

NOV 05 1993

State of North Carolina
Department of Environment,
Health and Natural Resources



James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary

November 2, 1993

Mr. David Thompson
Henderson Co. Manager
100 N. King Street
Hendersonville, NC 28739

Fac/Perm/Co#D #	Date	Doc ID#
45-01	7/19/90	DIN 14434

RE: Methane Gas Remediation at Henderson County Landfill

Dear Mr. Thompson:

It has been determined that the plans submitted to the North Carolina Solid Waste Section for installation of a methane gas migration control system at the Henderson County Landfill (Permit #45-01) are adequate. A compliance date of January 1, 1994 has been established for this system to be installed and operational.

Please call me at 704/251-6208 if you have any questions.

Sincerely,

James E. Patterson
Waste Management Specialist

cc: Julian Foscue
Jan McHargue
Jim Coffey
Eldon Owen



September 29, 1993

Mr. Gary Ahlberg
Solid Waste Section
Division of Solid Waste Management
PO Box 27687
Raleigh, NC 27611-7687

Ref: Phase I, Landfill Gas Migration Assessment and
Monitoring Program, Landfill Gas Remediation Plan,
Stony Mountain Road Landfill, Henderson County, NC.

Dear Mr. Ahlberg:

We have concluded the captioned Phase I Program and would like to provide you with a copy of our report and supportive field data. This package of material includes the following:

1. Our engineers report on the program with recommendations for corrective action;
2. A report of two weeks continuous monitoring of the landfill;
3. A report of well monitoring for the months of July and August. September's report will be ready in one week, and results will be forwarded to your office;
4. A permeability report of core samples taken from five perimeter wells, provided by Core Labs;
5. A Landfill Gas generation model projecting emission rates for the next 15 years;
6. A specification sheet on the Landfill Gas testing equipment employed in our program; and,
7. A conceptual plan indicating three landfill zones requiring active migration control to achieve compliance limits at specific perimeter monitor points.

There are several important aspects of our work which I would like to briefly highlight.

1. Three areas on the landfill have been identified which exceed the compliance limits of 40 CFR 258.23, of the Federal Code, and 15A NCAC 13B .1626 paragraph (4), of the North Carolina Code, both dealing with **Explosive Gases Control**. The affected areas include the northern boundary centered on perimeter monitor well MP-5, the northwest perimeter at MP-4, and the area underlying the Animal Shelter at MP-2.

2. The estimated daily Landfill Gas (LFG) generation rate is 450,000 Standard Cubic Feet (SCF) per day from approximately 770,000 tons of impounded waste. This LFG rate should peak in the year 2000 at 650,000 SCF per day. If another 300,000 tons of waste is added over the next three years, then the LFG rate should peak at 1,000,000 SCF per day by the year 2006.

3. Vacuum pressure tests were used to calculate impoundment permeability at well site LP-6 (3.2×10^{-3} power). This information together with core analysis (enclosed) from 5 monitor wells indicate sufficient permeability to allow for relative ease of gas migration, unless inhibited by surface features or subsurface structures.

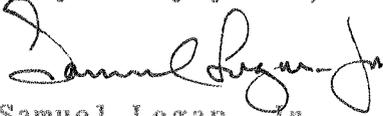
4. To affect control of gas migration at the specified zones and to reduce perimeter gas concentrations to compliance limits, protective vacuum barriers under the influence of LFG wells should be installed. Gas production from these wells should equal approximately 60% of the generation rate of the landfill to achieve desired control. The primary means of destroying the gas should be with a flare. Produced liquids should be destroyed by spray injection into the flare shroud. Once control has been established and compliance limits achieved, gas marketing may prove feasible as a means of remediation cost subsidy.

5. The remediation system should initially employ a variable speed electric motor and controls powering a positive displacement blower with output in the 500 CFM range at 10-12 psig. The gas flare should be sized with turn down capability to accommodate the entire range of blower output. Maximum operating temperature of the flare should be 1850 degrees Fahrenheit, and allow sufficient retention time to achieve 98% destruction of Volatile Organic Compounds.

6. Flared gas should be measured by digital flow meter. Several additional monitor wells should be sited and installed. All monitor wells should be tested daily at the commencement of remedial operations until monitor wells are within limits. Thereafter monitor wells should be tested weekly to assure continued compliance.

We are concluding our agreements with Henderson County before beginning the actual design and construction of the proposed system. When our first draft of plans and specifications is completed, we will provide same to you for comment. We hope to commence remedial operations early in the second quarter of 1994. Should you have any question or comments on our work thus far, or with what has been outlined above, please advise.

Very truly yours,



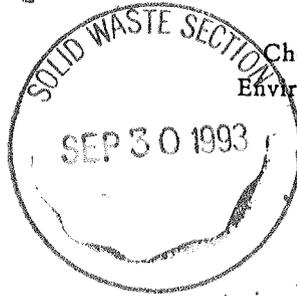
Samuel Logan, Jr.
President

cc: David Thompson, Henderson County, NC
Gary Tweed, Lapsley and Associates
Jim Clarkson, Cargan
Henry Barton, Cargan

enclosure

SCHRANZE & ASSOCIATES

A Professional Company



Chemical Engineering
Environmental Consulting

MEMORANDUM

17 July 1993

To: CARGAN RESOURCES, INC.
P.O. Box 1078
Camden, SC 29020
Attention: Mr. Skip Logan

From: Benjamin A. Schranze, P.E. *Benjamin A. Schranze*
Subject: Design Concept for the Landfill Gas Remediation Program
For the Hendersonville County Landfill, NC;
Project J9325

1.0 SUMMARY

Based on test information supplied by CARGAN RESOURCES on the Subject Landfill and through participation in testing on 7 and 8 July 1993, design information is developed for use in the implementation of a gas extraction system needed for remediation purposes.

2.0 OBJECTIVES

The prime objective of this remediation system will be to prevent off-site migration of gas generated at the landfill. A secondary objective is to provide sufficient flexibility in the gas extraction system so as to accommodate commercial uses of the gas when a market is subsequently developed.

3.0 REMEDIATION REQUIREMENTS

Three potential migration points have been uncovered in the test program:

MEMORANDUM: Henderson County Landfill Gas Remediation Program
SCHRANZE to CARGAN RESOURCES, 17 July 1993
J9325-01

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- 1) At the northern boundary of the site, approximately at the location of Test Well MP5,
- 2) At the north-western area of the site (west of the access road), approximately at the location of Test Well MP4, and
- 3) At the south-western portion of the site, at the Animal Shelter, as evidenced by data taken from Test Well MP2.

Gas migration is not in evidence at the southern boundary of the site near the Supervisor's Office and the Community Center (via measurements taken at Test Well MP1), nor is expected because of the depression in the site topography formed between parallel sections of the access road in this area. Additionally, gas migration is not expected to the east of the site because of the underlying geology and naturally increasing elevations of the topography as one proceeds eastward into the "borrow" area.

4.0 GAS PRODUCTION POTENTIAL

Landfill gas generation involves the anaerobic decomposition and reformation of organic matter within the impounded material in the landfill. The general parameters which affect such generation involve: temperature, moisture, volatile organic content of the impounded material, and chemical content, some of which may inhibit, and others which may encourage gas production. In addition, the mass of the impounded waste, its time of emplacement, and its distribution around the site will affect current and future gas generation levels.

Assuming a "base" elevation of 2270 feet above mean sea level, as shown in the W. G. LAPSLEY & ASSOCIATES topographical drawing of the site, the total fill volume is calculated to be 2,149,740 cubic yards. Assuming that lifts of eight feet in depth have been used, incorporating daily cover thickness amounting to 1/2 foot, and with an existing top cover of two feet, the net impounded volume of municipal solid waste is estimated to be 1,981,800 cubic yards. For an uncompacted waste density of 800 pounds per cubic foot, the mass of waste is calculated to be 792,718 tons. LAPSLEY has indicated that the figure is closer to 770,000 tons.

Since the landfill has been operating for a period of ten (10) years, and assuming a year-to-year placement rate which increases linearly from an initial level of 100 tons per day, to a current rate of 350 tons per day, the annual waste placement history is calculated, as shown in Table 1.

TABLE 1 - ESTIMATED ANNUAL WASTE EMPLACEMENT RATES

<u>Year</u>	<u>Daily Rate, TPD</u>	<u>Annual Rate, TPY</u>
1983	100	31,200
1984	125	39,000
1985	150	46,800
1986	175	54,600
1987	200	62,400
1988	225	70,200
1989	250	78,000
1990	275	85,800
1991	300	93,600
1992	325	101,400
1993	350	109,200
TOTAL		<u>772,200 Tons</u>

In general, gas is generated by the activity of anaerobic and facultative micro-organisms, which, in reality, consist of several types of spores and bacterial cultures. The persistence and hardiness of these micro-organisms explain why anaerobic processes are so pervasive around the world.

Initially, secreted enzymes derived from these spores as well as from other bacteria, convert complex organic compounds into soluble forms. For this activity, the presence of moisture is mandatory, and the rate of such conversion appears directly proportional to the amount of moisture contained within the impoundment. The solubilized compounds are then transformed into organic acids and simpler organic compounds by these organisms, and carbon dioxide (or carbonic acid in hydrated form) is also produced as a result of respiration of these organisms. The organic acids are then transformed into methane and additional carbon dioxide, and more complex forms of organic acids by so-called methane-former spores.

Predicting the amount of gas generated within an impoundment is difficult because of the variability and complexity of the anaerobic process and the inadequacy of field data. However, there are three approaches to landfill gas production modeling currently in vogue:

- a) Kinetic Analysis - using the growth rate of the micro-organism population, employing empirically-derived yield rate coefficients;

b) Curve Fit Analysis - which assumes a parabolic or exponential gas production rate vs. time relationship; and

c) Finite Difference Analysis - which simulates gas flow through the impoundment.

All approaches require field correlation for the various operating parameters and the computed results. However, the Kinetic Analysis is the most commonly used technique, and will be used in this analysis.

Using the Eberhardt Kinetic Algorithm:

$$G = (L_0/2) \exp[-k_1 (t_{1/2})]$$

where G is the methane produced up to time $t_{1/2}$,

L_0 is the total methane produced until the cessation of anaerobic activity, and

k_1 is the maximum rate of organic material utilization per unit mass of micro-organisms.

A two-step model is used in which the first step involves gas generation limited by the size of the micro-biol population and proportional to the amount of gas already produced. This analysis accommodates gas production estimates from the time the waste has been impounded (and the from the time that the accompanying free oxygen is consumed by aerobic processes), to the time where peak methane generation occurs (expressed by time, $t_{1/2}$).

In the second step, methane gas production is assumed to drop off in an inverse exponential function of time, from the point of peak gas generation until a time where such gas generation ceases. It is convenient to employ an expression which uses the ratio of such methane gas generation to the peak value:

$$(G/G_p) = \exp[-k_2 (t-t_{1/2})]$$

For the "usual" municipal solid waste composition (observed over many landfill gas production program studies) and for an average moisture content of 40%, by weight:

Peak generation of methane occurs 5-1/4 years after impoundment at a rate of 0.163 standard cubic feet of methane per pound of waste per year,

"Intermediate" gas generation occurs 16-1/4 years after impoundment at a rate of 0.0571 scf/lb/yr, and

Methane gas generation essentially stops after 29 years.

However, the Hendersonville Landfill exhibits a "dry" characteristic which may significantly reduce gas generation rates at any particular time. Assuming an average moisture content of 25%, reworking of the Kinetic equations provide the following:

PEAK METHANE GENERATION OCCURS 6-3/4 YEARS AFTER IMPOUNDMENT AT A RATE OF 0.102 SCF/LB/YR, AND

AN INTERMEDIATE RATE OCCURS 20.6 YEARS AFTER IMPOUNDMENT AT A RATE OF 0.0357 SCF/LB/YR.

Using the waste deposit rates shown in Table 1, augmented by a postulated future waste deposit rate through 1997:

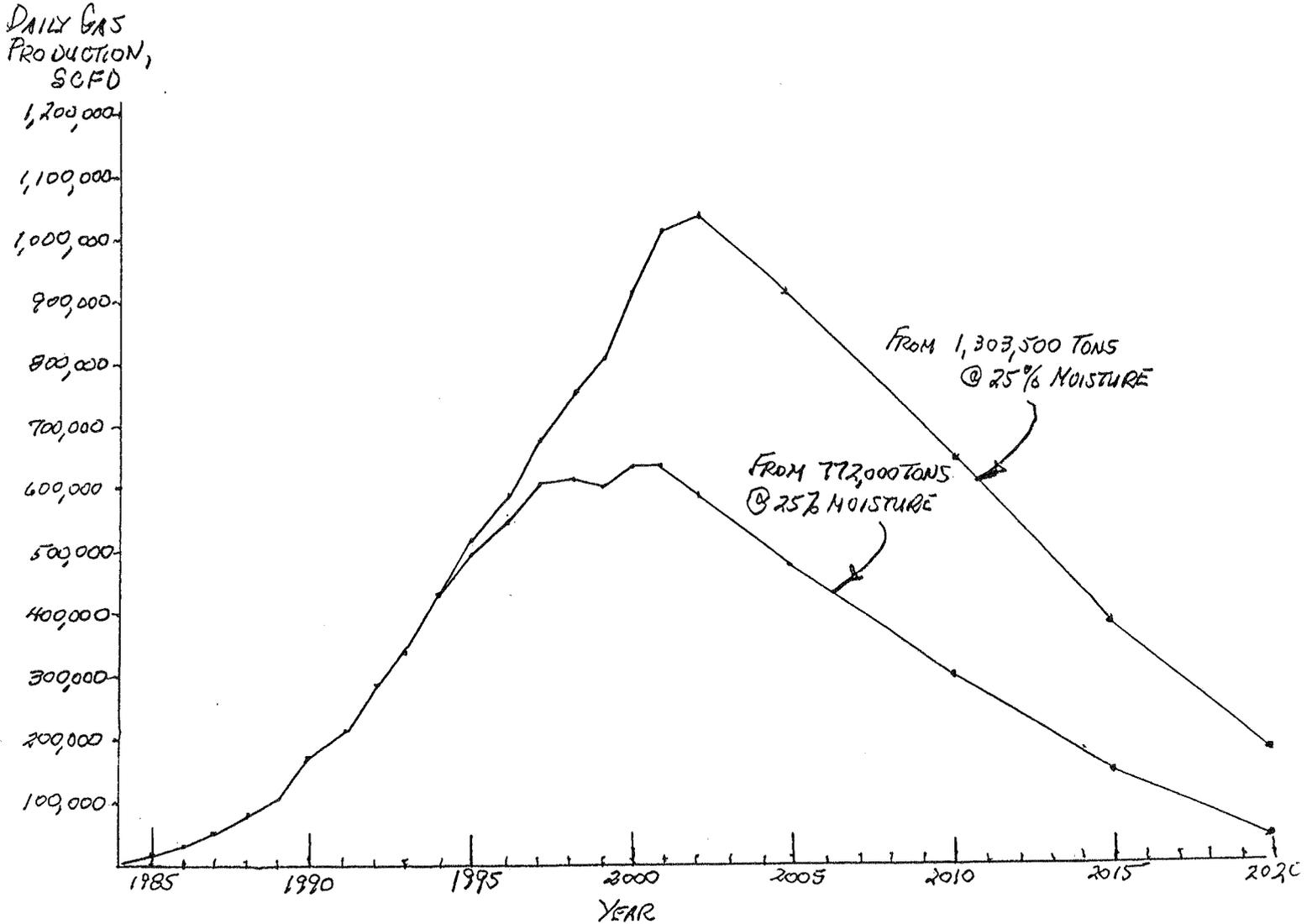
1994	117,800 tons emplaced
1995	127,400
1996	137,600
1997	148,600;

Figure 1 shows the total landfill gas generation potential expected year-by-year for two cases:

- 1) Where the landfill operation ceases in 1993, leaving a total impounded waste level of 772,000 tons, and
- 2) Where an additional 531,500 tons of waste are deposited through 1997.

It is to be noted that the gas generation values refer to the total gas generated, consisting of 54% methane, by volume, 2% moisture (at ambient temperature), and 44% carbon dioxide. Also note that the gas production units are expressed in terms of standard cubic feet per day (scfd).

FIGURE 1 - ESTIMATED LANDFILL GAS GENERATION RATES
AT THE HENDERSONVILLE COUNTY (NC) LANDFILL



Computed peak generation levels of about 650,000 scfd (total gas) is expected in the years 2000 to 2001 if no additional waste is desposited; whereas, as much as 1,050,000 scfd could be generated by the year 2003 if the additional waste is deposited. Gas generation is expected to cease by the years 2023 and 2027, respectively.

5.0 LANDFILL PERMEABILITY ESTIMATES

Test Wells LP4 and LP6 were designated for special testing to be used to:

- a) Verify the gas current gas production rate,
- b) Define the gas permeability of the impounded waste, and
- c) Define the gas permeability of the existing cover material.

As noted in the CARGAN RESOURCES Test Plan, LP6 was used to draw out the gas at various rates, with LP4 (about 100 feet distant) used to measure the corresponding pressure (or vacuum) level.

The subsequent modeling of the resultant test information employs the ASME algorithm for restricted flow:

$$(q_1/A_2) = (CY/\rho_{01}) [2g(p_1 - p_2)\rho_{01}]^{1/2}$$

where subscript 1 refers to upstream conditions,
subscript 2 refers to downstream conditions,
Y is the expansion factor (A value of 1.0 is used herein.),
q is the volumetric flow rate,
A is the equivalent flow area,
p is the pressure level,
rho is the density of the flowing fluid, and
C is the discharge coefficient, recognizing that gas has an
equivalence to water of about 0.6

Since "permeability" is commonly characterized in terms of water movement velocities (q_1/A_2) in cm/sec, the equivalent gas discharge coefficients (C) are estimated to be:

Water Permeability, cm/sec	Gas Discharge Coefficient, C
10 ⁻⁷	1.938x10 ⁻⁹
10 ⁻⁶	1.938x10 ⁻⁸
10 ⁻⁵	1.938x10 ⁻⁷
10 ⁻⁴	1.938x10 ⁻⁶

Working with a gas density level of 0.0723 lb/cu.ft. (at standard conditions), the gas flow through the borehole of the LP6 well can be expressed by:

$$(q_1/A_2)_{we11} = 29.85(C)[(p_1-p_2)]^{1/2}$$

where $(q_1/A_2)_{we11}$ is expressed in ft/sec, and p_1 and p_2 are expressed in lb/sq.ft.

THE CORRESPONDING PERMEABILITY OF THE IMPOUNDMENT WAS FOUND TO BE 3.2X10⁻³ CM/SEC, WATER EQUIVALENT.

Using the maximum measured extracted gas flow from LP6 immediately prior to air "breakthrough" of 40 scfm, a change in pressure measured at LP4, 100 feet away, was 0.20 inch, water column (i.e., from 0.5",wc to 0.3",wc).

THIS INDICATED THAT THE RADIUS OF INFLUENCE AROUND LP6 WAS 167 FEET.

THIS ALSO INDICATED THAT THE CURRENT TOTAL GAS PRODUCTION RATE IS APPROXIMATELY 292 SCFM, OR 420,700 SCFD.

The predicted gas production rate for mid-1993 (as illustrated in Figure 1), is about 400,000 scfd, a favorable comparison with the analyzed test data.

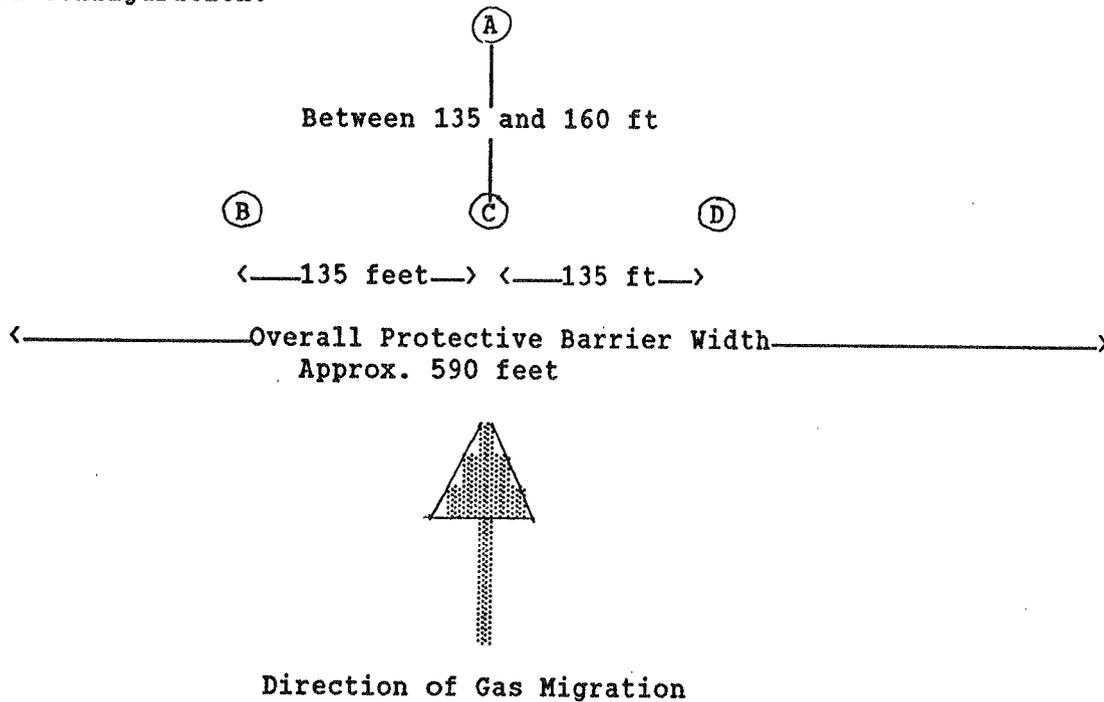
FINALLY, THE TEST DATA INDICATED THAT THE COVER PERMEABILITY HAS A WATER FLOW EQUIVALENCE OF 5.7X10⁻⁶ CM/SEC.

6.0 DESIGN REQUIREMENTS

The system will contain a remediation wellfield, buried gas transport lines and manifolding, a single positive displacement gas extraction blower controlled by a variable speed, three-phase electric motor, an air-inspirated flare and related pilot flame facilities, and associated startup and flame safety equipment. The remediation gas collection rate will be nominally 323 scfm, for gas containing as much as 25% induced air (6-1/4% oxygen). The flare will dispose of this extracted gas in an environmentally-acceptable manner, and both the extraction blower and flare will accommodate a flow up to 750 scfm, when needed.

6.1 Wellfield

Three (3) locations at the site are to be protected by each of four (4) gas extraction wells. In general, three wells are to be located upstream of the potential gas migration flow, with a single well located at the point where gas migration was evidenced in the testing program, in the following plan configuration:



Well "A" can be MP5, MP4, and MP2 at each of the three locations, even if they are only 20 ft. in depth and use a 2 inch well casing. Wells B, C, and D should be drilled using bore holes > 24 inches in diameter, and should employ 4 inch diameter casing. It would also be worthwhile to add several existing landfill wells to the system by hookup to the well head. These include LP3 and LP2. Thus, the total well compliment for remediation will consist of fourteen wells, including:

Nine (9) new (larger) wells for barrier protection,

Three (3) existing MP wells (MP2, MP4, and MP5),

Two (2) existing LP wells (LP2 and LP3).

New well construction will involve the use of Schedule 40 PVC piping, solid down to a depth of 10 feet, or more, below which perforated piping will be used to the bottom of the well. It is preferable to employ at least one (1) a slip coupling in the piping per well, in order to accommodate potential landfill subsidence. In general, solvent welding will be used to join the various pipe sections.

Each well will contain a wellhead fixture to be used to measure gas flow, as well as to allow periodic gas sampling. A high-g geared valve will be used to allow accurate "balancing" of flows at each well during operation, and such valving shall allow for total flow cutoff when required for maintenance purposes. It is important to allow at least ten pipe diameters upstream of the flow sampling port and five pipe diameters downstream, in a straight section, without bends in the flow passage nor obstructions, in order to provide valid velocity and flow readings.

For wells which may be subsequently covered by solid waste during future landfill operations, affected wellhead fixtures will be replaced (at that time) with a straight connection to the gas transmission line. The fixture will then be relocated to an access box in an area which will be free from future fill operations and away from vehicular access roads, in order to continue unhindered sampling and measurement activities on a periodic basis. Care must be exerted when the the top of the well is buried, in order to prevent casing rupture and subsequent loss of the well.

6.2 Gas Transmission Lines and Manifolding

Each well will be connected to a high-density polyethylene (PE) gas transmission line, nominally 1-1/2 inch in diameter. A flexible connector will be used at the wellhead interface in order to allow for some movement due to future subsidence. The line will be buried to a point below the frost line, nominally 24 inches. Magnetic tape will be installed above the line (also buried) for future location purposes.

Care will be taken to minimize undue water "trapping" during the installation of these lines. For each 27 inches of vertical height change in the gas flow direction, one (1) inch of mercury, vacuum, must be applied by the extraction blower in order to prevent water trapping. It is important to install the PE lines so as to allow the gas to flow in a generally downward direction.

The individual PE gas transmission lines will be connected to PVC manifolding via mechanical couplers, using suitable clamps, PVC "saddles", and barb connectors. No PE fusing is required in the field during installation. The PVC manifolding, which will include 4 inch and 6 inch diameter, Schedule 40 piping, will be buried in areas not expected to be influenced by landfill subsidence: near the access roads and downstream toward the blower and flare station.

This technique of employing small, flexible gas transmission lines in the fill proper, and larger PVC manifolding near access roads and in "virgin" ground, has been used for more than six years in three other gas extraction projects without undue maintenance and operating problems.

6.3 Knock-out Pot

A sealed knockout pot will be located at the end of the manifolding, at the blower and flare station. An insulated 150 gallon capacity tank will be used, containing water level actuators and cutoff switches, a submerged-type sump pump and a drain line. Its function is to trap and separate any leachate and condensate which may be extracted with the gas. When a pre-set level is reached the sump pump will be activated and the waters will be pumped through a check valve and toward a suitable disposal location. When the resultant water level is reduced down to another preset level, the pump will cutoff.

Access ports will be provided for inspection and maintenance purposes, but the pot shall be capable of containing up to 11 inches, mercury, in vacuum. The entire tank and exposed drain line will be heat-traced and insulated in order to prevent freezing during winter-time shut-down.

6.4 Extraction Blower

A positive displacement, vane-type blower (Cooper DuroFlow Series 4500, or equivalent) will be used to apply vacuum to the wellfield through the manifolding and gas transmission lines, collect and pressurize the extracted gas, and discharge it to the downstream flare. This blower will initially be required to handle as little as 240 scfm gas, providing a discharge pressure as low as 0.3 psig, and as much as 750 scfm gas, providing a discharge pressure as high as 15 psig, for subsequent sale of the gas when a market is found and to handle as much gas as may be generated on-site. This will be accommodated using a variable speed control. Lower speed operation will be used for the initial remediation requirement, with higher speeds to satisfy future extraction requirements.

6.5 Flare

An air-inspirated flare will be located at the blower-flare station, but it will be physically downstream from the blower by at least 50 feet. Any trees or brush within seventy-five (75) feet from the flare will be cleared for safety reasons.

The flare employs a spark-ignited propane pilot to provide pilot flame ignition on startup. Landfill gas is subsequently used for continuing pilot flame operation during steady operation. The pilot is fed by a high pressure inspirated-air venturi mixer, and mixture controls are fitted in order to produce and maintain a stable pilot flame under any operating condition, including startup. Suitable high voltage ignitors are employed to produced appropriate sparking for flame ignition.

The flare is designed to handle gas flow variations of eight to one (8:1), as well as to accommodate high levels of intruded air (down to the higher flammability limit). Its construction will be of steel, with any surfaces exposed to heat, of stainless steel (type 300 series). The flare will not require any variable shutter facilities and will be capable of handling 24 million Btu per hour of combustion heat. Maximum surface operating temperatures will be 1,850 degrees F, or lower (at the flare nozzle discharge plane).

6.6 Controls

A weather-proofed NEMA-approved control cabinet will be located near the blower and will contain the necessary monitoring and electrical control equipment. A second cabinet will be installed at the base of the flare and will contain the ignition transformers (for pilot light-off) and the control thermocouple distribution wiring.

The controls to be provided in this system include:

- Pilot thermocouple and control transmitter,
- Main flame duplexed thermocouple and dual transmitters, for ignition cutoff control and high temperature shutdown control,
- Startup timer, with automatic shutdown if main flame is not proven within a selectable time interval,
- Automatic restart timer, to allow proper purge time to pass prior to restart after an inadvertant external power failure,
- Pilot gas duplexed shutoff valving and feed lines: to provide propane gas on startup and landfill gas (tapped at the blower discharge) when steady operation is reached,
- High vacuum cutoff control,
- High blower discharge temperature cutoff control,
- Blower motor controllers, including high current and temperature cutoff control,
- Knock-out pot water level and pump actuation controls, including an activation cycle counter,
- Heat tracing temperature monitoring and electrical activation controls.

Flame arrestors will be fitted in the gas line feeding the flare, as well as the pilot gas line feeding the pilot flame nozzles. Both pilot and main gas lines will be fitted with automatic shutoff valves. The main gas line will also contain manual control valves (mountd fore and aft of the blower) for appropriate pressure balancing of the system, when needed. Additionally, vacuum and pressure gages will be fitted for diagnostic purposes.

Since the total amount of gas which will be extracted and flared (or subsequently sold) is of interest for tax credit (and billing) purposes, the system will be fitted with a flow monitoring unit with the capability to provide instantaneous and integrated flow readout. Ports will also be provided to provide a calibration check of measured flows as well as to periodically monitor methane and oxygen content of the gas.

CORE LABORATORIES
929 Howard Avenue, New Orleans, LA 70113

Cms 300 Report

Prepared by
Rick Hahn
Laboratory Supervisor

for
Skip Logan

CARSAN RESOURCES

June 29, 1993

CORE LABORATORIES - NEW ORLEANS

COMPANY: CARSEN RESOURCES
 SITE : LANDFILL PERIMETER
 FIELD :
 LOCATION: SOUTH CAROLINA

FILE NO : 57161-11317ACN
 DATE : 29-Jun-93
 ANALYST : TP/RH

CMS 300 REPORT 1.5 INCH PLUGS

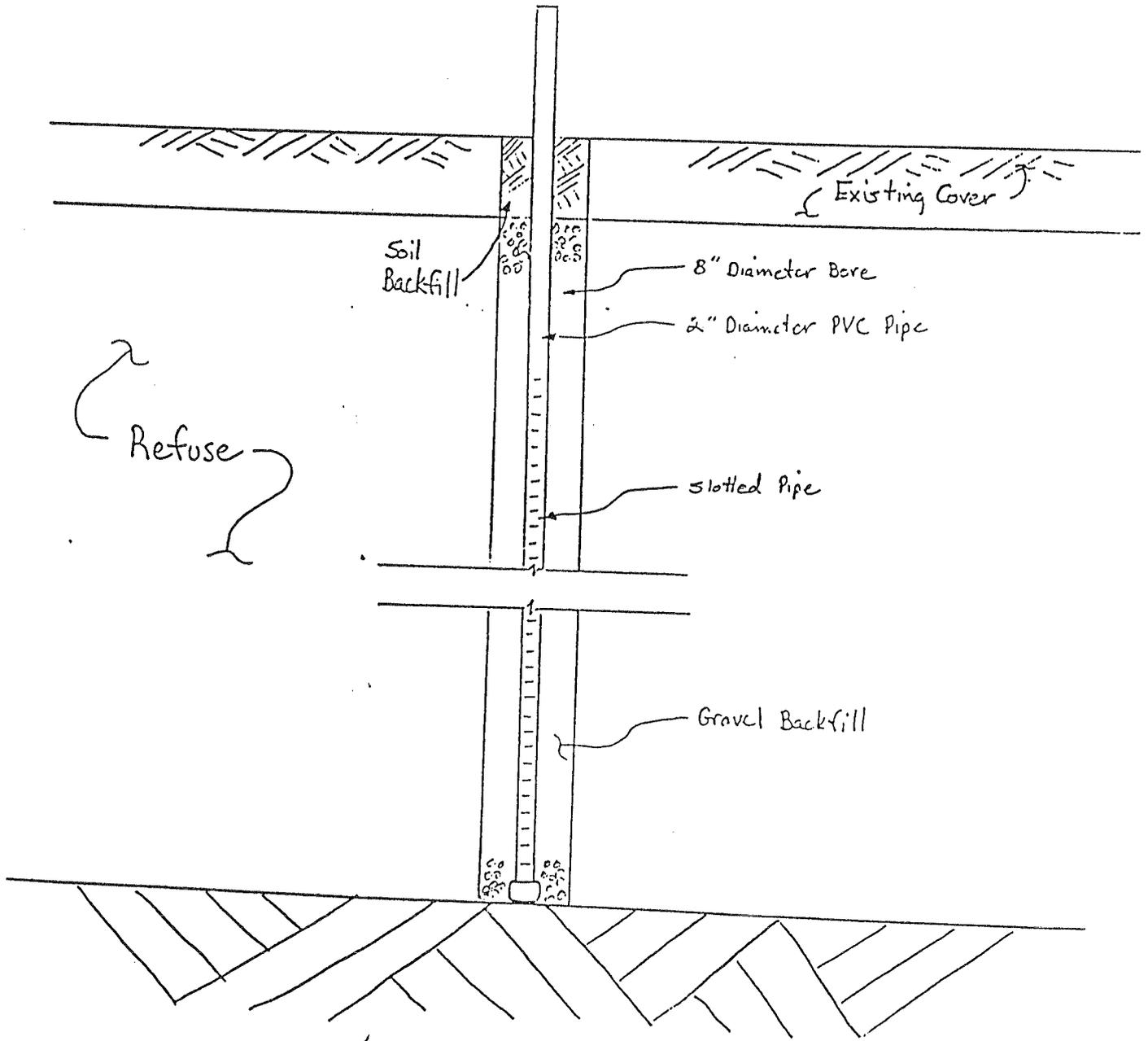
Sample I.D.	Sample Depth feet	Confining Stress psig	Adjusted PV cc	Porosity Helium %	K _{air} md	K _{gr} md	b factor psig	Beta ft-1	Grain Density gm/cc
MP-1	NA	500	12.34	36.2	268.00	289.00	3.730E+00	5.170E+06	2.64
MP-2	NA	500	12.76	37.5	560.00	586.00	2.120E+00	5.440E+06	2.63
MP-3	NA	500	13.12	36.2	285.00	307.00	3.520E+00	5.540E+06	2.65
MP-4	NA	500	6.44	29.3	18.30	22.50	1.239E+01	2.640E+08	2.67
MP-6	UNABLE TO OBTAIN PLUG								

NOTES:

NET CONFINING STRESSES PROVIDED BY CARSEN RESOURCES
 EQUIPMENT CALIBRATION AND CHECKS PERFORMED AND VERIFIED
 EQUIPMENT USED : SVP, CMS300, VACUUM OVEN

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ATTACHMENT I
CROSS SECTION LANDFILL MONITOR WELL



PERIMETER
MONITOR WELL
DATA

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

LEL MONITORING
WELL NUMBER: MP 1

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
6/22/1102	2	0.1	20.7	79.2	29.26
6/23/1201	0	0	20.6	78.8	27.88
6/24/1430	0	0	19.8	79.2	27.97
6/25/0910	0	0	20.9	79.1	28.02
6/26/2129	0	0	20.7	79.3	27.84
6/27/1323	0	0	20.6	79.4	27.83
6/28/1841	0	0	20	80	27.79
6/29/1230	0	0	19.3	80.7	27.79
6/30/1239	0	0	20.1	79.9	30.09
7/01/1244	0	0	20.3	79.7	27.84
7/02/1625	0	0	19.8	79.2	27.80
7/03/1145	0	0	19.3	80.7	0.00
7/04/0907	0	0	19	81	0.00
7/05/1500	0	0	18.4	81.6	0.00

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

LEL MONITORING
WELL NUMBER: MP 2

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
6/22/1033	802	40.1	6.6	53.3	29.26
6/23/0822	810	40.5	5.5	54	27.88
6/24/1435	810	40.5	5.3	54.2	27.97
6/25/0730	830	42	5.1	52.9	28.02
6/26/2025	834	41.7	5.7	52.6	27.84
6/27/1156	838	41.9	5.5	52.6	27.83
6/28/1700	952	48.1	3	48.9	27.79
6/29/1100	806	40.4	5.3	54.3	27.79
6/30/1319	736	36.8	7.1	56.1	30.09
7/01/1132	688	34.4	7.2	58.4	27.84
7/02/1530	900	44.8	4.2	51	27.80
7/03/1030	870	43.7	4.5	51.8	27.85
7/04/0817	710	35.8	5.8	58.4	27.89
7/05/1400	848	42.6	4.5	52.9	27.86

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

LEL MONITORING

WELL NUMBER: MP 3

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
6/22/1102	0	0.6	20.2	79.2	29.26
6/23/1208	0	0	20.4	79.6	27.88
6/24/1435	0	0	20.4	79.6	27.97
6/25/0850	2	0.01	18.6	79.4	28.02
6/26/2137	0	0	20.7	79.3	27.84
6/27/1336	0	0	20.7	79.3	27.83
6/28/1825	0	0	20	80	27.79
6/29/1300	0	0	19.8	80.2	27.79
6/30/1305	0	0	20.5	79.5	30.09
7/01/1227	0	0	20.2	79.8	27.84
7/02/1635	0	0	19.1	80.9	27.80
7/03/1200	0	0	18.8	81.2	27.85
7/04/0925	0	0	19	81	27.89
7/05/1515	0	0	17.1	82.9	27.86

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

LEL MONITORING
WELL NUMBER: MP 4

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
6/22/1117	0	0	20.8	79.2	29.26
6/23/1212	232	11.6	5.3	83.1	27.88
6/24/1440	534	26.4	0.1	73.5	27.97
6/25/0900	0	0	20.4	79.6	28.02
6/26/2142	12	0.6	19.5	79.9	27.84
6/27/1341	6	0.3	19.9	79.8	27.83
6/28/1835	0	0	20.1	79.9	27.79
6/29/1255	8	0.4	19	80.6	27.79
6/30/1300	0	0	20.4	79.6	30.09
7/01/1231	0	0	20.2	79.8	27.84
7/02/1640	376	18.6	1.02	80.3	27.80
7/03/1156	64	3.2	15.5	81.3	27.85
7/04/0920	30	1.5	17.8	80.7	27.89
7/05/1510	354	17.7	4.5	77.8	27.86

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

LEL MONITORING
WELL NUMBER: MP 5

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
6/22/1125	>1000	57	0.4	42.6	29.26
6/23/1247	>1000	56.6	0	43.4	27.88
6/24/1440	>1000	57.3	0	42.7	27.97
6/25/0750	>1000	56.8	0	43.2	28.02
6/26/2044	>1000	58.2	0	41.8	27.84
6/27/1231	>1000	58.1	0	41.9	27.83
6/28/1825	>1000	56.3	0	43.7	27.79
6/29/1155	>1000	56.1	0	43.9	27.79
6/30/1342	>1000	56.4	0	43.6	30.09
7/01/1148	>1000	55.6	0	44.4	27.84
7/02/1551	>1000	56	0	44	27.80
7/03/1100	>1000	55.4	0	44.6	27.85
7/04/0920	>1000	57.4	0	42.6	27.89
7/05/1421	>1000	56.3	0	43.7	27.86

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

LEL MONITORING
WELL NUMBER: MP 6

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
6/22/1129	0	0	20.5	79.5	29.26
6/23/1242	0	0	19.9	80.1	27.88
6/24/1445	0	0	20.4	79.6	27.97
6/25/0905	0	0	19.8	80.2	28.02
6/26/2150	0	0	20.6	79.4	27.84
6/27/1329	0	0	20.2	79.8	27.83
6/28/1835	0	0	19.8	80.2	27.79
6/29/1245	0	0	20.4	79.6	27.79
6/30/1244	0	0	20.2	79.8	30.09
7/01/1238	0	0	20.2	79.8	27.84
7/02/1630	0	0	20.1	79.9	27.80
7/03/1150	0	0	19.5	80.5	27.85
7/04/0914	0	0	19.7	80.3	27.89
7/05/1421	0	0	19.5	80.5	27.86

LANDFILL WELL DATA

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

WELL NUMBER: LP1

DAY/TIME	% CH4	%O2	%CO2	% BAL GAS	TEMP F	DIF PRESS	FLDW RATE CUBIC FT	BTU CUBIC FT
6/22/1350	59.6	0.3	40.1	0	72	0.06	< 1	603
6/23/1353	56.3	0	43.7	0	72	0	< 1	569
6/24/1720	57.5	0	42.5	0	80	0	< 1	578
6/25/0735	57.7	0	42.3	0	64	0	< 1	575
6/26/2136	58.2	0	40.8	1	66	0	< 1	588
6/27/1213	59.1	0	43.9	0	70	0	6.7 cfm	598
6/28/1715	57.5	0	42.5	0	72	0.04	5 cfm	581
6/29/1110	56.1	0.4	43.6	0	72	0	5 cfm	569
6/30/1331	56.8	0	43.2	0	74	0.02	2cfm	574
7/01/1139	58.5	0	41.5	0	76	0.03	3cfm	592
7/02/1540	55.7	0	44.3	0	73	0	8cfm	563
7/03/1050	55.9	0	43.1	0	71	0	8cfm	566
7/04/0825	57.4	0	42.6	0	68	0	8cfm	574
7/05/1405	53.3	0	41.4	5.3	78	0	8cfm	539

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

WELL NUMBER: LP 2

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE		BTU CUBIC FT
							CFM		
6/22/1319	58.2	0.7	41.1	0	72	0	< 1		589
6/23/1347	55.6	0	44.4	0	78	0	< 1		562
6/24/1725	57.5	0	42.5	0	80	0	< 1		573
6/25/0750	57.8	0	42.2	0	64	0	< 1		575
6/26/2140	58.9	0	38.5	2.6	77	0	< 1		596
6/27/1217	59.6	0	37.6	3.3	70	0	< 1		603
6/28/1720	57.3	0	42.7	0	80	0	5		560
6/29/1117	57.4	0	42.6	0	82	0	< 1		578
6/30/1337	56.7	0	43.3	0	75	0	< 1		573
7/01/1145	58.2	0	41.8	0	88	0	< 1		588
7/02/1546	56.8	0	43.2	0	85	0	< 1		571
7/03/1100	56.1	0	43.9	0	85	0	< 1		557
7/04/0835	57.1	0	42.9	0	80	0	< 1		570
7/05/1415	57.1	0	42.9	0	100	0	< 1		577

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

WELL NUMBER: LP 3

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE CFM	BTU CUBIC FT
6/22/1237	56.9	1.5	41.6	0	74	0.04	< 1	576
6/23/1341	55.9	0	44.1	0	76	0	< 1	565
6/24/1730	56.8	0	43.2	0	79	0.02	< 1	569
6/25/0800	56.6	0	43.4	0	66	0	< 1	566
6/26/2049	58.6	0	41.2	0.02	74	0	< 1	593
6/27/1226	58.6	0	41	0.4	78	0	< 1	593
6/28/1746	56.1	0	43.9	0	79	0.04	4	569
6/29/1125	55.6	0	44.4	0	82	0	< 1	567
6/30/1348	56.1	0	43.9	0	75	0	< 1	567
7/01/1212	57.2	0	42.8	0	85	0	< 1	578
7/02/1549	55.3	0	44.7	0	87	0	< 1	559
7/03/1109	51.1	0	48.9	0	82	0	< 1	550
7/04/0845	57.1	0	42.9	0	78	0	< 1	568
7/05/1420	55.3	0	44.7	0	90	0	< 1	556

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

WELL NUMBER: LP 4

DAY/TIME	% CH4	%O2	%CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE		BTU CUBIC FT
							CFM		
6/22/1205	57	1.4	41.6	0	74	0.06	< 1		576
6/23/1320	56.4	0	43.6	0	74	0.04	< 1		566
6/24/1740	57.5	0	42.5	0	80	0.03	< 1		578
6/25/0805	57.9	0	42.1	0	76	0	< 1		578
6/26/2049	58.6	0	41.7	0	72	0	< 1		590
6/27/1243	58.5	0	41.5	0	80	0	< 1		592
6/28/1800	56.9	0	43.1	0	73	0	< 1		571
6/29/1130	55.9	0	44.1	0	79	0	< 1		561
6/30/1359	56.1	0	43.9	0	76	0.01	< 1		576
7/01/1201	57.4	0	42.6	0	78	0	< 1		580
7/02/1600	55.4	0	44.6	0	80	0	< 1		560
7/03/1120	54.1	0	45.9	0	79	0	< 1		553
7/04/0855	56.6	0	43.4	0	75	0	< 1		570
7/05/1431	54.8	0	45.2	0	82	0	< 1		551

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

WELL NUMBER: LP 5

DAY/TIME	% CH4	%O2	%CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	BTU
							CFM	CUBIC FT
6/22/1146	57.4	1.1	41.5	0	76	0.06	< 1	581
6/23/1333	55.1	0	44.9	0	77	0.04	< 1	557
6/24/1745	56.5	0	43.5	0	81	0.01	< 1	568
6/25/0810	56.5	0	43.5	0	80	0	< 1	568
6/26/2101	57.3	0	42.7	0	75	0	< 1	580
6/27/1252	57.2	0	42.8	0	79	0	5.6	578
6/28/1805	56.3	0	43.7	0	70	0	< 1	569
6/29/1135	55.9	0	44.1	0	72	0	< 1	558
6/30/1403	55.3	0	44.7	0	73	0.04	2	559
7/01/1206	56.5	0	43.5	0	79	0.01	< 1	575
7/02/1608	54.7	0	45.3	0	81	0.01	< 1	553
7/03/1115	54.4	0	45.5	0	80	0.02	2	545
7/04/0850	56.6	0	43.4	0	75	0	< 1	570
7/05/1435	55	0	45	0	80	0	< 1	550

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE, JUNE 22 THROUGH JULY 5, 1993

WELL NUMBER: LP 6

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE CFM	BTU CUBIC FT
6/22/1139	57.5	1	41.5	0	74	0.07	< 1	582
6/23/1234	57.1	0	42.9	0	74	0.46	< 1	573
6/24/1815	55.4	0	44.6	0	79	0	< 1	562
6/25/0812	56.9	0	43.1	0	69	0	< 1	570
6/26/2136	58.2	0	40.8	1	66	0	< 1	588
6/27/1237	57.6	0	42.4	0	72	0	4.2	582
6/28/1752	55.4	0	44.6	0	80	0.03	3	559
6/29/1140	55.1	0	44.9	0	81	0	< 1	554
6/30/1355	56.3	0	43.7	0	75	0	< 1	569
7/01/1156	57.2	0	42.8	0	77	0.02	2	578
7/02/1610	54.7	0	45.3	0	84	0	< 1	540
7/03/1124	54.5	0	45.5	0	80	0	< 1	546
7/04/0855	56.6	0	43.4	0	79	0	< 1	568
7/05/1445	54.2	0.2	45.6	0	82	0	< 1	542

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA



MONITORING SCHEDULE: August, 1993

LEL MONITORING
WELL NUMBER: MP 1

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
8/6/1149	0	0	19.7	80.2	27.79
8/13/1150	0	0	19.9	79.8	27.96
8/19/1517	0	0	20.8	78.9	27.86
8/26/1123	0	0	17.8	79.5	27.87

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

LEL MONITORING
WELL NUMBER: MP 2

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
8/6/1214	942	47.1	3.7	49.2	28.44
8/13/1234	>1000	50.2	1.8	48	27.96
8/19/1449	996	49.8	1.7	48.5	27.86
8/26/1101	>1000	56	0.9	43.1	27.87

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

LEL MONITORING
WELL NUMBER: MP 3

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
8/6/1155	0	0	19.5	80.5	27.79
8/13/1210	0	0	19.7	80.3	27.96
8/19/1454	2	0.1	20.8	79.1	27.86
8/26/1107	2	0.1	17.4	82.5	27.87

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

LEL MONITORING
WELL NUMBER: MP 4

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
8/6/1202	0	0	19.1	80.9	27.79
8/13/1215	0	0	19.4	80.6	27.96
8/19/1502	0	0	20.8	79.2	27.86
8/26/1202	0	0	19.1	80.9	27.79

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

LEL MONITORING
WELL NUMBER: MP 5

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
8/6/1243	>1000	55.8	0	44.2	27.79
8/13/1238	>1000	54.9	0	45.1	27.96
8/19/1544	>1000	56.3	0	43.7	27.86
8/26/1137	>1000	57.5	0.2	42.3	27.87

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

LEL MONITORING
WELL NUMBER: MP 6

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
8/6/1142	0	0	19.6	80.4	27.79
8/13/1156	0	0	21	79	27.96
8/19/1510	0	0	21	79	27.86
8/26/1137	0	0	19.8	80.2	27.87

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

WELL NUMBER: LP1

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS " Hg.	FLOW RATE CUBIC FT/Min	BTU CUBIC FT
8/06/1221	57.8	0	42.2	0	82	0.02	2	584
8/13/1245	58.1	0	41.9	0	78	0.02	2	587
8/19/1611	57.5	0	42.5	0	79	0.03	3	581
8/26/1115	58.6	0	41.4	0	74	0.04	4	592

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

WELL NUMBER: LP 2

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	BTU
						" Hg.	CUBIC FT/Min	CUBIC FT
8/6/1229	53.1	0.8	38.1	8	84	0	0	537
8/13/1252	52.9	0.9	37.8	8.4	82	0	0	535
8/19/1616	51.9	1.8	38.7	7.6	83	0	0	525
8/26/1128	58.4	0.4	41.2	0	81	0	0	591

HENDERSOM COUNTY LANDFILL
HENDERSOM COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

WELL NUMBER: LP 3

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	BTU
							CFM	CUBIC FT
8/6/1239	56.3	0	43.7	0	85	0	0	569
8/13/1301	56.4	0	43.6	0	88	0	1	570
8/19/1608	57.2	0	42.8	0	88	0.01	1	578
8/26/1140	56.9	0.2	42.9	0	79	0	0	575

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

WELL NUMBER: LP 4

DAY/TIME	% CH4	XO2	XC02	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	BTU
							CFM	CUBIC FT
8/6/1255	56	0	44	0	79	0.01	2	566
8/13/1308	56.1	0	43.9	0	81	0.01	2	567
8/19/1555	55.6	0	44.4	0	79	0	< 1	562
8/26/1143	56.4	0	43.6	0	79	0	0	570

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

WELL NUMBER: LP 5

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	
							CFM	BTU CUBIC FT
8/6/1306	55.7	0	44.3	0	82	0.02	3	563
8/19/1604	55.4	0	44.6	0	83	0.02	4	560
8/13/1315	56	0	44	0	83	0.3	4	566
8/26/1306	55.7	0	44.3	0	82	0.2	3	563

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: August, 1993

WELL NUMBER: " LP 6

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	BTU
							CFM	CUBIC FT
8/6/1318	56	1	44	0	80	0.01	< 1	566
8/13/1322	56.4	0	43.6	0	79	0.01	1	570
8/19/1558	55.9	0	44.1	0	78	0.1	1	565
8/26/1150	57.2	0.2	42.6	0	70	0	0	578

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NORTH CAROLINA
LANDFILL GAS GENERATION MODEL

Parameters:

First Year: 1983 Hours per year: 8760
Current Year: 1993
Tons in place: 700000 7E+05
Methane (CH4) % by vol 56%
Carbon Dioxide % by volume: 44%
Anticipated closure: December 1997
Average annual deposition to date: 56000 tons

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1 Year	2 Empoundment Cum Tons	3 CH4 Emissions Tons per Yr.	4 CH4 Emissions/Yr. Std. Cubic Ft.	5 Production/YR. Std. Cubic Ft.
1983	42,545	102	5,956,000	3,275,800
1984	88,908	211	12,330,000	6,781,500
1985	139,817	329	19,210,000	10,565,500
1986	195,272	455	26,600,000	14,630,000
1987	255,272	592	34,370,000	18,903,500
1988	319,090	727	42,720,000	23,495,000
1989	387,271	883	51,420,000	28,281,000
1990	459,998	1,041	60,580,000	33,319,000
1991	536,361	1,204	70,080,000	38,544,000
1992	617,270	1,375	80,100,000	44,055,000
1993	702,724	1,636	95,330,000	52,431,500
1994	793,633	1,895	110,000,000	60,500,000
1995	893,633	2,147	125,000,000	68,750,000
1996	1,003,633	2,395	139,500,000	76,725,000
1997	1,003,633	2,348	136,700,000	75,185,000
1998	1,003,633	2,301	134,000,000	73,700,000
1999	1,003,633	2,255	131,300,000	72,215,000
2000	1,003,633	2,211	128,700,000	70,785,000
2001	1,003,633	2,167	126,200,000	69,410,000
2002	1,003,633	2,125	123,700,000	68,035,000
2003	1,003,633	2,082	121,200,000	66,660,000
2004	1,003,633	2,041	118,880,000	65,384,000
2005	1,003,633	2,001	116,500,000	64,075,000
2006	1,003,633	1,961	114,200,000	62,810,000
2007	1,003,633	1,922	111,900,000	61,545,000
2008	1,003,633	1,885	109,700,000	60,335,000

Assumptions:

CH4 generation potential: 7000 cubic feet per ton dry weight.
Volume 5 and 6 projected remediation system annual CH4 production efficiency: 35%



Capacity: 1,000,000 tons
 Projected deposition rate till closure: 109,710 tons per year

6	7	8	9	10	11
CH4 Ave/3Yr Interval Std. Cubic Ft.	Annual MMBtu	Hourly MMBtu	LFG Emissions/Yr Std. Cubic Ft.	LFG Daily Emissions Std. Cubic Ft.	LFG Hourly Emissions Std. Cubic Ft.
3,352,433	3,322	0.38	11,029,630	30,218	1,259
6,874,267	6,876	0.78	22,833,333	62,557	2,507
10,659,000	10,713	1.22	35,574,074	97,463	4,061
14,699,667	14,835	1.69	49,259,259	134,957	5,623
19,009,833	19,168	2.19	63,648,148	174,378	7,266
23,560,167	23,825	2.72	79,111,111	216,743	9,031
28,365,333	28,677	3.27	95,222,222	260,883	10,870
33,381,333	33,785	3.86	112,185,185	307,357	12,807
38,639,333	39,084	4.46	129,777,778	355,556	14,815
45,010,167	44,672	5.10	148,333,333	406,393	16,933
52,328,833	53,166	6.07	176,537,037	483,663	20,153
60,560,500	61,347	7.00	203,703,704	558,092	23,254
68,658,333	69,713	7.96	231,481,481	634,196	26,425
73,553,333	77,799	8.88	258,333,333	707,763	29,490
75,203,333	76,238	8.70	253,148,148	693,557	28,898
73,700,000	74,732	8.53	248,148,148	679,858	28,327
72,233,333	73,226	8.36	243,148,148	666,159	27,757
70,803,333	71,776	8.19	238,333,333	652,968	27,207
69,410,000	70,382	8.03	233,703,704	640,284	26,679
68,035,000	68,987	7.88	229,074,074	627,600	26,150
66,693,000	67,593	7.72	224,444,444	614,916	25,622
65,373,000	66,299	7.57	220,148,148	603,146	25,131
64,089,667	64,972	7.42	215,740,741	591,071	24,628
62,810,000	63,689	7.27	211,481,481	579,401	24,142
61,563,333	62,407	7.12	207,222,222	567,732	23,656
40,626,667	61,180	6.98	203,148,148	556,570	23,190



HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

LEL MONITORING
WELL NUMBER: MP 1

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
7/08/1320	0	0	19.6	80.4	28.44
7/15/1312	0	0	20.3	78.3	28.14
7/23/1215	0	0	19.6	80.4	27.88
7/30/0727	0	0	19.9	77.5	27.99

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

LEL MONITORING
WELL NUMBER: MP 2

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BARDMETRIC PRESS
7/08/1255	664	37.1	0.2	62.7	28.44
7/15/1255	>1000	50.1	2.5	47.4	28.14
7/23/1059	>1000	50.1	2.5	47.4	27.88
7/30/0610	998	49.9	2.7	47.4	27.91

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

LEL MONITORING
WELL NUMBER: MP 3

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
7/08/1245	0	0	20.3	79.7	28.44
7/15/1322	2	0.1	19.7	80.2	28.14
7/23/1142	0	0	20.3	79.7	27.88
7/30/0710	0	0	20.3	79.7	27.99

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

LEL MONITORING

WELL NUMBER: MP 4

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
7/08/1251	178	8.9	5.6	85.5	28.44
7/15/1252	198	9.8	7.6	82.6	28.14
7/23/1148	168	8.4	6.1	85.5	27.88
7/30/0715	182	9.1	5.8	85.1	27.90

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

LEL MONITORING
WELL NUMBER: MP 5

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
7/08/1225	>1000	55	0	45	28.44
7/15/1232	>1000	55.4	0	44.6	28.14
7/23/1115	>1000	56.3	0	43.7	27.88
7/30/0631	>1000	57.1	0	42.9	27.99

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

LEL MONITORING
WELL NUMBER: MP 6

DAY/TIME	% LEL	%CH4	%O2	% BAL GAS	BAROMETRIC PRESS
7/08/1312	0	0	19.3	80.7	28.44
7/15/1316	0	0	20.6	79.4	28.14
7/23/1201	0	0	19.3	80.7	27.88
7/30/0721	0	0	19.8	80.2	27.99

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

WELL NUMBER: LP1

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS " Hg.	FLOW RATE CUBIC FT/Min	CUBIC FT	BTU
7/08/1312	59.6	0.3	40.1	0	72	0.06	8		603
7/15/1217	56.5	0	43.5	0	79	0.03	8		571
7/23/1106	57.1	0	42.9	0	75	0.04	8		577
7/30/0617	58.6	0	41.4	0	74	0.04	6		592

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

WELL NUMBER: LP 2

DAY/TIME	% CH4	%O2	%CO2	% BAL GAS	TEMP F	DIF PRESS " Hg.	FLOW RATE CUBIC FT/Min	BTU CUBIC FT
7/08/1330	58.2	0.7	41.1	0	72	0.02	4	589
7/15/1222	56.2	0	42.3	1.5	90	0.02	5	568
7/23/1111	57.4	0	42.6	0	86	0.02	4	580
7/30/0621	57.9	0	42.1	0	88	0.03	4	587

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

WELL NUMBER: LP 3

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	
							CFM	BTU CUBIC FT
7/08/1335	56.9	1.5	41.6	0	74	0.04	4	576
7/15/1227	55.1	0	44.9	0	88	0.04	4	557
7/23/1119	55.3	0	44.7	0	87	0.01	2	559
7/30/0626	57	0	43	0	87	0.02	3	576

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

WELL NUMBER: LP 4

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	BTU
							CFM	CUBIC FT
7/08/1340	57	1.4	41.6	0	74	0.06	< 1	576
7/15/1240	53.7	0	46.3	0	79	0.02	2	543
7/23/1130	54.6	0	45.4	0	78	0	< 1	552
7/30/0644	57.5	0	42.5	0	77	0.01	2	581

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

WELL NUMBER: LP 5

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	BTU
							CFM	CUBIC FT
7/08/1345	57.4	1.1	41.5	0	76	0.03	3	581
7/15/1246	53.8	0	46.2	0	83	0.03	3	544
7/23/1134	54.7	0	45.3	0	79	0	2	553
7/30/0652	56.9	0	43.1	0	79	0.01	2	575

HENDERSON COUNTY LANDFILL
HENDERSON COUNTY, NC
LANDFILL GAS REMEDIATION PROJECT
PHASE I, WELL DATA

MONITORING SCHEDULE: JULY, 1993

WELL NUMBER: LP 6

DAY/TIME	% CH4	% O2	% CO2	% BAL GAS	TEMP F	DIF PRESS	FLOW RATE	BTU
							CFM	CUBIC FT
7/08/1350	57.5	1	41.5	0	74	0.01	< 1	582
7/15/1237	53.9	0	46.1	0	80	0.01	1	545
7/23/1125	55.5	0	44.5	0	86	0	2	561
7/30/0638	57.9	0	42.1	0	87	0.03	3	585

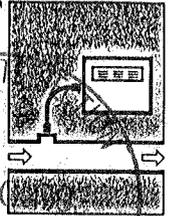


LANDTEC

LANDFILL CONTROL TECHNOLOGIES

GEMTM
Series 500

METERING/INSTRUMENTATION
Gas Extraction Monitor



GEM-500 Integrates Nine Landfill Gas Field Instruments with On-Board Computer

Versatile Analyzer Simplifies LFG Monitoring and Control

The GEM-500 was specifically designed by Landfill Control Technologies (LANDTEC) for use on landfills to monitor landfill gas (LFG) migration control systems, gas collection systems, flares, migration probes, LEL levels, subsurface fires, and more.

The light-weight, portable unit links nine field instruments with an on-board computer. The versatile monitor provides landfill technicians with an array of analysis and computation functions. The results can be stored and later down-loaded to a personal computer to provide error-free data management.

Multi-Functional Features

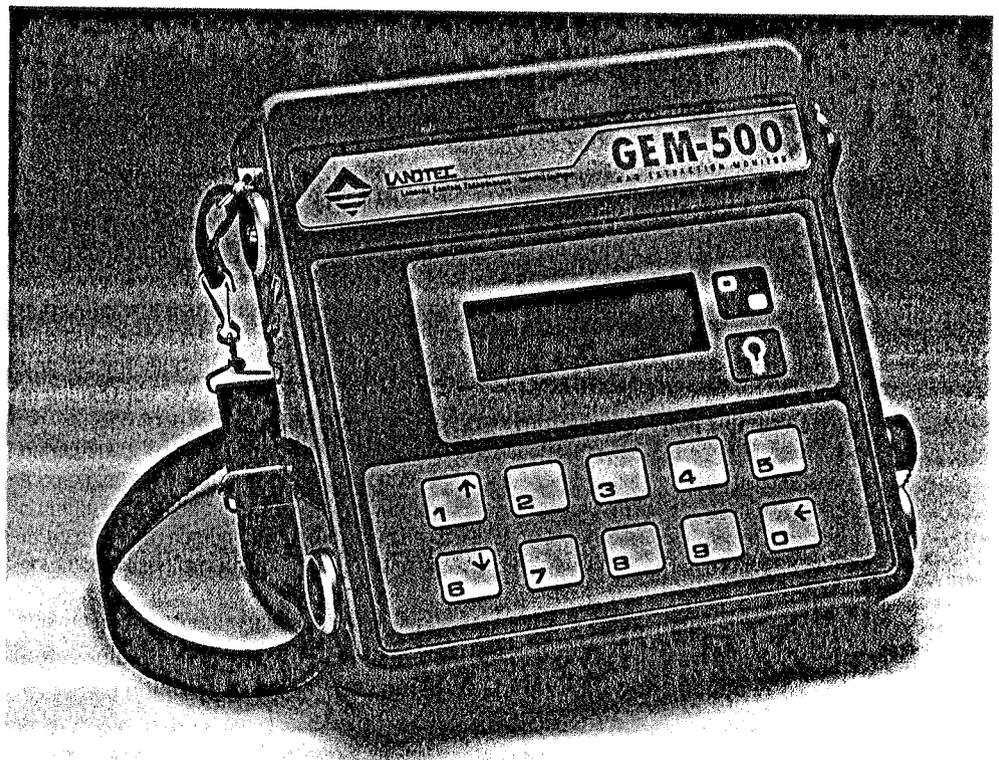
The GEM-500 automatically samples and analyzes the methane, carbon dioxide and oxygen content of landfill gas. The easy to read LCD screen shows the results as percentages of CH₄, CO₂, O₂ and "balance" gas (typically nitrogen). The GEM-500 also calculates and displays gas flow rate, Btu content, temperature, pressures and LEL (Lower Explosive Limit).

In addition, the user can recall prior data stored at up to 500 monitoring points for contrast with current data. Alarms can easily be set for methane, oxygen and temperature measurements.

The GEM-500 can automatically calculate gas flow rates, adjusted to standard temperature and pressure. The results can be displayed in either Imperial (USA) or SI (metric) units.

LANDTEC'S versatile GEM-500 can be used on orifice plate and Pitot tube meters, but most effectively on LANDTEC's Accu-Flo wellheads, which incorporates a built-in, precalibrated gas flow meter and quick-connect sample ports.

The Accu-Flo wellhead and GEM-500 were designed to work together to expedite information required by environmental regulations.



Rugged, User Friendly Design

The GEM-500 is an all-weather, self-contained portable monitor which uses a self-compensating infrared gas analyzer, rechargeable power supply for all day use, an internal sample pump capable of drawing a gas sample at up to 70" vacuum.

An easy to follow on-screen menu guides the operator through the sampling process which can be completed in less than a minute. I.D. codes allow the user to store and recall the last set of measurements for each monitoring point. Preset maintenance codes can be used to note field work required. The stored data can be later retrieved or down-loaded to a personal computer for use in a database, such as LANDTEC's LFG management software.

Time Saving Conveniences

Users will readily appreciate the built-in, time-saving conveniences provided by the GEM-500. Instead of fumbling with data sheets, temperature gauges, Pitot tubes, methane/oxygen/carbon dioxide analyzers, pressure gauges, calculators and other field equipment, the GEM-500 provides it all, and more, in an easy to carry light-weight case.

LANDTEC's Family of Landfill Products

The GEM-500 is part of a family of products developed by LANDTEC for the landfill industry. These products are based on a decade of corporate operating and regulatory experience at multiple sites by LANDTEC's parent, Pacific Energy.

Asbestos Disposal Site
(Inactive)

Waste Fill Area
Base Line

Existing Permit
Exp Elevation 2410

Existing
Sedimentation
Pond

Existing
Main Access
To Be Converted
To Terrace

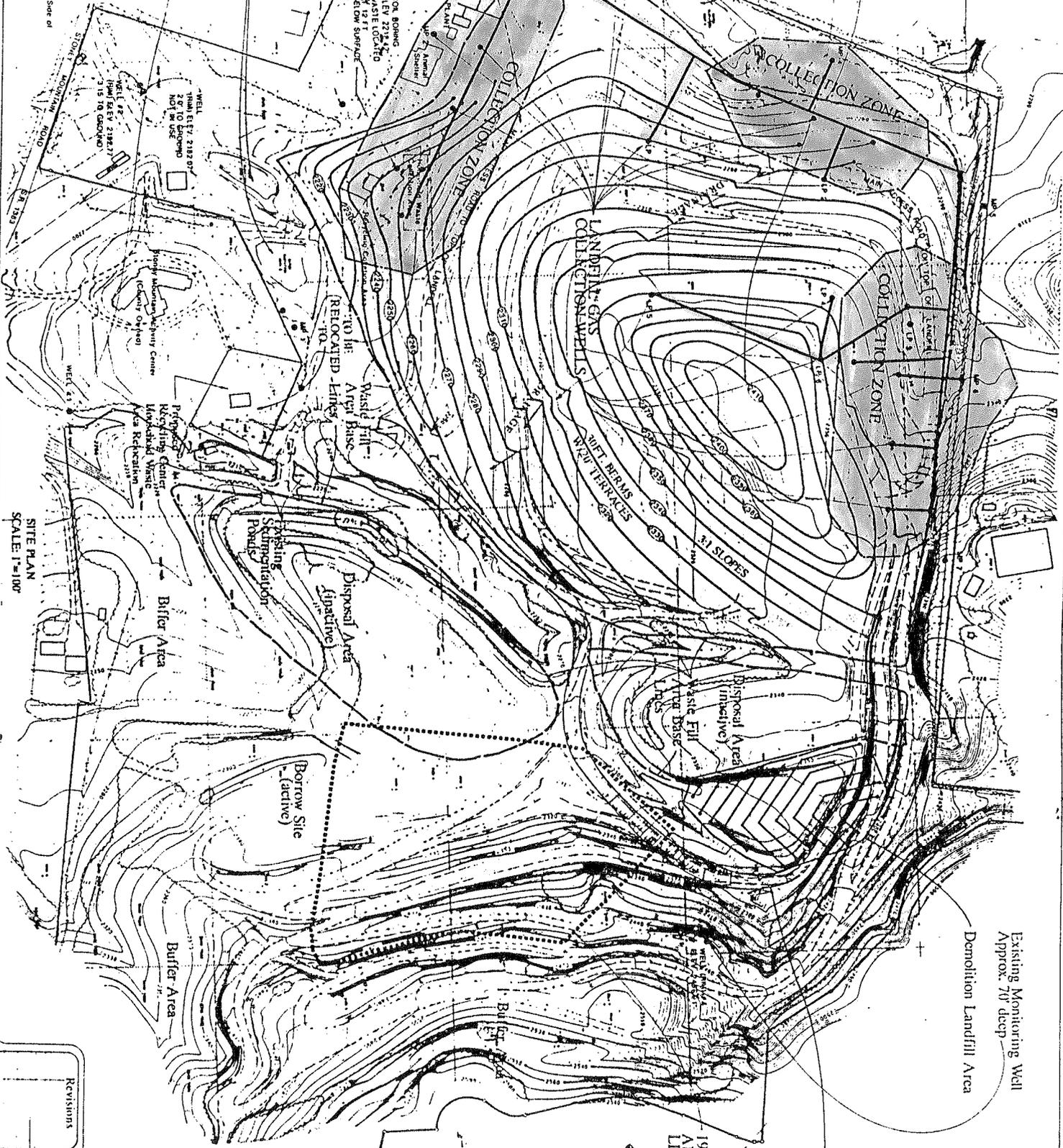
Proposed
Monitoring Wells

Existing
Sedimentation
Ponds

Existing
Monitoring Wells
Approximately
70' deep

TO Mountain Road S.R. 1381
N.C. Hwy 191

184' Top of 6" Asphalt East Side of
Employee Entrance 2177.58



Existing Monitoring Well
Approx. 70' deep

Demolition Landfill Area

Improved
Haul Road
For Main Access
To Top Of Landfill

1985 SITE
APPROVAL
LIMITS

184' PK. N.H. @ Well
Edge of Pavement
Drive & East
Shoulder
2463.70



Revisions
Date: 1/93
pk# 92214
Drawn: KHC

SITE PLAN
SCALE: 1"=100'

**HENDERSON COUNTY
BOARD OF COMMISSIONERS**

100 NORTH KING STREET
HENDERSONVILLE, N.C. 28792-5092
PHONE 704/697-4808
FAX 704/692-9855

J. MICHAEL EDNEY
CHAIRMAN
VOLLIE G. GOOD
F. RICHARD BAKER
HUGH D. RANDALL
WILLIAM MCKAY

DAVID F. THOMPSON
COUNTY MANAGER

December 11, 1992

Dexter R. Matthews, Chief
Solid Waste Section
SOLID WASTE MANAGEMENT DIVISION
P. O. Box 27687
Raleigh, NC 27611-7687

**RE: COMPLIANCE ORDER
HENDERSON COUNTY LANDFILL
STONEY MOUNTAIN ROAD
HENDERSON COUNTY, NORTH CAROLINA**

Dear Mr. Matthews:

As per the attached letter dated November 5, 1992 to Mr. Gary Ahlberg of your office, the County had retained William G. Lapsley and Associates to evaluate and develop remediation plans for resolution of the methane gas problems prior to the compliance order received by the County on December 2, 1992. Until we received your letter dated December 2, 1992, Henderson County had received no guidance on how to start remediation. Based on your compliance order, our consultants are presently developing the Phase I initial monitoring program and have been in contact with Mr. James E. Patterson of your staff concerning this matter. An informal conference has been scheduled with Mr. Patterson for December 15, 1992.

Due to time delays in processing the order, current inclement weather conditions, and desire to develop the appropriate action, Mr. Patterson recommended to our consultants that the County request a time extension to the December 31, 1992 deadline for submission of the Phase I remediation plan. Our consultants are pursuing this matter as quickly as possible but find it doubtful that on-site test boring locations can be approved by your staff, borings conducted, test results obtained, and Phase I monitoring report and remediation plan submitted by December 31, 1992. Therefore, it is requested that the December 31, 1992 deadline for submission of the Phase I remediation plan be extended 90 days to March 31, 1992. Without any unforeseen delays it is felt that the Phase I remediation plan can be developed within this time.

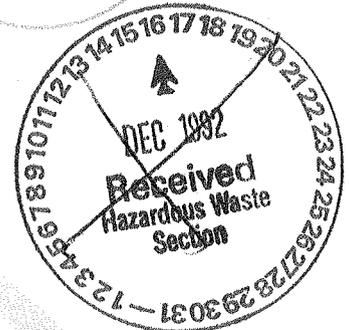
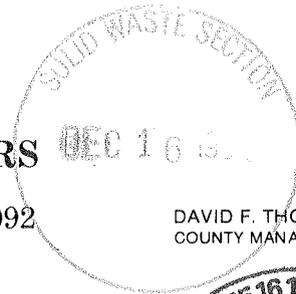
We will proceed with the development of the Phase I remediation plan and should you have any questions do not hesitate to contact our office at 704-697-4809 or Mr. Gary T. Tweed, P.E. with William G. Lapsley and Associates, P.A. at 704-697-7334.

Sincerely,

DAVID F. THOMPSON
COUNTY MANAGER

DFT:mwq

cc: Mr. Gary T. Tweed, P.E.
Mr. James E. Patterson



**HENDERSON COUNTY
BOARD OF COMMISSIONERS**
100 NORTH KING STREET
HENDERSONVILLE, N.C. 28792-5092
PHONE 704/697-4808
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CHAIRMAN
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WILLIAM MCKAY

DAVID F. THOMPSON
COUNTY MANAGER

November 5, 1992

Gary Ahlberg
Environmental Engineer II
Solid Waste Section
NCDEHNR
P. O. Box 27687
Raleigh, NC 27611-7687

**RE: RECENT METHANE GAS TESTING—HENDERSON COUNTY
LANDFILL**

Dear Mr. Ahlberg:

Please note the attached report that was filed by James Patterson, who is the Solid Waste Section Field Supervisor for Henderson County's Landfill. I am concerned in that the report just states that methane is migrating 150+ feet onto adjacent property. I have spoken to Mr. Patterson about what the County needs to do to determine the extent of our problem and begin immediate remediation of the problem, and he has informed me that you are the person in charge of this program. I am concerned also that Mr. Patterson said that you are the only person involved with methane gas remediation and that he believes you are tied up in another county. Please understand that to the citizens at large this migration of methane gas (if indeed it is migrating from the adjacent Landfill), is alarming, and thus, we need an opinion from your office quickly as to the seriousness of the problem and what needs to be done to remediate it.

I have contacted a local engineering firm to investigate this matter and to make recommendations to my office. The firm is William G. Lapsley & Associates P.A. The firm's address is 1635 Asheville Highway, Hendersonville, NC 28739, and the phone number is 704-697-7334. I have asked Mr. William Lapsley to contact you directly to seek any data that you may have on this situation and to also seek guidance on this matter. I would appreciate it if you would carbon copy me with any correspondence you have with our Mr. Lapsley.

Thank you for your immediate attention to this situation.

Sincerely,



DAVID F. THOMPSON
COUNTY MANAGER

DFT:mwq

cc: William G. Lapsley, P.A.

HENDERSON COUNTY
BOARD OF COMMISSIONERS
100 NORTH KING STREET
HENDERSONVILLE, N.C. 28792-5097
PHONE 704/697-4808
FAX 704/692-9855

VOLLIE G. GOOD
CHAIRMAN
J. MICHAEL EDNEY
HUGH D. RANDALL
WILLIAM MCKAY
RENEE KUMOR

Julian
DEC 07 1993
DAVID F. THOMPSON
COUNTY MANAGER

November 19, 1993

Mr. Jim Patterson
N. C. Division of Solid Waste Management
59 Woodfin Street
Asheville, North Carolina 28801



RE: Henderson County Landfill
Permit No. 45-01
Landfill Gas Remediation
Stoney Mountain Road
Henderson County

Dear Mr. Patterson:

This office is in receipt of your November 2, 1993 letter concerning approval of the Phase I Landfill Gas Remediation Study. However, your approval of plans for construction, we feel, is premature.

As you were informed by our consultant Mr. Gary T. Tweed, P.E. on November 16, 1993, the preliminary site plan for a gas collection system and flare station is not the full system design. The County is just now finalizing contractual agreements with Cargan Resources, Inc. and as indicated in their September 29, 1993 letter (copy attached) to Mr. Gary Ahlberg with your Raleigh office, it is not expected to have the system designs completed, approved, and construction completed before the second quarter of 1994.

On November 15, 1993, our staff held a full day meeting with Cargan Resources, Inc. to finalize agreements. It was stated at this meeting that Cargan Resources, Inc. plans to submit final design plans to your office very soon and, assuming approvals come quickly, have the system under construction in January, 1994. It is hoped to have the system completed and remediation underway by the end of April, 1994. This schedule is contingent upon receipt of approvals, air permits, weather, etc. The County is pursuing the installation of this project as quickly as possible. Substantial funds (\$12,000 per month for the first five years) are to be expended by the County for the construction and operation of this system. We feel that this landfill gas remediation system could become a model for future projects by other communities and care is being taken to insure the installation of the best system possible.

Mr. Jim Patterson
November 19, 1993
Page Two

It is apparent that your office in Asheville is not receiving copies of submittals and correspondences involving your Raleigh office. We will attempt to copy your office with all future submittals. Should there be any questions or if you need assistance, please contact our office at (704) 697-4809.

Sincerely,



David F. Thompson
Henderson County Manager

DFT/abm

attachments

cc: Jim Coffey
✓ Julian Foscoe
Skip Logan
Eidon Owen
Gary T. Tweed, P. E.



YOUR NATURAL PARTNER

September 29, 1993

Mr. Gary Ahlberg
Solid Waste Section
Division of Solid Waste Management
PO Box 27687
Raleigh, NC 27611-7687

Ref: Phase I, Landfill Gas Migration Assessment and
Monitoring Program, Landfill Gas Remediation Plan,
Stony Mountain Road Landfill, Henderson County, NC.

Dear Mr. Ahlberg:

We have concluded the captioned Phase I Program and would like to provide you with a copy of our report and supportive field data. This package of material includes the following:

1. Our engineers report on the program with recommendations for corrective action;
2. A report of two weeks continuous monitoring of the landfill;
3. A report of well monitoring for the months of July and August. September's report will be ready in one week, and results will be forwarded to your office;
4. A permeability report of core samples taken from five perimeter wells, provided by Core Labs;
5. A Landfill Gas generation model projecting emission rates for the next 15 years;
6. A specification sheet on the Landfill Gas testing equipment employed in our program; and,
7. A conceptual plan indicating three landfill zones requiring active migration control to achieve compliance limits at specific perimeter monitor points.

There are several important aspects of our work which I would like to briefly highlight.

1. Three areas on the landfill have been identified which exceed the compliance limits of 40 CFR 258.23, of the Federal Code, and 15A NCAC 13B .1626 paragraph (4), of the North Carolina Code, both dealing with Explosive Gases Control. The affected areas include the northern boundary centered on perimeter monitor well MP-5, the northwest perimeter at MP-4, and the area underlying the Animal Shelter at MP-2.

2. The estimated daily Landfill Gas (LFG) generation rate is 450,000 Standard Cubic Feet (SCF) per day from approximately 770,000 tons of impounded waste. This LFG rate should peak in the year 2000 at 650,000 SCF per day. If another 300,000 tons of waste is added over the next three years, then the LFG rate should peak at 1,000,000 SCF per day by the year 2006.

3. Vacuum pressure tests were used to calculate impoundment permeability at well site LP-6 (3.2×10^{-3} power). This information together with core analysis (enclosed) from 5 monitor wells indicate sufficient permeability to allow for relative ease of gas migration, unless inhibited by surface features or subsurface structures.

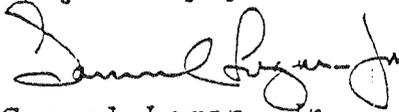
4. To affect control of gas migration at the specified zones and to reduce perimeter gas concentrations to compliance limits, protective vacuum barriers under the influence of LFG wells should be installed. Gas production from these wells should equal approximately 60% of the generation rate of the landfill to achieve desired control. The primary means of destroying the gas should be with a flare. Produced liquids should be destroyed by spray injection into the flare shroud. Once control has been established and compliance limits achieved, gas marketing may prove feasible as a means of remediation cost subsidy.

5. The remediation system should initially employ a variable speed electric motor and controls powering a positive displacement blower with output in the 500 CFM range at 10-12 psig. The gas flare should be sized with turn down capability to accommodate the entire range of blower output. Maximum operating temperature of the flare should be 1850 degrees Fahrenheit, and allow sufficient retention time to achieve 98% destruction of Volatile Organic Compounds.

6. Flared gas should be measured by digital flow meter. Several additional monitor wells should be sited and installed. All monitor wells should be tested daily at the commencement of remedial operations until monitor wells are within limits. Thereafter monitor wells should be tested weekly to assure continued compliance.

We are concluding our agreements with Henderson County before beginning the actual design and construction of the proposed system. When our first draft of plans and specifications is completed, we will provide same to you for comment. We hope to commence remedial operations early in the second quarter of 1994. Should you have any question or comments on our work thus far, or with what has been outlined above, please advise.

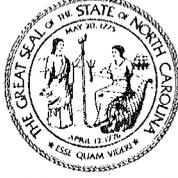
Very truly yours,



Samuel Logan, Jr.
President

cc: David Thompson, Henderson County, NC ✓
Gary Tweed, Lapsley and Associates
Jim Clarkson, Cargan
Henry Barton, Cargan

enclosure



State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687 · Raleigh, North Carolina 27611-7687

James G. Martin, Governor
William W. Cobey, Jr., Secretary

November 23, 1992

William L. Meyer
Director

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. David Thompson
Henderson County Manager
100 North King Street
Hendersonville, NC 28792

RE: Compliance Order without Administrative Penalty

Dear Mr. Thompson:

Enclosed is a Compliance Order without Administrative Penalty issued to Henderson County for a violation of the North Carolina's Solid Waste Management Act, N.C.G.S. 130A, Article 9 (ACT) and North Carolina Solid Waste Management Rules 15A NCAC 13B (Rules). The Compliance Order without Administrative Penalty describes both the violation and the actions required for compliance at your facility with the Act and Rules.

If you desire to schedule an informal conference to discuss the Compliance Order without Administrative Penalty, please contact James E. Patterson, Waste Management Specialist at (704) 251-6208.

Sincerely,

A handwritten signature in cursive script that reads "Dexter R. Matthews".

Dexter R. Matthews, Chief
Solid Waste Section
Solid Waste Management Division

DRM/mju

cc: Central Files
Gary Ahlberg
Julian Foscue
Nancy Scott
James Patterson

Compliance Order without Administrative Penalty
Henderson County
Page 2

(Permit #45-01) which lies adjacent to property belonging to Dr. Trace. The following violation of the North Carolina Solid Waste Management Rules, codified at 15A N.C.A.C. 13B was noted at the time to the investigation:

- A. 15A NCAC 13B .0503(2)(a)(ii) requires that the concentration of explosive gases generated by the site shall not exceed the lower explosive limit for gases at the property boundary. The Henderson County Landfill was operating in violation of 15A N.C.A.C. 13B .0503(2)(a)(ii) in that the concentration of explosive gases consistently exceeded the lower explosive limit when measured with a GP-204 Gas Tech Portable Combustible Gas Indicator at the northern property boundary of the Henderson County Landfill. (Adjacent to the Trace property).

CONDITIONS FOR CONTINUED OPERATION

Based on the foregoing, the County of Henderson is hereby ordered to comply with 15A NCAC 13B .0503(2)(a)(ii) by implementing a two-phase program with Phase II constituting remedial action.

Phase I

Phase I is an initial monitoring program which will assess the magnitude of the violation. The assessment is to be evaluated and verified by a licensed professional engineer. The Professional Engineer's proposals for probe locations and testing protocol shall be submitted to Gary Ahlberg, Environmental Engineer, N.C. Solid Waste Section, P.O. Box 27687, Raleigh, N.C. 27611 for review/approval.

Based on the data collected in Phase I monitoring, physical landfill characteristics, geological data, and any other pertinent information, Henderson County will propose a remediation plan to the Solid Waste Section by December 30, 1992. Subsequent events will constitute Phase II.

POTENTIAL CONSEQUENCES OF FAILURE TO COMPLY

The County of Henderson is hereby advised that pursuant to N.C.G.S. 130A-22, each day of continued violation of any requirement of the Act or Rules constitutes a separate violation for which a penalty of up to \$5,000.00 per day may be imposed. If the violation(s) continues, you may also be subject to further enforcement, including injunctive action, permit suspension and revocation, and such further relief as may be necessary to achieve compliance with the North Carolina Solid Waste Management Act and Rules.

Compliance Order without Administrative Penalty
Henderson County
Page 3

INFORMAL CONFERENCE

The Section encourages an informal conference to discuss this matter and to give the County of Henderson an opportunity to provide additional information, including any actions it has taken to correct the violation(s). If an informal conference is desired, please contact:

James E. Patterson
Waste Management Specialist
Solid Waste Section
59 Woodfin Place
Asheville, NC 28801
(704) 251-6208

By:



Dexter Matthews, Chief
Solid Waste Section
Solid Waste Management Division

Date: 11/25/92

Compliance Order without Administrative Penalty
Henderson County
Page 4

CERTIFICATE OF SERVICE

I hereby certify that I have caused a copy of the foregoing Compliance Order(s) without Administrative Penalty to be served upon the person(s) designated below, at the last known address, by causing said copy to be deposited in the U.S. Mail, First Class (certified mail, restricted delivery, and return receipt requested, postage prepaid) in an envelope addressed to:

Mr. David Thompson
Henderson County Manager
100 North King Street
Hendersonville, NC 28792

Date this 25 day of November, 1992.

Dexter R. Matthews, Chief
Solid Waste Section
Solid Waste Management Division



State of North Carolina
Department of Environment, Health, and Natural Resources
Asheville Regional Office

James G. Martin, Governor
William W. Cobey, Jr., Secretary

December 28, 1992

Ann B. Orr
Regional Manager

Mrs. Joyce Trace
P. O. Box 280
Mountain Home, NC 28758

Dear Mrs. Trace:

I am writing this letter in response to your request that we inform you in writing as to actions taken by the N. C. Solid Waste Section regarding trees dying on your property adjacent to the Henderson County Landfill.

After receiving your complaint of October 15, 1992, I visited the Henderson County Landfill on October 20, 1992, and conducted tests to determine if methane gas was migrating past the Henderson County Landfill property boundary onto your property. The tests indicated the presence of methane gas above 25% LEL at and beyond the landfill property boundary. A Compliance Order dated November 23, 1992 was issued by the Solid Waste Section to Henderson County requiring assessment and remediation of the methane gas problem.

Regarding the substance leaching out of the bank of your property next to the landfill, Mr. Larry Rose, Solid Waste Section Hydrogeologist Technician, collected samples of this material and submitted them to the State laboratory for testing. As of this date, we do not have the results of these tests.

Please let me know if you have further questions.

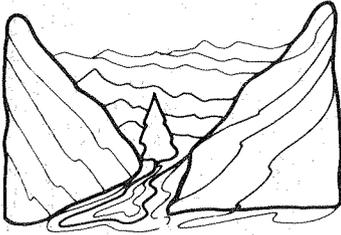
Sincerely,

A handwritten signature in cursive script that reads "James E. Patterson".

James E. Patterson
Waste Management Specialist

JEP:a

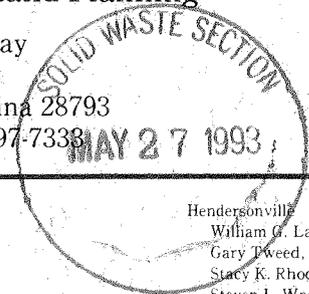
cc: Mr. Julian Foscue
Mr. Dexter Matthews



William G. Lapsley & Associates, P.A.

Engineering, Surveying and Land Planning

1635 Asheville Highway
Post Office Box 546
Hendersonville, North Carolina 28793
704-697-7334 • FAX 704-697-7338



May 24, 1993

Hendersonville
William G. Lapsley, P.E.
Gary Tweed, P.E.
Stacy K. Rhodes, R.L.S.
Steven L. Waggoner, R.L.S.
G. Marcus Brittain, R.L.S.

Sylva
Donald L. Hunley, P.E.

Mr. Gary Ahlberg
Environmental Engineer II
Solid Waste Section
NCDEHNR
P.O. Box 27687
Raleigh, N.C. 27611-7687

Ref: Phase I Landfill Gas Investigation
Stoney Mountain Road Landfill
Henderson County, N.C.

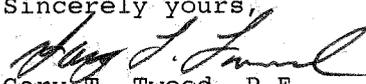
Dear Mr. Ahlberg:

Enclosed please find a copy of the Phase I Landfill Gas Investigation of the Henderson County Stoney Mountain Road Landfill to be conducted by Cargan Resources, Inc. It is anticipated that Cargan Resources will soon be installing the landfill gas monitoring well probes and begin the Phase I monitoring. This plan of action has been developed over the past few months and expanded to cover a much larger area of the landfill than originally anticipated. Subsequent investigations of the landfill migration indicated that landfill gas movement at the site is over a larger area than indicated by the vegetation damage on the northeast portion of the site. The planned investigation is to take in the northern side of the landfill from the animal shelter to beyond the upper zone where original migration was detected.

Cargan Resources, Inc. will conduct the investigation under review of this firm and develop the Phase II remediation plan of action. It is felt that the Phase I remediation monitoring will be completed by the end of June, 1993, with a final report to be completed by August, 1993. It is felt that with concurrence of your office that a Phase II remediation plan can be developed and in place by early 1994.

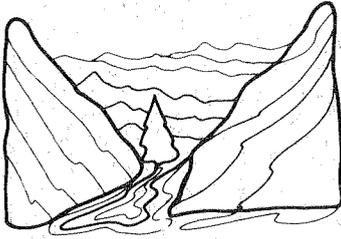
It is requested that you review the planned Phase I landfill gas investigation plan. Should you feel that any area of concern has not been addressed and the plan is not adequate, then please contact us immediately. Otherwise, Henderson County and Cargan Resources, Inc. plan to proceed with this plan of action. Should there be any questions or if you need assistance, please contact our office at 704-697-7334.

Sincerely yours,


Gary T. Tweed, P.E.

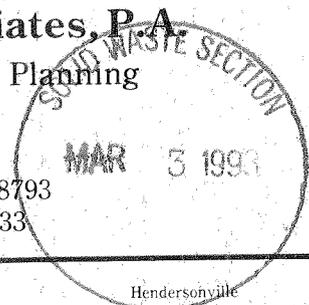
cc David Thompson
Samuel Logan, Jr.
Julian Foscue





William G. Lapsley & Associates, P.A.
Engineering, Surveying and Land Planning

1635 Asheville Highway
Post Office Box 546
Hendersonville, North Carolina 28793
704-697-7334 • FAX 704-697-7333



February 26, 1993

Hendersonville
William G. Lapsley, P.E.
Gary Tweed, P.E.
Stacy K. Rhodes, R.L.S.
Steven L. Waggoner, R.L.S.
G. Marcus Brittain, R.L.S.

Sylva
Donald L. Hunley, P.E.

Mr. Gary Ahlberg
Solid Waste Section
Division of Solid Waste Management
P.O. Box 27687
Raleigh, N.C. 27611-7687

Ref: Phase I Initial Monitoring Program
Landfill Gas Remediation Plan
Henderson County Landfill
Stoney Mountain Road
Henderson County, N.C.

Dear Mr. Ahlberg:

On December 16, 1992, a proposed phase I monitoring plan to begin a landfill gas remediation plan at the Henderson County Landfill was submitted to your Division with request that it be reviewed and authorization issued to proceed. To date there has been no response to the proposed plan of action by the Division of Solid Waste Management. We have discussed this with Mr. Jim Patterson of your office and advised him of our plans to proceed with the Phase I monitoring.

We have recommended to the County that they purchase a landfill gas monitor. It is our understanding that they are proceeding with the acquisition of a monitor. We have received quotes on the installation of landfill gas monitoring probes from one Company and are planning to obtain additional quotes. Once final costs are determined for the monitoring probes, we are recommending that the County proceed with their installation as planned. In addition to the plan submitted December 16, 1992, we are planning to install an additional probe in the area of the animal shelter which is experiencing some detection of gas. The site of the animal shelter is such that it may be above old waste fill areas. Borings into this area are to be conducted to determine the location of waste, if any.

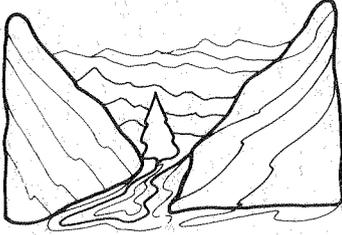
The input from your Division on our landfill gas remediation plans is needed. The County feels that they need to proceed with remediation and would like your input prior to installation of the monitoring probes. It is requested that the Division provide comments on the proposed plan of action by March 14, 1993. Should there be any questions regarding this matter, do not hesitate to contact our office at 704-697-7334.

Sincerely yours,

Gary T. Tweed, P.E.

cc: David Thompson
Jim Patterson





William G. Lapsley & Associates, P.A.

Engineering, Surveying and Land Planning

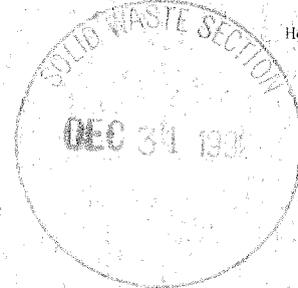
1635 Asheville Highway

Post Office Box 546

Hendersonville, North Carolina 28793

704-697-7334 • FAX 704-697-7333

December 16, 1992



Hendersonville
William G. Lapsley, P.E.
Donald L. Hunley, P.E.
Stacy K. Rhodes, R.L.S.
Steven L. Waggoner, R.L.S.
G. Marcus Brittain, R.L.S.

Mr. Dexter R. Matthews, Chief
Solid Waste Section
Solid Waste Management Division
P.O. Box 27687
Raleigh, N.C. 27611-7687

Ref: Phase I Initial Monitoring Program
Landfill Gas Remediation Plan
Compliance Order without Administrative Penalty
Henderson County Landfill
Stoney Mountain Road
Henderson County, N.C.

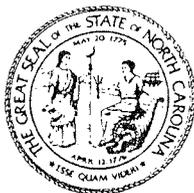
Dear Mr. Matthews:

On December 15, 1992, an informal conference was held with Mr. James E. Patterson of your staff and later telephone discussions held with Mr. Gary Alhberg concerning the preparation of a Phase I remediation plan for the landfill gas violations at the Henderson County Landfill. Enclosed please find a site drawing of the Henderson County landfill on which proposed monitoring probe locations have been identified. The approximate area of off-site landfill gas migration has been delineated based on current vegetation damage. It appears at this time that off-site vegetation damage is 100 to 150 feet beyond the upper property line. It is proposed to have geotechnical soils information obtained in conjunction with the installation of four test probes and for the County staff to obtain their own equipment to test for percent LEL, percent methane, and percent oxygen. It is planned to conduct the initial monitoring on a daily basis for a period of two weeks with an additional two weeks to be conducted if significant variations in the levels recorded are detected. Monitoring will continue no less than once per week following initial monitoring phase until such time as remediation has been obtained.

Following the initial monitoring phase, the data will be reviewed, and after comments from your staff, recommendations will be made for the development of a remediation plan leading to Phase II remedial action. It is requested that the proposed probe locations (see attached map) be reviewed by your staff and



FEB 19 1993



State of North Carolina
Department of Environment, Health, and Natural Resources
512 North Salisbury Street • Raleigh, North Carolina 27604

James B. Hunt, Jr., Governor

February 16, 1993

Jonathan B. Howes, Secretary

Mr. David Thompson
Henderson County Manager
100 N. King Street
Hendersonville, NC 28739

RE: Combustible Gas Monitoring at Henderson Co. Animal Shelter

Dear Mr. Thompson:

In response to a request by Mr. Eldon Owen, Henderson County Solid Waste Director, I conducted combustible gas monitoring inside the Henderson County Animal Shelter (located on property at the Henderson County Landfill location) on the afternoon of February 11, 1993. No combustible gases were detected in any of the rooms of the shelter "proper," but combustible gas was detected at levels up to 40% lower explosive limits in the two rooms on either side of the main lobby of the building where the plumbing pipes come through the concrete slab. Readings indicating the presence of combustible gases were obtained only when the monitoring probe was placed directly on the pipes.

Additional monitoring should be continued at the Animal Shelter on a regular basis and efforts should be taken to ensure that the building is well ventilated for employee safety.

Remediation of any combustible gas problems will be based on an assessment derived from the monitoring data obtained at this location.

Please call should you have any questions.

Sincerely,

A handwritten signature in cursive script that reads "James E. Patterson".

James E. Patterson
Waste Management Specialist

JEP:a

cc: Mr. Julian Foscue
Mr. Gary Ahlberg
Mr. Eldon Owen



May 13, 1993

Mr. Gary Tweed
William G. Lapsley and Associates, PA
PO Box 546
Hendersonville, NC 28793

Re: Stoney Mountain Road Landfill Project, Phase I Contract

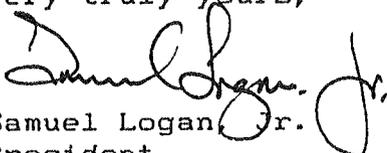
Dear Mr. Tweed,

I am forwarding two executed copies of our contract engaging the captioned project. Please review same and if they are acceptable in form and content then please have the appropriate Henderson County authority execute both copies, keeping one original and returning the other to this office.

On Monday we will initiate the permitting of the wells with North Carolina Department of Environment, Health, and Natural Resources, and begin planning a schedule of activities to complete the project. I will also contact you next week to review the contract and schedule an early meeting with Henderson County officials.

Many thanks for your assistance.

Very truly yours,


Samuel Logan, Jr.
President

SL/ldl
enclosure

cc: Mike Harvell
Henry Barton
Richard Rust

This work will be accomplished in accordance with paragraph 8 of Exhibit (A)

Section 1.5 LANDFILL GAS CONSULTING ENGINEER

From time to time Cargan will employ the services of its Landfill Gas Consulting Engineer of record, Dr. Richard Rust. This will be done in consultation with County Engineer at such times and in such manner as not to exceed the costs described in paragraph 9 of Exhibit (A).

Section 1.6 REPORT ON FINDINGS

At the conclusion of the testing and monitoring activity referred to in paragraph 1.3 above, Cargan will, within 30 days, produce a written report of the Phase I Monitoring of Landfill Gas at Stony Mountain Road Landfill. The report will focus first on Findings and Discoveries from the data gathered during the monitoring and test period. Secondly, the report will draw on Cargan's Opinions relative to those Findings and Discoveries. Thirdly, the report will cite specific Conclusions and Recommendations based on its Findings, Discoveries and Opinions.

**ARTICLE II
TIME OF COMMENCEMENT AND COMPLETION**

Section 2.1 The work to be performed under this agreement shall conform to the following schedule:

(a) Cargan shall commence Landfill Gas drilling operations on or before June 15, 1993, but subject to the availability of a suitable drilling rig and the receipt of all applicable permits.

(b) Cargan shall complete the work under this agreement within 90 days of its signing.

**ARTICLE III
THE CONTRACT SUM**

Section 3.1 Henderson County agrees to pay Cargan for the performance of this contract the sum of TWENTY NINE THOUSAND SIX HUNDRED DOLLARS, (\$29,600.00). The contract may be adjusted to allow for the actual number of core samples taken during drilling operations and submitted for analysis at a unit cost of Three Hundred Dollars per sample. The final contract amount may also be adjusted under the contingency allowed in paragraph 6 of Exhibit (A).

Section 3.2 Except as expressly provided above, Cargan shall provide and pay for all services, labor, methods,

materials, equipment, transportation, fuel, water, and all other services of every kind necessary to complete the Project.

ARTICLE IV PROGRESS PAYMENTS

Section 4.1 Cargan will submit to County, and copy to County Engineer, a request for advances under this contract in the following manner:

- (a) Following installation of the wells referenced in 1.1
- (b) Following the completion of the preliminary LFG monitoring and testing period, and following any subsequent validation period, if needed.
- (c) Following the delivery and acceptance of the Phase I Report on the Monitoring of Landfill Gas at Stony Mountain Road Landfill and the Landfill Gas Generation Model.

Section 4.2 Requests for advances will be in accordance with the amounts stated for the several activities listed in Exhibit (A).

- (a) Draws for services under paragraph 9 of Exhibit (A) may accompany any advance request, and will be accompanied by a statement of Engineer's time and expenses.

Section 4.3 County agrees to payment of any completed work or activity, referenced by Exhibit (A), within fifteen (15) days of receipt of Cargan's invoice for such work or activity. Such requests shall not be submitted more than twice within any 30 day period.

ARTICLE V RIGHT TO STOP WORK; TERMINATION BY COUNTY

Section 5.1 If Cargan should fail to carry out any work or activity established by this agreement, or if Cargan should fail to correct work which is not in accordance with the requirements of this Agreement, as required by Section 8.1 below, County may by written order direct Cargan to stop all work or activity hereunder; provided, however, that the right of County to intervene shall not give rise to the duty on the part of County to exercise this right for the benefit of Cargan or any other person or entity.

Section 5.2 County may terminate the Contract if Cargan:

(a) refuses or fails to commence operations as specified in Section 2.1 (a) above;

(b) breaches a provision of this Contract;

(c) fails to make proper payment to subcontractors for materials or labor in accordance with respective agreements between Cargan and any subcontractors.

Section 5.3 Upon the occurrence of any of the events specified in Section 5.2 above, County may by seven (7) days written notice terminate the employment of Cargan and may:

(a) take possession of the wells and of all materials located thereon;

(b) finish the work called for under this contract by whatever reasonable means County deems expedient.

ARTICLE VI INSURANCE

Section 6.1 Cargan shall maintain insurance from companies lawfully authorized to do business in North Carolina. Such insurance will protect Cargan from claims set forth below which may arise out of or result from operations under the Contract and for which it may be legally liable, whether such operation be by Cargan or by a subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, as follows:

(a) claims under workers compensation laws;

(b) claims for damages because of bodily injury, occupational sickness or disease, or death of an employee;

(c) claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom;

(d) claims for damage because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle.

Section 6.2 The insurance required by Section 6.1 above shall be maintained in the aggregate amount of One Million Dollars (\$1,000,000.00) per occurrence, respecting items (b), (c), and (d), and Three Hundred Thousand Dollars (\$300,000.00) with respect to item (e). Coverages shall remain in full force and effect for the duration of this contract, and a certificate of insurance may be issued to County upon request.

**ARTICLE VII
ASSUMPTION OF PROJECT RISK; INDEMNITY**

Section 7.1 Cargan represents that it has examined carefully all of the correspondence provided by County's Engineer, and it has acquainted itself with the site and all other conditions relevant to the Project, and made all investigations essential to a full understanding of the difficulties which may be encountered in performing the work.

Section 7.2 To the fullest extent permitted by law, Cargan shall indemnify and hold harmless County, its agents and employees from and against claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of the work under this Contract as a result of the negligent acts or omissions of Cargan, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this paragraph.

Section 7.3 County represents that it has provided Cargan or will provide Cargan with all relevant information, documentation and engineering data in its possession concerning the Project. County warrants that Stony Mountain Road Landfill, Henderson County, North Carolina is a sanitary landfill within the meaning established by the regulations of State of North Carolina Department of Environment, Health, and Natural Resources, Division of Solid Waste Management, and to its knowledge said landfill does not contain any materials which violate the above mentioned regulations, nor does it contain any harmful or toxic materials as may be classified under RCRA PART 29 CFR.

**ARTICLE VIII
ADDITIONAL DUTIES OF CARGAN**

Section 8.1 Cargan shall promptly correct work rejected by County or failing to conform to the requirements of this contract, whether observed before or after completion. Cargan shall bear the cost of correcting such rejected work.

Section 8.2 Cargan shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of this Contract.

Section 8.3 Cargan shall take reasonable precaution for the safety of, and shall provide reasonable protection to prevent damage, injury or loss to employees or other persons located at the Project site and materials to be incorporated in the project.

ARTICLE IX GENERAL PROVISIONS

Section 9.1 This Contract shall be made under and construed in accordance with the laws of the State of North Carolina.

Section 9.2 Cargan shall endeavor at all times to conduct the work and activities under this Contract in a skillful and competent manner.

Section 9.3 Cargan's activities shall comply with all applicable laws, ordinances, regulations, building codes, and requirements of all federal, state, and local governmental authorities and agencies having jurisdiction over the Project. Cargan shall obtain and verify that all necessary permits and approvals have been obtained for the Project.

Section 9.4 County agrees to remove and properly dispose of all landfill materials and debris unearthed by Cargan in the course of drilling the LFG test wells.

Section 9.5 No provisions of this Contract nor any agreement or contract entered into by Cargan with any subcontractor shall be construed as an agreement between County and such Contractor. Cargan shall be as fully responsible to County for the acts and omissions of any and all subcontractors, their agents, employees, or subcontractors, as he is for his own acts or omissions or those of his agents, employees, or subcontractors.

Section 9.6 The time limits stated in this Contract are of the essence.

Section 9.7 Notice to Cargan shall be deemed given when placed in the United States mail, postage prepaid, addressed as follows:

Cargan Resources, Inc.
PO Box 1078
Camden, SC 29020

IN WITNESS WHEREOF, the parties have caused this contract to be executed as of the date first above written.

WITNESSES:

Wm. J. Small
Archie B. Merrill

Lizbeth D. Logan
Michael J. Howell

COUNTY OF HENDERSON, NC

David J. [Signature]
ITS: COUNTY MANAGER

CARGAN RESOURCES, INC.

Samuel [Signature]
ITS: PRESIDENT

EXHIBIT (A)

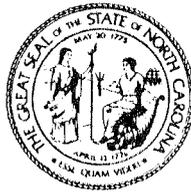
Estimated Costs of Services: Phase I

1. Install 7 gas migration probes down to the water table or bedrock (whichever first). Probes will have a metal encasement set in a concrete base with a lockable cap. Estimated 20 feet per well:		\$ 7,700
2. Geotechnical soil analysis in 3 gas migration probes * (We will get this price to you as soon as we here from lab.)		*
3. Install 5 landfill test probes (either to the bottom of the landfill or as deep as the drill rig can go) Estimated 400 feet @ \$18/ft:		\$ 7,200
4. Install 5 Accu-flow wellheads on landfill test probes:		\$ 2,000
5. Initial testing of gas migration probes and landfill test probes: 14 consecutive days @ \$300/day:		\$ 4,200
6. Optional additional 14 consecutive days @ \$300/day (to be determined later):	\$ 4,200	
7. Weekly monitoring of gas migration probes and landfill test probes with monthly report:	\$ 1,500/mo	
8. Landfill gas generation model:		\$ 2,000
9. Provide professional engineer to evaluate and verify the monitoring program, assist with probe locations, establish testing protocol, and assist with permits and/or negotiations as necessary. Estimated 40 hours + expenses:		\$ 4,000
10. Written Report w/Phase II Recommendation:		<u>\$ 2,500</u>
		\$ 29,600

EXHIBIT (A)

Estimated Costs of Services: Phase I

1. Install 7 gas migration probes down to the water table or bedrock (whichever first). Probes will have a metal encasement set in a concrete base with a lockable cap. Estimated 20 feet per well:		\$ 7,700
2. Geotechnical soil analysis in 3 gas migration probes * (We will get this price to you as soon as we here from lab.)		*
3. Install 5 landfill test probes (either to the bottom of the landfill or as deep as the drill rig can go) Estimated 400 feet @ \$18/ft:		\$ 7,200
4. Install 5 Accu-flow wellheads on landfill test probes:		\$ 2,000
5. Initial testing of gas migration probes and landfill test probes: 14 consecutive days @ \$300/day:		\$ 4,200
6. Optional additional 14 consecutive days @ \$300/day (to be determined later):	\$ 4,200	
7. Weekly monitoring of gas migration probes and landfill test probes with monthly report:	\$ 1,500/mo	
8. Landfill gas generation model:		\$ 2,000
9. Provide professional engineer to evaluate and verify the monitoring program, assist with probe locations, establish testing protocol, and assist with permits and/or negotiations as necessary. Estimated 40 hours + expenses:		\$ 4,000
10. Written Report w/Phase II Recommendation:		<u>\$ 2,500</u>
		\$ 29,600



State of North Carolina
Department of Environment, Health, and Natural Resources

512 North Salisbury Street • Raleigh, North Carolina 27604

Division of Solid Waste Management

919-733-0692

James B. Hunt, Jr., Governor

Jonathan B. Howes, Secretary

March 2, 1993

Mr. David F. Thompson, Manager
Henderson County
100 North King Street
Hendersonville, NC 28792-5092

RE: Henderson County Landfill, Permit No. 45-01
Compliance Order: Combustible gas concentrations
Phase I Initial Monitoring

Dear Mr. Thompson:

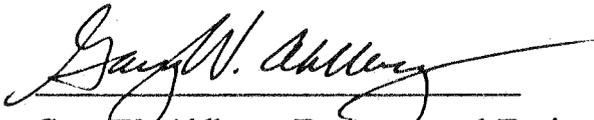
Our staff has had several conversations with Lapsley & Associates concerning the scope of the gas migration problem and the investigation to define the problem. The Section generally agrees with the scope of the initial monitoring plan as described in Lapsley's 16 Dec 92 letter with the following additions:

1. The area of investigation should be expanded to include the subject property line from A-A', the *monitoring zone*, as illustrated on the attached map.
2. Monitoring probes should be established at or inside the existing property line and equally spaced to measure gas concentrations along the *monitoring zone*. It may be useful to install probes in the landfill near the hot area to assess the gas generating potential of the landfill.
3. Data gathered from the probes at each monitoring event should include:
 - ◆ barometric pressure and weather conditions
 - ◆ probe pressure (inches of water)
4. Soil boring investigations should extend to the depth of the water table, landfill excavation (if known), or bedrock, whichever is encountered first.

5. The scope of investigation should identify any potential preferred paths (natural and man-made) for gas migration, i.e. pipeline or utility trenches, continuous gas permeable soil zones, etc. Boring logs, probe completion records, and other pertinent information should be documented and submitted with the proposed remediation or corrective action plan.
6. The recommendations in Mr. Patterson's 16 Feb 93 letter should be included in this investigation.

The option of adding property along the monitoring zone discussed previously could be considered as part of a corrective action plan, but would not affect the current requirement to define the scope of the migration problem. Please advise Mr. Patterson as you proceed with this investigation.

Sincerely,



Gary W. Ahlberg, Environmental Engineer
Solid Waste Section

cc: Jim Patterson
✓ Jan McHargue
Jim Coffey
Julian Foscue
Lapsley & Associates

AREA OF LANDFILL GAS MIGRATION
EVIDENT BY DEAD VEGETATION

PROPOSED
TEST PROBE
LOCATIONS

Main Access Road to top of Landfills

O3

O4

Main Trenching Zone
EXISTING CHAIN LINK FENCE

ACTIVE
DISPOSAL AREA

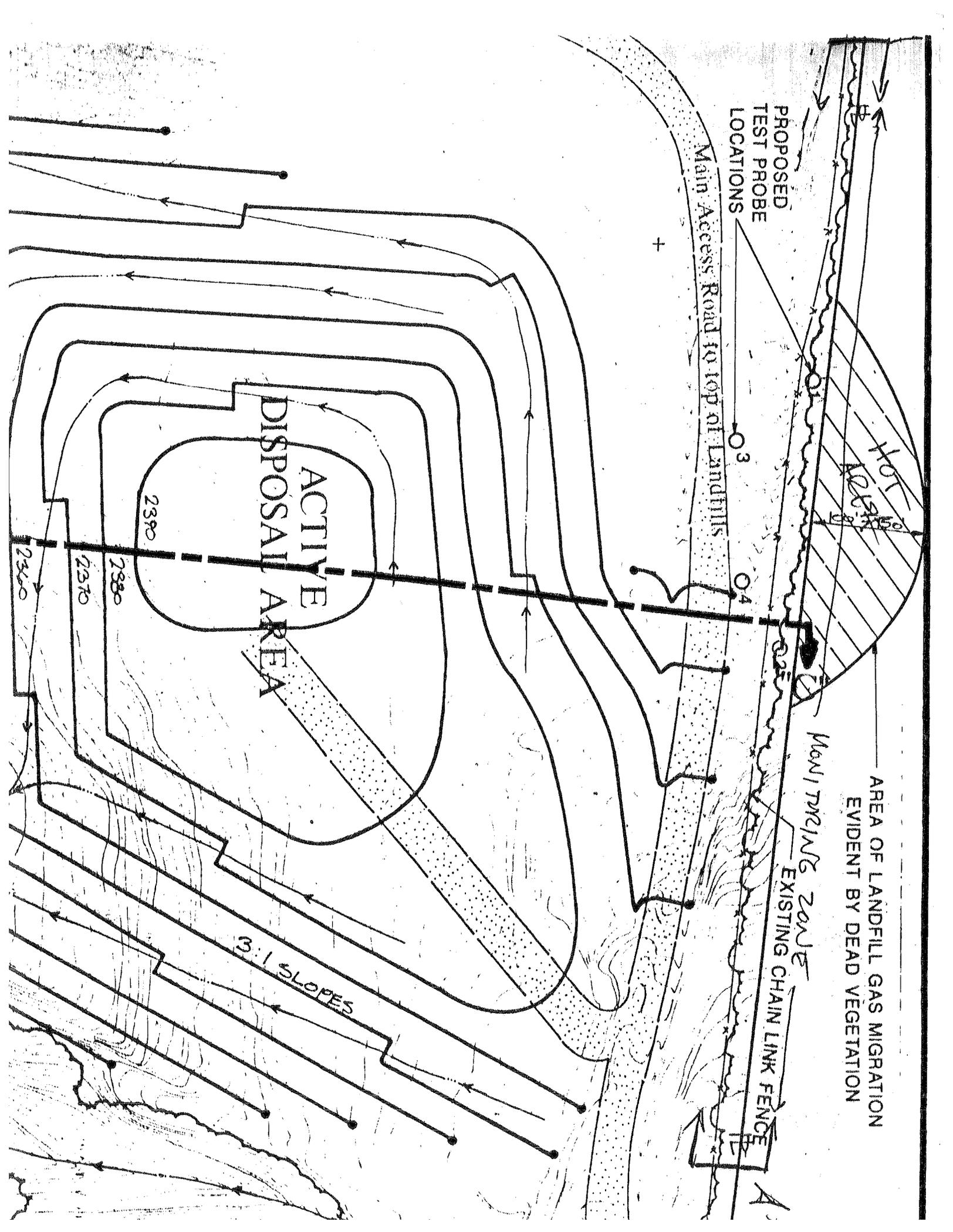
2390

2380

2370

2360

3:1 SLOPES





State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687 · Raleigh, North Carolina 27611

FILE

45-01

COMPLIANCE

James G. Martin, Governor
William W. Cobey, Jr., Secretary

William L. Meyer
Director

January 5, 1993

Mr. David F. Thompson
County Manager
Henderson County
100 N. King Street
Hendersonville, NC 28739

Re: Your letter of December 11, 1992
Phase I initial methane monitoring program
Henderson County Sanitary Landfill (Permit #45-01)

Dear Mr. Thompson:

In response to your letter of December 11, 1992, requesting additional time to complete the Phase I methane monitoring and proposed remediation plan at the Henderson County Landfill, we are clarifying the "Compliance Order Without Administrative Penalty" as follows:

1. Phase I is an initial monitoring program which will assess the magnitude of the violation. The monitoring program is to be evaluated and verified by a licensed professional engineer. The professional Engineer's proposals for probe locations and testing protocol shall be submitted to Gary Ahlberg, Environmental Engineer, N.C. Solid Waste Section, P.O. Box 27687, Raleigh, NC 27611 for review/approval not later than February 15, 1993.
2. Phase III will constitute the development and implementation of a remediation plan based on Phase I data. A compliance date for Phase II will be established at the time Phase I data is reviewed by the Section.

Mr. David T. Thompson
January 5, 1993
Page 2

If the Section may provide further clarification or information,
please advise.

Sincerely,

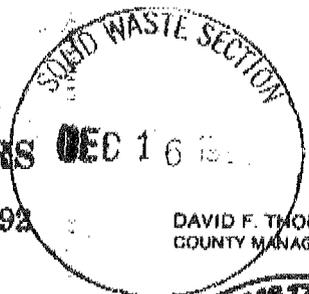
A handwritten signature in black ink, appearing to read "Dexter R. Matthews". The signature is fluid and cursive, with a large initial "D" and "M".

Dexter R. Matthews, Chief
Solid Waste Section

DRM/mju

cc: ✓ Gary Ahlberg
James E. Patterson
Julian M. Foscue, III
Janis D. McHargue

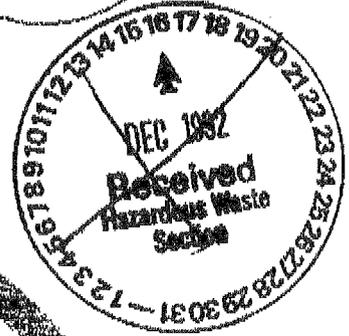
**HENDERSON COUNTY
BOARD OF COMMISSIONERS**
100 NORTH KING STREET
HENDERSONVILLE, N.C. 28792-5092
PHONE 704/697-4808
FAX 704/692-9855



DAVID F. THOMPSON
COUNTY MANAGER

J. MICHAEL EDNEY
CHAIRMAN
VOLLIE G. GOOD
F. RICHARD BAKER
HUGH D. RANDALL
WILLIAM MCKAY

December 11, 1992



Dexter R. Matthews, Chief
Solid Waste Section
SOLID WASTE MANAGEMENT DIVISION
P. O. Box 27687
Raleigh, NC 27611-0287

RE: COMPLIANCE ORDER —
HENDERSON COUNTY LANDFILL
STONE MOUNTAIN ROAD
HENDERSON COUNTY, NORTH CAROLINA

Dear Mr. Matthews:

As per the attached letter, Henderson County had retained William G. Lapeley and Associates, Inc. to develop remediation plans for resolution of the methane gas problem at the Stone Mountain Road Landfill. Prior to the order received by the County on December 2, 1992, Henderson County had received no guidance on how to start remediation. Your compliance order and your consultants are presently developing the Phase I initial monitoring program and have been in contact with Mr. James E. Patterson of your staff concerning this matter. A formal conference has been scheduled with Mr. Patterson on December 15, 1992.

Due to time delays in processing of the compliance order, inclement weather conditions, and desire to develop the appropriate action plan, it is recommended to our consultants that the County request a time extension to the December 31, 1992 deadline for submission of the Phase I remediation plan. Our consultants are pursuing this matter as quickly as possible, but find it doubtful that on-site test boring locations can be approved by your staff, borings conducted, test results obtained, and Phase I monitoring report and remediation plan submitted by December 31, 1992. Therefore, it is requested that the December 31, 1992 deadline for submission of the Phase I remediation plan be extended 90 days to March 31, 1993. If any unforeseen delays it is felt that the Phase I remediation plan can be developed within this time.

We will proceed with the development of the Phase I remediation plan and should you have any questions do not hesitate to contact our office at 704-697-4809 or Mr. Gary T. Tweed, P.E. with William G. Lapeley and Associates, P.A. at 704-697-7334.

Sincerely,

David F. Thompson
DAVID F. THOMPSON
COUNTY MANAGER

DFT:mwq

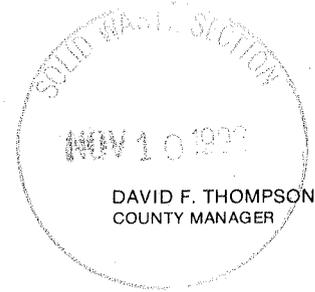
cc: Mr. Gary T. Tweed, P.E.
Mr. James E. Patterson

Post-It™ brand fax transmittal memo 7671 # of pages 2

To <i>Julian Foscoe</i>	From <i>Dexter Matthews</i>
Co.	Co.
Dept.	Phone #
Fax #	Fax #

**HENDERSON COUNTY
BOARD OF COMMISSIONERS**
100 NORTH KING STREET
HENDERSONVILLE, N.C. 28792-5092
PHONE 704/697-4808
FAX 704/692-9855

J. MICHAEL EDNEY
CHAIRMAN
VOLLIE G. GOOD
F. RICHARD BAKER
HUGH D. RANDALL
WILLIAM MCKAY



November 5, 1992

Gary Ahlberg
Environmental Engineer II
Solid Waste Section
NCDEHNR
P. O. Box 27687
Raleigh, NC 27611-7687

**RE: RECENT METHANE GAS TESTING--HENDERSON COUNTY
LANDFILL**

Dear Mr. Ahlberg:

Please note the attached report that was filed by James Patterson, who is the Solid Waste Section Field Supervisor for Henderson County's Landfill. I am concerned in that the report just states that methane is migrating 150+ feet onto adjacent property. I have spoken to Mr. Patterson about what the County needs to do to determine the extent of our problem and begin immediate remediation of the problem, and he has informed me that you are the person in charge of this program. I am concerned also that Mr. Patterson said that you are the only person involved with methane gas remediation and that he believes you are tied up in another county. Please understand that to the citizens at large this migration of methane gas (if indeed it is migrating from the adjacent Landfill), is alarming, and thus, we need an opinion from your office quickly as to the seriousness of the problem and what needs to be done to remediate it.

I have contacted a local engineering firm to investigate this matter and to make recommendations to my office. The firm is William G. Lapsley & Associates P.A. The firm's address is 1635 Asheville Highway, Hendersonville, NC 28739, and the phone number is 704-697-7334. I have asked Mr. William Lapsley to contact you directly to seek any data that you may have on this situation and to also seek guidance on this matter. I would appreciate it if you would carbon copy me with any correspondence you have with our Mr. Lapsley.

Thank you for your immediate attention to this situation.

Sincerely,

DAVID F. THOMPSON
COUNTY MANAGER

DFT:mwq

cc: William G. Lapsley, P.A.

NC DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

Division of Solid Waste Management

Solid Waste Section

SOLID WASTE MANAGEMENT FACILITY EVALUATION REPORT

Type of Facility Sanitary Landfill Permit # 45-01 County Henderson

Name of Facility Henderson County Landfill Location SR 1758, Hendersonville

Date of Last Evaluation 7/22/92

I. Permit Conditions Followed Yes No N/A

A. Specific Condition(s) Violated

II. Operational Requirements Followed Yes No

15A N.C. Admin. Code 138 Section 0505

A. Specific Violation(s) by number and letter.

0505 (D)(1)B - Methane gas migrating onto adjacent property -
monitoring / remediation efforts necessary -

III. Other Violations of Rule or Law

IV. Evaluator's Comments Landfill operation looks good!

Methane gas testing conducted. Methane found to be migrating onto
adjacent property, 150+'. Remediation to follow -

V. Continuation Page Required? Yes No Receiving Signature [Signature]

Evaluation Date 10-29-92 Solid Waste Section [Signature]

Purpose: G.S. 130A-294 requires that an evaluation program be established for the operation of solid waste management facilities on a statewide basis. The Solid Waste Management Act and Solid Waste Management Rules codified at 15A NCAC 13B list requirements which must be followed by solid waste facilities.

Instructions: Solid Waste Section personnel shall complete the evaluation form each time they conduct official evaluations. The form shall be signed by the person(s) receiving the report.

Distribution: Part I White: facility copy
Part II Canary: Raleigh central office file copy
Part III Pink: Regional office file copy

Disposition: This form may be retained in accordance with the Record Retention and Disposition Schedule of the Solid Waste Section, Solid Waste Management Division of the Department of Environment, Health and Natural Resources.

Mr. Dexter R. Matthews
Page 2
December 16, 1992

upon approval, authorization given to the County to proceed with these test probe borings.

In conference with Mr. Patterson, the option of the County purchasing additional property in the area to the landfill gas migration was discussed. In reviewing the regulations, it appears to us that if the property damaged by the landfill gas is purchased by the County, the noncompliance notification could be removed. Please advise us if this interpretation is correct. Purchasing this additional property would also allow an additional buffer in this area and provide additional on-site soils. We understand that purchasing the property would not relieve the County of continued gas level monitoring.

Should there be any questions, do not hesitate to contact our office at 704-697-7334.

Sincerely yours,



Gary T. Tweed, P.E.

cc David Thompson
Jim Patterson

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