	300
W5	W4	8	450
W4	W3	8	600
W3	W2	8	750
W3	W2	10	750
W2	Exit Pipe	10	900
W7	W8	6	150
W8	W9	6	300
W8	W9	8	300
W9	W10	8	450
W10	W1	8	600
W1	W11's Node	8	750
W11	W11's Node	4	150
W11's Node	Exit Pipe	10	900

Total Flow to Gas Flare (12" Exit Pipe) = 900 + 900 = 1,800 CFM
Check: 12 x 150 = 1,800 CFM

PBS

EAST DUVAL SANITARY LANDFILL
EXTRACTION WELL LOCATIONS AND GAS FLOW RATES

N69174

CITY OF JACKSONVILLE EAST DUVAL LANDFILL
LFG AND FLARE SYSTEM DESIGN MEMORANDUM

Post, Buckley, Schuh & Jernigan, Inc.
Prepared by Omar E. Smith

August 23, 1988
Revised: August 29, 1990
Revised for Final Design: September 27, 1990

1. Design Considerations

° Assume: Horizontal radius of influence (R.O.I.)/landfill depth ratio =

- For Top of Landfill: 1.75/1
- For Sideslopes : 2/1

° Assume: Bottom 10' ft. of LF assumed minimal LFG production
Bottom EL of LF = 10' MSL
LFG production from top of fill to EL 20' MSL

° Landfill Depth (for gas collection)

Side slopes @ EL 70' : 70' - 20' = 50'
Top @ EL 120' : 120' - 20' = 100'
For Top of Landfill:

Assume perforations =
Side slope = 1/2 D = 1/2 (50) = 25' from bottom
Top = 2/3 D = 2/3 (100) = 67' from bottom

° Radius of Influence (R.O.I)

R.O.I.: Side slopes @ 2:1 D = 50 ; R.O.I. = 100 (conservative)
Top @ 1.75:1 D= 100; R.O.I. = 175 (conservative)

Palm Beach County R.O.I has demonstrated 5:1.

° Well Spacing

For side slopes - For R.O.I. = 100; spacing = 200
For top - For R.O.I. = 175;
Spacing = R.O.I. X COS (30) X 2 = 300 feet

2. LFG Generation/Recovery Rate

From LFG Model (see attached sheets) = 275 cf - LFG/cy - yr (Ave. Peak)
Volume of Influence = 2/3 μ R^2H
For depth @ 50'; R.O.I. = 100; V = 38,800 cy
@ 100'; R.O.I. = 175; V = 237,700 cy

Assume Recovery Rate Factor = 0.70
or 0.7 (Generation rate) V

From LFG Model (See attached Sheets)
:Top of LF = Each well will deliver: 87 cfm
:Side Slopes = Each well will deliver: 14 cfm

Preliminary Design of layout demonstrated:

Side slopes : 27 wells required
Top : 12 wells required

Average Design

27 wells @ 14 cfm = 384 cfm
12 wells @ 87 cfm = 1045 cfm
1429 cfm or approximately 2.06 mmcfd

Peak Design

27 wells @ 24 cfm = 642 cfm
12 wells @ 146 cfm = 1748 cfm
2,390 cfm or approximately 3.44 mmcfd

3. Recommendations

- System design for odor and LFG migration control.
- Use PVC pipe and fittings. (Schedule 80) for well head and well collection piping.
- Use HDPE piping for collection and header lines.
- Minimum header size = 4 inches Ø
- Locate all piping underground, atop landfill.
- Pipe slopes
  - 3% minimum in direction of LFG flow
  - 4% minimum in direction opposite of LFG flow
- Condensate traps at all low points
- Flexible connectors at all high and low points.
- Maximum velocity in header = 40 ft/s.

- Minimum pipeline cover:

  - ° Pipelines to be installed prior to installation of liners.
  - ° 12 inches intermediate cover (under future liner).
  - ° Plus 24 inches of final cover.
  - ° Mark pipeline to prevent damage during placement of lines and final cover.
  - ° Maximum desired pipeline depth (below future liner) = 6 feet.

- Minimum well head pressure = 10 inches of H_2O.

- Manhole and condensate trap covers if used to be rated for H-15 loading.

- Since 12 wells on top of fill collect > 70% (1045 cfm/1429 cfm) of LFG and well installation cost increases doubles with installation of 27 additional wells on side slopes then do not install side slopes wells at this time. Top of landfill vents should collect gas and cause a negative pressure inside the landfill since landfill has liner on sides and top.

  Additional reasons include:

  - ° Difficulty in installing the pipe and wells on a side slopes (approximately 3:1).
  - ° Possible additional differential settlement compared to the flat surface of the LF.
  - ° Possible flooding of manholes and condensate traps if installed on side slopes.
  - ° Significantly more piping and wells required (3 times more piping for < 30% additional LFG recovery).
  - ° Higher unit cost for installation.

- If odor problems or migration of LFG persists then installation of collection field, and additional wells can be instituted in a Phase II construction scenario.

- Design collection piping and flare system for additional flow.

- Blower system

  = 1,200 cfm = Required 2 units @ 600 cfm
  plus 1 standby plus 1 future for Phase II

  Assume vacuum of
  40 inches water column

  for a total of 3 units.

- Flare system design for min.

  peak 2 @ 2,400 cfm (future with Phase II)
  peak 1 @ 1,000 cfm (Phase I)
  ave @ 1,200 cfm
  low @ 600 cfm

- To fully optimize the system; an actual extraction testing system should be used to verify the assumptions made in this analysis.

East Landfill
City of Jacksonville
Jacksonville, Florida

****
* SIDESLOPE OF LANDFILL *
****

27-Sep-90

LANDFILL GAS PRODUCTION MODEL
BASED ON THE PALOS VERDES KINETIC MODEL
VERSION 3.2 - MARCH 7, 1989

REFUSE QUANTITY & CHARACTERISTICS

ASSUMPTIONS:

TOTAL TONS OF REFUSE IN-PLACE=	3,720,500 TONS		FINAL MOISTURE CONTENT=	25%
REFUSE TEMPERATURE =	85 DEGREES F		YEARS LANDFILL WAS OPEN BEFORE CLOSURE =	0
INITIAL MOISTURE CONTENT =	35%		PERCENTAGE REDUCTION OF MOISTURE PER YEAR AFTER CLOSURE =	13%
METHANE CONTENT =	52%			
AVERAGE REFUSE THICKNESS =	50 FEET OR	15.2 METERS		
AVERAGE IN-PLACE DENSITY =	1200 LB/CY OR	711.7 KG/CM		

REFUSE COMPOSITION

DECOMPOSIBILITY CLASS	COMPONENT	% WET WEIGHT	% WATER	% DRY WEIGHT	% VOLATILE SOLIDS (dry wt.)	% VOLATILE SOLIDS BIODEGRAD. (dry wt.)	METHANE GAS PRODUCTION PER LB OF REFUSE (cf-CH4/lb) wet	by class	ADJUSTED FACTORS (cf-CH4/lb)
Readily	Food Waste	14%	63%	5%	60%	50%	0.131	0.131	0.146
Moderate	Garden Waste	12%	48%	6%	70%	35%	0.129	0.610	0.679
	Paper Waste	42%	20%	34%	85%	20%	0.481		
Slowly	Plastic/Rubber	5%	13%	4%	95%	2%	0.007	0.020	0.022
	Textiles	2%	16%	2%	94%	5%	0.007		
	Wood	2%	14%	2%	85%	5%	0.006		
Inert	Metal	9%	3%	9%	-	-			
	Glass/Ceramics	11%	2%	11%	-	-			
	Ash/Dirt/Rock	3%	8%	3%	-	-			
	TOTAL	100%		75%		Total	0.761	0.761	0.847

GAS GENERATION FACTORS

DECOMPATIBILITY CLASS	READILY	MODERATELY	SLOWLY
Total % Dry Weight	5%	40%	8%
Methane Yield Factor (cf/dry ton)	5,627	3,409	568
Half-Life (yrs)	2	5	20
Ult.-Life (yrs)	6	15	60
Lag-Time (yrs)	0.2	0.8	4.4

KINETIC FACTORS GENERATION

DECOMPOSIBILITY CLASS	Assumed Half-Life (yrs)	Assumed Ult.-Life (yrs)	k1 (yrs-1)	k2 (yrs-1)
Readily	2	6	1.956	0.978
Moderate	5	15	0.782	0.391
Slowly	20	60	0.196	0.098

RADIUS OF INFLUENCE

METHANE PRODUCTION RATE (r) =	0.0003	cf/lb/day or	20.4 ml/kg/day or
(Note: r designed at a peak = 2 x average)			143 cf-CH4/cy-yr
RADIUS OF INFLUENCE (ROI) ASSUMED=	100	FEET	
ROI: HORZ. RADIUS/LF DEPTH RATIO =	2		
RADIUS OF INFLUENCE THEORETICAL=	68	FEET	
VOLUME OF INFLUENCE =	38,804	CY	

DESIGN FACTORS

NO. OF WELLS IN RECOVERY FIELD=	27		
AVE. RECOVERY RATE =	70.0%		
WELL FLOW RATE (LFG) =	14	CFM OR	6.7 L/SEC
MAX. WITHDRAWAL RATE =	24	CFM/WELL	
AVE. WITHDRAWAL RATE =	10	CFM/WELL	
MIN. WELL SIZE FOR PASSIVE VENTS =	5	INCHES	
MIN. WELL SIZE FOR ACTIVE VENTS =	3	INCHES	
WELL SPACING=	200	FEET WELL TO WELL	
LFG SYSTEM DESIGN RECOVERY RATE =	384	CFM	0.55 MMcfd Recovered
LFG SYSTEM MAXIMUM RECOVERY RATE =	642	CFM	
MAXIMUM PRODUCTION =	2,846,238	CF-CH4/DAY	
AVERAGE PRODUCTION =	1,215,647	CF-CH4/DAY OVER 9 YEARS	

East Landfill
City of Jacksonville
Jacksonville, Florida

****
* TOP OF LANDFILL *
****

27-Sep-90

LANDFILL GAS PRODUCTION MODEL
BASED ON THE PALOS VERDES KINETIC MODEL
VERSION 3.2 - MARCH 7, 1989

REFUSE QUANTITY & CHARACTERISTICS

ASSUMPTIONS:

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REFUSE TEMPERATURE =	85 DEGREES F		YEARS LANDFILL WAS OPEN BEFORE CLOSURE =	0
INITIAL MOISTURE CONTENT =	35%		PERCENTAGE REDUCTION OF MOISTURE PER YEAR	
METHANE CONTENT =	52%		AFTER CLOSURE =	13%
AVERAGE REFUSE THICKNESS =	100 FEET OR	30.5 METERS		
AVERAGE IN-PLACE DENSITY =	1200 LB/CY OR	711.7 KG/CM		

REFUSE COMPOSITION

DECOMPOSIBILITY CLASS	COMPONENT	% WET WEIGHT	% WATER	% DRY WEIGHT	% VOLATILE SOLIDS (dry wt.)	% VOLATILE SOLIDS BIODEGRAD. (dry wt.)	METHANE GAS PRODUCTION PER LB OF REFUSE (cf-CH4/lb) wet	by class	ADJUSTED FACTORS (cf-CH4/lb)
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	Textiles	2%	16%	2%	94%	5%	0.007		
	Wood	2%	14%	2%	85%	5%	0.006		
Inert	Metal	9%	3%	9%	-	-			
	Glass/Ceramics	11%	2%	11%	-	-			
	Ash/Dirt/Rock	3%	8%	3%	-	-			
	TOTAL	100%		75%		Total	0.761	0.761	0.847

GAS GENERATION FACTORS

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Total % Dry Weight	5%	40%	8%
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Moderate	5	15	0.782	0.391
Slowly	20	60	0.196	0.098

RADIUS OF INFLUENCE

METHANE PRODUCTION RATE (r) =	0.0003 cf/lb/day or	20.4 ml/kg/day or
(Note: r designed at a peak = 2 x average)		143 cf-CH4/cy-yr
RADIUS OF INFLUENCE (ROI) ASSUMED=	175 FEET	
ROI: HORZ. RADIUS/LF DEPTH RATIO =	1.75	
RADIUS OF INFLUENCE THEORETICAL=	119 FEET	
VOLUME OF INFLUENCE =	237,677 CY	

DESIGN FACTORS

NO. OF WELLS IN RECOVERY FIELD=	12	
AVE. RECOVERY RATE =	70.0%	
WELL FLOW RATE (LFG) =	87 CFM OR	41.1 L/SEC
MAX. WITHDRAWAL RATE =	146 CFM/WELL	
AVE. WITHDRAWAL RATE =	62 CFM/WELL	
MIN. WELL SIZE FOR PASSIVE VENTS =	12 INCHES	
MIN. WELL SIZE FOR ACTIVE VENTS =	7 INCHES	
WELL SPACING=	303 FEET WELL TO WELL	
LFG SYSTEM DESIGN RECOVERY RATE =	1,045 CFM	1.51 MMcfd Recovered
LFG SYSTEM MAXIMUM RECOVERY RATE =	1,748 CFM	
MAXIMUM PRODUCTION =	2,846,238 CF-CH4/DAY	
AVERAGE PRODUCTION =	1,215,647 CF-CH4/DAY OVER 9 YEARS	

ENCLOSED FLARE SYSTEM CLIENT LIST

Job No.	Client	Landfill	Location	Dia./Ht.	Inlet (In.)
120343	Environ. Tech.	Shoosmith Bros.	Chester, VA	2 x 7	
120348	WMI	Central Disposal	Pompano Bch, FL	11 x 40	12
120369	WMI	Oakland Scavenger	Livermore, CA	9 x 35	12
120370	WMI	Oakland Scavenger	Fremont, CA	7 x 35	12
120372	Emcon	De Paoli Equip.	Livermore, CA	7 x 35	10
120373	Emcon	Ox Mountain	San Mateo, CA	6 x 35	8
120374	Emcon	Hillside	Colma, CA	5 x 35	8
120376	WMI	ELDA	Cincinnati, OH	9 x 40	12
120379	Emcon	Marsh Road	Menlo Park, CA	4 x 35	8
120385	WMI	Oakland Scavenger	Livermore, CA	9 x 40	12
120394	CID	Settlers Hill	Illinois	8 x 40	10
120396	Emcon	Leichner Bros.	Vancouver, WA	5 x 35	8
120402	Emcon	Junipero Serra	Colma, CA	5 x 40	8
120413	Emcon	Turk Island	Turk Island, CA	5 x 35	8
120420	WMI	Chesnut Ridge	Tennessee	8 x 35	8
120423	Emcon	Hidden Valley	Puyallup, WA	9 x 40	10
120426	BFI	Sunshine Canyon	California	13 x 50	12
120435	Grunau	Pheasant Run	Wisconsin	5 x 35	4
120443	City/Berkeley	City/Berkeley	Berkeley, CA	6 x 35	8
120445	Donahue		Fond Du Lac, WI	5 x 35	
120454	Environ. Res.	Singleton	San Jose, CA	5 x 35	6
120456	WMI	Gulf Coast	Ft. Myers, FL	11 x 40	
120457	BFI		Chicopee, MA	8 x 40	
120469	BFI	E & E Hauling			
120479	BFI	N/A	Fairfax, VA	6.5 x 40	8
120482	BFI	Disposal Spec.	Bellows Falls,VT	8 x 35	8
120483	S.D. Warren	S.D. Warren	Skowhegan, ME	5 x 35	6
120484	WMI	Valley Reclamation	Simi Valley, CA	8 x 40	10
120489	WMI	Valley Trail	Berlin, WI	6.5 x 35	8
120498	BFI	Holmes Road	Memphis, TN	9 x 40	12
120499	BFI	Newco Waste	Linwood, NJ	9 x 35	10
120500	Emcon	Emcon	Puyallup, WA	5 x 24	6
120508	General Elec.	General Electric	Pennsylvania	5 x 35	6
120510	BFI	Little Dixie	Jackson, MS	9 x 40	12
120511	Laidlaw		Plaineville, MA	9 x 40	12
120512	Homer J. Olsen	City of San Fran.	San Francisco, CA	5 x 65	4
120513	Shell Pipeline	Shell Pipeline	Kilgore, TX	5 x 35	6
120522	Laidlaw	Adrian Landfill	Adrian, MI	8 x 35	10
120524	BFI	N/A	Hong Kong	8 x 40	12
120525	WMI	Omega Hills	Menominee Falls	5 x 40	8
120526	BFI	Laubscher Mdws.	Evansville, IN	11 x 40	16
120532	Waste Energy	Valley Landfill	Irwin, PA	10 x 40	12
120533	BFI	Boulder Landfill	Boulder, CO	8 x 35	8
120535	WMI	Lakeview Landfill	Erie, PA	10 x 40	16
120538	WMI	York Landfill	Canada	8 x 35	10
120539	BFI	Chateau Fresno	Fresno, CA	9 x 40	12
120543	Laidlaw	Southeast	Kansas City, MO	8 x 40	12

Job No.	Client	Landfill	Location	Dia./Ht.	Inlet (In.)
120548	Accurate Mech.	East Landfill	DePere, WI	10 x 40	14
		West Landfill	Hobart, WI	8 x 40	12
120549	BFI	Aubrey Hills	Northville, MI	12 x 50	20
120552	BFI	Redbird	St. Louis, MO	9 x 40	12
120553	WMI	Woodlands	South Elgin, IL	9 x 40	12
120554	WMI	Pheasant Run	Bristol, WI	8 x 40	12
120556	Lakeland	Oneida County	Rhinelander, WI	5 x 35	6
120557	J.W. Operating	N/A	Babylon, NY	8 x 40	12
120559	J.W. Operating	Al Turi Landfill	Goshen, NY	9 x 40	12
120563*	WMI	Pottstown	Pottstown, PA	11 x 40	
130364	BFI	Norris Landfill	Baltimore, MD	10 x 40	14

* Refurbish 11' x 40' Flare (originally located at Pompano Beach) and ship to Pottstown, PA. Flare originally sold on Job 120348.

BKD/SPJ/410 - 10/18/90

CONVERSION CALCS FROM #/HR → TONS/YR

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

COMP. BY: K WHITEHEAD
CHK. BY: JAF 6/21/90
DATE: 6-21-90
SHEET NO.:
JOB NO.: 22-092.00

SUBJECT: EAST DUVAL SANITARY LANDFILL
CLOSURE — LANDFILL GAS FLARE

MAXIMUM EMISSIONS (IN LBS/HR) PROVIDED BY KYLE SCHOTTS OF McGILL ENVIRONMENTAL SYSTEMS, INC (918) 445-2431 ON 6-19-90 BASED ON 2100 CFM AND 52% METHANE ASSUMPTIONS.

	EMISSION	
	MAXIMUM LBS/HR	ACTUAL T/YR
CH_4	55.4	242.7
NO_x	5.36	23.48
CO_2	14,621	64,040
CO	23.84	104.42
N_2	88,168	386,176
O_2	15,632	68,468
H_2O	7,188	31,483

EG. CALCULATION: CH_4 = 55.4 LBS/HR
× 24 HRS/DAY
× 365 DAYS/YR

485,304 LBS/YR ÷ $\frac{2000 \text{ LBS}}{\text{TON}}$

= 242.7 TONS/YR

KS [redacted] 3-7-91
SAMPLE CALCS BASED ON PROGRAM.
MIRZA HAS THIS.

ASSUMPTIONS:

Operating Temperature	1,800°F
Destruction Efficiency	98 %
Waste Gas Rate (SCFM)	2,100 cf/min
Methane (CH_4) Content	52 %
Carbon Dioxide (CO_2) Content	48 %
Latent Heat Value (CH_4)	910 BTU/SCF

MAXIMUM HEAT RELEASE:

2,100 cf/min * 60 min/hr * 0.52 CH_4 * 910 BTU/SCF = 59.6 mmBTU/hr

MAJOR COMPONENTS:

CO_2 @ 14,621 lbs/hr
H_2O @ 7,188 lbs/hr
N_2 @ 88,168 lbs/hr
O_2 @ 15,632 lbs/hr

MINOR COMPONENTS:

CO @ 0.4 lbs/mmBTU = 0.4 * 59.6 mmBTU/hr = 23.84 lbs/hr

NOx @ 0.09 lbs/mmBTU = 0.09 * 59.6 mmBTU/hr = 5.36 lbs/hr

Hydrocarbons =

(2,100 cf/min * 0.52 * (1-0.98) * 60 min/hr) = 1,310 cf/hr

(1,310 cf/hr / 379.5 SCF/mol) * 16.04 lbs/mol = 55.4 lbs/hr

THIS IS PROGRAM WHICH MIRZA BAIG HAS A FAX OF

SUMMARY

****
IT/McGILL POLLUTION CONTROL SYSTEMS
TULSA, OKLAHOMA
****

LANDFILL FLARE MATERIAL AND ENERGY BALANCE
WORKSHEET
****

CUSTOMER:PBS&J
JOB NO. :FC-900264
DATE :NOV 13, 1990
DESIGNER:KDS

OPERATING TEMP (F)	1800	ATMOS TEMP (F)	100
EXCESS AIR (%)	25	ATMOS PRESS (PSIA)	14.7
HEAT LOSS (BTU/HR)	600000	RELATIVE HUMID (%)	50

WASTE GAS FLOW RATE (SCFM)	2100	
CH4 CONTENT OF WASTE STREAM (%)	52	REMAINDER ASSUMED CO2!
INLET WASTE STREAM TEMP. (F)	100	

	MOL/HR	LB/HR	RELEASE	DUTY	SENS. HT	PRODUCTS MOL/HR	PRODUCTS LB/HR
WASTE	INLET TEMP (F) =		100		AVG MW =	29.47	
CH4	172.65	2769.73	59.66	26.05	0.05	1820.84	50317.32
CO2	159.37	7013.93	0.00	3.30	0.05	159.37	7013.93
	332.02	9783.65	59.66	29.34	0.09	1980.21	57331.25
AIR FOR WASTE	INLET TEMP (F) =		100		AVG MW =	28.70	
STOCH AIR	1670.29	47945.23	0.00	0.00	0.37	22.10	398.16
EXCSS AIR	417.57	11986.31	0.00	5.43	0.09	417.57	11986.31
	2087.87	59931.5	0.00	5.43	0.46	439.67	12384.46
FUEL	INLET TEMP (F) =		100		AVG MW =	0.00	N/A
0	0.07	3.04	0.00	0.03	0.00	1.78	50.45
AIR FOR FUEL	INLET TEMP (F) =		100		AVG MW =	28.70	
STOCH AIR	1.67	47.81	0.00	0.00	0.00	0.02	0.40
EXCSS AIR	0.42	11.95	0.00	0.01	0.00	0.42	11.95
	2.08	59.77	0.00	0.01	0.00	0.44	12.35
QUENCH AIR	INLET TEMP (F) =		100		AVG MW =	28.70	
QUENCH	1944.95	55829.16	0.00	25.30	0.43	1944.95	55829.16
TOTAL	4366.98	125607.2	59.66	60.11	0.99	4367.05	125607.7

SYSTEM ENERGY BALANCE

SENSIBLE HEAT INTO SYSTEM (MMBTU/HR)		0.99
RELEASE FROM FUEL AND WASTE (MMBTU/HR)	+	59.66
TOTAL HEAT INTO SYSTEM (MMBTU/HR)		60.65
DUTY FOR WASTE PRODUCTS (MMBTU/HR)		60.11
HEAT LOSS THROUGH VESSEL WALLS (MMBTU/HR)	+	0.6
TOTAL HEAT USED UP IN SYSTEM (MMBTU/HR)		60.71

SYSTEM MATERIAL BALANCE

TOTAL MASS INTO SYSTEM (LB/HR)	125607.1
TOTAL MASS OUT OF SYSTEM (LB/HR)	125607.6

COMBUSTION PRODUCTS

	MOL/HR	LB/HR	MOLE %	WT %
CO2	332.2	14621.4	7.6	11.6
H2O	399.0	7187.6	9.1	5.7
N2	3147.4	88167.7	72.1	70.2
O2	488.5	15631.5	11.2	12.4
	4367.1	125608.3		

AVG. MW = 28.763

TOTAL AIR REQD (SCFM) 25520.7 FURNACE ACFS 2001.14
TOTAL AIR REQD (LB/HR) 115820.5
MOLAL HUMIDITY OF ATM AIR (MOL H2O/MOL B.D.A.) = 0.0134

****

MASS BALANCE

****

	TOTAL INLET WASTE RATE MOL/HR	332.0158
1	CH4 IN WASTE MOL/HR	172.6482
	CH4 IN WASTE LB/HR	2769.726
	CO2 IN WASTE MOL/HR	159.3675
	CO2 IN WASTE LB/HR	7013.926
	TOTAL INLET WASTE RATE LB/HR	9783.653
RELATIVE HUMIDITY	ASSUME 1 MOL WET AIR BASIS	
	PARTIAL PRESSURE OF WATER IN WET AIR PSIA	0.1945
	MOLE FRACTION OF WATER IN AIR	0.013231
	BONE DRY AIR MOLE FRACTION	0.986768
	MOLAL HUMIDITY MOL H20/MOL BDA	0.013408
	AVERAGE MW OF AIR LB/MOL	28.70467
	MOLE FRACTION OF N2 IN AIR	0.780040
	MOLE FRACTION OF O2 IN AIR	0.206728
2	STOCH AIR REQUIRED FOR WASTE MOL/HR	1670.293
	STOCH AIR REQUIRED FOR WASTE LB/HR	47945.22
3	EXCESS AIR REQUIRED FOR WASTE MOL/HR	417.5732
	EXCESS AIR REQUIRED FOR WASTE LB/HR	11986.30
4	FUEL FLOW RATE LB/HR	3.036437
MIN FUEL CALCS	FUEL FLOW RATE MOL/HR	0.068869
5	STOCH AIR REQUIRED FOR FUEL MOL/HR	1.665691
	STOCH AIR REQUIRED FOR FUEL LB/HR	47.81314
6	EXCESS AIR REQUIRED FOR FUEL MOL/HR	0.416422
	EXCESS AIR REQUIRED FOR FUEL LB/HR	11.95328
7	QUENCH AIR MOL/HR	1944.949
	LB/HR	55829.16

8 THEORETICAL PRODUCTS OF COMBUSTION OF METHANE

****

		MOL/HR	LB/HR
CO2	WSTCO2PD	172.6482	7598.420
H2O	WSTH2OPD	345.2964	6220.860
N2	WSTN2PD	1302.896	36498.04

****

	TOTAL	1820.841	50317.32
		METHPROD	METHPRLB

THEORETICAL PRODUCTS OF COMBUSTION OF CO2

	MOL/HR	LB/HR
CO2	159.3675	7013.926

	TOTAL THEO PROD OF COMB. OF WASTE	MOL/HR	1980.208
	TOTAL THEO PROD OF COMB. OF WASTE	LB/HR	57331.25
10	EXCESS AIR FOR WASTE IN PRODUCTS	MOL/HR	417.5732
	EXCESS AIR FOR WASTE IN PRODUCTS	LB/HR	11986.30
13	EXCESS AIR FOR FUEL IN PRODUCTS	MOL/HR	0.416422
	EXCESS AIR FOR FUEL IN PRODUCTS	LB/HR	11.95328
9	WATER IN STOCH AIR FOR WASTE IN PROD	MOL/HR	22.10013
	WATER IN STOCH AIR FOR WASTE IN PROD	LB/HR	398.1560
12	WATER IN STOCH AIR FOR FUEL IN PROD	MOL/HR	0.022039
	WATER IN STOCH AIR FOR FUEL IN PROD	LB/HR	0.397059

11 THEORETICAL PRODUCTS OF COMBUSTION OF FUEL

		MOL/HR	LB/HR
CO2	FUCO2PD	0.206607	9.092989
H2O	FUH2OPD	0.275476	4.962980
N2	FUN2PD	1.299307	36.39749
TOTAL		1.781390	50.45346
		MFPRDMOL	MFPRDLB

14	QUENCH AIR	MOL/HR	1944.949
		LB/HR	55829.16

CHECK FOR ACCURACY IN MATERIAL BALANCE

MAIN SYSTEM MAT'L BALANCE EQUATION LB'S MASS BASIS

1 + 2 + 3 + 4 + 5 + 6 + 7 = 8 + 9 + 10 + 11 +12 +13 +14

SYSTEM INPUTS	=	SYSTEM OUTPUTS
TOTAL = 125607.1		TOTAL = 125607.6

****
****
SUMMARY OF TOTAL AIR REQUIREMENTS EXCLUDING ONLY QUENCH AIR

****
ENERGY BALANCE
****

CALCULATE SPECIFIC HEATS OVER RANGES FOR CALCULATIONS

COMPONENT	RANGE OF APPLICABILITY (F)			SPEC HT (BTU/MOL-F
CH4	100	TO	100	8.55232
CO2	100	TO	100	9.169516
CO2 (AVG)	100	TO	1800	12.16430
O2	100	TO	100	7.009529
O2 (AVG)	100	TO	1800	8.013736
N2	100	TO	100	6.89016
N2 (AVG)	100	TO	1800	7.528297
H2O	100	TO	100	7.92664
H2O (AVG)	100	TO	1800	9.28919
AIR	100	TO	100	6.928551
AIR (AVG)	100	TO	1800	7.651950
0	100	TO	100	17.6

1 HEAT CONTAINED IN ENTERING CH4 IN WASTE (MMBTU/HR) 0.047249
HEAT CONTAINED IN ENTERING CO2 IN WASTE (MMBTU/HR) 0.046762

TOTAL HEAT CONTAINED IN WASTE STREAM (MMBTU/HR) 0.094011

2 HEAT RELEASED BY COMBUSTION OF CH4 (MMBTU/HR) 59.65708

3 HEAT CONTAINED IN ENTERING FUEL (MMBTU/HR) 0.000036

4 HEAT RELEASED BY COMBUSTION OF FUEL (MMBTU/HR) 0.06

5 TOTAL INCOMING AIR FLOWRATE (MOL/HR)
FROM MATERIAL BALANCE ADD 2 + 3 + 5 + 6 2089.948

TOTAL HEAT CONTAINED IN ENTERING AIR (MMBTU/HR) 0.463370

6	HEAT IN ENTERING QUENCH AIR WILL BE DETERMINED LATER	
AA	TOTAL OF HEAT INPUTS INTO SYSTEM 1 +2 +3 + 4 + 5	60.27449
7	HEAT LOSS THROUGH VESSEL WALLS (MMBTU/HR)	0.6
8	HT TO RAISE CO2 PRDCD FRM CMB CH4 TO OPTG T (MMBTU/HR)	3.570246
	HT TO RAISE H20 PRDCD FRM CMB CH4 TO OPTG T (MMBTU/HR)	5.452791
	HT TO RAISE N2 PRDCD FRM CMB CH4 TO OPTG T (MMBTU/HR)	16.67460
	HT TO RAISE H20 IN S.A.FOR WST TO OPTG T (MMBTU/HR)	0.348997
	HT TO RAISE CH4 PROD TO OPTINGT	26.04664
	HT TO RAISE CO2 IN WASTE TO OPTING T (MMBTU/HR)	3.295612
	TOTAL HEAT TO RAISE WASTE PROD UP TO OP T (MMBTU/HR)	29.34225
9	HT TO RAISE XCSS AIR FOR CH4 TO OPTINGT (MMBTU/HR)	5.431925
10	HT TO RAISE CO2 PRDCD FRM FUEL TO OP T (MMBTU/HR)	0.004272
	HT TO RAISE H2O PRDCD FRM FUEL TO OP T (MMBTU/HR)	0.004350
	HT TO RAISE N2 PRDCD FRM FUEL TO OP T (MMBTU/HR)	0.016628
	HT TO RAISE H2O IN S.A. FOR FUEL TO OPTG T (MMBTU/HR)	0.000348
	TOTAL HT TO RAISE FUEL PRODUCT TO OP T (MMBTU/HR)	0.025599
11	HT TO RAISE XCSS AIR FOR FUEL TO OP T (MMBTU/HR)	0.005416
BB	TOTAL HEAT IN EXITING PRODUCTS (MMBTU/HR) 7 + 8 + 9 + 10 + 11	35.40519
	DUTY OF QUENCH AIR = BB - AA (MMBTU/HR)	-24.8693
	QUENCH AIR REQUIRED (MOL/HR)	1944.949
	QUENCH AIR REQUIRED (LB/HR)	55829.16
6	HEAT IN ENTERING QUENCH AIR (MMBTU/HR)	0.431221
12	HEAT ABSORBED BY Q.A. IN GOING UP TO OP T (MMBTU/HR)	25.30052

COMPOSITION OF QUENCH AIR

	MOL/HR	LB/HR
O2	402.0757	12866.42
N2	1517.140	42499.64
H20	25.73420	463.6273
**********	**********	**********
TOTAL	1944.949	55829.69

IT McGill
Pollution Control Systems

5800 West 68th Street
Post Office Box 9667
Tulsa, Oklahoma 74157-0667
Telephone: 918-445-2431
FAX: 918-446-3892
Telex: 79-6434

Job _____ Date 3/6/91
For PBS&J
By KOS Sheet 1 of 1
Ck'd _____ Date _____
File _____ Rev _____

* Emission Calculations for Minor Components

* See attached Mat'l & Energy Balance for Major Component emissions (Page 2/2)

Basis: 1800 °F Operating Temp.
8X40 Vessel
2100 SCFM Land Fill Gas
52% Methane
59.6 MMBTU/HR Heat Release (See attached Mat'l & Energy Bal)

Test Data: (Based on Tests on Actual Operating Units)
Min Hydrocarbon Destruction Efficiency = 98%
CO emission rate 0.4 #/MMBTU Released
NO_x " 0.9 #/MMBTU Released

Methane Calculations:

Methane in = $(2100 \text{ SCFM} \times \frac{52}{100} \frac{\text{mol\% Methane}}{}) \div 379.5 \frac{\text{SCF}}{\text{Mol}}$
= 2.878 mol/min
X60 = 172.65 mol/hr

98% of Methane will be destroyed
∴ 2% will be emitted
∴
CH_4 in Flue Gas = .02 X 172.65 $\frac{\text{mol}}{\text{hr}}$ = 3.453 $\frac{\text{mol}}{\text{hr}}$
X16.04 = 55.39 #/hr

∴ **CH_4 Emitted = 55.39 #/hr**

CO Calculations: CO emission rate = 0.4 $\frac{\#\text{ CO}}{\text{MMBTU Released}}$

Heat Release = 59.6 $\frac{\text{MMBTU}}{\text{hr}}$

∴ **CO Emitted = .4 $\frac{\#\text{CO}}{\text{MMBTU}}$ X 59.6 $\frac{\text{MMBTU}}{\text{hr}}$ = 23.84 #/hr**

NO_x Calculations: NO_x emission rate = 0.9 $\frac{\#\text{ NO}_x}{\text{MMBTU Released}}$

∴ **NO_x Emitted = .9 $\frac{\#\text{NO}_x}{\text{MMBTU}}$ X 59.6 $\frac{\text{MMBTU}}{\text{hr}}$ = 53.64 #/hr**

****
MCGILL ENVIRONMENTAL SYTEMS INCORPORATED
TULSA, OKLAHOMA
****

LANDFILL FLARE MATERIAL AND ENERY BANLANCE
WORKSHEET
****

CUSTOMER:PBS&J
JOB NO. :

DATE :MARCH 6, 1991
DESIGNER:K. SHOTTS

OPERATING TEMP (F)	1800	ATMOS TEMP (F)	100
EXCESS AIR (%)	25	ATMOS PRESS (PSIA)	14.7
HEAT LOSS (BTU/HR)	600000	RELATIVE HUMID (%)	50

WASTE GAS FLOW RATE (SCFM) 2100
CH4 CONTENT OF WASTE STREAM (%) 52 REMAINDER ASSUMED CO2!
INLET WASTE STREAM TEMP. (F) 100

Landfill Gas Heat Release

	MOL/HR	LB/HR	RELEASE	DUTY	SENS. HT	PRODUCTS MOL/HR	PRODUCTS LB/HR
WASTE	INLET TEMP (F) =		100		AVG MW =	29.47	
CH4	172.65	2769.73	59.66	26.05	0.05	1820.84	50317.32
CO2	159.37	7013.93	0.00	3.30	0.05	159.37	7013.93
	332.02	9783.65	59.66	29.34	0.09	1980.21	57331.25
AIR FOR WASTE	INLET TEMP (F) =		100		AVG MW =	28.70	
STOCH AIR	1670.29	47945.23	0.00	0.00	0.37	22.10	398.16
EXCSS AIR	417.57	11986.31	0.00	5.43	0.09	417.57	11986.31
	2087.87	59931.5	0.00	5.43	0.46	439.67	12384.46
FUEL	INLET TEMP (F) =		100		AVG MW =	0.00	
0	0.07	3.04	0.00	0.03	0.00	1.78	50.45
AIR FOR FUEL	INLET TEMP (F) =		100		AVG MW =	28.70	
STOCH AIR	1.67	47.81	0.00	0.00	0.00	0.02	0.40
EXCSS AIR	0.42	11.95	0.00	0.01	0.00	0.42	11.95
	2.08	59.77	0.00	0.01	0.00	0.44	12.35
QUENCH AIR	INLET TEMP (F) =		100		AVG MW =	28.70	
QUENCH	1944.95	55829.16	0.00	25.30	0.43	1944.95	55829.16
TOTAL	4366.98	125607.2	59.66	60.11	0.99	4367.05	125607.7

SYSTEM ENERGY BALANCE

SENSIBLE HEAT INTO SYSTEM (MMBTU/HR)		0.99
RELEASE FROM FUEL AND WASTE (MMBTU/HR)	+	59.66
TOTAL HEAT INTO SYSTEM (MMBTU/HR)		60.65
DUTY FOR WASTE PRODUCTS (MMBTU/HR)		60.11
HEAT LOSS THROUGH VESSEL WALLS (MMBTU/HR)	+	0.6
TOTAL HEAT USED UP IN SYSTEM (MMBTU/HR)		60.71

SYSTEM MATERIAL BALANCE

TOTAL MASS INTO SYSTEM (LB/HR)	125607.1
TOTAL MASS OUT OF SYSTEM (LB/HR)	125607.6

COMBUSTION PRODUCTS

major component Emissions

	MOL/HR	LB/HR	MOLE %	WT %
CO2	332.2	14621.4	7.6	11.6
H2O	399.0	7187.6	9.1	5.7
N2	3147.4	88167.7	72.1	70.2
O2	488.5	15631.5	11.2	12.4
	4367.1	125608.3		

AVG. MW = 28.763

TOTAL AIR REQD (SCFM) 25520.7 FURNACE ACFS 2001.14
TOTAL AIR REQD (LB/HR) 115820.5
MOLAL HUMIDITY OF ATM AIR (MOL H2O/MOL B.D.A.) = 0.0134

PBS&J
POST, BUCKLEY, SCHUH & JERNIGAN, INC.

ENGINEERING
PLANNING

November 12, 1992

Mr. Steve Smallwood, P.E.
Director - Bureau of Air Regulation
Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

RE: EAST DUVAL SANITARY LANDFILL
FDER File No. AC 16-186047
Equivalent Flare Notification

Dear Mr Smallwood:

On behalf of the City of Jacksonville, Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) submits the following information for the East Duval Sanitary Landfill's enclosed flare system.

In accordance with Specific Condition No. 1 of the Construct/Operate Air Pollution Source Permit No. AC-186047, PBS&J requests written approval on an equivalent flare.

The Engineer has reviewed LFG Specialties, Inc. Model No. EF840S4 and has found it to be an equal to IT-McGill Model No. EGF-60.

Please contact our office if you should have comments or questions. I will look forward to your response.

Sincerely,

Karl A Schmit

Karl Schmit, E.I.
Project Engineer
Solid Waste Division

cc: [redacted] Hamaker/City of Jacksonville
[redacted] E. Hilton/PBS&J

KS/cla/FLARESC

07-421.05