St. Louis County (SW)
West Lake SLF

file

JOHN ASHCROFT
Governor

RON KUCERA
Acting Director

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

Division of Energy
Division of Environmental Quality
Division of Geology and Land Survey
Division of Management Services
Division of Parks, Recreation, and Historic Preservation

DIVISION OF ENVIRONMENTAL QUALITY
ST. LOUIS REGIONAL OFFICE
10805 Sunset Office Drive, Suite 100
St. Louis, MO 63127-1017
314-822-0101
Fax No. 314-822-0943

December 30, 1992

Mr. Glenn A. O'Bryan
Laidlaw Waste Systems, Inc.
13570 St. Charles Rock Road
Bridgeton, MO 63044

Dear Mr. O'Bryan:

Enclosed is a report of an inspection conducted by Mr. Joe Trunko of my staff. The report contains recommendations which the inspector has determined are warranted based on his findings at the facility.

Please review the report and implement the recommendations presented. Should you have any questions or comments, please contact the St. Louis Regional Office at (314) 822-0101.

Sincerely,

ST. LOUIS REGIONAL OFFICE

Robert S. P. Eck

Robert S. P. Eck
Regional Director

RSPE/JJT/lv

Enclosures

c: SWMP
Brad Bomanz, St. Louis County Health Dept., Solid Waste
Miles Stotts, Laidlaw Waste Systems, Inc.
Dennis Wike, Laidlaw Waste Systems, Inc.

St. Louis County
West Lake SLF

SANITARY LANDFILL INSPECTION REPORT

FACILITY

West Lake (Bridgeton) Sanitary Landfill
Laidlaw Waste Systems, Inc.
St. Louis County
MDNR Permit #118912

INTRODUCTION

On December 29, 1992, the above referenced facility was inspected for compliance with regulations pursuant to the Missouri Solid Waste Management Law. Messrs. Joe Trunko and Terry Hoevelkamp represented the Missouri Department of Natural Resources (MDNR), St. Louis Regional Office. Also present was Mr. Frank Dolan of the MDNR, Solid Waste Management Program. Ms. Sue Taylor and Mr. Brad Bomanz represented the St. Louis County Health Department. Mr. Glenn A. O'Bryan represented the facility.

FINDINGS

1. A large amount of exposed waste was observed at the facility.

2. Erosion gullies were observed in the wet-weather area.

3. An underground fire was occurring in the wet-weather area.

4. The new flare has not been constructed.

5. Regulated quantities of hazardous waste have been disposed of at this facility.

DISCUSSION

A large amount of exposed waste was observed in the wet-weather area, along the quarry walls and in the north area of the active pit. Exposed waste may contribute to the generation of odors at this facility. Efforts must be made to ensure that at least six inches of compacted cover is applied daily and that inactive areas are recovered and regraded as needed.

As per the approved engineering report, intermediate cover (one foot of compacted soil) is not required at this facility until the landfill reaches an elevation where surface water can be drained to the natural ground surface. The lack of intermediate cover on the inactive sections of the landfill may also be contributing to odor generation. Consideration should be made by Laidlaw to apply intermediate cover, especially if odor problems persist after completion and start up of the new gas extraction system. The intermediate cover could be stripped off when landfilling resumed in an inactive area. A permit modification request must be submitted to the SWMP if this is pursued.

Numerous erosion gullies were observed on the south slope of the wet-weather area. The occurrence of erosion in this area is common due to the steep slope and the large amount of surface water that drains into this area. Actions to minimize the erosion, such as the establishment of vegetation and/or terracing, should be taken.

An underground fire was burning in the wet-weather area near the quarry wall. Additional cover had been placed along the quarry wall in order to minimize the flow of oxygen into the fill. Mr. O'Bryan stated that additional actions would be taken (such as grouting the walls) should the fire continue.

Installation of the new flare has been delayed due to zoning restrictions by the City of Bridgeton. As a result of this delay, Laidlaw has decided to relocate the flare to an area that will not require zoning approval (area of existing flare station). Due to the continued odor problem at this facility, it is imperative that construction of the flare be completed as soon as possible.

On August 5, 1992, approximately 10 cubic yards of filter waste from the P.D. George Company was dumped at this facility. A hazardous waste determination performed by P.D. George has shown that the filters contained cresols above the regulatory limit as specified in 40 CFR 261. Laidlaw has developed a plan for removal of the waste. Selection of a consultant for coordinating the project is near completion. As per a letter dated December 14, 1992, from Glenn O'Bryan to the Department, a timeline for removal of the waste will be submitted to the Department by January 31, 1993. The project is scheduled to be completed by March 31, 1993.

RECOMMENDATIONS

1. Additional cover must be applied to all areas of exposed waste. Efforts must be made to ensure that at least six inches of compacted cover is applied to the active face on a daily basis. The regrading and recovering of fill areas must be performed on a regular basis so that erosion of cover material is minimized and solid waste is not exposed.

2. Consideration should be made by Laidlaw to apply intermediate cover to inactive areas at the facility should odor problems persist.

3. The south slope of the wet weather area should be terraced and/or vegetation established so that erosion on the area is minimized.

4. Continue with efforts to eliminate the fire in the wet-weather area.

5. By February 1, 1993, construction of the new flare must be completed and the gas collection system must be operable. Failure to complete construction of the flare by this date may result in the initiation of enforcement action by the Department.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY

SOLID WASTE AND RECOVERED MATERIALS DATA SHEET

NAME OF FACILITY	PERMIT NUMBER
Westlake (Bridgeton) Sanitary Landfill	118912
DATE	**REGIONAL OFFICE**
12-29-92	St. Louis
INSPECTOR	Joseph L. Trunko

TIPPING FEES

CUBIC YARD $8.00 compacted $20.00 Special waste	PICKUP LOAD –	WHITE GOODS N/A
TON $ 10.50 Demo	CAR LOAD –	TIRES N/A

APPLICABLE *	TYPE OF MATERIAL RECOVERED	AMOUNT RECOVERED/MONTH CUBIC YARDS OR TONS	AMOUNT RECYCLED/MONTH CUBIC YARDS OR TONS
N/A	ALUMINUM		
	Cans		
	Scrap		
	OTHER METAL		
	Ferrous		
	Non-Ferrous		
	PAPER		
	Newspaper		
	Corrugated		
	Computer/White		
	Mixed		
	GLASS		
	Clear		
	Mixed		
	PLASTIC		
	Milk Jugs		
	Soda Bottles		
	Mixed		
	CAR BATTERIES		
	TIRES		
	WHITE GOODS		
	COMPOST FROM YARD WASTE		
	COMPOST FROM SOLID WASTE		

NOTE ▶ * CHECK IF APPLICABLE
PRINT "N/A" IF NOT APPLICABLE

MO 780-0345 (5-89)

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY

SANITARY LANDFILL INSPECTION CHECKLIST

TYPE OF INSPECTION ▶ Quarterly

I GENERAL INFORMATION

DATE OF INSPECTION: 12-29-92	DAYS/WEEK OPEN: 6 (4:30-4:00 M-F, 6-1 Sat.)	TIME OF ARRIVAL: 9:30 a.m.
WEATHER: Overcast, wet		TEMPERATURE: 50°F
FACILITY NAME: Westlake (Bridgeton) Sanitary Landfill	COUNTY: St. Louis	PERMIT NUMBER: 118912
OWNER: Laidlaw Waste Systems, Inc.		TELEPHONE NUMBER: (314) 739-1919
ADDRESS: 13570 St. Charles Rock Road	CITY: Bridgeton	STATE: Mo ZIP CODE: 63044
OPERATOR: Same as owner		TELEPHONE NUMBER: "
ADDRESS: "	CITY: "	STATE: " ZIP CODE: "

II REMAINING LIFE OF LANDFILL

A. Estimated quantity of waste accepted, ≈ 35,000 (yards) or tons/week

B. Estimated life of remaining landfill 10 years.

C. Fixed operating term date, 11-18-95.

AREA SERVED

A. Cities: St. Louis, various municipalities

B. Counties: St. Louis, St. Charles

NOTE ▶ Check all subsections: SAT-Satisfactory or UNS-Unsatisfactory. If necessary, describe "UNS" violations under "Remarks."		SAT	UNS
10 CSR 80-2.020 PERMIT ISSUANCE, SPECIAL OPERATING PERMITS, AND PERMIT EXEMPTIONS			
(5)(E)	SITE CONSTRUCTED AND OPERATED PER APPROVED TERMS AND CONDITIONS OF PERMIT.	✓	
10 CSR 80-2.060 CERTIFIED SOLID WASTE TECHNICIANS			
(2)(A)	CERTIFIED SOLID-WASTE TECHNICIAN. (Joe Durako)	✓	
10 CSR 80-3.010 SANITARY LANDFILLS DESIGN AND OPERATION			
(2) SOLID WASTE ACCEPTED	(2)(C)1. BULKY SOLID WASTE CRUSHED ON SOLID GROUND.	✓	
(2)(C)2.	SMALL DEAD ANIMALS COVERED IMMEDIATELY.	✓	
(3) SOLID WASTE EXCLUDED AND SPECIAL WASTE APPROVALS			
(3)(C)1.	THE DISPOSAL OF SPECIAL WASTE APPROVED IN THE PERMIT IN ACCORDANCE WITH APPROVED PLANS.	✓	
(3)(C)2.A.	WRITTEN APPROVAL FOR SPECIAL WASTE NOT APPROVED IN PERMIT.	✓	
(3)(C)2.B.	APPROVED SPECIAL WASTE DISPOSED OF PROPERLY.	✓	
(3)(C)3.	SIGN POSTED AT ENTRANCE LISTING EXCLUDED WASTES.	✓	
(3)(C)4.	PROCEDURE FOR SCREENING AND REMOVAL OF EXCLUDED WASTES.	✓	
(3)(C)5.	LARGE DEAD ANIMALS PLACED IN PIT AND COVERED WITH FOUR FEET OF COMPACTED SOIL.	✓	
(3)(C)6.	EXCLUDED WASTES LISTED IN SUBSECTION (3)(A) OF THIS RULE NOT ACCEPTED FOR DISPOSAL. (1)		✓
(4) SITE SELECTION	(4)(C)1. SITE ACCESSIBLE IN ALL WEATHER CONDITIONS. TEMPORARY ROADS PROVIDED TO WORKING FACE.	✓	
(4)(C)2.	IF ACCESS ROADS ARE FLOODED, ALTERNATE SANITARY LANDFILL AVAILABLE. NAME:	✓	
(5) DESIGN	(5)(C)1. CONSTRUCTION AND OPERATION OF THE SITE IN ACCORDANCE WITH PLANS AND SPECIFICATIONS.	✓	
(5)(C)2.	MINIMUM 50-FOOT BUFFER ZONE MAINTAINED.	✓	
(5)(C)3.	OPERATING MANUAL AVAILABLE.	✓	
(6) SURVEY CONTROL			
(6)(C)1.	BOUNDARY MARKERS, BENCHMARKS, HORIZONTAL CONTROL STATIONS, & CONSTRUCTION STAKES CLEARLY MARKED & IDENTIFIED.	✓	
(6)(C)2.	MISSING OR DISPLACED BENCHMARKS OR HORIZONTAL CONTROL STATIONS REESTABLISHED.	✓	
(6)(C)3.	MISSING OR DISPLACED CONSTRUCTION STAKES REESTABLISHED.	✓	
(6)(C)4.	MONUMENTS AND BOUNDARY MARKERS PLACED PRIOR TO RECEIVING AUTHORIZATION TO OPERATE.	✓	
(6)(C)5.	CONSTRUCTION STAKES MARKING THE ACTIVE AREA PLACED PRIOR TO DEPOSITION OF WASTE.	✓	
(7) WATER QUALITY			
(7)(C)1.	SURFACE WATERCOURSES & RUNOFF PROPERLY DIVERTED. CONSTRUCTION & GRADING TO PROMOTE RUNOFF WITHOUT EXCESSIVE EROSION. (4)		✓
(7)(C)2.	CONTACT BETWEEN WATER AND SOLID WASTE MINIMIZED.	✓	
(7)(C)5.	LEACHATE GENERATED ON-SITE CONTROLLED ON-SITE AND NOT ALLOWED TO DISCHARGE OFF SITE OR DISCHARGE INTO WATERS OF THE STATE.	✓	
(8) GROUND-WATER MONITORING			
(8)(C)1.B.	GROUND-WATER-MONITORING WELLS OPERATIONAL PRIOR TO ACCEPTANCE OF WASTE.	✓	
(9) AIR QUALITY			
(9)(C)	BURNING OF SOLID WASTE PROHIBITED UNLESS A BURNING PERMIT IS OBTAINED.	✓	

			SAT	UNS
(10) GAS CONTROL	(10)(C)1.	DECOMPOSITION GAS CONTROL SYSTEMS IMPLEMENTED AS NECESSARY. (a)		✓
(10)(C)2.A.		METHANE NOT ALLOWED TO CONCENTRATE IN BUILDINGS ON-SITE ABOVE 25 PERCENT LEL FOR METHANE.	✓	
(10)(C)2.B.		METHANE NOT ALLOWED TO CONCENTRATE IN THE SOIL AT THE PROPERTY BOUNDARY ABOVE 5 PERCENT LEL FOR METHANE.	✓	
(10)(C)3.		DECOMPOSITION GAS MONITORING RESULTS SUBMITTED TO THE DEPARTMENT AS REQUIRED BY PERMIT.	✓	
(11) VECTORS	(11)(C)	VECTOR CONTROL PROGRAMS IMPLEMENTED WHEN NECESSARY.	✓	
(12) AESTHETICS			✓	
(12)(C)1.		LITTER CONTROL DEVICES UTILIZED AS NEEDED. LITTER COLLECTED & INCORPORATED INTO THE ACTIVE CELL AT THE END OF EACH DAY OR PLACED IN CONTAINERS.	✓	
(12)(C)2.		WASTES EASILY MOVED BY WIND COVERED AS NECESSARY.	✓	
(12)(C)3.		ON-SITE VEGETATION CLEARED ONLY AS NECESSARY.	✓	
(12)(C)4.		SALVAGED MATERIALS REMOVED DAILY OR STORED IN AESTHETICALLY ACCEPTABLE CONTAINERS.	✓	
(13) COVER	(13)(C)1.	DAILY COVER APPLIED.	✓	
(13)(C)2.		INTERMEDIATE COVER APPLIED. (b)	✓	
(13)(C)3.		FINAL COVER APPLIED.	✓	
(13)(C)4.		FINAL SIDE SLOPES NOT TO EXCEED 33.3 PERCENT.	✓	
(13)(C)5.		VEGETATION ESTABLISHED WITHIN 180 DAYS OF APPLICATION OR REGRADING OF COVER.	✓	
(13)(C)6.		REGRADING AND RECOVERING AS NECESSARY. (3)		✓
(14) COMPACTION	(14)(C)1.	SOLID-WASTE HANDLING EQUIPMENT ON-SITE AND OPERATED AS NECESSARY.	✓	
(14)(C)1.A.		SOLID WASTE TO BE COMPACTED, SPREAD IN LAYERS NO MORE THAN 2 FEET THICK, & CONFINED TO SMALLEST PRACTICAL AREA.	✓	
(14)(C)1.B.		WASTE COMPACTED TO SMALLEST PRACTICAL VOLUME.	✓	
(14)(C)1.C.		COVER COMPACTED AS MUCH AS PRACTICAL.	✓	
(14)(C)2.		PREVENTIVE MAINTENANCE PERFORMED ON EQUIPMENT.	✓	
(14)(C)3.		SOLID WASTE NOT DISPOSED OF IN WATER.	✓	
(15) SAFETY	(15)(C)1.	FIRE EXTINGUISHERS PROVIDED.	✓	
(15)(C)2.		ALL FIRES IN WASTES BEING DELIVERED AT THE WORKING FACE OR WITHIN EQUIPMENT EXTINGUISHED.	✓	
(15)(C)3.		COMMUNICATIONS EQUIPMENT AVAILABLE.	✓	
(15)(C)4.		SCAVENGING PROHIBITED.	✓	
(15)(C)5.		CONTROLLED ACCESS TO SITE BY ESTABLISHED ROADWAYS & LIMITED TO HOURS WHEN OPERATING PERSONNEL ARE ON DUTY.	✓	
(15)(C)6.		TRAFFIC CONTROLLED AND DIRECTED TO DISTINGUISH DISPOSING POINTS.	✓	
(15)(C)7.		SITE DUST CONTROLLED.	✓	
(16) RECORDS	(16)(C)1.A.	RECORDS OF MAJOR PROBLEMS AND COMPLAINTS.	✓	
(16)(C)1.B.		MONITORING RECORDS	✓	
		A. LEACHATE SAMPLING AND ANALYSES, B. GAS SAMPLING AND ANALYSES, C. GROUND- AND SURFACE-WATER ANALYSES.	✓	
(16)(C)1.C.		RECORDS OF VECTOR-CONTROL EFFORTS.	✓	
(16)(C)1.D.		RECORDS OF DUST- AND LITTER-CONTROL EFFORTS.	✓	
(16)(C)1.E.		RECORDS OF QUANTITY OF WASTE HANDLED.	✓	
(16)(C)1.F.		RECORDS OF DESCRIPTION, SOURCES, AND VOLUME OF SPECIAL WASTES LISTED IN SUBSECTION (3)(A).	✓	
OTHER DESIGN SPECIFICATIONS				
(7)(C)3.		LEACHATE COLLECTION SYSTEM PROPERLY INSTALLED AND OPERATED.	✓	
(7)(C)4		LINER CONSTRUCTED BY APPROVED DESIGN SPECIFICATION.	✓	
(8)(C)1.A.		GROUNDWATER MONITORING WELLS INSTALLED.	✓	
(13)(C)7.		BORROW AREAS RECLAIMED.	✓	

REMARKS

(1) 10 yds³ of creosol waste from PD George has been disposed of at the facility.
(2) Location of the flare has been changed to avoid zoning delays. Construction must be completed by 2/1/93.
(3) Exposed waste observed along quarry walls, the wet-weather area and in north section of active pit.
(4) erosion on south side of wet weather area - should be terraced and/or seeded.

TO THE OWNER/OPERATOR:

This inspection of your facility has been conducted under the authority of Sec. 260.225.1 (9) RSMo. The department representative has marked those items found in violation of the applicable environmental laws and regulations adopted thereunder pertaining to your facility. Your signature below or that of your agent acknowledges that you have been notified of the deficiencies and have received recommendations and specific time frames for corrective action(s). If future inspections determine these violations persist, the Department may proceed with more formal enforcement procedures as authorized under Sections 260.230 and 260.240 RSMo, including but not limited to the assessment of penalties up to $1000 per day for each day, or part thereof, the violation occurred. If any questions occur following your receipt of this inspection record, please contact the inspector named below.

COMPLIANCE EVALUATION

- ☐ Facility in Compliance
- ☑ Facility Not in Compliance
  - ☐ Notice of Violation Issued: ___ / ___ / ___
  - ☑ Return to Compliance By: 1 / 31 / 93
  - ☐ Follow-up Visit Scheduled: ___ / ___ / ___

SIGNATURE OF INSPECTOR	OFFICE	COPY RECEIVED BY
Douglas L. Lumbo	St. Louis	By Mail
OFFICE ADDRESS	**TELEPHONE**	**TITLE**
10805 Sunset Office Dr., St. Louis, Mo 63127	(314) 822-0101	—

MO 780-0354 (3-90)

ST. LOUIS COUNTY HEALTH DEPARTMENT
WASTE MANAGEMENT SECTION

SANITARY LANDFILL SURVEILANCE RECORD

Date: 12/29/92 Days/Week Open: 6
Name of Facility: Laidlaw Waste Systems (Sanitary)
Permit No.: 0419 Expires: 6/22/93
Owner: Laidlaw Waste Systems Inc.
Address: 13570 St. Charles Rock Rd.
Bridgeton, MO 63044

Estimated amount of solid waste coming through gate.
Compacted Loads 42,250 yds./wk. _____ tons/wk.
Noncompacted Loads _____ yds./wk. _____ tons/wk.

Estimated volume of remaining landfill covered by approved engineering plans. _____ acre(s) 11.5 years

Ordinance 13,320 Chapter 607
Compliance Status

Check all sections: SAT-Satisfactory; UNS-Unsatisfactory; * - Area(s) requiring additional attention.

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
FACILITY PLAN				
720.0	Operations comply with facility plan.	X		
SOLID WASTE HANDLING				
730.5	Bulky waste crushed and pushed to bottom of cell.	X		
730.6	Demolition and construction waste, tree stumps, etc. pushed to bottom of cell.	X		
730.7	Dead animals under 40 lbs. covered immediately.	X		
730.8	Dead animals over 40 lbs. placed in pit and covered with 4 ft. of compacted soil.	X		
730.9	Water treatment plant sludges incorporated into active face and covered immediately.	X		
	Quantity of sludges does not interfere with normal active face operation.	X		
730.10	Incinerator and air pollution control residues incorporated into working face and prevented from becoming airborne.	X		
SOLID WASTE EXCLUDED				
730.4	Responsible supervisor present.	X		
760.0	Entrance sign posted listing wastes not accepted.	X		
SAFETY				
730.25	Fire extinguishers provided on all equipment.	X		
730.26	Provisions made for extinguishing fires.	X		
730.27	Communications equipment met standard.	X		
730.28	Scavenging prohibited.	X		
730.29	Controlled access limited to operating hours.	X		
730.30	Traffic directed to designated disposal points.	X		
730.31	Dust control adequate.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
WATER QUALITY				
730.11	Surface water courses diverted.			X
	Grading promotes surface water runoff without excessive erosion.			X
	Grading does not exceed 33 1/3%.	X		
	Surface water courses and runoff control 20 year rainfall.	X		
730.12	Minimum 15 feet between waste and maximum water table.	X		
730.13	Water quality protection secure (ie. liner, bedrock).	X		
730.14	Leachate and treatment systems used where necessary.	X		
760.15	Ground/surface water not contacting waste.			X
730.36	All drinking water sources within 1/4 mile sampled annually.	X		
COVER MATERIAL				
730.3	Minimum of 6 inches approved cover applied daily.	X		
	Minimum 15 day stockpile of daily cover.	X		
730.32	Intermediate cover (min. 1 ft. after compaction) applied to all areas idle more than 60 days.	X		
730.33	Final cover (min. 2 ft. after compaction) applied to completed areas.	X		
COMPACTION				
730.1	Solid waste spread in layers not to exceed 2 ft. and reduced to smallest volume.	X		
730.2	Waste confined to smallest practical area on working face.	X		
730.24	Adequate equipment maintained and operated.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
AIR QUALITY				
730.16	No open burning without permission.	X		
GAS CONTROL				
730.17	Decomposition gas control implemented.			X
730.18	Gases vented to prohibit explosive or toxic accumulations.			X
AESTHETICS				
730.20	Litter control devices used properly.	X		
	Litter collected and secured daily.	X		
730.21	Blowable waste covered promptly.	X		
730.22	Vegetation and natural windbreaks used where necessary.			X
730.23	Salvaged materials stored or removed daily.	X		
730.34	Final vegetation planted and graded as required.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
VECTORS				
730.19	Vector control programs implemented.	X		
RECORDS				
730.35	Records maintained to cover: a. Major problems and complaints.	X		
	b. Monitoring of leachate, gas, ground, and surface water sampling and analyses.		*	
	c. Vector control efforts.	X		
	d. Dust and litter control efforts.	X		
	e. Quantity of waste handled.	X		
BONDING				
690.1	Operating bond adequate.	X		
CLOSURE				
790.1	Final cover and vegetation provided.	X		

Weather Conditions: rainy, cloudy, 50° and breezy

Observed With: Glen O'Bryan, Laidlaw Waste Systems; Joe Trunko, Frank Dolan & Terry Hoevelkamp, MDN; Sue Taylor and Brad Bomanz, St. Louis County

Consulted With: SAME

Additional Remarks/Comments: 1. Exposed waste was noted along the quarry walls in pit #3. A new technique of running the compactor parallel to the quarry walls and providing additional cover will, hopefully, remedy the problems of poorly compacted waste and insufficient cover material in these areas. It is to be noted that inadequate soil cover along quarry walls will contribute to passive gas venting and thus contribute to the enormous odor problem currently existing at this site. The new gas flaring system's 60 horsepower motor should increase subterranean negative air pressure. Areas with exposed waste and inadequate cover could have detrimental effects on the effectiveness of the gas extraction system by drafting in ambient air (02).

2. The subterranean fire in pit #2 which was first noted Sept. 25, 1992 appears to have subsided.

cc:

Signature of Inspector

Signature of Section Chief

OVER

3. A request to provide the office with leachate sampling/recording procedures is pending.

4. Surface water courses are not diverted from pit #3. This problem has been noted by Mr. O'Bryan and plans to recontour the site and provide drainage away from the landfill are in the planning stage.

5. Grading contours are promoting erosion and creating areas of exposed waste on the northern slope of pit #3. Plans by Laidlaw to address this issue such as terracing, strategic placement of straw bales and the application of additional soil cover were proposed by Mr. O'Bryan as possible solutions.

This office is requesting Laidlaw to submit in writing within two (2) weeks from receipt of this inspection an implementation schedule to correct violations [Section 607.730.11 (surface water courses diverted and proper grading as indicated)and 607.760.15 (surface water not contacting waste)]. If corrections have not been completed within the specified schedule, legal notification may ensue.

cc: Glen O'Bryan, Laidlaw, Oper. Mgr.
John Boonstra, Laidlaw, Reg. Div. Mgr.
Joe Trunko, MDNR-SLRO
Richard Houchin, Bridgeton City Hall
Glen Hampton, St. Louis Co. Waste Mgmt.

Signature of Inspector

Signature of Section Chief

St. Louis Regional Office
Date Received

JAN2893

Route:

APCU_____

SWI&U_____

WP-PRMT___

I&NJI_____

LAIDLAW WASTE SYSTEMS INC.

January 7, 1993

Mr. Brad Bomanz, C.P.S.
Environmental Control Inspector
St. Louis County Department of Health
111 South Meramec Avenue
Clayton, Missouri 63105

Route:
APCU
SWMU
Joe T

Re: Laidlaw Waste Systems (Bridgeton), Inc.

Dear Mr. Bomanz,

Pursuant to your request, this letter outlines the recent chronology of the underground fire located in the wet weather area. I was first made aware of the fire on November 30, 1992. At that time, small wisps of smoke were emanating from the quarry wall in a few locations around the wet weather area. The magnitude of the problem was not significant at that time. We began a daily inspection of the area, beginning the next day. On December 7, 1992, the fire was dramatically more intense, with visible flames at the north quarry wall in the wet weather area. Site personnel removed burning debris from the sidewall, and began placing a soil berm along the entire north wall. Further, the landfill gas collection system in this area was turned off. The berm along the north was completed on December 8. The landfill gas collection system was then turned back on December 9. Since then, site personnel have conducted daily visual inspections of the area. Persistent wisps of smoke and/or steam continue to be present in a few locations along the eastern quarry wall. I have determined that the smoke is finding a pathway through weathered rock and presenting itself approximately 15' above the elevation of the refuse in that location.

As conditions warrant, we are placing additional soil along the walls and over the area as a whole. We are also developing some data in the area by taking temperature readings in the landfill gas system. Additionally, we have purchased a Drager tube sampling pump and CO tubes. We are training site personnel in the use of this equipment and sampling will begin in the very near future.

LAIDLAW WASTE SYSTEMS INC.

I will keep you apprised of further developments in this area and the data generated from the described monitoring. Should any questions arise or clarification be necessary, please call me at (314) 739-1919.

Sincerely,

Glenn A. O'Bryan, P.E.
General Manager

cc: Joseph L. Trunko, MDNR
Dennis Wike, Laidlaw

13570 ST. CHARLES ROCK ROAD, BRIDGETON, MISSOURI 63044 (314) 739-1919

St Louis Co.
Westlake SLF

LAIDLAW WASTE SYSTEMS INC.

January 25, 1993

Mr. Robert S.P. Eck, Regional Director
Missouri Department of Natural Resources
Division of Environmental Quality
St. Louis Regional Office
10805 Sunset Office Drive, Suite 100
St. Louis, Missouri 63127-1017

Re: Laidlaw Waste Systems (Bridgeton), Inc.
Bridgeton Sanitary Landfill
MDNR Permit #118912

Dear Mr. Eck,

Pursuant to your December 30, 1992 letter, this correspondence outlines the steps that we are undertaking to address the issues raised by the inspection performed by members of your staff on December 29, 1992. Specifically referencing items from the inspection report area FINDINGS:

1. A large amount of exposed waste was observed at the facility.
2. Erosion gullies were observed in the wet-weather area.

Wet Weather Area (WWA) - We started cover improvements in the WWA during the week of January 4, 1993. This activity is ongoing and has been done in tandem with the construction of a new 12" landfill gas (LFG) pipe which traverses the WWA. Further actions, as weather allows, will include adding an estimated 7800 bcy of soil to the WWA, constructing a soil wedge along approximately 600' of the quarry wall in the WWA, constructing erosion control berms and installing downdrains. In conjunction with the underground fire (see next item) we may install a synthetic cover over the WWA for oxygen deprivation, or we may vegetate the area. A final decision will be made after additional study of the underground fire character and extent.

Northern Area of the Active Pit - The northern area of the active pit has been regraded and repaired.

LAIDLAW

3. An underground fire was occuring in the wet-weather area.

A number of actions have already been taken on this issue. Our first effort has been directed toward shutting off oxygen pathways to the fire. Toward that end, we installed a soil wedge along the north wall of the WWA on December 8, 1992. As described above, we are adding to the soil wedge along the eastern and southwestern edges of the WWA along the quarry walls. This effort, combined with the additional cover soils in the WWA should dramatically reduce the oxygen potential. Further, we have purchased a Drager sampling pump and carbon monoxide (CO) tubes and a thermometer, to monitor LFG flows from the area, as well as the wisps of smoke/steam which emanate from the quarry wall in a few locations. We will monitor this situation daily and keep the Department apprised of the results.

4. The new flare has not been constructed.

Site clearing was started on the new flare location on December 28, 1992. Construction began on January 4, 1993. The concrete foundation and pad are now complete. The blowers, piping, and electrical will be installed during the week of January 18. The flare stack will be installed during the week of January 25, and we expect the flare to be operational during this same week.

5. Regulated quantities of hazardous waste have been disposed of at this facility.

We submitted a plan to the MDNR on December 14, 1992 for the remediation of this issue, with a completion date of March 31, 1993.

We trust that this correspondence satisfactorily addresses the concerns from the referenced inspection. Should any questions arise or clarification be necessary, please call me at (314) 739-1919.

Sincerely,

Glenn A. O'Bryan, P.E.
General Manager

cc: Joe Trunko, MDNR
Brad Bomanz, St. Louis County Health Department
Miles Stotts, Laidlaw
Dennis Wike, Laidlaw

LAIDLAW WASTE SYSTEMS INC.

March 20, 1993

Ms. Sue Taylor, Supervisor
Waste Management Section
St. Louis County Department of Health
111 South Meramec Avenue
Clayton, Missouri 63105

Re: Laidlaw Waste Systems (Bridgeton), Inc.
Bridgeton Sanitary Landfill
St. Louis County Permit No. 0419
Inspection of 12/29/92

Dear Ms. Taylor:

I was reviewing my inspection files this morning and determined that I had not written a specific response to your inspection of 12/29/92. Your office was, however, copied on the response to the MDNR inspection of that same date which noted my responses to the same issues identified in your inspection. I did not, however, specify dates for the anticipated actions, which was requested within your inspection documents.

Regarding 607.730.11 (surface water courses diverted and proper grading as indicated) and 607.760.15 (surface water not contacting waste), please find attached a sketch describing the corrective construction features. The corrective construction features include an all-weather access road, west downdrain, east downdrain, erosion control berms, additional cover soils and vegetation. The road has been under construction during the past month, and should be completed by April 15. The road will provide a solid path for our heavy equipment to move between the sanitary site and the demolition site. We may also use this new road for refuse vehicle ingress and egress, particularly when maintenance is required for the main quarry road. Completion of the road will allow access for performing the additional work. I plan to complete the construction of the cover soils, berms and other drainage features by May 15.

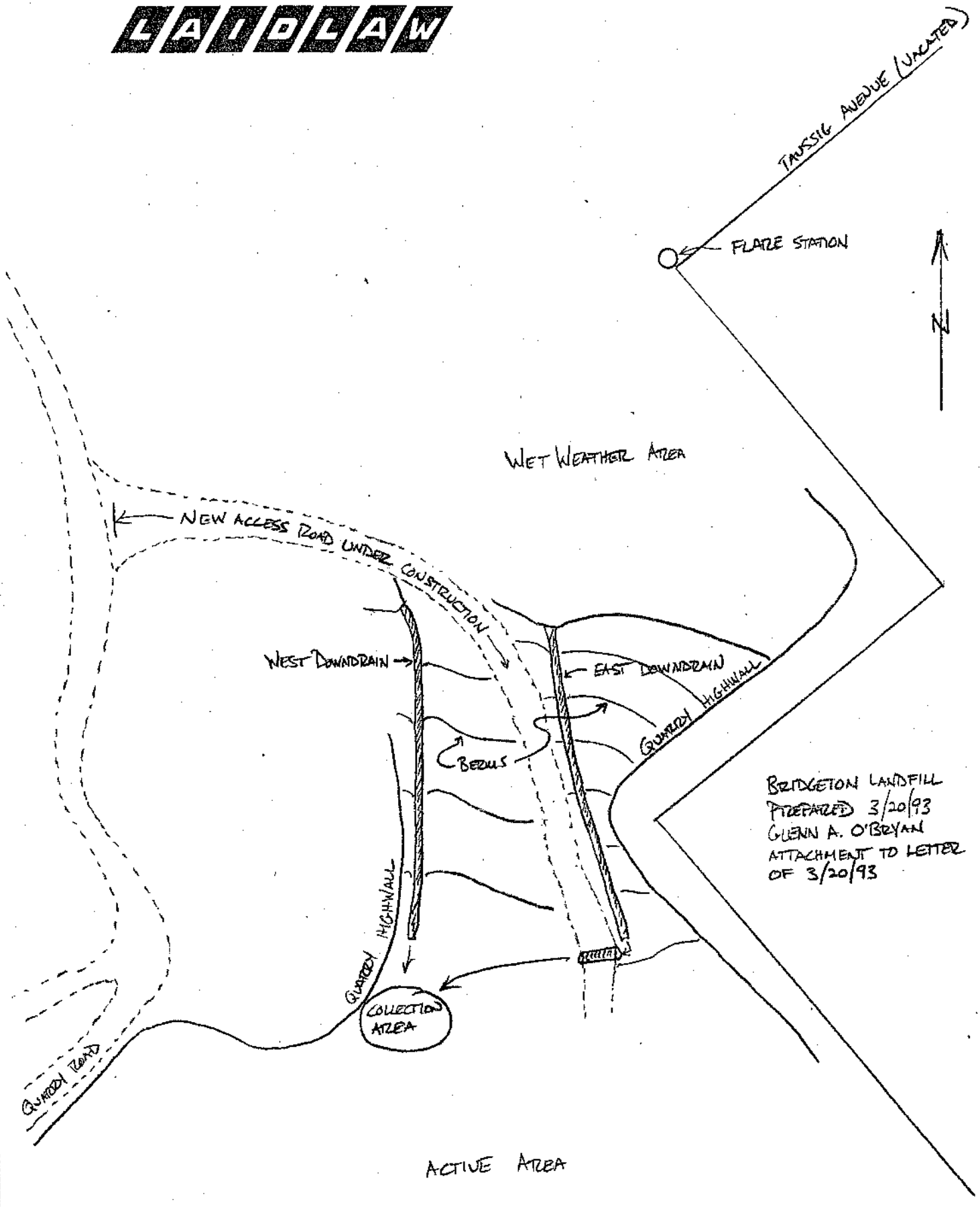
I trust that this correspondence adequately addresses your request. Should any questions arise or clarification be necessary, please call me at (314) 739-1919.

Sincerely,

Glenn A. O'Bryan, P.E.
General Manager

cc: Joe Trunko, MDNR-SLRO
Dick Houchins, P.E., City Engineer/Director of Public Works
Miles Stotts, Laidlaw
Dennis Wike, Laidlaw

LAIDLAW


TAUSSIG AVENUE (UNCUTED)
FLARE STATION
N
WET WEATHER AREA
NEW ACCESS ROAD UNDER CONSTRUCTION
WEST DOWNDRAIN
EAST DOWNDRAIN
HIGHWALL
BERMS
QUARRY
BRIDGETON LANDFILL
PREPARED 3/20/93
GLENN A. O'BRYAN
ATTACHMENT TO LETTER
OF 3/20/93
HIGHWALL
QUARRY
COLLECTION AREA
QUARRY ROAD
ACTIVE AREA

PROPOSAL

LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL
BRIDGETON, MISSOURI

Submitted to:

Laidlaw Bridgeton Sanitary Landfill
Laidlaw Waste Systems, Inc.
13570 Saint Charles Rock Road
Bridgeton, Missouri 63044
(314) 739-1919

Submitted by:

SCS Engineers
2060 Reading Road
Cincinnati, Ohio 45202
(513) 421-5353

December 10, 1993
Revised January 10, 1994
File No. 0507893

PROPOSAL

LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL
BRIDGETON, MISSOURI

BACKGROUND

This submittal represents a proposal from SCS Engineers for landfill fire mitigation at the Bridgeton Sanitary Landfill. Symptoms of landfill fire have existed at the Bridgeton Landfill for about one year. A fire appears to have developed in an area of the landfill indicated on Exhibit 1. The landfilling operation at Bridgeton consists of a quarry fill operation. As in all quarry fills, settlement of refuse mass creates a shear plane against the quarry sidewall. Typically, this shear plane develops into a separation distance of several inches. This separation gap provides the opportunity for air intrusion.

The Bridgeton Sanitary Landfill also has an active gas extraction system. This system consists of dozens of vertical gas extraction wells, and horizontal collectors. These all feed to an existing blower/flare station. At this location, the collected gases are combusted, and vented to atmosphere.

A horizontal collector formerly operated within several hundred feet of the fire area. Although the gas system is now closed off, this system may have created the opportunity for air intrusion into the gap between the landfill and its quarry sidewall. Specifically, the gas collection system places vacuum on subsurface refuse. The vacuum can be relieved through atmospheric intrusion, at the point of least resistance. This point of least resistance was likely the quarry sidewall, where a gap of several inches allowed easy entry of atmospheric air, to a depth of dozens of feet.

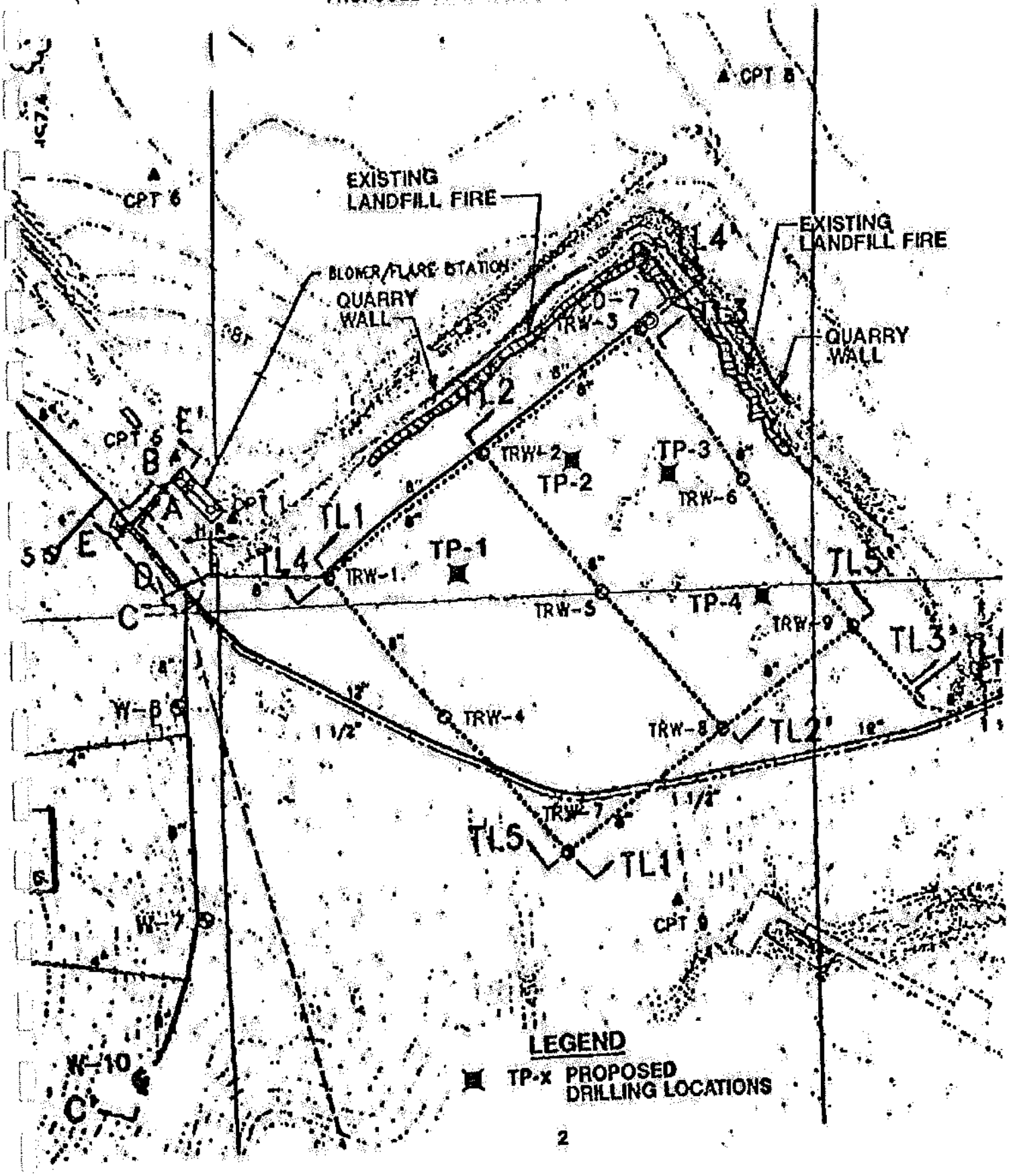
Since the time that fire symptoms were first detected, the gas extraction system has been turned off. In addition, the operators have piled cover soil atop the crack, in an effort to extinguish the fire and starve it from atmospheric air. Though this approach appears to have had some success, the fire continues in many areas to this date.

It is recognized at this point that piling additional cover soil atop the fire will likely not permanently mitigate the problem. As a result, this proposal was solicited. Its purpose was to develop an investigative program, to collected necessary background information, and determine the best mitigative approach to completely and permanently extinguish the landfill fire. As a final task under this proposal, mitigation would actually be applied.

The balance of this proposal addresses the proposed work scope, schedule, costs, project team, and qualifications for SCS Engineers. Our Scope of Work contains a total of five tasks. The first four of these tasks deal with investigation. The last of these assumes a certain mitigative approach, and proceeds to scope, schedule, and price that task.

EXHIBIT 1

PROPOSED TEMPERATURE PROBE LOCATIONS



SCOPE OF WORK

General

This portion of the proposal describes the approach to be taken in investigating and mitigating a potential landfill fire at the Laidlaw Bridgeton Landfill near St. Louis, Missouri. Based on its prior experience on other landfill fires, SCS has developed the following five tasks to accommodate the proposed work flow on this assignment.

- Task 1. Fly infrared thermography.
- Task 2. Install temperature probes.
- Task 3. Monitor temperature probes.
- Task 4. Prepare report and propose mitigation.
- Task 5. Mitigate landfill fire.

The balance of this section will identify the objectives and detailed approach to be taken under each of these tasks.

Task 1 -- Fly Infrared Thermography

Objectives--

1. Finalize plans for infrared thermography, including selection of appropriate technique and vendor.
2. Perform infrared thermography. Create color video tape and still photographs.
3. Process and evaluate thermography. Draw conclusions about subsurface fire, as a basis for temperature probe installation.

Approach--

SCS Engineers has utilized infrared thermography on other landfill fire projects. Those three projects, and the techniques applied at each are summarized below:

1. Port Washington Landfill, North Hempstead, New York

   Due to the improper operation of an existing landfill gas collection system, a subsurface fire apparently developed around selected gas extraction wells. To determine the depth, intensity, and extent of subsurface combustion, aerial thermography was flown at the Port Washington Landfill at the direction of SCS Engineers. The thermography was performed in about 1985, and prepared a single black and white photo taken from an airplane flown during night.

   The thermographic effort proved to be of little use. At this point, the more intense, surface manifestation of the fire had ceased to exist. In addition, the

remaining fire appeared to be relatively calm, and at far greater depth. Little surface manifestation of the fire could be seen. This thermography proved to be valuable only in identifying that near-surface combustion was not occurring.

2. Industrial Excess Landfill, Uniontown, Ohio

Elevated carbon monoxide and subsurface temperature readings were recorded at this Superfund landfill. SCS was the design engineer of record, under contract to the U.S. EPA, and performing its Emergency Response Contract Services (ERCS) assignment. Based on prior experience by SCS on other sites, we recommended the performance of an aerial overflight to perform infrared thermography. Black and white videotape was prepared, using a plane flown during the night.

This was a relatively shallow landfill. The results and tape revealed little to no subsurface combustion. This was later confirmed with more intensive subsurface probing, including subsurface temperature profiles, well head monitoring, further carbon monoxide readings, and other related data.

In conclusion, the thermography at this site was useful in determining that the earlier feared landfill fire was now at a relatively low level, or altogether non-existent.

3. G B Auto Parts and Landfill, Ironton, Ohio

SCS Engineers responded to this landfill fire under its U.S. EPA Emergency Response Contract Services (ERCS) assignment. Approximately 5 acres of the total 10 acre site was actively burning. Smoke emanating from the landfill had caused the evacuation of several residential structures nearby.

In order to determine the subsurface extent of the fire (as it may be different from the surface manifestation), SCS ordered that an infrared photography be performed in 1993. An aerial plane overflight was performed during early evening hours after sunset. A color videotape was compiled, and used for subsequent interpretation.

The actively burning areas (as could be seen from the ground surface) were confirmed through the infrared thermogram as having active combustion. Active combustion appeared to be confined to these areas of surface manifestation. Because the landfill was relatively shallow (30 ft or less) and in combination with infrared photography, it was determined that the fire was confined to those areas emanating smoke. The infrared thermography was therefore useful in determining that the subsurface fire was not more extensive than what could be seen on the surface.

Based on the above, SCS has had mixed results with the use of infrared thermography in the past. In some cases, it has been successful in determining the extent of subsurface combustion, as it may exceed those areas readily identified through surface manifestation of smoke. In other cases, the buffering effects of soil could mislead interpretation of the aerial overflight. This is a particular problem if the combustion is contained at great depth, as often occurs in deeper landfills.

Generally, there exist several alternatives for performance of infrared thermograms:

1. Black and white versus color.
2. Videotape versus still photos.
3. Ground surface examination versus aerial overflight.
4. Helicopter versus airplane.

Based on our prior experience, we recommend that Laidlaw proceed with infrared thermography at this site. Although there is some risk that the thermogram could be misleading or fail to add new information, on balance we find it to be a useful tool. Our chief purpose here would be to determine whether subsurface combustion has spread laterally, at shallow distance, beyond those areas currently emanating smoke. If so, placement of temperature probes in these areas would be appropriate. Thus, the outcome of Task 1 (Thermography) could readily affect Task 2 (Temperature Probe Installation).

At this time, we recommend use of a helicopter, to compile color videotape atop the site. This should be flown during nighttime, with early morning hours preferred. The videotape can be used for subsequent interpretation. From past experience, the color videotape can be used to prepare still photographs, produced at the same scale as topographic maps. In this manner, the exact limits of the subsurface combustion can be drawn to scale, on topographic maps available from other sources.

As a first step as work proceeds, SCS would research available contractors capable of performing infrared thermography in the St. Louis area. SCS has utilized Midwest Aerial Photography out of Columbus, Ohio for this purpose. Another candidate is Entech Systems from St. Louis. The expected cost of this effort would be approximately $4,000. The deliverable would include a color videotape, and a select number of still photos.

After contacting these and other aerial firms, a determination would be made as to price, technology, approach, quality, and delivery schedule. A final selection would then be made. Plans would be prepared for the aerial overflight itself. The overflight would then be performed at night with SCS personnel present.

The videotape from the overflight is expected to be available immediately. It would be viewed and interpreted with "ground truthing" performed, to identify the fringe areas of fire. Selected images within the videotape would be identified, and compiled into still photographs. These still photos would be prepared to scale. The two scaled photographs would then be utilized to draw the extent of the fire on the topographic maps described above.

As an outcome of this task, a determination can be made as to the placement of the temperature probes under Task 2. A plan for their placement is already included here in this proposal. However, modification of their location, or expansion of the number of probes, may be both be necessary as a result of the infrared photography here.

Task 2 -- Install Temperature Probes

Objectives--

1. Finalize plan for installation of temperature probes including location, installation, and backfill. The final plan to be based upon results of Task 1 infrared thermography.

2. Contact competent drilling firm for well installations. Capability must include angled drilling proposed for this program. Select a driller based on availability, capability, quality, delivery schedule, and price.

3. Install two drilled-well clusters at two separate locations in the landfill. These locations to be generally offset from the quarry edge by about 50 ft back from the existing fire area.

4. Each cluster to consist of two separate well points. One to be vertical, and 75 ft deep. The other to be angled, and traverse through the quarry wall.

5. Supervise well drilling and backfill operations. Compile boring logs. Make on-site design decisions. Complete backfill and well construction.

Approach--

Another useful tool in examining subsurface landfill fires, is the installation of dedicated temperature monitoring points. SCS Engineers has installed such points at numerous landfills. Typically, they are installed with steel or iron pipe. Through use of down hole thermocouples, we can determine the temperature levels and gradient, at two ft differentials down the entire bore hole depth. This allows us to determine the presence, intensity, and depth of any landfill fire.

At this time, and based on expected results from Task 1, we anticipate installing two separate well clusters. Each cluster would have two wells, one of them vertically downward, and one of them angled toward the quarry wall. The straight vertical wells are an estimated 75 ft deep from the ground surface. The angled wells are an estimated 80 ft deep. Both wells would be installed in the same general location, offset into the landfill about 50 ft from the quarry wall. The vertical well would be installed first, followed by the angled well. Our intention is to install the angled well through the quarry wall by several feet, and to determine the presence of combustion at this interface.

Boring logs would be carefully compiled during well installations. Any refuse removed from the bore hole would be examined for elevated temperature. Temperatures would be recorded, and other physical observations made on the boring logs.

Steel or iron pipe, 1 in. in diameter, would be installed to the bottom of each of these eight bore holes. Proposed bore hole locations are as indicated on Exhibit 1. All holes would then be backfilled with gravel around the perforated interval (estimated to begin 5 ft below the ground surface). The annular space within 5 ft of the surface would be packed with clay and concrete material, to provide structural and airtight integrity.

Task 3 -- Monitor Temperature Probes

Objectives--

1. Perform down hole temperature and other monitoring of all four monitoring probes. Perform monitoring twice, at two week intervals.

2. Perform monitoring for down-hole temperature, gas composition, water presence, and trace constituents.

3. Record selected "ambient landfill temperatures" at gas extraction wells located elsewhere on the fill. Utilize this data as a baseline.

Approach--

The primary purpose of the temperature monitoring probes would be to collect data on down hole temperatures at various intervals. SCS has in its possession several down-hole thermocouples. These have been used in the past to record landfill temperatures, at periodic intervals, down the total well depth.

Steel or iron well points have been installed to fend against attack from any subsurface landfill combustion. Plastic well points (though less expensive) would melt or otherwise fail as a result of the elevated temperatures found in a landfill fire. Steel well points are more durable, and have shown to sustain around landfill fire.

SCS proposes to perform two separate rounds of temperature monitoring associated with these eight well points. Monitoring would be performed at two week intervals for a total of two rounds, over a two week term. SCS would perform the first monitoring, immediately after the time of well installation and backfill. Simultaneously, SCS would train Laidlaw personnel, and leave monitoring equipment. This would allow Laidlaw to lead monitoring round two, two weeks after original well installation.

During each monitoring round, and at each of the four well points, the following monitoring would be performed:

1. Most importantly, down-hole temperatures in degrees F, at two ft intervals down each probe. Down-hole temperature monitoring allows one to see a gradient of subsurface temperatures. The location, intensity, and depth of any subsurface combustion can be determined.

2. Well head pressure.

3. Gas composition including methane, oxygen, and carbon dioxide. These major constituents would be monitored using handheld instruments available at SCS.

4. Water level.

5. Total well depth.

6. Trace constituents including carbon monoxide (CO) and vinyl chloride (VC). These parameters would be monitored using either Draeger tubes or handheld instruments.

SCS will also collect selected ambient temperature data on other gas extraction wells located at Bridgeton Landfill. From past experience, we find that temperatures that may otherwise indicate a landfill fire, can sometimes be an indication of "elevated anaerobic decomposition". To determine this condition, down hole temperatures should be recorded from at least three other ambient landfill gas extraction wells, located in other portions of the landfill, where they are apparently unaffected by potential fire. This data can then serve as a baseline, to allow comparison with down hole temperatures from the eight selected wells in our temperature well clusters.

Task 4 -- Prepare Report and Propose Mitigation

Objectives--

1. Tabulate and plot temperature and other monitoring data.

2. Determine temperature trends at each well location. Compare with background conditions. Determine presence, extent, depth, and intensity of any subsurface fire.

3. Utilize infrared photography to determine presence of any likely fire.

4. Compile and evaluate background data on existing gas collection system. Determine and evaluate history of "landfill fire" as told by Laidlaw operations personnel.

5. Draw final conclusions on subsurface fire.

6. Prepare recommendations on need for and approach taken by, mitigation.

Approach--

Following the second temperature monitoring round, all data will be tabulated, plotted, and evaluated. The infrared thermogram would also be used to evaluate data, with the new temperature data in hand. Historical perspective on the landfill fire will be gained, by interviewing Laidlaw personnel. Lastly, the configuration of the existing landfill gas extraction system will be examined. This system could have an impact on starting or promoting any landfill fire.

After examination of this data, SCS will be able to determine the following factors:

1. Is a landfill fire present? Where is it located, at what intensity, and at what depth?

2. How did the landfill fire likely begin? Is it now expanding? What are the future risks of "no action"?

3. Should mitigative steps be taken? If so, what technique should be applied? What is the specific approach, schedule, and cost?

At the conclusion of this Task, SCS will submit a report on the subject. This report will include the following contents:

1. Introduction and background.
2. Compilation of existing data.
3. Compilation of new data from test monitoring program.
4. Discussion, evaluation, and conclusions.
5. Recommendation on landfill fire mitigation.

The report will be submitted in draft form to Laidlaw personnel for review. A meeting will be conducted to present our findings. Based on comments received, the report will be finalized, and final recommendations on mitigative action will be made.

Task 5 -- Mitigate Landfill Fire

Objectives--

1. Implement approach chosen during Task 4 report. Mobilize equipment to site. Set up for landfill fire mitigation.
2. Apply methodology for landfill fire mitigation in a first application. Monitor thereafter, to determine effectiveness.
3. Perform second and third applications if needed. Continue to monitor to determine effectiveness.
4. After halting mitigative action, continue to monitor periodically thereafter, to ascertain continued effectiveness.
5. Prepare final letter report to Laidlaw, reporting on mitigative action, its success, and its prospects for maintenance in the future.

Approach--

SCS Engineers has been involved in numerous landfill fire investigations and mitigations in the past. Some of the tools typically used in identifying and researching landfill fires have included those previously mentioned: infrared thermography, down-hole temperature monitoring, etc. Based on these prior efforts, we have proposed mitigative actions. The actions applied previously, which may have some relevance here, include:

1. Gas system.

   Often a landfill fire is related to an existing gas extraction system. If overdrawn, or if channels for rapid air intrusion are created, there exists the potential for gas extraction systems to draw in atmospheric air, starting or fueling an existing landfill fire.

   From past experience, the gas extraction system in the suspected area must immediately be turned off. The fire must be proven to be totally extinguished, before the gas system can be returned to operation.

   The first step has already been taken at Bridgeton Landfill, with deactivation of the gas extraction system in the area of the alleged landfill fire. Monitoring can be performed during Task 3 of this program, to ascertain whether a zone of influence effect no longer exists in this area.

2. Soil cover.

   Once a landfill fire begins, it can "breathe in" its own oxygen from the atmosphere, to a greater depth than may otherwise occur in a common anaerobically-decomposing sanitary landfill. Even with halting the operation of a gas extraction system, our experience indicates that landfill fires 10 or 20 ft deep (or deeper) can reach to the landfill surface, and draw in oxygen. Commonly, SCS moves to apply additional clay soil cover. The effect of this cover will be to starve or shut off such air intrusion.

   To this end, SCS has applied 4 ft of compacted clay soil to the G B Auto Parts and Landfill in Ironton, Ohio. This approach appears to be successful in starving the existing landfill fire, and lowering temperatures. With time, we expect the fire will be totally extinguished. Unfortunately, some level of subsurface combustion will likely occur for many months to come.

3. Foam application.

   Chemical foams are commonly used by fire fighting departments, and have been used for landfill fires in the past. They are particularly effective when the fire manifests itself on the surface of the landfill. Clearly this is not the case at Bridgeton Landfill. Though foams have some effectiveness subsurface, particularly when injected below grade, they do not long survive. Most foam lasts for less than a day, unless special agents are added. Even when such agents are added, longevity for no more than two weeks can be expected.

   Foam provides the following beneficial effects: adds water to cool and extinguish the fire, minimizes or prevents air intrusion, and otherwise covers or suffocates such combustion. However, the longevity of such foam makes it questionable for subsurface fire mitigation.

4. Liquid nitrogen or carbon dioxide.

   SCS has applied liquid nitrogen and carbon dioxide on three sites to date. Typically, the material is injected through the temperature monitoring probes (described under Task 2) to the subsurface fire area. As for foam above, liquid gases have the following benefits: cools the fire, extinguishes the fire, and prevents air/oxygen intrusion. However, like foams, liquid nitrogen and carbon dioxide can be very expensive. Our past experience indicates that the materials applied escape rapidly to atmosphere. New material must be constantly applied over a multi-week period.

5. Water application.

   Water application may have some relevance on landfill fires. Obviously they provide all the benefits of foams or liquid nitrogen and carbon dioxide. They cool, smother, and seal off from air intrusion. However, they also add water to a landfill, which is usually undesirable, since the application of water can create additional leachate quantities. Without a well sealed bottom-lined landfill, water application is not advised.

6. Bentonite slurry application.

   A slurry or bentonite application lasts longer than foam or liquid air injections. Like foams, slurries also provide the benefits of cooling, fire extinguishment, and air sealing. SCS has used such applications in any of the following scenarios: (1) flooding a given ground surface area with bentonite soil, so as to minimize air intrusion; (2) subsurface injection through temperature monitoring probes or other ports; and (3) injection into landfill cracks.

The latter seems like the best choice at Bridgeton Landfill, owing to the large crack along the interface of the quarry wall and refuse fill.

At this time it appears the bentonite slurry application may have most value. Thus, the chronology of assumed actions we present here is based upon selection of slurry as the preferred application.

As a first step, equipment for bentonite slurry material would be mobilized to the site. The slurry would be mixed, and pumped into the crack along the quarry sidewall. Thereafter, temperature probes would be monitored, in an effort to determine whether the slurry has had any benefit.

Some settlement of the slurry can be expected over a period of several days. As a result, and for scoping purposes, we propose that the slurry application equipment remain on site, and be used for a second application some two weeks later. Again temperature probes will be monitored. Some settlement would likely occur. Finally, a third application would occur two weeks later.

Monitoring would be performed thereafter. Based on past experience, it is assumed that the fire would be adequately settled at this point, to allow for the slurry equipment to de-mobilized from the site.

From past experience, some subsurface combustion can be expected for months thereafter. However, the temperatures should gradually decrease over time. Surface manifestation of fire should not occur. Subsurface temperature monitoring should continue, in an effort to determine that the levels have returned to acceptable ranges, and that the trend continues downward. This monitoring would be performed by Laidlaw personnel, based on guidance provided by SCS.

PROJECT SCHEDULE

The proposed project schedule for this program has been included as Exhibit 2. As shown, the total investigative program would be completed within 2½ months after project initiation. This includes two to four weeks for aerial thermography, two to three weeks for temperature probe installation, four weeks for temperature probe monitoring, and four weeks for report preparation and agreement on the proposed mitigation. Several of these tasks overlap, creating a total estimated 2½ month period of performance.

Mitigation of the landfill fire can proceed thereafter. A significant portion of this work would be performed within four weeks of initiation of this task. For budgeting purposes, SCS effort would expire at the end of that six month term (based on the mitigation now proposed). Some involvement by Laidlaw personnel to continue monitoring the situation for several months thereafter would likely be required.

PROJECT COSTS

Vendor costs on this program include those for a driller and for performance of the aerial thermogram. Drilling and probe installation costs have been estimated in Exhibit 3, and amount to $5,401. The aerial thermogram has been estimated at $4,000. This is predicated on the performance of a single aerial overflight using a helicopter, and compilation of a color videotape to observe subsurface thermographic conditions. Processing of selected still photographs from the videotape has also been included within this amount.

SCS manhours and total costs have been presented by task in Exhibit 4. A summary of those costs has been included on Exhibit 5. Please note that these costs are negotiable. Outside vendor costs can be contracted directly to Laidlaw Waste Systems if appropriate. In addition, Laidlaw could choose to initiate and proceed with any individual task, foregoing application of subsequent tasks until the outcome of early tasks has become known.

The specifics surrounding our proposed costs for Task 5 are detailed below:

1. We have provided a budgetary estimate of $10,000 for the additional construction-related activity under Task 5, Landfill Fire Mitigation. This includes a total of five days of on-site activity, at an estimated $2,000 per day.

2. Our original proposal described the application of a slurry grout injection along the landfill sidewall during each of three separate rounds. The first round was to be the most expansive, and was to consume a total of three elapsed days. The subsequent two rounds were to be at two week intervals thereafter. Each round

EXHIBIT 2

PROJECT SCHEDULE

Task No. and Title	Months from Project Start				
	1	2	3	4	5
1. Fly Infrared Thermography	-------				
2. Install Temperature Probes	----	--			
3. Monitor Temperature Probes		-------			
4. Prepare Report and Propose Mitigation		----	---		
5. Mitigate Landfill Fire				-----	---->

Activity:

------- SCS Activity

EXHIBIT 3

DRILLING/PROBE INSTALLATION COST ESTIMATE

1.	Mobilization		$100
2.	Drilling		
	-- 2 straight holes x 75 ft deep each	= 150 ft x $9/ft	1,350
	-- 2 angled holes x 80 ft deep each	= 160 ft x $11/ft	1,760
3.	Probe Installation		
	-- 2 straight holes	= 150 ft x $5/ft	750
	-- 2 angled holes	= 150 ft x $5/ft	750
4.	Decontamination Charge		200
Subtotal			$4,910
5.	Contingency (10%)		491
TOTAL			$5,401

EXHIBIT 4

DETAILED COST ESTIMATE

Labor Classification	Rates	Task 1 Infra-Red Thermography	Task 2 Install Probes	Task 3 Monitor Probes	Task 4 Report	Task 5 Mitigate*	Total
LABOR MAN-HOURS:							
Project Director		4	4	4	8	16	36
Sr. Project Engineer		16	8	8	16	64	112
Staff Engineer		8	32	16	16	80	152
Drafter		--	4	--	8	8	20
Secretary		4	4	--	16	16	40
Subtotal -- Labor Man-Hours		32	52	28	64	184	360
LABOR DOLLARS:							
Project Director	$135 /hr	$540	$540	$540	$1,080	$2,160	$4,860
Sr. Project Engineer	89 /hr	1,424	712	712	1,424	5,696	9,868
Staff Engineer	56 /hr	448	1,792	896	896	4,480	8,512
Drafter	42 /hr	--	168	--	336	336	840
Secretary	38 /hr	152	152	--	608	608	1,520
Subtotal -- Labor Dollars		$2,564	$3,364	$2,148	$4,344	$13,280	$25,700
EXPENSES:							
Thermography		$4,000	--	--	--	--	$4,000
Drilling/Probe Installation		--	5,401	--	--	--	5,401
Grout Slurry Contract Cost		--	--	--	--	10,000	10,000
Travel		1,000	1,000	1,000	500	1,500	5,000
Per Diem	$75 /day	225	375	225	150	600	1,575
Field Equipment		100	200	200	--	200	700
Supplies		100	200	100	--	200	600
Reproduction		50	50	50	100	50	300
Express/Shipping		50	50	50	100	100	350
Computer	$30 /hr	150	240	--	480	150	1,020
Long-Distance Telephone		25	50	25	50	75	225
G&A (15% of outside non-labor expenses)		810	1,061	210	120	1,871	4,075
Subtotal -- Expenses		$6,510	$8,627	$1,860	$1,500	$14,746	$33,244
TOTAL		$9,074	$11,991	$4,008	$5,844	$28,026	$58,944

* Note: Task 5 costs estimated, and dependent upon mitigation selected and the duration of its application. Task 5 includes SCS costs, but excludes any outside cost for mitigation materials, supplies, or equipment.

EXHIBIT 5

COST SUMMARY

Task No. and Title	SCS Labor And Expenses	Outside Venders
1. Fly Infrared Thermography	$5,074	$4,000
2. Install Temperature Probes	6,590	5,401
3. Monitor Temperature Probes	4,008	--
4. Prepare Report and Propose Mitigation	5,844	--
5. Mitigate Landfill Fire	18,026	10,000
TOTAL	$39,542	$19,401

was estimated to consume a total of one day. Thus, among all three rounds, a total of five days would be consumed.

3. In calculating our unit daily cost, we have assumed that heavy equipment would be provided through this contract to cut a bench in the existing mound of soil piled atop the landfill fire. This would be applied only in the first round. The bulldozer would be demobilized after the first round, and not used thereafter.

   For the first and subsequent two rounds, a cement mixer, conveyor, bentonite, water, and an estimated two to four personnel would be required each day. Some nominal support may be required from on-site Laidlaw personnel and operating equipment. However, this assistance would be on a spot basis, and would not be required full-time during those days.

SCS PROJECT TEAM

Three key personnel have been assigned to performance of this Laidlaw project. These include James Walsh (as Project Director), William Held (as Senior Project Engineer), and Eric Waldmann (as Staff Engineer). Qualifications of each of these individuals with regard to landfill fires is summarized below.

James J. Walsh, P.E. has a B.S. in Civil Engineering, and is a registered professional engineer in multiple states. Mr. Walsh has nearly 20 years professional experience in landfill and landfill gas projects. To date, he has been engaged on four separate landfill fires. Landfill fire projects have included Industrial Excess Landfill in Uniontown, Ohio; Port Washington Landfill in North Hempstead, New York; Lake County Landfill in Cleveland, Ohio; and G B Auto Parts and Landfill in Ironton, Ohio. Through these projects, Mr. Walsh has gained successful experience with various landfill fire investigative and mitigative approaches. Investigative approaches have included temperature probe installation and aerial thermograms. Mitigative approaches successfully applied have included: liquid nitrogen injection, liquid carbon dioxide injection, and clay cap application.

William M. Held is a degreed civil and environmental engineer. Mr. Held has 13 years professional experience, mostly on landfill and landfill gas projects. He has performed past work at the Bridgeton Landfill on behalf of Laidlaw Waste Systems. He has used the investigative measures and mitigation actions proposed for this project including: temperature probe installations, subsurface temperature profiles, aerial overflights, well head gas monitoring, and clay cover application.

Eric J. Waldmann is a design engineer with five years professional experience. Since joining SCS, Mr. Waldmann has been engaged nearly full-time on landfill and landfill gas projects. Most recently, he has been engaged on a full-time basis over a multi-month period at the GB Auto Parts and Landfill in Ironton, Ohio. At this site, he was responsible for landfill fire mitigation. Investigative actions supervised by Mr. Waldmann included temperature probe installation, subsurface temperature profiles, aerial overflight, thermogram, and clay cover application.

EXHIBIT 6

REPRESENTATIVE LANDFILL FIRE AND EXCAVATION PROJECTS

- Subsurface Fire Investigation at NPL Landfill Site, Industrial Excess Landfill, Uniontown, Ohio.
- Subsurface Fire Investigation, Extinguishment and Post-Extinguishment Monitoring, Lake County Landfill, Cleveland, Ohio.
- Subsurface Landfill Fire Control and Extinguishment via Carbon Dioxide Injection, South Bay Six Drive-In Theater, Carson, California.
- Landfill Fire Control Utilizing Subsurface Flooding, Excavation and Addition of Suitable Cover Material at Five Adjacent Landfill Sites, Wilmington, California.
- Repair of Fire Damaged LFG Recovery Facilities/Regrading of Settled Areas, Wilmington, California.
- Identification and Monitoring of Subsurface Landfill Fire Impacting LFG Migration Control Facilities, Mountaingate Development, Los Angeles, California.
- Identification and Control Plan Development for Subsurface Landfill Fire, Industry Hills Development, Industry Hills, California.
- Development of Landfill Fire Mitigation Program, Industry Hills Development, Industry Hills, California.
- Development of Landfill Fire Control Program, Guam.
- Landfill Fire Status Evaluation and Development of Short-Term Mitigation Plan, Including Health and Safety Risk Assessment, Go East Landfill, Snohomish County, Washington.
- Subsurface Landfill Fire Control and Extinguishment, Palailai Sanitary Landfill, Oahu, Hawaii.
- Subsurface Landfill Fire Control and Extinguishment, Laguna Seca Landfill, Monterey County, California.
- Subsurface Landfill Fire Investigation and Control, Mountain View Sanitary Landfill, Mountain View, California.
- Subsurface Landfill Combustion Investigation, Port Washington Landfill, Town of North Hempstead, New York.
- Landfill Fire Consulting, Salem, New Hampshire.
- Subsurface Landfill Fire, Preliminary Investigation, Ferry Point Park, New York City, New York.
- Landfill Excavation, Denton Avenue, Developed Health and Safety Plan and Monitored Compliance, Town of North Hempstead, New York.
- Landfill Relocation, Construction Contract Documents, and Health and Safety, Avondale Landfill, Arizona. 700,000 cubic yards of refuse was relocated from an old landfill in a floodplain to a new, lined site.

SCS QUALIFICATIONS

SCS Engineers is an environmental engineering consulting firm, specializing in solid waste management. The firm has ten engineering offices located throughout the nation. Out of approximately $35 million in annual consulting fees, approximately one-half of that work deals with landfill engineering. Practice areas include landfill gas control, landfill gas recovery, landfill engineering, permitting, site selection, hydrogeologic investigations, geotechnical investigations, construction quality assurance, and landfill fires.

The appendix to this proposal includes brochures of SCS Engineers, describing our general background. In addition, the firm has detailed experience on landfill fires. Principals of the firm have authored previous articles on the subject of landfill fires. A complete listing of landfill fire projects has been included as Exhibit 6. Selected key of those projects are highlighted below, as a demonstration of our landfill fire experience.

1. Lake County Landfill, Cleveland, Ohio

   A localized landfill fire had developed at this active landfill, as a result of failure of an interface between an active landfill gas withdrawal well, and the geomembrane cap. Extensive quantities of atmospheric air were drawn in, starting or fueling the fire. The fire rapidly expanded to cover an area about 1 acre in size, with a depth exceeding 40 ft.

   Initially, steps were taken by the operator to dig out the refuse. The fire depth was found to be greater than that which could be readily handled by the landfill operator. As a result, the landfill fire was re-sealed. SCS was subsequently mobilized to the site.

   SCS recommended installation of steel point monitoring wells, to determine the subsurface temperature profile. Monitoring was performed over a two week period. The exact location and intensity of the fire was determined. These same steel well points were later used for injection of liquid carbon dioxide and nitrogen. This had the effect of lowering landfill temperatures, and eventually extinguished the fire.

   Temperature monitoring was performed thereafter for a multi-month period. At the end of a one year term, temperatures had returned to ambient conditions found elsewhere throughout the site. As a result of these efforts, the landfill could then be successfully closed.

2. G B Auto Parts and Landfill, Ironton, Ohio

   SCS Engineers responded under its U.S. EPA contract for Emergency Response Contract Services (ERCS). An approximately 5 acre area of the landfill was burning at the time SCS arrived at the site. The immediate concern was with residential structures located near the site. As a rasult of the smoke, approximately 10 such structures were evacuated, until the hazard could be removed.

SCS supervised the installation of temperature monitoring points, to determine the depth of the landfill fire. In addition, an aerial thermogram was performed. This revealed the subsurface fire was limited to those areas now burning at the surface.

SCS then recommended the application of a two ft thick clay cap. Within three days the smoke had disappeared from the site. Subsequent temperature monitoring revealed that the fire remained, albeit at controlled depths. A thicker clay cap was then applied, and a program of long-term temperature monitoring was implemented.

The fire has now been extinguished for an approximate one month term. It is expected that temperature monitoring will continue for a one year period. At the end of that time, it is expected that subsurface temperatures will have returned to ambient conditions.

3. South Bay Six Drive-In Theater, Carson, California

This was a former quarry pit utilized as a sanitary landfill. Refuse had been filled approximately 150 ft deep, to the top of the quarry. Upon landfill completion, the final surface was used as a drive-in theater. A landfill gas extraction system was installed throughout the site, to protect theater occupants.

The operator of the gas collection system failed to prevent air intrusion. As a result, a subsurface fire started, and expanded over several acres. In addition, the fire extended to great depth. Subsequent temperature monitoring revealed that the landfill fire extended to depths exceeding 100 ft.

SCS mobilized to the site, and installed several steel monitoring points. These points were used for temperature monitoring, and subsequently for a liquid gas injection (nitrogen and carbon dioxide). These injections had success in extinguishing the landfill fire. In the months thereafter, temperatures slowly returned to ambient conditions.

In all, SCS has been involved in approximately 18 landfill fire related projects. Those projects are listed on Exhibit 6. In addition, we invite you to review the articles included in the appendix of this report.

EXHIBIT A

SCOPE OF WORK
LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL

APPENDIX A

LANDFILL FIRE ARTICLES BY SCS ENGINEERS

Treating Subsurface Landfill Fires

The days of hoping a fire within a landfill would "burn itself out" are gone. Today's landfill operator seeks to find troublespots early, and has several options for treatment.

by Robert C. Stearns and Galen S. Petayan

Years ago, open burning dumps served as our solid waste disposal sites. Wastes were purposely burned with attendant smoke emissions and waste volume reduction. Burning was slow and often incomplete. Many former burning dumps smoldered for years following their closure.

With the advent of sanitary landfills, open burning ceased and our solid wastes were compacted and buried with layers of soil. As a result, open burning was replaced with the relatively slow biological decomposition of the waste materials with landfill gas (LFG) production. LFG was soon recognized as both a safety hazard and as an energy recovery opportunity.

The potential impacts of landfill settlement on LFG recovery/control system design and operation have been recognized. However, little information has been available on subsurface landfill fires. As efforts are made to increase LFG recovery, or to control LFG emissions or migration, subsurface fire problems can be expected to increase.

Fire mechanics

Ignition and propagation of subsurface landfill fires is complex and a function of many factors. These include waste composition and moisture content, available oxygen, ambient pressure in area of combustion, etc.

In general, as a combustible material is heated, either through biological decomposition or chemical oxidation, ignition will occur at some given temperature, termed the ignition temperature for the material. The resulting heat of combustion will support flame spread under most conditions. Combustion will continue until at least one of the following occurs:

- The combustible material is consumed
- The oxidizing agent (typically atmospheric oxygen) is depleted
- Heat acting as the ignition source is removed faster than it is produced.

Identification and size determination for a subsurface fire can be difficult. A subsurface fire is typically indicated by:

- unusual or rapid settlement;
- venting of smoke;
- carbon monoxide in extracted LFG;
- combustion residue in header lines; and
- elevated LFG temperatures.

Determination of the location and a real extent of the subsurface fire can involve several approaches. These are:

- thermographic scans;
- excavation or borings to allow visual examination of refuse; and
- installation of test wells to allow monitoring of subsurface temperature gradients.

Organic waste materials (containing primarily carbon and hydrogen) buried in a landfill decompose aerobically (in the presence of oxygen) or anaerobically (in the absence of oxygen), and release heat in the process. For most materials, the rate of biological decomposition is slow. Produced heat is transferred to surroundings as it is formed, and a stable, but somewhat elevated, temperature occurs as decomposition proceeds.

Spontaneous ignition (autoignition) of a combustible material can occur if enough air is available and higher temperatures exist to permit chemical oxidation. Under highly insulating conditions, the heat produced is retained and the chemical oxidation rate continues to increase. Under these conditions, the combustible material will eventually reach its ignition temperature and spontaneous combustion will occur. The rate of heat generation, available air supply, and the insulating properties of the surrounding materials all influence whether chemical oxidation will result in temperatures reaching and/or exceeding ignition temperatures of the combustible material.

Wastes placed in a landfill initially undergo biological decomposition aerobically, producing carbon dioxide (CO_2), water, and heat which can result in maximum landfill temperatures in the 140° to 160° Fahrenheit range. As available oxygen is consumed (assuming a new source of oxygen is not available), biological decomposition becomes anaerobic with resultant production of

Subsurface Landfill Fire Control Technique Selection

Fire Control Technique	APPLICABILITY					
	Fire Depth		Extraction System		On-Site Development	
	<30'	>30'	Control	Recovery	Vacant	Developed*
Excavation	Yes	No	Yes	Yes	Yes	No
Smother	Yes	No	Yes	Yes	Yes	Yes
Extinguish						
Inject inert gas	Yes	Yes	Yes	Yes	Yes	Yes
Inject water	Yes	Yes	No	Yes	Yes	Yes

*Site surface developed as golf course, drive-in theater, storage facility, etc., requiring public site occupancy.

methane (CH_4) and CO_2. Heat is also a product of anaerobic decomposition. Temperatures will remain in the 140° to 160° F range if the insulating properties of the waste materials are high. In loosely compacted or dry landfills, the heat retention is inadequate, and temperatures usually return to the 70° to 110° F range.

The high insulating characteristics of in-place refuse causes retention of heat within the refuse mass. Increasing temperatures cause an increase in the rate of chemical oxidation of refuse (which initially occurs simultaneously with biological decomposition processes). This heating can continue past the limit of biological survival of the bacteria. Heating to the point of spontaneous combustion is the result of continued chemical oxidation, which follows the initial heat generated by biological decomposition. A continuous source of oxygen is necessary for this process to proceed to the point of ignition.

As temperatures within the landfill increase, the refuse material undergoes pyrolysis, i.e., chemical decomposition of matter through the action of heat. Pyrolysis converts the refuse material to a black carbonaceous char. Continued air supply bringing additional oxygen in contact with the pyrolyzing refuse causes the char material to become red hot. The heat generated is subsequently transferred to additional refuse materials, propagating the pyrolytic reaction. Open flames within the landfill are considered unlikely. However, once the subsurface fire reaches the surface, open flames could occur.

Transfer of heat within the landfill environment is accomplished by conduction and/or convection. Conduction is heat transfer by direct contact, while convection is heat transfer by a circulating medium (liquid or gas). Conduction of heat in the landfill is limited to the surface area of the refuse undergoing oxidation. Combustible gases produced during pyrolysis near this zone may also be heated by conduction. Convective forces cause the hot gas to expand and rise through the landfill. When the hot gas comes in contact with cooler refuse material, heat is transferred by conduction.

The operation of LFG extraction systems (for either recovery or migration control) can result in air entering the landfill. Overdrawing extraction wells, especially those installed near the perimeter or a slope face, creates a situation where air can be drawn into the refuse mass. Open cracks and fissures in a landfill site surface facilitate drawing of air through the site cover.

Convection currents within the landfill (due to higher gas temperature) can establish a chimney effect and cause air to be drawn into the landfill.

Routine testing and adjustment of flow rates from extraction wells, as well as maintenance of the landfill site surface, are required to control air infiltration and the resultant potential for a subsurface fire. Obviously, the withdrawal of LFG at a rate faster than its production will result in air infiltration.

Identification of subsurface fire

Inspection of site surfaces for settlement resulting from subsurface void space can give an indication as to the location and extent of subsurface combustion. Distinguishing between settlement resulting from normal decomposition processes, as opposed to collapsing of upper refuse layers into a void space created by subsurface combustion, may be difficult. Surface settlement may provide no indication of subsurface fire if combustion is sufficiently deep within the landfill such that bridging supports upper refuse layers.

Venting of smoke through cover soils confirms the existence of subsurface combustion, but provides little information as to location of the fire. Channeling within the landfill can result in smoke venting at locations distant from the actual point of combustion. Depending on the location of subsurface fire, smoke could be drawn through the extraction system unnoticed.

CO presence may indicate fire

Analysis of venting and/or extracted gas for the presence of carbon monoxide (a product of incom-

plete combustion) can also identify the existence of subsurface fire. Gas analysis can be accomplished using portable equipment in the field, such as gas detector tubes, or via gas chromatography. Carbon monoxide concentrations in LFG exceeding a few parts per million should result in additional testing and observation for a possible fire.

Continued operation of an LFG extraction system with wells in the vicinity of subsurface fire can result in drawing the residue of combustion processes through the extraction system and eventual destruction of the well. Visual evidence can be observed in a thick, black, tar-like coating in header lines. Experience has shown that combustion temperatures can be high enough to destroy extraction system components (i.e., wells and header lines) while tar-like residues can coat valves and pump station components to a point where they become inoperable.

Monitor gas well temperatures

Regular monitoring of extraction well heads and header line gas temperatures can aid in locating the general region of subsurface combustion. For example, gas temperatures 45° F above baseline gas temperatures were observed at one site just prior to verification of a subsurface fire. The higher temperatures were recorded in a header line adjacent to the extraction well. The well was subsequently excavated and found to be partially destroyed by the subsurface fire.

Use of temperature sensing equipment, such as a linear pyrometer and/or a thermographic scanner, can aid in identification of the limits of subsurface combustion by providing a site surface temperature profile. The linear pyrometer gives a digital readout of surface temperatures with an accuracy of +1° F. The hand-held instrument is portable, and allows rapid point source survey of site surfaces. A thermographic scan provides a real time infrared image of surface temperatures. The scan shows best resolution from locations elevated above a landfill site surface (e.g., an aerial scan).

The scan does not give quantitative temperature data, but rather an image with differences in intensity corresponding to areas exhibiting elevated surface temperatures with a resolution of 1° to 2° F. Use of thermographic scanners allows survey of large areas of a landfill in one view. The usefulness of these instruments is limited to near-surface combustion, and must be used at night to eliminate solar radiation at the heat source.

Bore for information

Subsurface borings into a suspected zone of combustion and logging of the materials excavated provides information on the extent and depth of the fire. Precautions must be taken to protect drilling personnel and equipment from high-temperature gas and refuse excavated. Due to the high cost of drilling, a drilling program should be developed (e.g., drilling at designated points in a grid pattern). The program should be implemented after preliminary identification of a suspected fire by one or more of the above methods.

Borings into and adjacent to a subsurface fire zone can serve as test wells to monitor subsurface temperature gradients. Subsurface temperature gradients can be obtained by the use of a thermocouple. If test wells are constructed using high pressure steel pipe and fittings, they can be used for subsequent injection of water and/or inert gas to aid in extinguishing the subsurface fire.

Controlling subsurface fires

Selection of a subsurface fire control technique is dependent on several factors, including depth, composition, and configuration of the landfill site; depth and size of the subsurface fire; site surface development; and type and operational requirements of the LFG extraction facilities. Control of subsurface fire requires either removal of the combustible material, elimination of the oxidizing agent (air supply), or cooling of the fire zone to temperatures below the ignition temperature. Available techniques for fire control all employ one or more of these three approaches.

The refuse material in the landfill represents the combustible material, and therefore its removal may be impractical. Depriving the subsurface fire of its air supply will terminate combustion. However, the insulating properties of the refuse materials will keep subsurface temperatures high, necessitating an extended cooldown period by natural heat dissipation. During this period (possibly with an order or magnitude of tens of years), any reintroduction of an air supply could result in regeneration of subsurface combustion. Given that LFG extraction is essential at the site, cooling of the fire zone may be essential to provide positive control of the fire.

Options for treatment

Techniques employed to control a subsurface fire and some criteria for selection are summarized in the table on page 48. Removal of waste is limited to shallow subsurface fires for practical reasons. The excavated material would be cooled by spreading and dousing the water or other fire retardant. Backfilling excavated areas would be accomplished with either the completely cooled refuse material or imported soil. Associated with excavation are potential problems with odor and particular/air pollution from the excavated materials. Excavating equipment and personnel must be protected from hazards associated with handling/removing burning refuse material and/or explosive and possible toxic gas emissions. Since site disruption could be extensive, this method of control would not be applicable for a developed landfill site. A favorable aspect would be to allow return of control and/or recovery extraction systems to their operational status in a relatively short time period.

Eliminating the air supply (i.e., smothering) subsurface combustion will deprive the process of needed oxygen. As previously discussed, LFG extraction wells, site surface cracks/fissures, and natural convection can provide the necessary pathway for air to enter a landfill site. In attempting to deprive subsurface fire of its air supply, the first step would be to reduce or shut down flow from extraction wells in the immediate vicinity of the combustion zone. Following this step, all settlement cracks and fissures in site cover soils should be sealed to prevent any passive influx of air. As refuse decomposition proceeds, LFG production will create positive pressures within the landfill, replacing any atmospheric oxygen present

with LFG and therefore prevent further subsurface combustion.

At some sites, LFG recovery and/or migration control is critical, and extraction wells must be reactivated as soon as practical. Since reactivation of extraction wells could potentially draw air through cover soils to the zone of previous combustion resulting in reignition of subsurface fire, it may be advisable to take additional steps to seal site surfaces. These steps could include application of additional cover soils or synthetic membranes to further seal the site surface or side slopes. Subsequent to sealing the surface area, extraction wells can be slowly reactivated for desired control and/or recovery purposes. Stringent testing must coincide with reactivation of extraction wells to assure that regeneration of the subsurface fire does not occur. Sealing site surfaces in this manner lends itself to vacant sites where additional soil cover or installation of a membrane would not disrupt activities.

Inject water or gas

The principle involved in extinguishing subsurface fire by injecting water or an inert gas is to remove heat (and in the case of inert gas, displace oxygen) from the combustion zone. Injection can be used for both deep and shallow fires, and can be accomplished with minimal disruption to a developed site. High temperature and pressure rated steel pipe injection wells would be used as a conduit to deliver water/inert gas to the combustion zone. Injection of water and/or an inert gas such as CO_2 can produce a high-temperature, high-pressure steam and/or gas within the landfill as heat is transferred from the pyrolyzing refuse material. This high-pressure hot gas will likely vent through cracks in the site surface. Thus injecting water or an inert gas under pressure can result in the formation of cracks and fissures within the landfill that could allow air intrusion. Any openings formed must be resealed. Injection of water has the disadvantage of leachate formation, and therefore its use may not be acceptable in some situations.

Monitor temperatures to determine success

Following injection, monitoring of subsurface temperatures can determine whether the fire has been controlled. Repeated applications may be necessary to achieve complete control.

Many landfills contain the combustible materials, insulating characteristics, and other attributes necessary to allow autoignition (spontaneous combustion), and to support subsurface combustion with introduction of an air supply. Over withdrawal from LFG extraction systems for recovery and/or migration control (and air injection systems for migration control) can provide the air source. It is probable that many older landfills may have subsurface "hot spots" which could become fire zones with introduction of air supply.

Identification and size definition of subsurface fires is difficult, involving use of one or more assessment techniques. Selection of a fire control method is site-specific, and must take into consideration many factors, including the cost of the control technique as well as its impact on site development and LFG revenues.

Successful control of subsurface fires requires post-control monitoring to assure that fire regeneration does not occur. WA

Robert Stearns is president of SCS Engineers of Los Angeles, California. Golen Peloyan is project engineer for the same firm.

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IDENTIFYING AND CONTROLLING LANDFILL FIRES*

Robert P. Stearns† and Galen S. Petoyan†

(Received 23 July 1984)

Factors leading to subsurface landfill fires and fire identification and control techniques are discussed. The paper is oriented towards completed sanitary landfill sites containing active landfill gas (LFG) extraction systems for either recovery or migration control purposes. The fire identification and control techniques discussed can be applied to both developed and undeveloped former landfill sites.

The ignition and propagation of subsurface landfill fires are a function of factors which include waste composition and moisture content, available oxygen, and ambient pressure in the area of combustion.

Identification and size of a subsurface landfill fire can be determined by unusual or rapid site surface settlement, surface venting of smoke, detection of carbon monoxide in extracted LFG, accumulation of combustion residue in LFG collection header lines, and elevated LFG temperatures.

Subsurface landfill fire control techniques include excavation, smothering, and extinguishing with injections of water or inert gas.

Key Words—Subsurface landfill fire, landfill gas (LFG) recovery, LFG migration control, fire mechanics, fire ignition and propagation, autoignition, pyrolysis, subsurface fire identification, subsurface fire control, extinguishing landfill fires.

1. Introduction

This paper will discuss factors leading to subsurface landfill fires and fire identification and control techniques. The discussion is oriented towards completed sanitary landfill sites containing active extraction systems for either landfill gas (LFG) recovery or migration control. The fire control techniques can be applied to both developed and undeveloped former landfills.

With the advent of sanitary landfills, open burning ceased and solid wastes were compacted and buried with layers of soil. As a result open burning was replaced with the relatively slow biological decomposition of the waste materials with LFG production. LFG was soon recognized as both a safety hazard and as an energy recovery opportunity. As efforts are made to increase LFG recovery or to control LFG emissions or migration, subsurface fire problems can be expected to increase.

Some former burning dumps were converted to sanitary landfill operations years ago. Burning materials were covered with soil with the presumption that the fire would be smothered. Somewhat similar techniques are employed today when "hot loads" are delivered to a sanitary landfill. Typically, the burning materials are wetted with water or otherwise extinguished, then incorporated into the landfill.

These practices may result in "hot spots" (areas with elevated temperatures) within

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the landfill. These "hot spots" can become excellent candidates for subsurface fires with the addition of an air supply.

2. Overview of fire mechanics

Initial ignition and propagation of subsurface landfill fires is complex, and a function of many factors. These include waste composition and moisture content, available oxygen, ambient pressure in area of combustion, etc.

In general, as a combustible material is heated, either through biological decomposition or chemical oxidation, ignition will occur at some given temperature termed the ignition temperature for the material. The resulting heat of combustion will support flame spread under most conditions. Combustion will continue until at least one of the following occurs.

(1) The combustible material is consumed.
(2) The oxidizing agent (typically atmospheric oxygen) is depleted.
(3) Heat acting as the ignition source is removed faster than it is produced.

2.1. *Biological decomposition*

Organic waste materials (containing primarily carbon and hydrogen) buried in a landfill decompose aerobically (in the presence of oxygen) or anaerobically (absence of oxygen), and release heat in the process. For most materials, the rate of biological decomposition is slow. Produced heat is transferred to surroundings as it is formed and a stable, but somewhat elevated, temperature occurs as decomposition proceeds.

2.2. *Chemical oxidation*

Spontaneous ignition (autoignition) of a combustible material can occur if enough air is available and higher temperatures exist to permit chemical oxidation. Under highly insulating conditions the heat produced is retained and the chemical oxidation rate continues to increase. Under these conditions, the combustible material will eventually reach its ignition temperature and spontaneous combustion will occur. The rate of heat generation, available air supply, and the insulating properties of the surrounding materials all influence whether chemical oxidation will result in temperatures reaching, and/or exceeding, ignition temperatures of the combustible material.

2.3. *Landfill fire ignition*

Wastes placed in a landfill initially undergo biological decomposition aerobically, producing carbon dioxide (CO_2), water, and heat which can result in maximum landfill temperatures in the 60–71 °C (140–160 °F) range. As available oxygen is consumed (and assuming a new source of oxygen is not available), biological decomposition becomes anaerobic with resultant production of methane (CH_4) and CO_2. Heat is also a product of anaerobic decomposition. Temperatures will remain in the 60–71 °C (140–160 °F) range if the insulating properties of the waste materials are high. In loosely compacted or dry landfills the heat retention is inadequate and temperatures usually return to the 21–43 °C (70–110 °F) range.

The high insulating characteristics of in-place refuse causes retention of heat within the refuse mass. Increasing temperatures cause an increase in the rate of chemical

oxidation of refuse (which initially occurs simultaneously with biological decomposition processes). This heating can continue past the limit of biological survival of the bacteria. Heating to the point of spontaneous combustion is the result of continued chemical oxidation, which follows the initial heat generated by biological decomposition. A continuous source of oxygen is necessary for this process to proceed to the point of ignition.

As temperatures within the landfill increase, the refuse material undergoes pyrolysis, i.e. chemical decomposition of matter through the action of heat. Pyrolysis converts the refuse material to a black carbonaceous char. Continued air supply bringing additional oxygen in contact with pyrolyzing refuse causes the char material to become red hot. The heat generated is subsequently transferred to additional refuse materials, propagating the pyrolytic reaction. Open flames within the landfill are considered unlikely. However, once the subsurface fire reaches the surface, open flames could occur.

Transfer of heat within the landfill environment is accomplished by conduction and/or convection. Conduction is heat transfer by direct contact while convection is heat transfer by a circulating medium (liquid or gas). Conduction of heat in the landfill is limited to the surface area of the refuse undergoing oxidation. Combustible gases produced during pyrolysis near this zone may also be heated by conduction. Convective forces cause the hot gas to expand and rise through the landfill. When the hot gas comes in contact with cooler refuse material, heat is transferred by conduction.

2.4. *Sources of air*

The operation of LFG extraction systems (for either recovery or migration control) can result in air entering the landfill. Overdrawing extraction wells, especially those installed near the perimeter or a slope face, creates a situation where air can be drawn into the refuse mass. Open cracks and fissures in a landfill site surface facilitate drawing of air through the site cover.

Convection currents within the landfill (due to higher gas temperature) can establish a chimney effect and cause air to be drawn into the landfill.

Routine testing and adjustment of flow rates from extraction wells, as well as maintenance of the landfill site surface, are required to control air infiltration and the resultant potential for a subsurface fire. Obviously, the withdrawal of LFG at a rate faster than its production will result in air infiltration.

3. Identification of subsurface fire

Identification and size determination for a subsurface fire can be difficult. A subsurface fire is typically indicated by:

unusual or rapid settlement,
venting of smoke,
carbon monoxide in extracted LFG,
combustion residue in header lines,
elevated LFG temperatures.

Determination of the location and areal extent of the subsurface fire can involve several approaches. These are:

thermographic scans,

excavation or borings to allow visual examination of refuse.
installation of test wells to allow monitoring of subsurface temperature gradients.

Inspection of site surfaces for settlement resulting from subsurface void space can give an indication as to the location and extent of subsurface combustion. Distinguishing between settlement resulting from normal decomposition processes, as opposed to collapsing of upper refuse layers into a void space created by subsurface combustion, may be difficult. Surface settlement may provide no indication of subsurface fire if combustion is sufficiently deep within the landfill such that bridging supports upper refuse layers.

Venting of smoke through cover soils confirms the existence of subsurface combustion but provides little information as to location of the fire. Channelling within the landfill can result in smoke venting at locations distant from the actual point of combustion. Depending on the location of subsurface fire, smoke could be drawn through the LFG extraction system unnoticed.

Analysis of venting and/or extracted LFG for the presence of carbon monoxide (a product of incomplete combustion) can also identify the existence of subsurface fire. Gas analysis can be accomplished using portable equipment in the field, such as gas detector tubes, or via gas chromatography. Carbon monoxide concentrations exceeding a few parts per million in LFG should result in additional testing and observation for a possible fire.

Continued operation of an LFG extraction system with wells in the vicinity of subsurface fire can result in drawing the residue of combustion processes through the extraction system and eventual destruction of the well. Visual evidence can be observed in a thick, black, tar-like coating in header lines. Experience has shown that combustion temperatures can be high enough to destroy extraction systems components (i.e. wells and header lines) while tar-like residues can coat valves and pump station components to a point where they become inoperable.

Regular monitoring of extraction well heads and header line gas temperatures can aid in locating the general region of subsurface combustion. For example, gas temperatures 45°F above baseline gas temperatures were observed at one site just prior to verification of a subsurface fire. The higher temperatures were recorded in a header line adjacent to the extraction well. The well was subsequently excavated and found to be partially destroyed by the subsurface fire.

Use of temperature sensing equipment, such as a linear pyrometer and/or a thermographic scanner, can aid in identification of the limits of subsurface combustion by providing a site surface temperature profile. The linear pyrometer gives a digital readout of surface temperatures with an accuracy of ± 1°F. The hand-held instrument is portable and allows rapid point source survey of site surfaces. A thermographic scan provides a real time infrared image of surface temperatures. The scan shows best resolution from locations elevated above a landfill site surface (e.g. an aerial scan).

The scan does not give quantitative temperature data, but rather an image with differences in intensity corresponding to areas exhibiting elevated surface temperatures with a resolution of 0.5-1.0°C (1-2°F). Use of thermographic scanners allows survey of large areas of a landfill in one view. The usefulness of these instruments is limited to near-surface combustion, and they must be used at night to eliminate solar radiation as the heat source.

Subsurface borings into a suspected zone of combustion and logging of the materials excavated provides information on the extent and depth of the fire. Precautions must be taken to protect drilling personnel and equipment from high-temperature gas and

refuse excavated. Due to the high cost of drilling, a drilling program should be developed (e.g. drilling at designated points in a grid pattern). The program should be implemented after preliminary identification of a suspected fire by one or more of the above methods.

Borings into and adjacent to a subsurface fire zone can serve as test wells to monitor subsurface temperature gradients. Subsurface temperature gradients can be obtained by the use of a thermocouple. If test wells are constructed using high pressure steel pipe and fittings, they can be used for subsequent injection of water and/or inert gas to aid in extinguishing the subsurface fire.

4. Control of subsurface fires

Selection of a subsurface fire control technique is dependent on several factors, including depth, composition, and configuration of the landfill site; depth and size of the subsurface fire; site surface development; type and operational requirements of the LFG extraction facilities; etc. Control of subsurface fire requires either removal of the combustible material, elimination of the oxidizing agent (air supply), or cooling of the fire zone to temperatures below the ignition temperature. Available techniques for fire control all employ one or more of these three approaches.

The refuse material in the landfill represents the combustible material, and therefore its removal may be impractical. Depriving the subsurface fire of its air supply will terminate combustion; however, the insulating properties of the refuse materials will keep subsurface temperatures high, necessitating an extended cool down period by natural heat dissipation. During this period (possibly with an order of magnitude of tens of years) any reintroduction of an air supply could result in regeneration of subsurface combustion. Given that LFG extraction is essential at the site, cooling of the fire zone may be essential to provide positive control of the fire.

Techniques employed to control a subsurface fire and some criteria for selection are summarized on Table 1. Removal of waste is limited to shallow subsurface fires for practical reasons. The excavated material would be cooled by spreading and dousing with water or other fire retardant. Backfilling excavated areas would be accomplished with either the completely cooled refuse material or imported soil. Associated with excavation are potential problems with odour and particulate/air pollution from the excavated materials. Excavating equipment and personnel must be protected from

TABLE 1

Subsurface landfill fire control technique selection

	Applicability					
	Fire depth		Extraction system		On-site development	
Fire control technique	< 9 m (< 30 ft)	> 9 m (> 30 ft)	Control	Recovery	Vacant	Developed*
Excavation	Yes	No	Yes	Yes	Yes	No
Smother	Yes	No	Yes	Yes	Yes	Yes
Extinguish						
Inject inert gas	Yes	Yes	Yes	Yes	Yes	Yes
Inject water	Yes	Yes	No	Yes	Yes	Yes

*Site surface developed as golf course, drive-in theatre, storage facility, etc., requiring public site occupancy.

hazards associated with handling/removing burning refuse material and/or explosive and possibly toxic gas emissions. Since site disruption could be extensive, this method of control would not be applicable for a developed landfill site. A favourable aspect is that it would allow return of control and/or recovery extraction systems to their operational status in a relatively short time period.

Eliminating the air supply (i.e. smothering) subsurface combustion will deprive the process of needed oxygen. As previously discussed, LFG extraction wells, site surface cracks/fissures, and natural convection can provide the necessary pathway for air to enter a landfill site. In attempting to deprive subsurface fire of its air supply the first step would be to reduce or shut down flow from extraction wells in the immediate vicinity of the combustion zone. Following this step all settlement cracks and fissures in site cover soils should be sealed to prevent any passive influx of air. As refuse decomposition proceeds LFG production will create positive pressures within the landfill, replacing any atmospheric oxygen present with LFG and therefore prevent further subsurface combustion.

At some sites LFG recovery and/or migration control is critical and extraction wells must be reactivated as soon as practical. Since reactivation of extraction wells could potentially draw air through cover soils to the zone of previous combustion resulting in reignition of subsurface fire, it may be advisable to take additional steps to seal site surfaces. These steps could include application of additional cover soils of synthetic membranes to further seal the site surface or side slopes. Subsequent to sealing the surface area, extraction wells can be slowly reactivated for desired control and/or recovery purposes. Stringent testing must coincide with reactivation of extraction wells to assure that regeneration of the subsurface fire does not occur. Sealing site surfaces in this manner lends itself to vacant sites where additional soil cover or installation of a membrane would not disrupt activities.

The principle involved in extinguishing subsurface fire by injecting water or an inert gas is to remove heat (and in the case of inert gas, displace oxygen) from the combustion zone. Injection can be used for both deep and shallow fires, and can be accomplished with minimal disruption to a developed site. High temperature and pressure rated steel pipe injection wells would be used as a conduit to deliver water/inert gas to the combustion zone. Injection of water and/or an inert gas such as CO_2 can produce a high-temperature, high-pressure steam and/or gas within the landfill as heat is transferred from the pyrolyzing refuse material. This high-pressure hot gas will likely vent through cracks in the site surface. Thus, injecting water or inert gas under pressure can result in the formation of cracks and fissures within the landfill that could allow air intrusion. Any openings formed must be resealed. Injection of water has the disadvantage of leachate formation, and therefore its use may not be acceptable in some situations.

Following injection, monitoring of subsurface temperatures can determine whether the fire has been controlled. Repeated applications may be necessary to achieve complete control.

5. Summary

Many landfills contain the combustible materials, insulating characteristics, and other attributes necessary to allow autoignition (spontaneous combustion), and to support subsurface combustion with introduction of an air supply. Over withdrawal from LFG extraction systems for recovery and/or migration control (and air injection systems for migration control) can provide the air source. It is probable that many older landfills

may have subsurface "hot spots" which could become fire zones with introduction of air supply.

Identification and size definition of subsurface fires is difficult, involving use of one or more assessment techniques. Selection of a fire control method is site-specific and must take into consideration many factors including the cost of the control technique as well as its impact on site development and LFG revenues.

Successful control of subsurface fires requires post-control monitoring to assure that fire regeneration does not occur.

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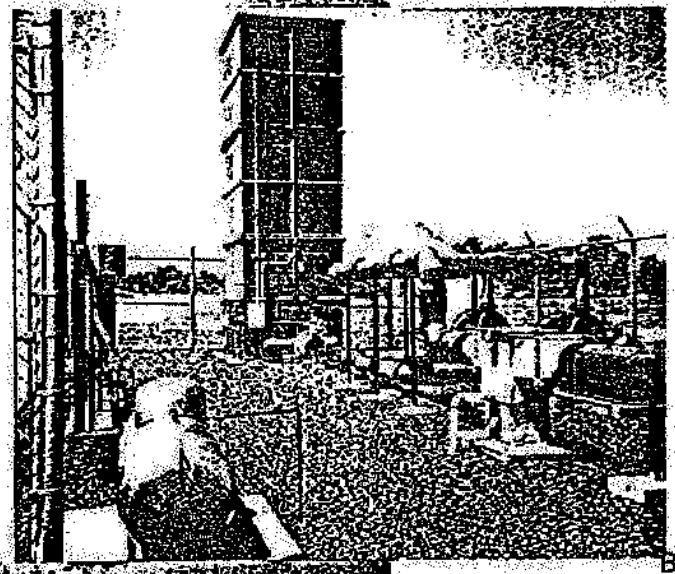
APPENDIX B

BROCHURES AND QUALIFICATIONS FOR SCS ENGINEERS

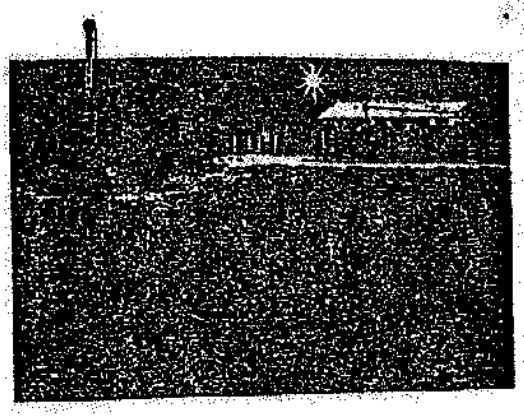
SCS ENGINEERS

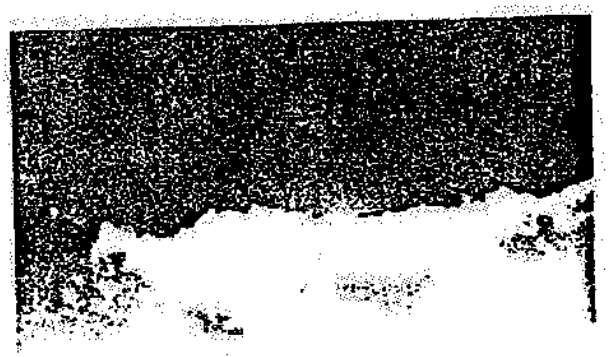
Landfill Gas Control and Recovery

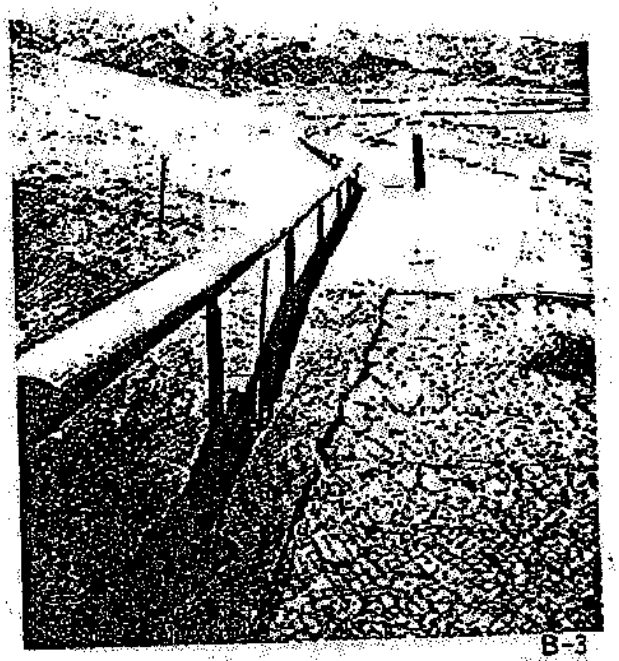
Landfill-derived methane gas is used as fuel in boilers at this civic recreation/conference center site located in the City of Industry, California. This project was selected as the Outstanding Civil Engineering Achievement in 1981 by the American Society of Civil Engineers.



SCS was awarded the Florida Engineering Society's 1989 Engineering Excellence Award for the design of a landfill gas odor and migration control system in Seffner, Florida.







An SCS subsidiary, SCS Field Services, provides construction, operation, and maintenance of landfill gas systems.

Landfill Gas

Anaerobic decomposition of organic solid waste in the landfill environment produces landfill gas (LFG). LFG mainly consists of methane and carbon dioxide, both of which are odorless. Trace concentrations of other volatiles, often malodorous or toxic gases, are also found in LFG.

LFG can migrate through soil into structures located on or near landfills. Since methane presents a fire or explosive threat, LFG must be controlled to protect property, and public health and safety. Also, many jurisdictions require landfill owners/operators to reduce reactive organic gas emissions to improve regional air quality. Thus, engineered solutions are needed to efficiently and safely monitor, collect, and process landfill gas.

A positive side to LFG control is energy recovery. Today's technology allows a landfill owner/operator to recover the energy in LFG while reducing gas emissions. Revenue from the sale of LFG or electricity generated using LFG as a fuel can offset costs for landfill environmental compliance and/or closure.

SCS Engineers - A Quarter Century of Experience

Since 1970, SCS Engineers has been a national leader in the planning, permitting, investigation, design, construction, and operation of LFG control and energy recovery systems. Our LFG designs are working at hundreds of locations around the world. SCS specializes in: (a) engineering design services and investigations, and (b) design/build projects. Working through its subsidiary SCS Field Services, SCS provides design/build services for construction of landfill gas systems. A design/build project typically combines the design and construction steps into a single contract, resulting in an expedited construction schedule and reduced overall costs.

RCRA Subtitle D

The Resource Conservation and Recovery Act (RCRA) establishes landfill design and performance standards under Subtitle D. Subtitle D requires monitoring of landfill gas, and establishes performance standards for combustible gas migration control. Landfill owners/operators must:

- Establish LFG monitoring programs. Use of gas monitoring probes is typical.
- Monitor for subsurface migration of combustible gas on a quarterly basis.
- Maintain combustible gas concentrations under 5 percent in soil at the property line, and under 1.25 percent in facility structures.
- Mitigate gas hazards if conditions are not in compliance.

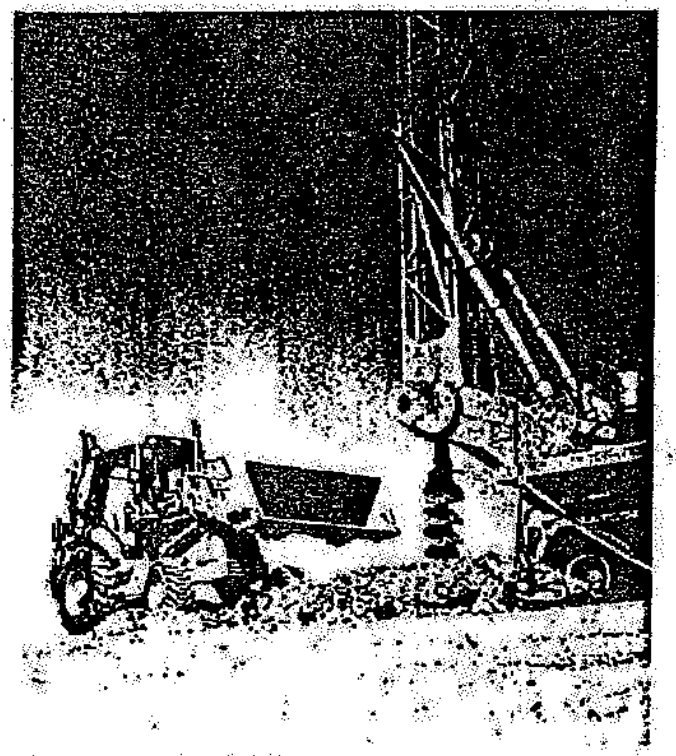
SCS has designed and implemented the types of LFG programs required under Subtitle D at hundreds of landfills.

New Source Performance Standards

The U.S. EPA has proposed control of surface LFG emissions under the Clean Air Act. The New Source Performance Standards (NSPS) will require LFG testing and collection system installations at many sites, even those otherwise in compliance with RCRA Subtitle D. NSPS will require landfill owners/operators to:

- Estimate total LFG emissions using sophisticated gas models, laboratory analyses, and gas pump tests.
- Install comprehensive gas collection systems throughout the landfill at any site found to have high emissions of non-methane organic compounds.
- Perform long-term operation and record keeping of such landfill gas systems.

SCS offers the services required for NSPS compliance including engineering test services, laboratory analysis, gas system design, system installation, and operation.



SCS professionals conduct field and laboratory testing to access LFG quantities, characteristics, current and future production rates, and optimal recovery system configurations.

SCS has hands-on experience in subsurface landfill fire containment, suppression, and emergency response.

SCS offers comprehensive landfill gas services to assist you in meeting regulatory compliance and budgetary constraints.

Combustible Gas Migration Control

- Gas Monitoring
- Control System Design
- Landfill Underground Fire Control
- Long Term Monitoring and Certification
- Permits and Regulatory Support

Energy Recovery

- Feasibility Studies
- Gas Modeling
- Field Test Programs
- Market Investigations
- System Design
- Gas Sale Contract Services
- Construction and Operation Services
- Long-Term Monitoring and Certification

Odor Abatement

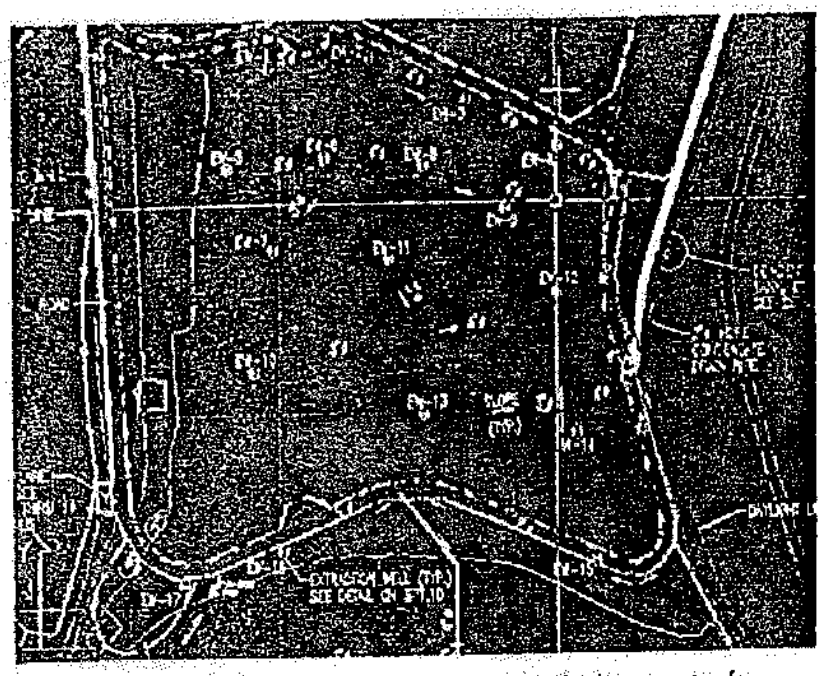
- Odor Assessments
- Odor Abatement Design
- Construction Services
- Start Up and Well Field Balancing
- Long-Term Monitoring and Certification
- Permits and Regulatory Support

Toxic Gases

- Gas Characterization
- Air Modeling
- Stack Testing
- Permits and Regulatory Support

Design/Build

SCS Field Services can construct and operate your landfill gas collection system, and provide comprehensive closure and post-closure operation and maintenance services.



SCS has extensive expertise in LFG technology, ranging from feasibility studies and collection systems design to operation and maintenance of control and recovery systems.

SCS ENGINEERS
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3711 Long Beach Boulevard, Ninth Floor
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Printed On Recycled Paper 11/93 6M

EXHIBIT B

FEE SCHEDULE
LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL

Environmental Consultants

2060 Reading Road
Suite 200
Cincinnati, Ohio 45202-1416

513 421-5353
FAX 513 421-2647

SCS ENGINEERS

January 1, 1994

LAIDLAW FEE SCHEDULE

(Effective January 1, 1994 through June 30, 1994)

	Rate/Hour
Project Director	$135
Project Manager	99
Senior Professional	89
Project Professional	71
Staff Professional	56
Associate Professional	48
Assistant Professional	40
Designer	48
Drafter/Graphics	42
Technician	40
Secretarial/Administrative	38

General Terms:

1. Rates for principals of the firm are negotiated on a project-specific basis and range from $130 to $170 per hour depending on experience and qualifications.

2. Scheduled rates are effective through June 30, 1994. Work performed thereafter is subject to a new Fee Schedule.

3. Scheduled labor rates include overhead, administration and profit. Costs for outside consultants and subcontractors, and for job-related employee travel and subsistence, external reproduction, telephone, equipment, and supplies are billed at actual cost plus a 15 percent administrative fee. Internal costs such as fax, computer, CADD, field equipment, and internal reproduction will be billed at cost.

4. Charges for field equipment and instruments will be in accordance with the SCS Standard Fee Schedule for Field Equipment in effect at the time the work is performed.

5. Invoices will be prepared monthly or more frequently for work in progress unless otherwise agreed. Invoices are due and payable upon receipt. Invoices not paid within 45 days are subject to a service charge of 1 percent per month on the unpaid balance.

6. Payment of SCS invoices for services performed will not be contingent upon the client's receipt of payment from other parties, unless otherwise agreed in writing. Client agrees to pay legal costs, including attorney's fees, incurred by SCS in collecting any amounts past due and owing on client's account.

7. For special situations, such as expert court testimony and limited consultation, hourly rates will be on an individually negotiated basis.

Environmental Consultants

2060 Reading Road
Suite 200
Cincinnati, Ohio 45202-1416

513 421-5353
FAX 513 421-2847

SCS ENGINEERS

January 1, 1994

LAIDLAW FEE SCHEDULE FOR FIELD EQUIPMENT

(Effective January 1, 1994 through June 30, 1994)

	Rate
Extraction Test Blower/Motor	$100/day, 300/week
GEM-500 Analyzer	75/day
Methane Meter	20/day
Oxygen Meter	30/day
Carbon Dioxide Fyrite Indicator	15/day
Pressure Measurement Device (magnehelics, manometers, etc.)	15/day
Flow Measurement Device (orifice plates, flow meters, etc.)	25/day
Gas Temperature Measurement Device (digital read-out with probe)	15/day
Detector Tube (hydrogen sulfide, carbon monoxide, etc.)	5/each
Vacuum Sampling Pump - Draeger Pump	10/day
- Low Capacity MSA Pump	15/day
- High Capacity Bellows Pump	40/day
Grundfos 2 in. Groundwater Pump	100/day
Punch Bar	15/day
Gas Sampling Burette	10/each
Gas Sampling Bag	15/each
Photoionization Detector	75/day
Water Level Indicator	20/day
ph/Conductivity/Temperature Meter	25/day
Well Bailer	15/day
Disposable Well Bailers	15/each
Field Groundwater Filter Unit/Pump	20/day
Disposable Groundwater Filters	15/each
Buckets (5 gallon disposable)	6/each
Soil Sampler	10/day
Soil Sample Container	4/each
VOA Sample Containers	3/each
QA/QC Supplies	15/day
Level B SCBA (used on-site)	60/day
(available on-site and unused)	20/day
Level C North Full-Face Respirator (used on-site)	20/day
(available on-site and unused)	6/day
Level C North Half-Face Respirator (used on-site)	10/day
(available on-site and unused)	2/day
Latex Over-Boots (disposable)	5/pair
Tyvek Suit (disposable)	6/each
Scales - Spring (0-70 lb)	50/week
- Spring (0-100 lb)	50/week
- Platform	100/week
- Truck/Axle	300/week

LAIDLAW FEE SCHEDULE FOR FIELD EQUIPMENT (continued)

General Terms:

1. Rates are in effect until June 30, 1994. Any work performed after that date is subject to a new Schedule of Fees.

2. Equipment usage rates are exclusive of freight charges to and from the project site. Freight is an additional expense chargeable to the client.

3. Rates for extraction test blower/motor are exclusive of expenses for electric line installation, electricity, generators, or fuel. These expenses are charged to the client separately.

Environmental Consultants

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Cincinnati Ohio 45202-1416

513 421 5353
FAX 513 421 2847

SCS ENGINEERS

January 1, 1994

LAIDLAW FEE SCHEDULE
IN-HOUSE COSTING RATES
(Effective January 1, 1994 through June 30, 1994)

CADD Computer	$25/hour
Word Processing Computer	$10/hour
Facsimile	$1/page
Reproduction (8.5 in. × 11in.)	$0.10/page
Reproduction (blueline prints)	$1.50/sheet
Reproduction (vellum reproducibles)	$3/sheet
Reproduction (nulon reproducibles)	$10/sheet

EXHIBIT C

PROJECT SCHEDULE
LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL

EXHIBIT 2

PROJECT SCHEDULE

Task No. and Title	Months from Project Start				
	1	2	3	4	5
1. Fly Infrared Thermography	-------				
2. Install Temperature Probes	-------				
3. Monitor Temperature Probes		-------			
4. Prepare Report and Propose Mitigation		-------	-------		
5. Mitigate Landfill Fire				-------	------>

Activity:

------- SCS Activity

File
#0-6260
Westlakes LF

STATE OF MISSOURI

Mel Carnahan, Governor • David A. Shorr, Director

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL QUALITY

P.O. Box 176 Jefferson City, MO 65102-0176

March 8, 1994

CERTIFIED MAIL #P 199 806 820
RETURN RECEIPT REQUESTED

Mr. Larry Giroux
Laidlaw Waste Systems (Bridgeton), Inc.
2340 S. Arlington Heights Road
Arlington Heights, IL 60005

RE: Landfill Fire Mitigation; Westlakes Landfill, Permit 0118912, in St. Louis County

Dear Mr. Giroux:

The SWMP (Solid Waste Management Program) has recently reviewed your request of a project for Landfill Fire Mitigation at the Westlakes Landfill renamed Laidlaw Waste Systems (Bridgeton), Inc., Permit 0118912, in St. Louis County. The proposal was prepared by SCS Engineers, dated January 10, 1994 and was received February 17, 1994. This project was received without an engineer's seal, but nevertheless was considered because of the potential threat to human health and safety of landfill personnel and the surrounding community. The SWMP has reviewed this request for this condition that does not appear to present a serious threat to the state of Missouri's public health and environment. The SWMP concurs with the proposed plan with the following conditions:

1. The document entitled Proposal, Landfill Fire Mitigation, Laidlaw Bridgeton Sanitary Landfill, Bridgeton, Missouri dated December 10, 1993 and revised January 10, 1994 shall be revised and submitted under the seal of a professional engineer registered in Missouri within thirty (30) days of receipt of this letter.

2. Any change in the operation and/or design of this facility other than that which has been described in the application and approved in this permit is considered by the department to be a modification of the permit and prior written approval must be obtained.

3. Three copies of the report, as part of Task 4 in the referenced document, on data from field observations and evaluations and recommendations for fire mitigation shall be sent to the SWMP. The report shall be reviewed and approved by a professional engineer registered in the state of Missouri.

4. Three copies of the report, as part of Task 5 in the referenced document, on mitigative action, its success, and its prospects for maintenance in the future shall be sent to the SWMP. The report shall be reviewed and approved by a professional engineer registered in the state of Missouri.

5. Laidlaw shall include all reports on continuing monitoring and maintenance efforts for control of the fire as part of the quarterly gas monitoring report to be sent to the SWMP.

This concurrence is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management Law, nor should this be construed as a waiver for other regulatory requirements.

This concurrence is not to be construed as compliance with any existing local ordinances or zoning requirements, nor does it supersede any local permitting and/or zoning requirements.

Should you have any questions, please contact me at (314) 751-5401.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Frank J. Dolan

Frank J. Dolan, P.E.
Environmental Engineer

FD:lf

c: James J. Walsh, SCS Engineers
Joe Trunko, St. Louis Regional Office
Kathrina M. Donegan, St. Louis County Dept. of Health

Westlakes
Bridgeton
General Correspondence
File

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

February 18, 1994

Harold Morton
Dept. Natural Resources
Division of Environmental Quality
Solid Waste Management Program
P.O. Box 176
Jefferson City, MO 65102

Dear Harold:

I would like to request immediate approval to remediate an underground fire at the Bridgeton Landfill.

I submitted to Mr. Dolan and Mr. Sherman a scope of work for the project.

Again, I would appreciate immediate attention on this issue.

Thank you.

Sincerely,

Larry Giroux
Sr. Div. Gen. Manager
Laidlaw Waste Systems

cc: Brad Bomanz
Dennis Wike
Dick Sieburg

13570 ST. CHARLES ROCK ROAD, BRIDGETON, MISSOURI 63044 (314) 739-1919

File
#0.0950
Westlakes LF

STATE OF MISSOURI

Mel Carnahan, Governor • David A. Shorr, Director

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL QUALITY

P.O. Box 176 Jefferson City, MO 65102-0176

March 8, 1994

CERTIFIED MAIL #P 199 806 820
RETURN RECEIPT REQUESTED

Mr. Larry Giroux
Laidlaw Waste Systems (Bridgeton), Inc.
2340 S. Arlington Heights Road
Arlington Heights, IL 60005

RE: Landfill Fire Mitigation; Westlakes Landfill, Permit 0118912, in St. Louis County

Dear Mr. Giroux:

The SWMP (Solid Waste Management Program) has recently reviewed your request of a project for Landfill Fire Mitigation at the Westlakes Landfill renamed Laidlaw Waste Systems (Bridgeton), Inc., Permit 0118912, in St. Louis County. The proposal was prepared by SCS Engineers, dated January 10, 1994 and was received February 17, 1994. This project was received without an engineer's seal, but nevertheless was considered because of the potential threat to human health and safety of landfill personnel and the surrounding community. The SWMP has reviewed this request for this condition that does not appear to present a serious threat to the state of Missouri's public health and environment. The SWMP concurs with the proposed plan with the following conditions:

1. The document entitled Proposal, Landfill Fire Mitigation, Laidlaw Bridgeton Sanitary Landfill, Bridgeton, Missouri dated December 10, 1993 and revised January 10, 1994 shall be revised and submitted under the seal of a professional engineer registered in Missouri within thirty (30) days of receipt of this letter.

2. Any change in the operation and/or design of this facility other than that which has been described in the application and approved in this permit is considered by the department to be a modification of the permit and prior written approval must be obtained.

3. Three copies of the report, as part of Task 4 in the referenced document, on data from field observations and evaluations and recommendations for fire mitigation shall be sent to the SWMP. The report shall be reviewed and approved by a professional engineer registered in the state of Missouri.

4. Three copies of the report, as part of Task 5 in the referenced document, on mitigative action, its success, and its prospects for maintenance in the future shall be sent to the SWMP. The report shall be reviewed and approved by a professional engineer registered in the state of Missouri.

5. Laidlaw shall include all reports on continuing monitoring and maintenance efforts for control of the fire as part of the quarterly gas monitoring report to be sent to the SWMP.

This concurrence is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management Law, nor should this be construed as a waiver for other regulatory requirements.

This concurrence is not to be construed as compliance with any existing local ordinances or zoning requirements, nor does it supersede any local permitting and/or zoning requirements.

Should you have any questions, please contact me at (314) 751-5401.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Frank J. Dolan, P.E.
Environmental Engineer

FD:lf

c: James J. Walsh, SCS Engineers
Joe Trunko, St. Louis Regional Office
Kathrina M. Donegan, St. Louis County Dept. of Health

St. Louis County
Department of Health

March 22, 1994

Mr. Larry Giroux, General Manager
Laidlaw Waste Systems, Inc.
13570 St. Charles Rock Road
Bridgeton, Mo 63044

Re: Laidlaw Bridgeton Landfill's Fire Mitigation Proposal

Dear Mr. Giroux:

The St. Louis County Department of Health, Waste Management Section has received and reviewed Laidlaw Bridgeton Landfill's request to drill and install probes for fire remediation as described in the scope of work prepared by SCS Engineers dated December 10 and 22, 1993.

In accordance with Chapter 607, Section 800, "Scavenging at Facilities Prohibited; Disturbance of Waste Following Closure" St. Louis County Waste Management approves the drilling for and installation of temperature monitoring probes to monitor and investigate the subterranean fire in Pit 2. Conditions of said approval are that Laidlaw submit to this office any changes to the proposed plan, a copy of all field documentation and testing as proposed and the final remediation plan for approval.

Additional drilling or fire mitigation beyond the scope of the plan as submitted shall require review and approval by this office prior to implementation. This does not constitute any other Federal, State or local approvals that may be required to proceed.

Should you have any questions concerning this denial please contact me at 854-6936 or Sue Taylor at 854-6919.

Sincerely,

Kathrina M. Donegan

Kathrina M. Donegan
Waste Management Specialist
Waste Management Section

cc: Frank Dolan, MDNR
Bob Eck, MDNR-SLRO
Richard Houchins, City of Bridgeton
Chris Byrne, Air, Land & Water Branch
Sue Taylor, Waste Management Section
Brad Bomanz, Waste Management Section

Buzz Westfall
County Executive

Alpha Fowler Bryan, M.D.
Director

111 S. Meramec Avenue
Clayton, Missouri 63105

Phone: (314) 854-6000
Fax: (314) 854-6435
TDD: (314) 854-6446

llfire.wrk

ST. LOUIS COUNTY HEALTH DEPARTMENT
WASTE MANAGEMENT SECTION

MAR 2 3 1994

SANITARY LANDFILL SURVEILLANCE RECORD

Date: 3-4-94 Days/Week Open: 6

Name of Facility: Laidlaw Waste Systems (Sanitary)

Permit No.: 0419 Expires: 6-22-94

Owner: Laidlaw Waste Systems, Inc.

Address: 13570 St. Charles Rock Road
Bridgeton, MO 63044

Estimated amount of solid waste coming through gate.
Compacted Loads 37,500 yds./wk. _____ tons/wk.
Noncompacted Loads _____ yds./wk. _____ tons/wk.

Estimated volume of remaining landfill covered by approved engineering plans. _____ acre(s) 10 years

Ordinance 13,320 Chapter 607
Compliance Status

Check all sections: SAT-Satisfactory; UNS-Unsatisfactory; * - Area(s) requiring additional attention.

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
FACILITY PLAN				
720.0	Operations comply with facility plan.			X
SOLID WASTE HANDLING				
730.5	Bulky waste crushed and pushed to bottom of cell.	X		
730.6	Demolition and construction waste, tree stumps, etc. pushed to bottom of cell.	N/A		
730.7	Dead animals under 40 lbs. covered immediately.	X		
730.8	Dead animals over 40 lbs. placed in pit and covered with 4 ft. of compacted soil.	X		
730.9	Water treatment plant sludges incorporated into active face and covered immediately.	X		
	Quantity of sludges does not interfere with normal active face operation.	X		
730.10	Incinerator and air pollution control residues incorporated into working face and prevented from becoming airborne.	X		
SOLID WASTE EXCLUDED				
730.4	Responsible supervisor present.	X		
760.0	Entrance sign posted listing wastes not accepted.	X		
SAFETY				
730.25	Fire extinguishers provided on all equipment.	X		
730.26	Provisions made for extinguishing fires.	X		
730.27	Communications equipment met standard.	X		
730.28	Scavenging prohibited.	X		
730.29	Controlled access limited to operating hours.	X		
730.30	Traffic directed to designated disposal points.	X		
730.31	Dust control adequate.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
WATER QUALITY				
730.11	Surface water courses diverted.	X		
	Grading promotes surface water runoff without excessive erosion.			X
	Grading does not exceed 33 1/3%.	X		
	Surface water courses and runoff control 20 year rainfall.	X		
730.12	Minimum 15 feet between waste and maximum water table.	X		
730.13	Water quality protection secure (ie. liner, bedrock).	X		
730.14	Leachate and treatment systems used where necessary.	X		
730.15	Ground/surface water not contacting waste.	X		
730.36	All drinking water sources within 1/4 mile sampled annually.	X		
COVER MATERIAL				
730.3	Minimum of 6 inches approved cover applied daily.	X		
	Minimum 15 day stockpile of daily cover.	X		
730.32	Intermediate cover (min. 1 ft. after compaction) applied to all areas idle more than 60 days.	X		
730.33	Final cover (min. 2 ft. after compaction) applied to completed areas.	X		
COMPACTION				
730.1	Solid waste spread in layers not to exceed 2 ft. and reduced to smallest volume.	X		
730.2	Waste confined to smallest practical area on working face.	X		
730.24	Adequate equipment maintained and operated.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
AIR QUALITY				
730.16	No open burning without permission.	X		
GAS CONTROL				
730.17	Decomposition gas control implemented.			X
730.18	Gases vented to prohibit explosive or toxic accumulations.	X		
AESTHETICS				
730.20	Litter control devices used properly.	X		
	Litter collected and secured daily.	X		
730.21	Blowable waste covered promptly.	X		
730.22	Vegetation and natural windbreaks used where necessary.	X		
730.23	Salvaged materials stored or removed daily.	X		
730.34	Final vegetation planted and graded as required.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
VECTORS				
730.19	Vector control programs implemented.	X		
RECORDS				
730.35	Records maintained to cover: a. Major problems and complaints.	X		
	b. Monitoring of leachate, gas, ground, and surface water sampling and analyses.	X		
	c. Vector control efforts.	X		
	d. Dust and litter control efforts.	X		
	e. Quantity of waste handled.	X		
BONDING				
690.1	Operating bond adequate.	X		
CLOSURE				
790.1	Final cover and vegetation provided.	X		

Weather Conditions: Clear, Sunny, 65° and breezy with low humidity.

Observed With: Susan Taylor, DOH

Consulted With: Larry Giroux, Laidlaw Waste Systems, Inc. & Susan Taylor, DOH

Additional Remarks/Comments: UNSATISFACTORY CONDITIONS NOTED:

1a. In areas idle for more than 60 days (Pits 2 and 3), settlement has occured pulling waste and cover material away from the quarry walls. Without proper cover and a good seal along the quarry walls, the odor problems will be accentuated and potentially decrease the efficiency of the gas collection system. (Section 607.720.0)

2a. Ponded surface water was noted throughout the site (Pits 1,2 and 3) due to settlement and poor contouring. Some erosion was also noted, however, trash was not exposed. (Section 607.730.11)

3a. Flames and smoke from an ongoing subterranean fire were noted along the eastern wall in Pit #2 (previously the wet weather area).

4a. Pit #2 has an apparently abandoned leachate well that has emerged due to settlement. Landfill gases are passively venting from this location.

In pit #1, adjacent to the radioactive area, settlement of waste has created a large blow hole (approximately 5 feet in diameter) and fissures which are venting significant amounts of landfill gas. (Section 607.730.17)

continued on page 2

cc:

Signature of Inspector

Signature of Section Chief

RECOMMENDATIONS

1b. Cover all waste up to the quarry walls and compact to eliminate all gas migration (an O2 intrusion). Particular attention to obtain a good seal should be made at the quarry wall. This violation was noted and has remained since the previous inspection on December 20, 1993. Soil coverage at the quarry wall should be monitored (preferably weekly) to assess the maintenance of a good soil/rock seal.

2b. Add additional cover material to establish proper contour levels as soon as possible. It is to be noted that this is the same violation that was noted in December, however, numerous areas have already been corrected since that time. Mr. Giroux is implementing the gradual regrading of Pit #3 to address this situation.

3b. Extinguish the subterranean fire. Aerial infrared photography has pinpointed the extent and location of the fire. Previous efforts to control the fire by placing additional soil cover along the quarry wall were noted. Efforts have been scheduled to remediate the situation and are to commence on March 9, 1994

4b. Properly reactivate and seal the base of the leachate well or properly close and cap the well. This violation was noted in the December inspection.

Add sufficient additional compacted soil cover material to seal off any escaping gases from the fissures. This area had additional cover placed on it in the recent past. It is recommended that this area be regularly inspected for fissures and blow holes and address such conditions immediately.

SATISFACTORY CONDITIONS NOTED:

Overall - Soil cover over most of the site was good.

cc: Larry Giroux, Laidlaw - Operations Manager
John Boonstra, Laidlaw - Regional Division Manager
Joe Trunko, MDNR - SLRO
Richard Houchin, Bridgeton City Hall

Environmental Consultants

2060 Reading Road
Suite 200
Cincinnati, Ohio 45202-1416

513 421-5353
FAX 513 421-2847

SCS ENGINEERS

March 17, 1994
File No. 0593034

RECEIVED
APR 05 1994
SWMP

POSTED

Mr. Frank J. Dolan, P.E.
Environmental Engineer
State of Missouri
Department of Natural Resources
Division of Environmental Quality
P.O. Box 176
Jefferson City, Missouri 65102-0176

Subject: Landfill Fire Mitigation, Westlakes Landfill, Permit 0118912 (Bridgeton Inc.)
St. Louis County, Missouri

Dear Mr. Dolan:

As you know, Laidlaw Waste Systems is currently proceeding with the investigation, design, and implementation of the landfill fire mitigation program at Westlakes Landfill. We earlier submitted a copy of our proposed approach to you, prepared by SCS Engineers, and dated December 10, 1993 (revised January 10, 1994). You forwarded comments to us on that proposal by your letter of March 8, 1994.

Item 1 of that letter requested submittal of three copies of the original document, stamped and sealed by a Registered Professional Engineer in the State of Missouri. That task has now been completed, and three copies are enclosed.

We will proceed to accommodate the remaining items in your March 8, 1994 letter. Three copies of the Tasks 4 and 5 reports (certified by a Registered Professional Engineer in the State of Missouri) will be forwarded to you as they become available.

Thank you for your consideration on this matter. If you have any questions or concerns, please do not hesitate to call me at the letterhead phone.

Sincerely,

James J. Walsh, P.E.
Project Director
SCS ENGINEERS

RECEIVED
APR 05 1994
SWMP

POSTED

PROPOSAL

LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL
BRIDGETON, MISSOURI

Submitted to:

Laidlaw Bridgeton Sanitary Landfill
Laidlaw Waste Systems, Inc.
13570 Saint Charles Rock Road
Bridgeton, Missouri 63044
(314) 739-1919

Submitted by:

SCS Engineers
2060 Reading Road
Cincinnati, Ohio 45202
(513) 421-5353

4/1/94

STATE OF MISSOURI
LARRY D. LOUDY
NUMBER E21257
REGISTERED PROFESSIONAL ENGINEER

December 10, 1993
Revised January 10, 1994
File No. 0507893

PROPOSAL

LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL
BRIDGETON, MISSOURI

BACKGROUND

This submittal represents a proposal from SCS Engineers for landfill fire mitigation at the Bridgeton Sanitary Landfill. Symptoms of landfill fire have existed at the Bridgeton Landfill for about one year. A fire appears to have developed in an area of the landfill indicated on Exhibit 1. The landfilling operation at Bridgeton consists of a quarry fill operation. As in all quarry fills, settlement of refuse mass creates a shear plane against the quarry sidewall. Typically, this shear plane develops into a separation distance of several inches. This separation gap provides the opportunity for air intrusion.

The Bridgeton Sanitary Landfill also has an active gas extraction system. This system consists of dozens of vertical gas extraction wells, and horizontal collectors. These all feed to an existing blower/flare station. At this location, the collected gases are combusted, and vented to atmosphere.

A horizontal collector formerly operated within several hundred feet of the fire area. Although the gas system is now closed off, this system may have created the opportunity for air intrusion into the gap between the landfill and its quarry sidewall. Specifically, the gas collection system places vacuum on subsurface refuse. The vacuum can be relieved through atmospheric intrusion, at the point of least resistance. This point of least resistance was likely the quarry sidewall, where a gap of several inches allowed easy entry of atmospheric air, to a depth of dozens of feet.

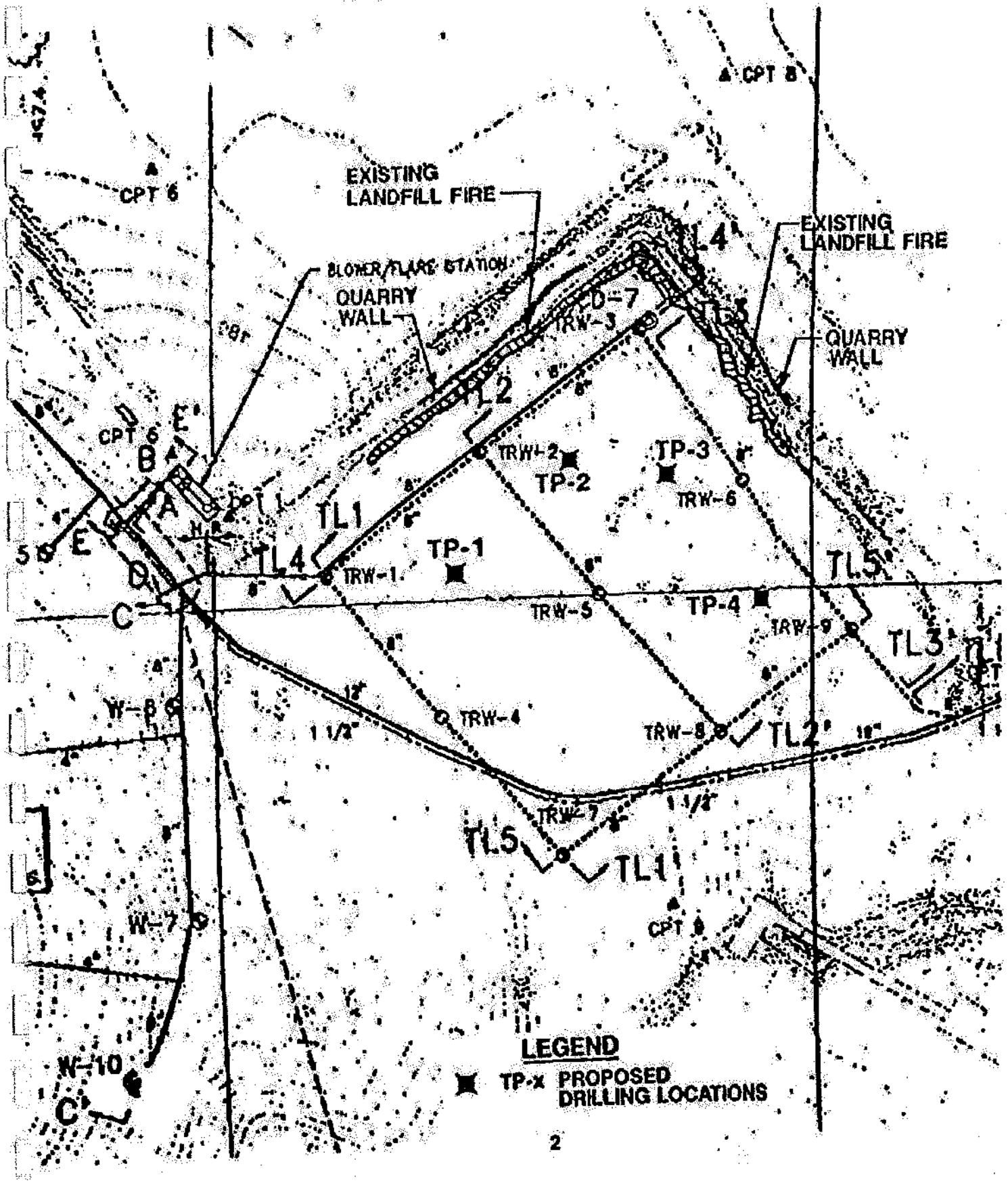
Since the time that fire symptoms were first detected, the gas extraction system has been turned off. In addition, the operators have piled cover soil atop the crack, in an effort to extinguish the fire and starve it from atmospheric air. Though this approach appears to have had some success, the fire continues in many areas to this date.

It is recognized at this point that piling additional cover soil atop the fire will likely not permanently mitigate the problem. As a result, this proposal was solicited. Its purpose was to develop an investigative program, to collected necessary background information, and determine the best mitigative approach to completely and permanently extinguish the landfill fire. As a final task under this proposal, mitigation would actually be applied.

The balance of this proposal addresses the proposed work scope, schedule, costs, project team, and qualifications for SCS Engineers. Our Scope of Work contains a total of five tasks. The first four of these tasks deal with investigation. The last of these assumes a certain mitigative approach, and proceeds to scope, schedule, and price that task.

EXHIBIT 1

PROPOSED TEMPERATURE PROBE LOCATIONS



SCOPE OF WORK

General

This portion of the proposal describes the approach to be taken in investigating and mitigating a potential landfill fire at the Laidlaw Bridgeton Landfill near St. Louis, Missouri. Based on its prior experience on other landfill fires, SCS has developed the following five tasks to accommodate the proposed work flow on this assignment.

- Task 1. Fly infrared thermography.
- Task 2. Install temperature probes.
- Task 3. Monitor temperature probes.
- Task 4. Prepare report and propose mitigation.
- Task 5. Mitigate landfill fire.

The balance of this section will identify the objectives and detailed approach to be taken under each of these tasks.

Task 1 -- Fly Infrared Thermography

Objectives--

1. Finalize plans for infrared thermography, including selection of appropriate technique and vendor.
2. Perform infrared thermography. Create color video tape and still photographs.
3. Process and evaluate thermography. Draw conclusions about subsurface fire, as a basis for temperature probe installation.

Approach--

SCS Engineers has utilized infrared thermography on other landfill fire projects. Those three projects, and the techniques applied at each are summarized below:

1. Port Washington Landfill, North Hempstead, New York

   Due to the improper operation of an existing landfill gas collection system, a subsurface fire apparently developed around selected gas extraction wells. To determine the depth, intensity, and extent of subsurface combustion, aerial thermography was flown at the Port Washington Landfill at the direction of SCS Engineers. The thermography was performed in about 1985, and prepared a single black and white photo taken from an airplane flown during night.

   The thermographic effort proved to be of little use. At this point, the more intense, surface manifestation of the fire had ceased to exist. In addition, the

remaining fire appeared to be relatively calm, and at far greater depth. Little surface manifestation of the fire could be seen. This thermography proved to be valuable only in identifying that near-surface combustion was not occurring.

2. Industrial Excess Landfill, Uniontown, Ohio

Elevated carbon monoxide and subsurface temperature readings were recorded at this Superfund landfill. SCS was the design engineer of record, under contract to the U.S. EPA, and performing its Emergency Response Contract Services (ERCS) assignment. Based on prior experience by SCS on other sites, we recommended the performance of an aerial overflight to perform infrared thermography. Black and white videotape was prepared, using a plane flown during the night.

This was a relatively shallow landfill. The results and tape revealed little to no subsurface combustion. This was later confirmed with more intensive subsurface probing, including subsurface temperature profiles, well head monitoring, further carbon monoxide readings, and other related data.

In conclusion, the thermography at this site was useful in determining that the earlier feared landfill fire was now at a relatively low level, or altogether non-existent.

3. G B Auto Parts and Landfill, Ironton, Ohio

SCS Engineers responded to this landfill fire under its U.S. EPA Emergency Response Contract Services (ERCS) assignment. Approximately 5 acres of the total 10 acre site was actively burning. Smoke emanating from the landfill had caused the evacuation of several residential structures nearby.

In order to determine the subsurface extent of the fire (as it may be different from the surface manifestation), SCS ordered that an infrared photography be performed in 1993. An aerial plane overflight was performed during early evening hours after sunset. A color videotape was compiled, and used for subsequent interpretation.

The actively burning areas (as could be seen from the ground surface) were confirmed through the infrared thermogram as having active combustion. Active combustion appeared to be confined to these areas of surface manifestation. Because the landfill was relatively shallow (30 ft or less) and in combination with infrared photography, it was determined that the fire was confined to those areas emanating smoke. The infrared thermography was therefore useful in determining that the subsurface fire was not more extensive than what could be seen on the surface.

Based on the above, SCS has had mixed results with the use of infrared thermography in the past. In some cases, it has been successful in determining the extent of subsurface combustion, as it may exceed those areas readily identified through surface manifestation of smoke. In other cases, the buffering effects of soil could mislead interpretation of the aerial overflight. This is a particular problem if the combustion is contained at great depth, as often occurs in deeper landfills.

Generally, there exist several alternatives for performance of infrared thermograms:

1. Black and white versus color.
2. Videotape versus still photos.
3. Ground surface examination versus aerial overflight.
4. Helicopter versus airplane.

Based on our prior experience, we recommend that Laidlaw proceed with infrared thermography at this site. Although there is some risk that the thermogram could be misleading or fail to add new information, on balance we find it to be a useful tool. Our chief purpose here would be to determine whether subsurface combustion has spread laterally, at shallow distance, beyond those areas currently emanating smoke. If so, placement of temperature probes in these areas would be appropriate. Thus, the outcome of Task 1 (Thermography) could readily affect Task 2 (Temperature Probe Installation).

At this time, we recommend use of a helicopter, to compile color videotape atop the site. This should be flown during nighttime, with early morning hours preferred. The videotape can be used for subsequent interpretation. From past experience, the color videotape can be used to prepare still photographs, produced at the same scale as topographic maps. In this manner, the exact limits of the subsurface combustion can be drawn to scale, on topographic maps available from other sources.

As a first step as work proceeds, SCS would research available contractors capable of performing infrared thermography in the St. Louis area. SCS has utilized Midwest Aerial Photography out of Columbus, Ohio for this purpose. Another candidate is Entech Systems from St. Louis. The expected cost of this effort would be approximately $4,000. The deliverable would include a color videotape, and a select number of still photos.

After contacting these and other aerial firms, a determination would be made as to price, technology, approach, quality, and delivery schedule. A final selection would then be made. Plans would be prepared for the aerial overflight itself. The overflight would then be performed at night with SCS personnel present.

The videotape from the overflight is expected to be available immediately. It would be viewed and interpreted with "ground truthing" performed, to identify the fringe areas of fire. Selected images within the videotape would be identified, and compiled into still photographs. These still photos would be prepared to scale. The two scaled photographs would then be utilized to draw the extent of the fire on the topographic maps described above.

As an outcome of this task, a determination can be made as to the placement of the temperature probes under Task 2. A plan for their placement is already included here in this proposal. However, modification of their location, or expansion of the number of probes, may be both be necessary as a result of the infrared photography here.

Task 2 -- Install Temperature Probes

Objectives--

1. Finalize plan for installation of temperature probes including location, installation, and backfill. The final plan to be based upon results of Task 1 infrared thermography.

2. Contact competent drilling firm for well installations. Capability must include angled drilling proposed for this program. Select a driller based on availability, capability, quality, delivery schedule, and price.

3. Install two drilled-well clusters at two separate locations in the landfill. These locations to be generally offset from the quarry edge by about 50 ft back from the existing fire area.

4. Each cluster to consist of two separate well points. One to be vertical, and 75 ft deep. The other to be angled, and traverse through the quarry wall.

5. Supervise well drilling and backfill operations. Compile boring logs. Make on-site design decisions. Complete backfill and well construction.

Approach--

Another useful tool in examining subsurface landfill fires, is the installation of dedicated temperature monitoring points. SCS Engineers has installed such points at numerous landfills. Typically, they are installed with steel or iron pipe. Through use of down hole thermocouples, we can determine the temperature levels and gradient, at two ft differentials down the entire bore hole depth. This allows us to determine the presence, intensity, and depth of any landfill fire.

At this time, and based on expected results from Task 1, we anticipate installing two separate well clusters. Each cluster would have two wells, one of them vertically downward, and one of them angled toward the quarry wall. The straight vertical wells are an estimated 75 ft deep from the ground surface. The angled wells are an estimated 80 ft deep. Both wells would be installed in the same general location, offset into the landfill about 50 ft from the quarry wall. The vertical well would be installed first, followed by the angled well. Our intention is to install the angled well through the quarry wall by several feet, and to determine the presence of combustion at this interface.

Boring logs would be carefully compiled during well installations. Any refuse removed from the bore hole would be examined for elevated temperature. Temperatures would be recorded, and other physical observations made on the boring logs.

Steel or iron pipe, 1 in. in diameter, would be installed to the bottom of each of these eight bore holes. Proposed bore hole locations are as indicated on Exhibit 1. All holes would then be backfilled with gravel around the perforated interval (estimated to begin 5 ft below the ground surface). The annular space within 5 ft of the surface would be packed with clay and concrete material, to provide structural and airtight integrity.

Task 3 -- Monitor Temperature Probes

Objectives--

1. Perform down hole temperature and other monitoring of all four monitoring probes. Perform monitoring twice, at two week intervals.

2. Perform monitoring for down-hole temperature, gas composition, water presence, and trace constituents.

3. Record selected "ambient landfill temperatures" at gas extraction wells located elsewhere on the fill. Utilize this data as a baseline.

Approach--

The primary purpose of the temperature monitoring probes would be to collect data on down hole temperatures at various intervals. SCS has in its possession several down-hole thermocouples. These have been used in the past to record landfill temperatures, at periodic intervals, down the total well depth.

Steel or iron well points have been installed to fend against attack from any subsurface landfill combustion. Plastic well points (though less expensive) would melt or otherwise fail as a result of the elevated temperatures found in a landfill fire. Steel well points are more durable, and have shown to sustain around landfill fire.

SCS proposes to perform two separate rounds of temperature monitoring associated with these eight well points. Monitoring would be performed at two week intervals for a total of two rounds, over a two week term. SCS would perform the first monitoring, immediately after the time of well installation and backfill. Simultaneously, SCS would train Laidlaw personnel, and leave monitoring equipment. This would allow Laidlaw to lead monitoring round two, two weeks after original well installation.

During each monitoring round, and at each of the four well points, the following monitoring would be performed:

1. Most importantly, down-hole temperatures in degrees F, at two ft intervals down each probe. Down-hole temperature monitoring allows one to see a gradient of subsurface temperatures. The location, intensity, and depth of any subsurface combustion can be determined.

2. Well head pressure.

3. Gas composition including methane, oxygen, and carbon dioxide. These major constituents would be monitored using handheld instruments available at SCS.

4. Water level.

5. Total well depth.

6. Trace constituents including carbon monoxide (CO) and vinyl chloride (VC). These parameters would be monitored using either Draeger tubes or handheld instruments.

SCS will also collect selected ambient temperature data on other gas extraction wells located at Bridgeton Landfill. From past experience, we find that temperatures that may otherwise indicate a landfill fire, can sometimes be an indication of "elevated anaerobic decomposition". To determine this condition, down hole temperatures should be recorded from at least three other ambient landfill gas extraction wells, located in other portions of the landfill, where they are apparently unaffected by potential fire. This data can then serve as a baseline, to allow comparison with down hole temperatures from the ~~eight~~ four selected wells in our temperature well clusters.

Task 4 -- Prepare Report and Propose Mitigation

Objectives--

1. Tabulate and plot temperature and other monitoring data.

2. Determine temperature trends at each well location. Compare with background conditions. Determine presence, extent, depth, and intensity of any subsurface fire.

3. Utilize infrared photography to determine presence of any likely fire.

4. Compile and evaluate background data on existing gas collection system. Determine and evaluate history of "landfill fire" as told by Laidlaw operations personnel.

5. Draw final conclusions on subsurface fire.

6. Prepare recommendations on need for and approach taken by, mitigation.

Approach--

Following the second temperature monitoring round, all data will be tabulated, plotted, and evaluated. The infrared thermogram would also be used to evaluate data, with the new temperature data in hand. Historical perspective on the landfill fire will be gained, by interviewing Laidlaw personnel. Lastly, the configuration of the existing landfill gas extraction system will be examined. This system could have an impact on starting or promoting any landfill fire.

After examination of this data, SCS will be able to determine the following factors:

1. Is a landfill fire present? Where is it located, at what intensity, and at what depth?

2. How did the landfill fire likely begin? Is it now expanding? What are the future risks of "no action"?

3. Should mitigative steps be taken? If so, what technique should be applied? What is the specific approach, schedule, and cost?

At the conclusion of this Task, SCS will submit a report on the subject. This report will include the following contents:

1. Introduction and background.
2. Compilation of existing data.
3. Compilation of new data from test monitoring program.
4. Discussion, evaluation, and conclusions.
5. Recommendation on landfill fire mitigation.

The report will be submitted in draft form to Laidlaw personnel for review. A meeting will be conducted to present our findings. Based on comments received, the report will be finalized, and final recommendations on mitigative action will be made.

Task 5 -- Mitigate Landfill Fire

Objectives--

1. Implement approach chosen during Task 4 report. Mobilize equipment to site. Set up for landfill fire mitigation.
2. Apply methodology for landfill fire mitigation in a first application. Monitor thereafter, to determine effectiveness.
3. Perform second and third applications if needed. Continue to monitor to determine effectiveness.
4. After halting mitigative action, continue to monitor periodically thereafter, to ascertain continued effectiveness.
5. Prepare final letter report to Laidlaw, reporting on mitigative action, its success, and its prospects for maintenance in the future.

Approach--

SCS Engineers has been involved in numerous landfill fire investigations and mitigations in the past. Some of the tools typically used in identifying and researching landfill fires have included those previously mentioned: infrared thermography, down-hole temperature monitoring, etc. Based on these prior efforts, we have proposed mitigative actions. The actions applied previously, which may have some relevance here, include:

1. Gas system.

   Often a landfill fire is related to an existing gas extraction system. If overdrawn, or if channels for rapid air intrusion are created, there exists the potential for gas extraction systems to draw in atmospheric air, starting or fueling an existing landfill fire.

   From past experience, the gas extraction system in the suspected area must immediately be turned off. The fire must be proven to be totally extinguished, before the gas system can be returned to operation.

   The first step has already been taken at Bridgeton Landfill, with deactivation of the gas extraction system in the area of the alleged landfill fire. Monitoring can be performed during Task 3 of this program, to ascertain whether a zone of influence effect no longer exists in this area.

2. Soil cover.

   Once a landfill fire begins, it can "breathe in" its own oxygen from the atmosphere, to a greater depth than may otherwise occur in a common anaerobically-decomposing sanitary landfill. Even with halting the operation of a gas extraction system, our experience indicates that landfill fires 10 or 20 ft deep (or deeper) can reach to the landfill surface, and draw in oxygen. Commonly, SCS moves to apply additional clay soil cover. The effect of this cover will be to starve or shut off such air intrusion.

   To this end, SCS has applied 4 ft of compacted clay soil to the G B Auto Parts and Landfill in Ironton, Ohio. This approach appears to be successful in starving the existing landfill fire, and lowering temperatures. With time, we expect the fire will be totally extinguished. Unfortunately, some level of subsurface combustion will likely occur for many months to come.

3. Foam application.

   Chemical foams are commonly used by fire fighting departments, and have been used for landfill fires in the past. They are particularly effective when the fire manifests itself on the surface of the landfill. Clearly this is not the case at Bridgeton Landfill. Though foams have some effectiveness subsurface, particularly when injected below grade, they do not long survive. Most foam lasts for less than a day, unless special agents are added. Even when such agents are added, longevity for no more than two weeks can be expected.

   Foam provides the following beneficial effects: adds water to cool and extinguish the fire, minimizes or prevents air intrusion, and otherwise covers or suffocates such combustion. However, the longevity of such foam makes it questionable for subsurface fire mitigation.

4. Liquid nitrogen or carbon dioxide.

   SCS has applied liquid nitrogen and carbon dioxide on three sites to date. Typically, the material is injected through the temperature monitoring probes (described under Task 2) to the subsurface fire area. As for foam above, liquid gases have the following benefits: cools the fire, extinguishes the fire, and prevents air/oxygen intrusion. However, like foams, liquid nitrogen and carbon dioxide can be very expensive. Our past experience indicates that the materials applied escape rapidly to atmosphere. New material must be constantly applied over a multi-week period.

5. Water application.

   Water application may have some relevance on landfill fires. Obviously they provide all the benefits of foams or liquid nitrogen and carbon dioxide. They cool, smother, and seal off from air intrusion. However, they also add water to a landfill, which is usually undesirable, since the application of water can create additional leachate quantities. Without a well sealed bottom-lined landfill, water application is not advised.

6. Bentonite slurry application.

   A slurry or bentonite application lasts longer than foam or liquid air injections. Like foams, slurries also provide the benefits of cooling, fire extinguishment, and air sealing. SCS has used such applications in any of the following scenarios: (1) flooding a given ground surface area with bentonite soil, so as to minimize air intrusion; (2) subsurface injection through temperature monitoring probes or other ports; and (3) injection into landfill cracks.

The latter seems like the best choice at Bridgeton Landfill, owing to the large crack along the interface of the quarry wall and refuse fill.

At this time it appears the bentonite slurry application may have most value. Thus, the chronology of assumed actions we present here is based upon selection of slurry as the preferred application.

As a first step, equipment for bentonite slurry material would be mobilized to the site. The slurry would be mixed, and pumped into the crack along the quarry sidewall. Thereafter, temperature probes would be monitored, in an effort to determine whether the slurry has had any benefit.

Some settlement of the slurry can be expected over a period of several days. As a result, and for scoping purposes, we propose that the slurry application equipment remain on site, and be used for a second application some two weeks later. Again temperature probes will be monitored. Some settlement would likely occur. Finally, a third application would occur two weeks later.

Monitoring would be performed thereafter. Based on past experience, it is assumed that the fire would be adequately settled at this point, to allow for the slurry equipment to de-mobilized from the site.

From past experience, some subsurface combustion can be expected for months thereafter. However, the temperatures should gradually decrease over time. Surface manifestation of fire should not occur. Subsurface temperature monitoring should continue, in an effort to determine that the levels have returned to acceptable ranges, and that the trend continues downward. This monitoring would be performed by Laidlaw personnel, based on guidance provided by SCS.

PROJECT SCHEDULE

The proposed project schedule for this program has been included as Exhibit 2. As shown, the total investigative program would be completed within 2½ months after project initiation. This includes two to four weeks for aerial thermography, two to three weeks for temperature probe installation, four weeks for temperature probe monitoring, and four weeks for report preparation and agreement on the proposed mitigation. Several of these tasks overlap, creating a total estimated 2½ month period of performance.

Mitigation of the landfill fire can proceed thereafter. A significant portion of this work would be performed within four weeks of initiation of this task. For budgeting purposes, SCS effort would expire at the end of that six month term (based on the mitigation now proposed). Some involvement by Laidlaw personnel to continue monitoring the situation for several months thereafter would likely be required.

PROJECT COSTS

Vendor costs on this program include those for a driller and for performance of the aerial thermogram. Drilling and probe installation costs have been estimated in Exhibit 3, and amount to $5,401. The aerial thermogram has been estimated at $4,000. This is predicated on the performance of a single aerial overflight using a helicopter, and compilation of a color videotape to observe subsurface thermographic conditions. Processing of selected still photographs from the videotape has also been included within this amount.

SCS manhours and total costs have been presented by task in Exhibit 4. A summary of those costs has been included on Exhibit 5. Please note that these costs are negotiable. Outside vendor costs can be contracted directly to Laidlaw Waste Systems if appropriate. In addition, Laidlaw could choose to initiate and proceed with any individual task, foregoing application of subsequent tasks until the outcome of early tasks has become known.

The specifics surrounding our proposed costs for Task 5 are detailed below:

1. We have provided a budgetary estimate of $10,000 for the additional construction-related activity under Task 5, Landfill Fire Mitigation. This includes a total of five days of on-site activity, at an estimated $2,000 per day.

2. Our original proposal described the application of a slurry grout injection along the landfill sidewall during each of three separate rounds. The first round was to be the most expansive, and was to consume a total of three elapsed days. The subsequent two rounds were to be at two week intervals thereafter. Each round

EXHIBIT 2

PROJECT SCHEDULE

Task No. and Title	Months from Project Start				
	1	2	3	4	5
1. Fly Infrared Thermography	-------				
2. Install Temperature Probes	-----	--			
3. Monitor Temperature Probes		-------			
4. Prepare Report and Propose Mitigation		-----	---		
5. Mitigate Landfill Fire				---------->	

Activity:

------- SCS Activity

EXHIBIT 2

PROJECT SCHEDULE

Task No. and Title	Months from Project Start				
	1	2	3	4	5
1. Fly Infrared Thermography	-------				
2. Install Temperature Probes	----	---			
3. Monitor Temperature Probes		-------			
4. Prepare Report and Propose Mitigation		----	---		
5. Mitigate Landfill Fire				-------	---->

Activity:

------- SCS Activity

EXHIBIT 3

DRILLING/PROBE INSTALLATION COST ESTIMATE

1.	Mobilization		$100
2.	Drilling		
	-- 2 straight holes x 75 ft deep each	= 150 ft x $9/ft	1,350
	-- 2 angled holes x 80 ft deep each	= 160 ft x $11/ft	1,760
3.	Probe Installation		
	-- 2 straight holes	= 150 ft x $5/ft	750
	-- 2 angled holes	= 150 ft x $5/ft	750
4.	Decontamination Charge		200
Subtotal			$4,910
5.	Contingency (10%)		491
TOTAL			$5,401

EXHIBIT 4

DETAILED COST ESTIMATE

Labor Classification	Rates	Task 1 Infra-Red Thermography	Task 2 Install Probes	Task 3 Monitor Probes	Task 4 Report	Task 5 Mitigate*	Total
LABOR MAN-HOURS:							
Project Director		4	4	4	8	16	36
Sr. Project Engineer		16	8	8	16	64	112
Staff Engineer		8	32	16	16	80	152
Drafter		--	4	--	8	8	20
Secretary		4	4	--	16	16	40
Subtotal -- Labor Man-Hours		32	52	28	64	184	360
LABOR DOLLARS:							
Project Director	$135 /hr	$540	$540	$540	$1,080	$2,160	$4,860
Sr. Project Engineer	89 /hr	1,424	712	712	1,424	5,696	9,968
Staff Engineer	56 /hr	448	1,792	896	896	4,480	8,512
Drafter	42 /hr	--	168	--	336	336	840
Secretary	38 /hr	152	152	--	608	608	1,520
Subtotal -- Labor Dollars		$2,564	$3,364	$2,148	$4,344	$13,280	$25,700
EXPENSES:							
Thermography		$4,000	--	--	--	--	$4,000
Drilling/Probe Installation		--	5,401	--	--	--	5,401
Grout Slurry Contract Cost		--	--	--	--	10,000	10,000
Travel		1,000	1,000	1,000	500	1,500	5,000
Per Diem	$75 /day	225	375	225	150	600	1,575
Field Equipment		100	200	200	--	200	700
Supplies		100	200	100	--	200	600
Reproduction		50	50	50	100	50	300
Express/Shipping		50	50	50	100	100	350
Computer	$30 /hr	150	240	--	480	150	1,020
Long-Distance Telephone		25	50	25	50	75	225
G&A (15% of outside non-labor expenses)		810	1,061	210	120	1,671	4,073
Subtotal -- Expenses		$6,510	$8,627	$1,860	$1,500	$14,746	$33,244
TOTAL		$9,074	$11,991	$4,008	$5,844	$28,026	$58,944

* Note: Task 5 costs estimated, and dependent upon mitigation selected and the duration of its application. Task 5 includes SCS costs, but excludes any outside cost for mitigation materials, supplies, or equipment.

EXHIBIT 5

COST SUMMARY

	Task No. and Title	SCS Labor And Expenses	Outside Venders
1.	Fly Infrared Thermography	$5,074	$4,000
2.	Install Temperature Probes	6,590	5,401
3.	Monitor Temperature Probes	4,008	--
4.	Prepare Report and Propose Mitigation	5,844	--
5.	Mitigate Landfill Fire	18,026	10,000
TOTAL		$39,542	$19,401

was estimated to consume a total of one day. Thus, among all three rounds, a total of five days would be consumed.

3. In calculating our unit daily cost, we have assumed that heavy equipment would be provided through this contract to cut a bench in the existing mound of soil piled atop the landfill fire. This would be applied only in the first round. The bulldozer would be demobilized after the first round, and not used thereafter.

   For the first and subsequent two rounds, a cement mixer, conveyor, bentonite, water, and an estimated two to four personnel would be required each day. Some nominal support may be required from on-site Laidlaw personnel and operating equipment. However, this assistance would be on a spot basis, and would not be required full-time during those days.

SCS PROJECT TEAM

Three key personnel have been assigned to performance of this Laidlaw project. These include James Walsh (as Project Director), William Held (as Senior Project Engineer), and Eric Waldmann (as Staff Engineer). Qualifications of each of these individuals with regard to landfill fires is summarized below.

James J. Walsh, P.E. has a B.S. in Civil Engineering, and is a registered professional engineer in multiple states. Mr. Walsh has nearly 20 years professional experience in landfill and landfill gas projects. To date, he has been engaged on four separate landfill fires. Landfill fire projects have included Industrial Excess Landfill in Uniontown, Ohio; Port Washington Landfill in North Hempstead, New York; Lake County Landfill in Cleveland, Ohio; and G B Auto Parts and Landfill in Ironton, Ohio. Through these projects, Mr. Walsh has gained successful experience with various landfill fire investigative and mitigative approaches. Investigative approaches have included temperature probe installation and aerial thermograms. Mitigative approaches successfully applied have included: liquid nitrogen injection, liquid carbon dioxide injection, and clay cap application.

William M. Held is a degreed civil and environmental engineer. Mr. Held has 13 years professional experience, mostly on landfill and landfill gas projects. He has performed past work at the Bridgeton Landfill on behalf of Laidlaw Waste Systems. He has used the investigative measures and mitigation actions proposed for this project including: temperature probe installations, subsurface temperature profiles, aerial overflights, well head gas monitoring, and clay cover application.

Eric J. Waldmann is a design engineer with five years professional experience. Since joining SCS, Mr. Waldmann has been engaged nearly full-time on landfill and landfill gas projects. Most recently, he has been engaged on a full-time basis over a multi-month period at the GB Auto Parts and Landfill in Ironton, Ohio. At this site, he was responsible for landfill fire mitigation. Investigative actions supervised by Mr. Waldmann included temperature probe installation, subsurface temperature profiles, aerial overflight, thermogram, and clay cover application.

EXHIBIT 6

REPRESENTATIVE LANDFILL FIRE AND EXCAVATION PROJECTS

- Subsurface Fire Investigation at NPL Landfill Site, Industrial Excess Landfill, Uniontown, Ohio.
- Subsurface Fire Investigation, Extinguishment and Post-Extinguishment Monitoring, Lake County Landfill, Cleveland, Ohio.
- Subsurface Landfill Fire Control and Extinguishment via Carbon Dioxide Injection, South Bay Six Drive-In Theater, Carson, California.
- Landfill Fire Control Utilizing Subsurface Flooding, Excavation and Addition of Suitable Cover Material at Five Adjacent Landfill Sites, Wilmington, California.
- Repair of Fire Demaged LFG Recovery Facilities/Regrading of Settled Areas, Wilmington, California.
- Identification and Monitoring of Subsurface Landfill Fire Impacting LFG Migration Control Facilities, Mountaingate Development, Los Angeles, California.
- Identification and Control Plan Development for Subsurface Landfill Fire, Industry Hills Development, Industry Hills, California.
- Development of Landfill Fire Mitigation Program, Industry Hills Development, Industry Hills, California.
- Development of Landfill Fire Control Program, Guam.
- Landfill Fire Status Evaluation and Development of Short-Term Mitigation Plan, Including Health and Safety Risk Assessment, Go East Landfill, Snohomish County, Washington.
- Subsurface Landfill Fire Control and Extinguishment, Palailai Sanitary Landfill, Oahu, Hawaii.
- Subsurface Landfill Fire Control and Extinguishment, Laguna Seca Landfill, Monterey County, California.
- Subsurface Landfill Fire Investigation and Control, Mountain View Sanitary Landfill, Mountain View, California.
- Subsurface Landfill Combustion Investigation, Port Washington Landfill, Town of North Hempstead, New York.
- Landfill Fire Consulting, Salem, New Hampshire.
- Subsurface Landfill Fire, Preliminary Investigation, Ferry Point Park, New York City, New York.
- Landfill Excavation, Denton Avenue, Developed Health and Safety Plan and Monitored Compliance, Town of North Hempstead, New York.
- Landfill Relocation, Construction Contract Documents, and Health and Safety, Avondale Landfill, Arizona. 700,000 cubic yards of refuse was relocated from an old landfill in a floodplain to a new, lined site.

SCS QUALIFICATIONS

SCS Engineers is an environmental engineering consulting firm, specializing in solid waste management. The firm has ten engineering offices located throughout the nation. Out of approximately $35 million in annual consulting fees, approximately one-half of that work deals with landfill engineering. Practice areas include landfill gas control, landfill gas recovery, landfill engineering, permitting, site selection, hydrogeologic investigations, geotechnical investigations, construction quality assurance, and landfill fires.

The appendix to this proposal includes brochures of SCS Engineers, describing our general background. In addition, the firm has detailed experience on landfill fires. Principals of the firm have authored previous articles on the subject of landfill fires. A complete listing of landfill fire projects has been included as Exhibit 6. Selected key of those projects are highlighted below, as a demonstration of our landfill fire experience.

1. Lake County Landfill, Cleveland, Ohio

   A localized landfill fire had developed at this active landfill, as a result of failure of an interface between an active landfill gas withdrawal well, and the geomembrane cap. Extensive quantities of atmospheric air were drawn in, starting or fueling the fire. The fire rapidly expanded to cover an area about 1 acre in size, with a depth exceeding 40 ft.

   Initially, steps were taken by the operator to dig out the refuse. The fire depth was found to be greater than that which could be readily handled by the landfill operator. As a result, the landfill fire was re-sealed. SCS was subsequently mobilized to the site.

   SCS recommended installation of steel point monitoring wells, to determine the subsurface temperature profile. Monitoring was performed over a two week period. The exact location and intensity of the fire was determined. These same steel well points were later used for injection of liquid carbon dioxide and nitrogen. This had the effect of lowering landfill temperatures, and eventually extinguished the fire.

   Temperature monitoring was performed thereafter for a multi-month period. At the end of a one year term, temperatures had returned to ambient conditions found elsewhere throughout the site. As a result of these efforts, the landfill could then be successfully closed.

2. G B Auto Parts and Landfill, Ironton, Ohio

   SCS Engineers responded under its U.S. EPA contract for Emergency Response Contract Services (ERCS). An approximately 5 acre area of the landfill was burning at the time SCS arrived at the site. The immediate concern was with residential structures located near the site. As a result of the smoke, approximately 10 such structures were evacuated, until the hazard could be removed.

SCS supervised the installation of temperature monitoring points, to determine the depth of the landfill fire. In addition, an aerial thermogram was performed. This revealed the subsurface fire was limited to those areas now burning at the surface.

SCS then recommended the application of a two ft thick clay cap. Within three days the smoke had disappeared from the site. Subsequent temperature monitoring revealed that the fire remained, albeit at controlled depths. A thicker clay cap was then applied, and a program of long-term temperature monitoring was implemented.

The fire has now been extinguished for an approximate one month term. It is expected that temperature monitoring will continue for a one year period. At the end of that time, it is expected that subsurface temperatures will have returned to ambient conditions.

3. South Bay Six Drive-In Theater, Carson, California

This was a former quarry pit utilized as a sanitary landfill. Refuse had been filled approximately 150 ft deep, to the top of the quarry. Upon landfill completion, the final surface was used as a drive-in theater. A landfill gas extraction system was installed throughout the site, to protect theater occupants.

The operator of the gas collection system failed to prevent air intrusion. As a result, a subsurface fire started, and expanded over several acres. In addition, the fire extended to great depth. Subsequent temperature monitoring revealed that the landfill fire extended to depths exceeding 100 ft.

SCS mobilized to the site, and installed several steel monitoring points. These points were used for temperature monitoring, and subsequently for a liquid gas injection (nitrogen and carbon dioxide). These injections had success in extinguishing the landfill fire. In the months thereafter, temperatures slowly returned to ambient conditions.

In all, SCS has been involved in approximately 18 landfill fire related projects. Those projects are listed on Exhibit 6. In addition, we invite you to review the articles included in the appendix of this report.

APPENDIX A

LANDFILL FIRE ARTICLES BY SCS ENGINEERS

Treating Subsurface Landfill Fires

The days of hoping a fire within a landfill would "burn itself out" are gone. Today's landfill operator seeks to find troublespots early, and has several options for treatment.

by Robert C. Steams and Galen S. Petersen

Years ago, open burning dumps served as our solid waste disposal sites. Wastes were purposely burned with attendant smoke emissions and waste volume reduction. Burning was slow and often incomplete. Many former burning dumps smoldered for years following their closure.

With the advent of sanitary landfills, open burning ceased and our solid wastes were compacted and buried with layers of soil. As a result, open burning was replaced with the relatively slow biological decomposition of the waste materials with landfill gas (LFG) production. LFG was soon recognized as both a safety hazard and as an energy recovery opportunity.

The potential impacts of landfill settlement on LFG recovery/control system design and operation have been recognized. However, little information has been available on subsurface landfill fires. As efforts are made to increase LFG recovery, or to control LFG emissions or migration, subsurface fire problems can be expected to increase.

Fire mechanics

Ignition and propagation of subsurface landfill fires is complex and a function of many factors. These include waste composition and moisture content, available oxygen, ambient pressure in area of combustion, etc.

In general, as a combustible material is heated, either through biological decomposition or chemical oxidation, ignition will occur at some given temperature, termed the ignition temperature for the material. The resulting heat of combustion will support flame spread under most conditions. Combustion will continue until at least one of the following occurs:

- The combustible material is consumed.
- The oxidizing agent (typically atmospheric oxygen) is depleted.
- Heat acting as the ignition source is removed faster than it is produced.

Identification and size determination for a subsurface fire can be difficult. A subsurface fire is typically indicated by:

- unusual or rapid settlement;
- venting of smoke;
- carbon monoxide in extracted LFG;
- combustion residue in header lines; and
- elevated LFG temperatures.

Determination of the location and a real extent of the subsurface fire can involve several approaches. These are:

- thermographic scans;
- excavation or borings to allow visual examination of refuse; and
- installation of test wells to allow monitoring of subsurface temperature gradients.

Organic waste materials (containing primarily carbon and hydrogen) buried in a landfill decompose aerobically (in the presence of oxygen) or anaerobically (in the absence of oxygen), and release heat in the process. For most materials, the rate of biological decomposition is slow. Produced heat is transferred to surroundings as it is formed, and a stable, but somewhat elevated, temperature occurs as decomposition proceeds.

Spontaneous ignition (autoignition) of a combustible material can occur if enough air is available and higher temperatures exist to permit chemical oxidation. Under highly insulating conditions, the heat produced is retained and the chemical oxidation rate continues to increase. Under these conditions, the combustible material will eventually reach its ignition temperature and spontaneous combustion will occur. The rate of heat generation, available air supply, and the insulating properties of the surrounding materials all influence whether chemical oxidation will result in temperatures reaching and/or exceeding ignition temperatures of the combustible material.

Wastes placed in a landfill initially undergo biological decomposition aerobically, producing carbon dioxide (CO_2), water, and heat which can result in maximum landfill temperatures in the 140° to 160° Fahrenheit range. As available oxygen is consumed (assuming a new source of oxygen is not available), biological decomposition becomes anaerobic with resultant production of

Subsurface Landfill Fire Control Technique Selection

Fire Control Technique	APPLICABILITY					
	Fire Depth		Extraction System		On-Site Development	
	<30'	>30'	Control	Recovery	Vacant	Developed*
Excavation	Yes	No	Yes	Yes	Yes	No
Smother	Yes	No	Yes	Yes	Yes	Yes
Extinguish						
Inject inert gas	Yes	Yes	Yes	Yes	Yes	Yes
Inject water	Yes	Yes	No	Yes	Yes	Yes

*Site surface developed as golf course, drive-in theater, storage facility, etc., requiring public site occupancy.

methane (CH_4) and CO_2. Heat is also a product of anaerobic decomposition. Temperatures will remain in the 140° to 160° F range if the insulating properties of the waste materials are high. In loosely compacted or dry landfills, the heat retention is inadequate, and temperatures usually return to the 70° to 110° F range.

The high insulating characteristics of in-place refuse causes retention of heat within the refuse mass. Increasing temperatures cause an increase in the rate of chemical oxidation of refuse (which initially occurs simultaneously with biological decomposition processes). This heating can continue past the limit of biological survival of the bacteria. Heating to the point of spontaneous combustion is the result of continued chemical oxidation, which follows the initial heat generated by biological decomposition. A continuous source of oxygen is necessary for this process to proceed to the point of ignition.

As temperatures within the landfill increase, the refuse material undergoes pyrolysis, i.e., chemical decomposition of matter through the action of heat. Pyrolysis converts the refuse material to a black carbonaceous char. Continued air supply bringing additional oxygen in contact with the pyrolyzing refuse causes the char material to become red hot. The heat generated is subsequently transferred to additional refuse materials, propagating the pyrolytic reaction. Open flames within the landfill are considered unlikely. However, once the subsurface fire reaches the surface, open flames could occur.

Transfer of heat within the landfill environment is accomplished by conduction and/or convection. Conduction is heat transfer by direct contact, while convection is heat transfer by a circulating medium (liquid or gas). Conduction of heat in the landfill is limited to the surface area of the refuse undergoing oxidation. Combustible gases produced during pyrolysis near this zone may also be heated by conduction. Convective forces cause the hot gas to expand and rise through the landfill. When the hot gas comes in contact with cooler refuse material, heat is transferred by conduction.

The operation of LFG extraction systems (for either recovery or migration control) can result in air entering the landfill. Overdrawing extraction wells, especially those installed near the perimeter or a slope face, creates a situation where air can be drawn into the refuse mass. Open cracks and fissures in a landfill site surface facilitate drawing of air through the site cover.

Convection currents within the landfill (due to higher gas temperature) can establish a chimney effect and cause air to be drawn into the landfill.

Routine testing and adjustment of flow rates from extraction wells, as well as maintenance of the landfill site surface, are required to control air infiltration and the resultant potential for a subsurface fire. Obviously, the withdrawal of LFG at a rate faster than its production will result in air infiltration.

Identification of subsurface fire

Inspection of site surfaces for settlement resulting from subsurface void space can give an indication as to the location and extent of subsurface combustion. Distinguishing between settlement resulting from normal decomposition processes, as opposed to collapsing of upper refuse layers into a void space created by subsurface combustion, may be difficult. Surface settlement may provide no indication of subsurface fire if combustion is sufficiently deep within the landfill such that bridging supports upper refuse layers.

Venting of smoke through cover soils confirms the existence of subsurface combustion, but provides little information as to location of the fire. Channeling within the landfill can result in smoke venting at locations distant from the actual point of combustion. Depending on the location of subsurface fire, smoke could be drawn through the extraction system unnoticed.

CO presence may indicate fire

Analysis of venting and/or extracted gas for the presence of carbon monoxide (a product of incom-

plete combustion) can also identify the existence of subsurface fire. Gas analysis can be accomplished using portable equipment in the field, such as gas detector tubes, or via gas chromatography. Carbon monoxide concentrations in LFG exceeding a few parts per million should result in additional testing and observation for a possible fire.

Continued operation of an LFG extraction system with wells in the vicinity of subsurface fire can result in drawing the residue of combustion processes through the extraction system and eventual destruction of the well. Visual evidence can be observed in a thick, black, tar-like coating in header lines. Experience has shown that combustion temperatures can be high enough to destroy extraction system components (i.e., wells and header lines) while tar-like residues can coat valves and pump station components to a point where they become inoperable.

Monitor gas well temperatures

Regular monitoring of extraction well heads and header line gas temperatures can aid in locating the general region of subsurface combustion. For example, gas temperatures 45° F above baseline gas temperatures were observed at one site just prior to verification of a subsurface fire. The higher temperatures were recorded in a header line adjacent to the extraction well. The well was subsequently excavated and found to be partially destroyed by the subsurface fire.

Use of temperature sensing equipment, such as a linear pyrometer and/or a thermographic scanner, can aid in identification of the limits of subsurface combustion by providing a site surface temperature profile. The linear pyrometer gives a digital readout of surface temperatures with an accuracy of ± 1° F. The hand-held instrument is portable, and allows rapid point source survey of site surfaces. A thermographic scan provides a real time infrared image of surface temperatures. The scan shows best resolution from locations elevated above a landfill site surface (e.g., an aerial scan).

The scan does not give quantitative temperature data, but rather an image with differences in intensity corresponding to areas exhibiting elevated surface temperatures with a resolution of 1° to 2° F. Use of thermographic scanners allows survey of large areas of a landfill in one view. The usefulness of these instruments is limited to near-surface combustion, and must be used at night to eliminate solar radiation at the heat source.

Bore for information

Subsurface borings into a suspected zone of combustion and logging of the materials excavated provides information on the extent and depth of the fire. Precautions must be taken to protect drilling personnel and equipment from high-temperature gas and refuse excavated. Due to the high cost of drilling, a drilling program should be developed (e.g., drilling at designated points in a grid pattern). The program should be implemented after preliminary identification of a suspected fire by one or more of the above methods.

Borings into and adjacent to a subsurface fire zone can serve as test wells to monitor subsurface temperature gradients. Subsurface temperature gradients can be obtained by the use of a thermocouple. If test wells are constructed using high pressure steel pipe and fittings, they can be used for subsequent injection of water and/or inert gas to aid in extinguishing the subsurface fire.

Controlling subsurface fires

Selection of a subsurface fire control technique is dependent on several factors, including depth, composition, and configuration of the landfill site; depth and size of the subsurface fire; site surface development; and type and operational requirements of the LFG extraction facilities. Control of subsurface fire requires either removal of the combustible material, elimination of the oxidizing agent (air supply), or cooling of the fire zone to temperatures below the ignition temperature. Available techniques for fire control all employ one or more of these three approaches.

The refuse material in the landfill represents the combustible material, and therefore its removal may be impractical. Depriving the subsurface fire of its air supply will terminate combustion. However, the insulating properties of the refuse materials will keep subsurface temperatures high, necessitating an extended cooldown period by natural heat dissipation. During this period (possibly with an order or magnitude of tens of years), any reintroduction of an air supply could result in regeneration of subsurface combustion. Given that LFG extraction is essential at the site, cooling of the fire zone may be essential to provide positive control of the fire.

Options for treatment

Techniques employed to control a subsurface fire and some criteria for selection are summarized in the table on page 48. Removal of waste is limited to shallow subsurface fires for practical reasons. The excavated material would be cooled by spreading and dousing the water or other fire retardant. Backfilling excavated areas would be accomplished with either the completely cooled refuse material or imported soil. Associated with excavation are potential problems with odor and particular/air pollution from the excavated materials. Excavating equipment and personnel must be protected from hazards associated with handling/removing burning refuse material and/or explosive and possible toxic gas emissions. Since site disruption could be extensive, this method of control would not be applicable for a developed landfill site. A favorable aspect would be to allow return of control and/or recovery extraction systems to their operational status in a relatively short time period.

Eliminating the air supply (i.e., smothering) subsurface combustion will deprive the process of needed oxygen. As previously discussed, LFG extraction wells, site surface cracks/fissures, and natural convection can provide the necessary pathway for air to enter a landfil site. In attempting to deprive subsurface fire of its air supply, the first step would be to reduce or shut down flow from extraction wells in the immediate vicinity of the combustion zone. Following this step, all settlement cracks and fissures in site cover soils should be sealed to prevent any passive influx of air. As refuse decomposition proceeds, LFG production will create positive pressures within the landfill, replacing any atmospheric oxygen present

with LFG and therefore prevent further subsurface combustion.

At some sites, LFG recovery and/or migration control is critical, and extraction wells must be reactivated as soon as practical. Since reactivation of extraction wells could potentially draw air through cover soils to the zone of previous combustion resulting in reignition of subsurface fire, it may be advisable to take additional steps to seal site surfaces. These steps could include application of additional cover soils or synthetic membranes to further seal the site surface or side slopes. Subsequent to sealing the surface area, extraction wells can be slowly reactivated for desired control and/or recovery purposes. Stringent testing must coincide with reactivation of extraction wells to assure that regeneration of the subsurface fire does not occur. Sealing site surfaces in this manner lends itself to vacant sites where additional soil cover or installation of a membrane would not disrupt activities.

Inject water or gas

The principle involved in extinguishing subsurface fire by injecting water or an inert gas is to remove heat (and in the case of inert gas, displace oxygen) from the combustion zone. Injection can be used for both deep and shallow fires, and can be accomplished with minimal disruption to a developed site. High temperature and pressure rated steel pipe injection wells would be used as a conduit to deliver water/inert gas to the combustion zone. Injection of water and/or an inert gas such as CO_2 can produce a high-temperature, high-pressure steam and/or gas within the landfill as heat is transferred from the pyrolyzing refuse material. This high-pressure hot gas will likely vent through cracks in the site surface. Thus injecting water or an inert gas under pressure can result in the formation of cracks and fissures within the landfill that could allow air intrusion. Any openings formed must be resealed. Injection of water has the disadvantage of leachate formation, and therefore its use may not be acceptable in some situations.

Monitor temperatures to determine success

Following injection, monitoring of subsurface temperatures can determine whether the fire has been controlled. Repeated applications may be necessary to achieve complete control.

Many landfills contain the combustible materials, insulating characteristics, and other attributes necessary to allow autoignition (spontaneous combustion), and to support subsurface combustion with introduction of air/air supply. Over withdrawal from LFG extraction systems for recovery and/or migration control (and air injection systems for migration control) can provide the air source. It is probable that many older landfills may have subsurface "hot spots" which could become fire zones with introduction of air supply.

Identification and size definition of subsurface fires is difficult, involving use of one or more assessment techniques. Selection of a fire control method is site-specific, and must take into consideration many factors, including the cost of the control technique as well as its impact on site development and LFG revenues.

Successful control of subsurface fires requires post-control monitoring to assure that fire regeneration does not occur. WA

Robert Steorns is president of SCS Engineers of Los Angeles, California. Galen Peloyan is project engineer for the same firm.

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IDENTIFYING AND CONTROLLING LANDFILL FIRES*

Robert P. Stearns† and Galen S. Peloyan†

(Received 23 July 1984)

Factors leading to subsurface landfill fires and fire identification and control techniques are discussed. The paper is oriented towards completed sanitary landfill sites containing active landfill gas (LFG) extraction systems for either recovery or migration control purposes. The fire identification and control techniques discussed can be applied to both developed and undeveloped former landfill sites.

The ignition and propagation of subsurface landfill fires are a function of factors which include waste composition and moisture content, available oxygen, and ambient pressure in the area of combustion.

Identification and size of a subsurface landfill fire can be determined by unusual or rapid site surface settlement, surface venting of smoke, detection of carbon monoxide in extracted LFG, accumulation of combustion residue in LFG collection header lines, and elevated LFG temperatures.

Subsurface landfill fire control techniques include excavation, smothering, and extinguishing with injections of water or inert gas.

Key Words—Subsurface landfill fire, landfill gas (LFG) recovery, LFG migration control, fire mechanics, fire ignition and propagation, autoignition, pyrolysis, subsurface fire identification, subsurface fire control, extinguishing landfill fires.

1. Introduction

This paper will discuss factors leading to subsurface landfill fires and fire identification and control techniques. The discussion is oriented towards completed sanitary landfill sites containing active extraction systems for either landfill gas (LFG) recovery or migration control. The fire control techniques can be applied to both developed and undeveloped former landfills.

With the advent of sanitary landfills, open burning ceased and solid wastes were compacted and buried with layers of soil. As a result open burning was replaced with the relatively slow biological decomposition of the waste materials with LFG production. LFG was soon recognized as both a safety hazard and as an energy recovery opportunity. As efforts are made to increase LFG recovery or to control LFG emissions or migration, subsurface fire problems can be expected to increase.

Some former burning dumps were converted to sanitary landfill operations years ago. Burning materials were covered with soil with the presumption that the fire would be smothered. Somewhat similar techniques are employed today when "hot loads" are delivered to a sanitary landfill. Typically, the burning materials are wetted with water or otherwise extinguished, then incorporated into the landfill.

These practices may result in "hot spots" (areas with elevated temperatures) within

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the landfill. These "hot spots" can become excellent candidates for subsurface fires with the addition of an air supply.

2. Overview of fire mechanics

Initial ignition and propagation of subsurface landfill fires is complex, and a function of many factors. These include waste composition and moisture content, available oxygen, ambient pressure in area of combustion, etc.

In general, as a combustible material is heated, either through biological decomposition or chemical oxidation, ignition will occur at some given temperature termed the ignition temperature for the material. The resulting heat of combustion will support flame spread under most conditions. Combustion will continue until at least one of the following occurs.

(1) The combustible material is consumed.
(2) The oxidizing agent (typically atmospheric oxygen) is depleted.
(3) Heat acting as the ignition source is removed faster than it is produced.

2.1. *Biological decomposition*

Organic waste materials (containing primarily carbon and hydrogen) buried in a landfill decompose aerobically (in the presence of oxygen) or anaerobically (absence of oxygen), and release heat in the process. For most materials, the rate of biological decomposition is slow. Produced heat is transferred to surroundings as it is formed and a stable, but somewhat elevated, temperature occurs as decomposition proceeds.

2.2. *Chemical oxidation*

Spontaneous ignition (autoignition) of a combustible material can occur if enough air is available and higher temperatures exist to permit chemical oxidation. Under highly insulating conditions the heat produced is retained and the chemical oxidation rate continues to increase. Under these conditions, the combustible material will eventually reach its ignition temperature and spontaneous combustion will occur. The rate of heat generation, available air supply, and the insulating properties of the surrounding materials all influence whether chemical oxidation will result in temperatures reaching, and/or exceeding, ignition temperatures of the combustible material.

2.3. *Landfill fire ignition*

Wastes placed in a landfill initially undergo biological decomposition aerobically, producing carbon dioxide (CO_2), water, and heat which can result in maximum landfill temperatures in the 60–71 °C (140–160 °F) range. As available oxygen is consumed (and assuming a new source of oxygen is not available), biological decomposition becomes anaerobic with resultant production of methane (CH_4) and CO_2. Heat is also a product of anaerobic decomposition. Temperatures will remain in the 60–71 °C (140–160 °F) range if the insulating properties of the waste materials are high. In loosely compacted or dry landfills the heat retention is inadequate and temperatures usually return to the 21–43 °C (70–110 °F) range.

The high insulating characteristics of in-place refuse causes retention of heat within the refuse mass. Increasing temperatures cause an increase in the rate of chemical

oxidation of refuse (which initially occurs simultaneously with biological decomposition processes). This heating can continue past the limit of biological survival of the bacteria. Heating to the point of spontaneous combustion is the result of continued chemical oxidation, which follows the initial heat generated by biological decomposition. A continuous source of oxygen is necessary for this process to proceed to the point of ignition.

As temperatures within the landfill increase, the refuse material undergoes pyrolysis, i.e. chemical decomposition of matter through the action of heat. Pyrolysis converts the refuse material to a black carbonaceous char. Continued air supply bringing additional oxygen in contact with pyrolyzing refuse causes the char material to become red hot. The heat generated is subsequently transferred to additional refuse materials, propagating the pyrolytic reaction. Open flames within the landfill are considered unlikely. However, once the subsurface fire reaches the surface, open flames could occur.

Transfer of heat within the landfill environment is accomplished by conduction and/or convection. Conduction is heat transfer by direct contact while convection is heat transfer by a circulating medium (liquid or gas). Conduction of heat in the landfill is limited to the surface area of the refuse undergoing oxidation. Combustible gases produced during pyrolysis near this zone may also be heated by conduction. Convective forces cause the hot gas to expand and rise through the landfill. When the hot gas comes in contact with cooler refuse material, heat is transferred by conduction.

2.4. *Sources of air*

The operation of LFG extraction systems (for either recovery or migration control) can result in air entering the landfill. Overdrawing extraction wells, especially those installed near the perimeter or a slope face, creates a situation where air can be drawn into the refuse mass. Open cracks and fissures in a landfill site surface facilitate drawing of air through the site cover.

Convection currents within the landfill (due to higher gas temperature) can establish a chimney effect and cause air to be drawn into the landfill.

Routine testing and adjustment of flow rates from extraction wells, as well as maintenance of the landfill site surface, are required to control air infiltration and the resultant potential for a subsurface fire. Obviously, the withdrawal of LFG at a rate faster than its production will result in air infiltration.

3. Identification of subsurface fire

Identification and size determination for a subsurface fire can be difficult. A subsurface fire is typically indicated by:

unusual or rapid settlement,
venting of smoke,
carbon monoxide in extracted LFG,
combustion residue in header lines,
elevated LFG temperatures.

Determination of the location and areal extent of the subsurface fire can involve several approaches. These are:

thermographic scans,

excavation or borings to allow visual examination of refuse.
installation of test wells to allow monitoring of subsurface temperature gradients.

Inspection of site surfaces for settlement resulting from subsurface void space can give an indication as to the location and extent of subsurface combustion. Distinguishing between settlement resulting from normal decomposition processes, as opposed to collapsing of upper refuse layers into a void space created by subsurface combustion, may be difficult. Surface settlement may provide no indication of subsurface fire if combustion is sufficiently deep within the landfill such that bridging supports upper refuse layers.

Venting of smoke through cover soils confirms the existence of subsurface combustion but provides little information as to location of the fire. Channelling within the landfill can result in smoke venting at locations distant from the actual point of combustion. Depending on the location of subsurface fire, smoke could be drawn through the LFG extraction system unnoticed.

Analysis of venting and/or extracted LFG for the presence of carbon monoxide (a product of incomplete combustion) can also identify the existence of subsurface fire. Gas analysis can be accomplished using portable equipment in the field, such as gas detector tubes, or via gas chromatography. Carbon monoxide concentrations exceeding a few parts per million in LFG should result in additional testing and observation for a possible fire.

Continued operation of an LFG extraction system with wells in the vicinity of subsurface fire can result in drawing the residue of combustion processes through the extraction system and eventual destruction of the well. Visual evidence can be observed in a thick, black, tar-like coating in header lines. Experience has shown that combustion temperatures can be high enough to destroy extraction systems components (i.e. wells and header lines) while tar-like residues can coat valves and pump station components to a point where they become inoperable.

Regular monitoring of extraction well heads and header line gas temperatures can aid in locating the general region of subsurface combustion. For example, gas temperatures 45°F above baseline gas temperatures were observed at one site just prior to verification of a subsurface fire. The higher temperatures were recorded in a header line adjacent to the extraction well. The well was subsequently excavated and found to be partially destroyed by the subsurface fire.

Use of temperature sensing equipment, such as a linear pyrometer and/or a thermographic scanner, can aid in identification of the limits of subsurface combustion by providing a site surface temperature profile. The linear pyrometer gives a digital readout of surface temperatures with an accuracy of ± 1°F. The hand-held instrument is portable and allows rapid point source survey of site surfaces. A thermographic scan provides a real time infrared image of surface temperatures. The scan shows best resolution from locations elevated above a landfill site surface (e.g. an aerial scan).

The scan does not give quantitative temperature data, but rather an image with differences in intensity corresponding to areas exhibiting elevated surface temperatures with a resolution of 0.5–1.0°C (1–2°F). Use of thermographic scanners allows survey of large areas of a landfill in one view. The usefulness of these instruments is limited to near-surface combustion, and they must be used at night to eliminate solar radiation as the heat source.

Subsurface borings into a suspected zone of combustion and logging of the materials excavated provides information on the extent and depth of the fire. Precautions must be taken to protect drilling personnel and equipment from high-temperature gas and

refuse excavated. Due to the high cost of drilling, a drilling program should be developed (e.g. drilling at designated points in a grid pattern). The program should be implemented after preliminary identification of a suspected fire by one or more of the above methods.

Borings into and adjacent to a subsurface fire zone can serve as test wells to monitor subsurface temperature gradients. Subsurface temperature gradients can be obtained by the use of a thermocouple. If test wells are constructed using high pressure steel pipe and fittings, they can be used for subsequent injection of water and/or inert gas to aid in extinguishing the subsurface fire.

4. Control of subsurface fires

Selection of a subsurface fire control technique is dependent on several factors, including depth, composition, and configuration of the landfill site; depth and size of the subsurface fire; site surface development; type and operational requirements of the LFG extraction facilities; etc. Control of subsurface fire requires either removal of the combustible material, elimination of the oxidizing agent (air supply), or cooling of the fire zone to temperatures below the ignition temperature. Available techniques for fire control all employ one or more of these three approaches.

The refuse material in the landfill represents the combustible material, and therefore its removal may be impractical. Depriving the subsurface fire of its air supply will terminate combustion; however, the insulating properties of the refuse materials will keep subsurface temperatures high, necessitating an extended cool down period by natural heat dissipation. During this period (possibly with an order of magnitude of tens of years) any reintroduction of an air supply could result in regeneration of subsurface combustion. Given that LFG extraction is essential at the site, cooling of the fire zone may be essential to provide positive control of the fire.

Techniques employed to control a subsurface fire and some criteria for selection are summarized on Table 1. Removal of waste is limited to shallow subsurface fires for practical reasons. The excavated material would be cooled by spreading and dousing with water or other fire retardant. Backfilling excavated areas would be accomplished with either the completely cooled refuse material or imported soil. Associated with excavation are potential problems with odour and particulate/air pollution from the excavated materials. Excavating equipment and personnel must be protected from

TABLE 1

Subsurface landfill fire control technique selection

	Applicability					
	Fire depth		Extraction system		On-site development	
Fire control technique	< 9 m (< 30 ft)	> 9 m (> 30 ft)	Control	Recovery	Vacant	Developed*
Excavation	Yes	No	Yes	Yes	Yes	No
Smother	Yes	No	Yes	Yes	Yes	Yes
Extinguish						
Inject inert gas	Yes	Yes	Yes	Yes	Yes	Yes
Inject water	Yes	Yes	No	Yes	Yes	Yes

*Site surface developed as golf course, drive-in theater, storage facility, etc., requiring public site occupancy.

hazards associated with handling/removing burning refuse material and/or explosive, and possibly toxic, gas emissions. Since site disruption could be extensive, this method of control would not be applicable for a developed landfill site. A favourable aspect is that it would allow return of control and/or recovery extraction systems to their operational status in a relatively short time period.

Eliminating the air supply (i.e. smothering) subsurface combustion will deprive the process of needed oxygen. As previously discussed, LFG extraction wells, site surface cracks/fissures, and natural convection can provide the necessary pathway for air to enter a landfill site. In attempting to deprive subsurface fire of its air supply the first step would be to reduce or shut down flow from extraction wells in the immediate vicinity of the combustion zone. Following this step all settlement cracks and fissures in site cover soils should be sealed to prevent any passive influx of air. As refuse decomposition proceeds LFG production will create positive pressures within the landfill, replacing any atmospheric oxygen present with LFG and therefore prevent further subsurface combustion.

At some sites LFG recovery and/or migration control is critical and extraction wells must be reactivated as soon as practical. Since reactivation of extraction wells could potentially draw air through cover soils to the zone of previous combustion resulting in reignition of subsurface fire, it may be advisable to take additional steps to seal site surfaces. These steps could include application of additional cover soils of synthetic membranes to further seal the site surface or side slopes. Subsequent to sealing the surface area, extraction wells can be slowly reactivated for desired control and/or recovery purposes. Stringent testing must coincide with reactivation of extraction wells to assure that regeneration of the subsurface fire does not occur. Sealing site surfaces in this manner lends itself to vacant sites where additional soil cover or installation of a membrane would not disrupt activities.

The principle involved in extinguishing subsurface fire by injecting water or an inert gas is to remove heat (and in the case of inert gas, displace oxygen) from the combustion zone. Injection can be used for both deep and shallow fires, and can be accomplished with minimal disruption to a developed site. High temperature and pressure rated steel pipe injection wells would be used as a conduit to deliver water/inert gas to the combustion zone. Injection of water and/or an inert gas such as CO_2 can produce a high-temperature, high-pressure steam and/or gas within the landfill as heat is transferred from the pyrolyzing refuse material. This high-pressure hot gas will likely vent through cracks in the site surface. Thus, injecting water or inert gas under pressure can result in the formation of cracks and fissures within the landfill that could allow air intrusion. Any openings formed must be resealed. Injection of water has the disadvantage of leachate formation, and therefore its use may not be acceptable in some situations.

Following injection, monitoring of subsurface temperatures can determine whether the fire has been controlled. Repeated applications may be necessary to achieve complete control.

5. Summary

Many landfills contain the combustible materials, insulating characteristics, and other attributes necessary to allow autoignition (spontaneous combustion), and to support subsurface combustion with introduction of an air supply. Over withdrawal from LFG extraction systems for recovery and/or migration control (and air injection systems for migration control) can provide the air source. It is probable that many older landfills

may have subsurface "hot spots" which could become fire zones with introduction of air supply.

Identification and size definition of subsurface fires is difficult, involving use of one or more assessment techniques. Selection of a fire control method is site-specific and must take into consideration many factors including the cost of the control technique as well as its impact on site development and LFG revenues.

Successful control of subsurface fires requires post-control monitoring to assure that fire regeneration does not occur.

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APPENDIX B

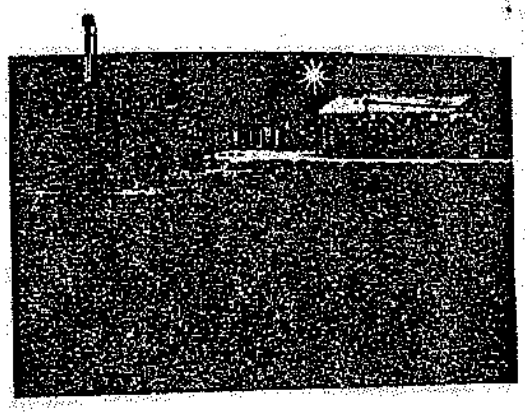
BROCHURES AND QUALIFICATIONS FOR SCS ENGINEERS

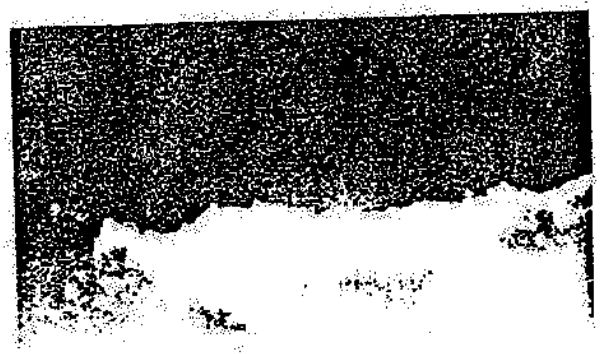
SCS ENGINEERS

Landfill Gas Control and Recovery

Landfill-derived methane gas is used as fuel in boilers at this civic recreation/conference center site located in the City of Industry, California. This project was selected as the Outstanding Civil Engineering Achievement in 1981 by the American Society of Civil Engineers.

SCS was awarded the Florida Engineering Society's 1989 Engineering Excellence Award for the design of a landfill gas odor and migration control system in Seffner, Florida.





An SCS subsidiary, SCS Field Services, provides construction, operation, and maintenance of landfill gas systems.

Landfill Gas

Anaerobic decomposition of organic solid waste in the landfill environment produces landfill gas (LFG). LFG mainly consists of methane and carbon dioxide, both of which are odorless. Trace concentrations of other volatiles, often malodorous or toxic gases, are also found in LFG.

LFG can migrate through soil into structures located on or near landfills. Since methane presents a fire or explosive threat, LFG must be controlled to protect property, and public health and safety. Also, many jurisdictions require landfill owners/operators to reduce reactive organic gas emissions to improve regional air quality. Thus, engineered solutions are needed to efficiently and safely monitor, collect, and process landfill gas.

A positive side to LFG control is energy recovery. Today's technology allows a landfill owner/operator to recover the energy in LFG while reducing gas emissions. Revenue from the sale of LFG or electricity generated using LFG as a fuel can offset costs for landfill environmental compliance and/or closure.

SCS Engineers - A Quarter Century of Experience

Since 1970, SCS Engineers has been a national leader in the planning, permitting, investigation, design, construction, and operation of LFG control and energy recovery systems. Our LFG designs are working at hundreds of locations around the world.

SCS specializes in: (a) engineering design services and investigations; and (b) design/build projects. Working through its subsidiary SCS Field Services, SCS provides design/build services for construction of landfill gas systems. A design/build project typically combines the design and construction steps into a single contract, resulting in an expedited construction schedule and reduced overall costs.

RCRA Subtitle D

The Resource Conservation and Recovery Act (RCRA) establishes landfill design and performance standards under Subtitle D. Subtitle D requires monitoring of landfill gas, and establishes performance standards for combustible gas migration control. Landfill owners/operators must:

- Establish LFG monitoring programs. Use of gas monitoring probes is typical.
- Monitor for subsurface migration of combustible gas on a quarterly basis.
- Maintain combustible gas concentrations under 5 percent in soil at the property line, and under 1.25 percent in facility structures.
- Mitigate gas hazards if conditions are not in compliance.

SCS has designed and implemented the types of LFG programs required under Subtitle D at hundreds of landfills.

New Source Performance Standards

The U.S. EPA has proposed control of surface LFG emissions under the Clean Air Act. The New Source Performance Standards (NSPS) will require LFG testing and collection system installations at many sites, even those otherwise in compliance with RCRA Subtitle D. NSPS will require landfill owners/operators to:

- Estimate total LFG emissions using sophisticated gas models, laboratory analyses, and gas pump tests.
- Install comprehensive gas collection systems throughout the landfill at any site shown to have significant emissions of non-methane organic compounds.
- Perform landfill operation and record keeping on such landfill gas systems.

SCS offers the services required for NSPS compliance including engineering test services, laboratory analysis, gas system design, system installation, and operations.

SCS professionals conduct field and laboratory testing to access LFG quantities, characteristics, current and future production rates, and optimal recovery system configurations.

SCS has hands-on experience in subsurface landfill fire containment, suppression, and emergency response.

SCS offers comprehensive landfill gas services to assist you in meeting regulatory compliance and budgetary constraints.

Combustible Gas Migration Control

- Gas Monitoring
- Control System Design
- Landfill Underground Fire Control
- Long Term Monitoring and Certification
- Permits and Regulatory Support

Energy Recovery

- Feasibility Studies
- Gas Modeling
- Field Test Programs
- Market Investigations
- System Design
- Gas Sale Contract Services
- Construction and Operation Services
- Long-Term Monitoring and Certification

Odor Abatement

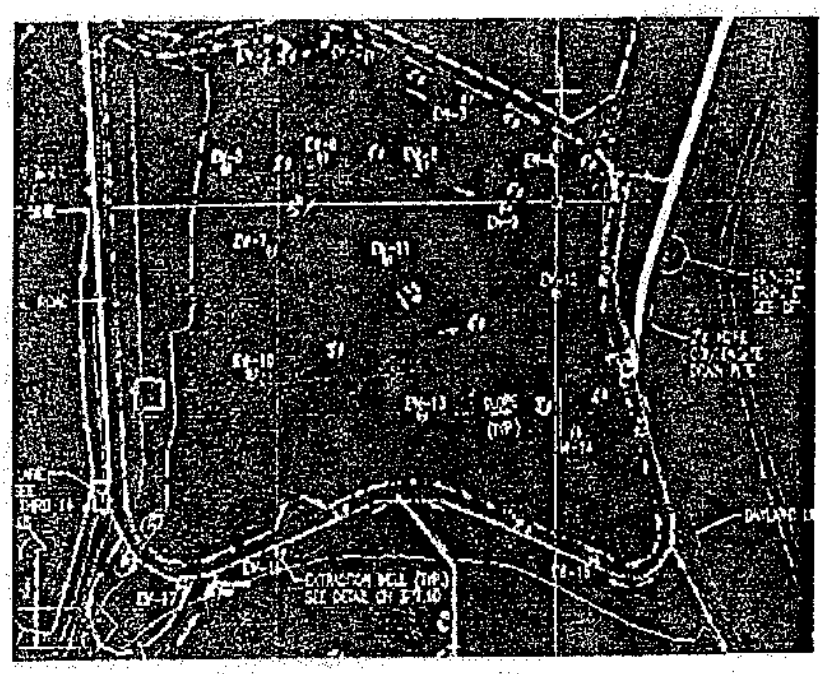
- Odor Assessments
- Odor Abatement Design
- Construction Services
- Start Up and Well Field Balancing
- Long-Term Monitoring and Certification
- Permits and Regulatory Support

Toxic Gases

- Gas Characterization
- Air Modeling
- Stack Testing
- Permits and Regulatory Support

Design/Build

SCS Field Services can construct and operate your landfill gas collection system, and provide comprehensive closure and postclosure operation and maintenance services.



SCS has extensive expertise in LFG technology, ranging from feasibility studies and collection systems design to operation and maintenance of control and recovery systems.

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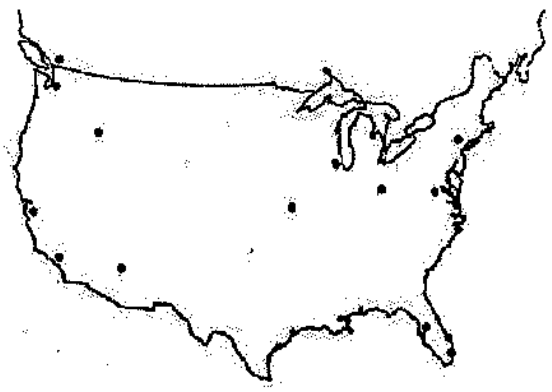

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EXHIBIT B

FEE SCHEDULE
LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL

Environmental Consultants

2000 Powers Ferry Road
Suite 200
Cincinnati Ohio 45202-1416

513 421-5353
FAX 513 421-2847

SCS ENGINEERS

January 1, 1994

LAIDLAW FEE SCHEDULE

(Effective January 1, 1994 through June 30, 1994)

	Rate/Hour
Project Director	$135
Project Manager	99
Senior Professional	89
Project Professional	71
Staff Professional	56
Associate Professional	48
Assistant Professional	40
Designer	48
Drafter/Graphics	42
Technician	40
Secretarial/Administrative	38

General Terms:

1. Rates for principals of the firm are negotiated on a project-specific basis and range from $130 to $170 per hour depending on experience and qualifications.

2. Scheduled rates are effective through June 30, 1994. Work performed thereafter is subject to a new Fee Schedule.

3. Scheduled labor rates include overhead, administration and profit. Costs for outside consultants and subcontractors, and for job-related employee travel and subsistence, external reproduction, telephone, equipment, and supplies are billed at actual cost plus a 15 percent administrative fee. Internal costs such as fax, computer, CADD, field equipment, and internal reproduction will be billed at cost.

4. Charges for field equipment and instruments will be in accordance with the SCS Standard Fee Schedule for Field Equipment in effect at the time the work is performed.

5. Invoices will be prepared monthly or more frequently for work in progress unless otherwise agreed. Invoices are due and payable upon receipt. Invoices not paid within 45 days are subject to a service charge of 1 percent per month on the unpaid balance.

6. Payment of SCS invoices for services performed will not be contingent upon the client's receipt of payment from other parties, unless otherwise agreed in writing. Client agrees to pay legal costs, including attorney's fees, incurred by SCS in collecting any amounts past due and owing on client's account.

7. For special situations, such as expert court testimony and limited consultation, hourly rates will be on an individually negotiated basis.

Environmental Consultants

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Cincinnati, Ohio 45202-1416

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SCS ENGINEERS

January 1, 1994

LAIDLAW FEE SCHEDULE FOR FIELD EQUIPMENT

(Effective January 1, 1994 through June 30, 1994)

	Rate
Extraction Test Blower/Motor	$100/day, 300/week
GEM-500 Analyzer	75/day
Methane Meter	20/day
Oxygen Meter	30/day
Carbon Dioxide Fyrite Indicator	15/day
Pressure Measurement Device (magnehelics, manometers, etc.)	15/day
Flow Measurement Device (orifice plates, flow meters, etc.)	25/day
Gas Temperature Measurement Device (digital read-out with probe)	15/day
Detector Tube (hydrogen sulfide, carbon monoxide, etc.)	5/each
Vacuum Sampling Pump - Draeger Pump	10/day
- Low Capacity MSA Pump	15/day
- High Capacity Bellows Pump	40/day
Grundfos 2 in. Groundwater Pump	100/day
Punch Bar	15/day
Gas Sampling Burette	10/each
Gas Sampling Bag	15/each
Photoionization Detector	75/day
Water Level Indicator	20/day
ph/Conductivity/Temperature Meter	25/day
Well Bailer	15/day
Disposable Well Bailers	15/each
Field Groundwater Filter Unit/Pump	20/day
Disposable Groundwater Filters	15/each
Buckets (5 gallon disposable)	6/each
Soil Sampler	10/day
Soil Sample Container	4/each
VOA Sample Containers	3/each
QA/QC Supplies	15/day
Level B SCBA (used on-site)	60/day
(available on-site and unused)	20/day
Level C North Full-Face Respirator (used on-site)	20/day
(available on-site and unused)	6/day
Level C North Half-Face Respirator (used on-site)	10/day
(available on-site and unused)	2/day
Latex Over-Boots (disposable)	5/pair
Tyvek Suit (disposable)	6/each
Scales - Spring (0-70 lb)	50/week
- Spring (0-100 lb)	50/week
- Platform	100/week
- Truck/Axle	300/week

LAIDLAW FEE SCHEDULE FOR FIELD EQUIPMENT (continued)

General Terms:

1. Rates are in effect until June 30, 1994. Any work performed after that date is subject to a new Schedule of Fees.

2. Equipment usage rates are exclusive of freight charges to and from the project site. Freight is an additional expense chargeable to the client.

3. Rates for extraction test blower/motor are exclusive of expenses for electric line installation, electricity, generators, or fuel. These expenses are charged to the client separately.

Environmental Consultants

2000 Reading Road
Suite 200
Cincinnati, Ohio 45202-1416

513 421-3333
FAX 513 421-2847

SCS ENGINEERS

January 1, 1994

LAIDLAW FEE SCHEDULE
IN-HOUSE COSTING RATES
(Effective January 1, 1994 through June 30, 1994)

CADD Computer	$25/hour
Word Processing Computer	$10/hour
Facsimile	$1/page
Reproduction (8.5 in. × 11in.)	$0.10/page
Reproduction (blueline prints)	$1.50/sheet
Reproduction (vellum reproducibles)	$3/sheet
Reproduction (nylon reproducibles)	$10/sheet

EXHIBIT C

PROJECT SCHEDULE
LANDFILL FIRE MITIGATION
LAIDLAW BRIDGETON SANITARY LANDFILL

Environmental Consultants

2060 Reading Road
Suite 200
Cincinnati, Ohio 45202-1416

513 421-5353
FAX 513 421-2847

SCS ENGINEERS

March 29, 1994
File No. 0593034

Mr. Dennis Wike
Environmental Manager
Laidlaw Waste Systems, Inc.
P.O. Box 97
Cahokia Road
Roxana, Illinois 62084

Subject: Task 4 Report
Assessment of Results/Recommendations for Future Action
Subsurface Combustion at Laidlaw Bridgeton Landfill

Dear Mr. Wike:

This letter provides you with a summary of our activities to date at the Bridgeton Landfill. Work included: infrared thermography of site, installation of temperature probes, and monitoring of temperature probes. A discussion and our recommendations are also included.

TASK 1 - CONDUCT INFRARED THERMOGRAPHY

On March 9, 1994, SCS Engineers performed an infrared thermography of the Bridgeton Landfill. The purpose of the infrared thermography was to gather additional information which would be used in helping make a determination as to the horizontal or lateral extent of the subsurface fire at the Bridgeton Landfill.

Infrared thermography is a non-contact, non-invasive means of producing visible images from the invisible or infrared heat energy emitted from an object. Infrared thermography (also known as infrared imaging) consists of an infrared scanner with optics transparent only to infrared radiation and a real-time computer display monitor, similar to a portable television.

The scanner converts the radiated heat that is allowed to pass through the optics to create an electronic signal. The signal is then turned into a real time thermal image on the computer screen of the display unit. The thermal image is composed of a gray scale with continuous tones ranging from black to white. Areas of higher relative temperature normally appear lighter and areas of lower relative temperature normally appear darker. Intermediate shades of gray indicate variations between the extremes of temperature the unit is set to detect. Color gradations can also be used and were, in fact, used some on this project; however, most of the effort was done using black and white which produced good results.

With the equipment used, it is possible to observe, quantify, and record the thermal image of the surface of an object whose temperature is between -20°C and +2,000°C. The sensitivity of the imaging equipment is such that it has the capacity to detect surface temperature differences between two given objects to an accuracy of ±0.05°C. For this effort, the low end of the temperature scale was generally set between 15 and 25°F, and the upper end was set between 38 and 41°F.

On this project, a hand-held scanner was used. Two representatives of Entech Engineering, a representative from SCS Engineers, and the helicopter pilot performed an approximate 1-1/2 hour flyover of the site on the morning of Wednesday, March 9, 1994. The helicopter used was a Bell Jet Ranger III. The two representatives from Entech Engineering sat in the back two seats with the scanner and electronic equipment. The representative from Entech holding the camera sat on the pilot side of the aircraft. The scan was done with the camera held in his right hand, and held as far out the helicopter window as possible.

Both the representative from SCS and the other Entech representative watched the image on television monitors and through verbal commands to the camera operator directed the movement and position of the camera. Images were obtained both with the helicopter in a hovering position, and in a moving position flying both the perimeter of the entire site and the perimeter of the quarry area.

The initial 1/3 to 1/2 of the video tape represents various views of the small quarry area near the blower flare station where areas of fire have been noted and/or suspected in the past. Three bright white circular spots predominate in the views of this area. The two that are close together are the existing ground flare and candle flare for the gas collection system. Obviously, these burning landfill gas (LFG) sources are excellent infrared emitters and show up as the bright white spots. The third bright white spot that predominates is not quite as big as the other two, and is an area along the north quarry wall at about the midpoint where flames are visible at the ground and rock wall interface. There appear to be small warm areas in the vicinity of this flame area, and they are isolated to locations near the rock wall landfill cover interface.

In summary, the infrared thermography provided supporting information to the theory that the fire is limited to the interface of the rock wall and landfill cover. It does not provide any evidence that the fire has extended out from the rock wall. This subject will be addressed in the Task 2 temperature probe installation work described below.

TASK 2 - INSTALL TEMPERATURE PROBES

Six monitoring temperature probes (T-1 through T-6) were installed on March 9, 10, and 11, 1994, by United Geosciences of St. Louis, Missouri, in the areas of surface and subsurface combustion. These probes were installed approximately 20 to 35 ft from the quarry wall. T-1 through T-4 are along the northwest quarry wall. T-1 is near TRW-1.

T-2 and T-3 are near TRW-2. T-4 is near TRW-3. T-5 and T-6 are along the southwest quarry wall. T-5 is near TRW-3. T-6 is downslope from T-6. The locations of T-1 through T-6 are shown in Exhibit 1. Boring and backfill logs are in Appendix A.

Surface and subsurface combustion is currently taking place from cracks along the quarry wall near T-2 and T-3. Surface combustion is evidenced by open flame. Subsurface combustion is evidenced by extremely high temperature greater than 800°F inside cracks up to approximately 20 ft from the open flame. Smoke emanating from the cracks is also evidence of subsurface combustion. Black soot and baked, brick-like dirt along the quarry wall indicates past and present surface and subsurface combustion. A total of approximately 100 ft of quarry wall near TRW-2 has or has had surface and subsurface combustion.

Smoke from subsurface combustion has also been observed along an approximately 100 ft section of the quarry wall in the vicinity of T-6. Black soot and some blackened dirt is along cracks of the quarry wall. Smoke has not been detected in several months.

The temperatures of refuse of T-1, T-4, T-5, and T-6 were generally less than 100°F which is typical of landfills. The temperatures of T-2 and T-3 were 100 to 140°F which is higher than typical refuse in landfills. The temperature may be higher because of the surface and subsurface combustion along the quarry wall. There was no evidence from the refuse drill hole cuttings that subsurface combustion was or had taken place at these locations (such as combusted/charred refuse).

T-1, T-2, T-4, and T-5 are vertical probes. The purpose was to determine the vertical and horizontal extent of subsurface combustion (if any) in the refuse away from the quarry wall. T-3 and T-6 were drilled towards the quarry wall at angles of approximately 20 and 30 degrees from the vertical, respectively. The purpose was to determine the vertical extent of subsurface combustion (if any) in the refuse beneath the quarry wall.

The temperature probes were drilled with 4-1/4 inch I.D. and 7 inch O.D. hollow-stem augers. T-1, T-3, and T-5 were drilled to a depth of 18 ft below the surface. T-2 was drilled to a depth of 50 ft below the surface. T-3 was drilled 40 ft at an angle from the vertical. T-6 was drilled 22 ft at an angle. A drill rig (CME 55) used by United Geosciences was capable of drilling vertical and angle borings.

The temperature probes were constructed with 1-1/2 inch diameter, flush joint, iron pipe. Slotted iron pipe was used from 5 to 8 ft below the surface to the bottom of the boring. Slots were cut into the iron pipe with a cutting torch. Solid iron pipe was above the slotted iron pipe to approximately 3 ft above the surface. Pea gravel was placed around the annular space of the slots. A bentonite seal was placed above the pea gravel to reduce the amount of vertical migration of gases in the borehole. Monitoring ports consisting of quick connect valves were installed in 1-1/2 inch PVC slip caps at the top of the probes. They allow for measuring gas composition and pressure with instruments.

TASK 3 - MONITOR TEMPERATURE PROBES

Monitoring was conducted on T-1 through T-6 for temperature with depth, pressure, and gas concentrations. Temperature was measured with a thermocouple and digital readout. The thermocouple has a length of approximately 100 ft. The slip cap was removed from the top of the probes and the thermocouple was lowered into the probes. Temperature readings were taken every 2 ft to the bottom of the probe.

Pressure and gas composition for methane, carbon dioxide, oxygen, and nitrogen were measured with a GEM-500 Gas Monitor. This instrument was fastened to the quick connect valves installed in the slip cap at the top of the probes. Readings were then taken.

Carbon monoxide was measured with Draeger tubes. Both tips of the tubes were broken off and inserted into a Draeger pump with the flow arrow pointed towards the pump. The quick connect valve was removed and the tube was inserted through the cap. Gas was drawn through the tubes based on the number of strokes (pumps) directed on the scale along the tube. The result was the amount of discoloration on the Draeger tube scale.

Temperature readings were taken on March 14, 15, and 16. Pressure and gas composition readings were taken on March 17. The data recorded is shown in Appendix B. The average, maximum, and minimum temperatures for each probe are also shown. The average, highest, and lowest temperatures of each probe were relatively consistent during this period.

The subsurface temperatures show a high variability with depth. The lowest temperatures are near the surface where the surface is cooler. The temperatures generally increase with depth. The highest temperatures in T-1, T-2, T-4, T-5, and T-6 are near the bottom of the probe. The highest temperature in T-3 is from 12 to 20 ft below the top of the probe. The temperatures in T-3 then decrease towards the quarry wall where the temperature is cooler.

The subsurface temperatures also show a high variability from probe to probe. T-1, T-5, and T-6 are relatively cool. The average and highest temperature of T-1, T-5, and T-6 are significantly lower than T-2, T-3, and T-4. The average and highest temperatures on March 16 for T-1, T-5, and T-6 were 92 and 106, 87 and 110, and 75 and 100 degrees F, respectively. T-4 was warmer with the average and highest temperature of 93 and 123 degrees F, respectively. T-2 and T-3 were relatively warm. The average and highest temperatures were 127 and 134 degrees F for T-2, and 121 and 142 degrees F for T-3. T-2 and T-3 are near the active area of surface and subsurface combustion.

The methane, carbon dioxide, oxygen, and nitrogen concentrations taken on March 17 are typical for LFG (see Appendix B). The ranges of methane, carbon dioxide, oxygen, and nitrogen were 50.4 to 64.8; 34.4 to 42.4; 0.1 to 2.5 percent by volume and 0 to 6.7 percent by volume, respectively. Pressures were relatively low ranging from 0 to 0.1 inches of water. The carbon monoxide contents ranged from 5 to 15 ppm by volume. The concentrations of carbon monoxide are significantly lower than on landfills where SCS has mitigated active subsurface combustion.

DISCUSSION

Temperature levels and carbon monoxide are indicators of active subsurface combustion. Temperatures exceeding 175 degrees F are often measured in and near the combustion area in landfills where SCS has mitigated subsurface combustion at other sites. Temperatures as low as approximately 120 degrees F may indicate a nearby source of subsurface combustion. Temperatures of approximately 100 to 140 degrees F are commonly found in deep landfills such as the Bridgeton Sanitary Landfill, where heat can concentrate because of the insulation ability of refuse. Temperatures of less than 100 degrees F are more typical for LFG.

Carbon monoxide concentrations exceeding 0.5 percent (5,000 ppm) by volume are often measured in and near the combustion area in other landfills where SCS has mitigated active subsurface combustion. Carbon monoxide concentrations as low as approximately 250 ppm by volume may also indicate a nearby source of subsurface combustion. Carbon monoxide concentrations lower than approximately 250 ppm by volume may be:

- Residual carbon monoxide from previous subsurface combustion.
- Carbon monoxide from a distant area of subsurface combustion.
- "Interference gases" detected in the Draeger tubes.

The temperatures and carbon monoxide concentrations in T-1, T-4, T-5, and T-6 indicate that active subsurface combustion in refuse is not currently taking place in these areas along the quarry wall. The higher temperatures in T-2 and T-3 may represent typical landfill temperatures or a nearby source of surface or subsurface combustion. The temperature increase with depth in T-2 indicates landfill temperatures greater than 120 degrees F occur in the landfill below 20 ft of the surface.

The temperature probe in T-3 from approximately 12 to 20 ft below the top of the probe may reflect the surface and subsurface combustion along the quarry wall. The rapid decrease in temperature below approximately 20 ft beneath the top of the probe indicates that the subsurface combustion is within 20 ft of the surface. The low concentrations of carbon monoxide in T-2 and T-3 also indicates that subsurface combustion in the refuse is limited (or non-existent), and is restricted to within 20 ft of the surface along the quarry wall. Carbon monoxide produced in the combustion may be venting through the surface cracks along the quarry wall.

RECOMMENDATIONS

Four steps should be taken to further mitigate the surface and subsurface combustion. These steps are as follows:

1. For the near term, maintain current conditions (i.e., maintain a sealed landfill surface, positive pressure conditions, and no LFG extraction in the immediate vicinity of the quarry wall and monitoring probes). TRW-1, TRW-2, and TRW-3 should remain shut off from header vacuum to maintain positive pressure conditions.

2. Inject a Portland cement slurry in the cracks along the quarry wall of the surface and subsurface combustion. The slurry must be thin so that it can penetrate and fill all cracks within 20 to 30 ft of the surface. The Portland cement slurry may be purchased from Redbird Concrete Company.

   Slurry would first be injected in cracks on either side of the surface and subsurface combustion to contain the combustion in the present location. Otherwise, the combustion could move laterally if initially injected directly into the area of combustion. The injection of slurry on the sides would also reduce the pathways of oxygen from the atmosphere and methane from the landfill feeding the combustion. Preventing oxygen from entering into the refuse mass is of paramount importance in suppressing the combustion. The slurry should be injected with high pressure pumps which could be provided by United Geosciences.

Injection of slurry into the area of combustion can proceed once the cracks on the two sides have been filled. Temperatures in the combustion may exceed 1,000 degrees F. All safety precautions should be taken including the wearing of protective clothing and safety glasses. The addition of bentonite to the slurry may be necessary to increase the thickness of the slurry. Injection of slurry should proceed until the combustion has terminated, and all cracks in the combustion area have been filled.

3. Line the areas along the quarry wall with bentonite. The areas of past and present surface and subsurface combustion should be lined. Other areas may be considered. All dirt and debris should be cleared from the quarry wall. A trench up to 2 ft deep should be excavated and filled with bentonite. A non-shrinking bentonite is preferred. The bentonite will remain in a semi-gel, and will settle along the quarry wall along with the landfill. Cracks along the quarry wall will be minimal since the bentonite should remain in a semi-gel stage.

4. Monitor T-1 through T-6 after mitigation for up to several weeks. TRW-1, TRW-2, and TRW-3 can be slowly opened to header vacuum once the temperatures in T-2 and T-3 reach an acceptable level. The landfill should be maintained under pressure to prevent air intrusion. T-1 through T-6 should be monitored and should maintain positive pressure.

SUMMARY

The infrared thermography of the site and the data from T-1 through T-6 both suggest that the surface and subsurface combustion is limited to the area along the quarry well in the vicinity of T-2 and T-3. There appears to be a hot mass consisting of dirt and possibly refuse approximately 10 to 20 ft below the surface along the quarry wall.

An injection of a Portland cement slurry in cracks on the sides of combustion and then into the combustion area is recommended. This will prevent the combustion from moving laterally and will plug the source of oxygen to the combustion area. Bentonite should be placed around the quarry wall to reduce air intrusion and possible future combustion. TRW-1, TRW-2, and TRW-3 can be operated once subsurface temperature in T-2 and T-3 are acceptable. A re-evaluation of the mitigation efforts can be performed at that time.

Please feel free to discuss our findings and recommendations with any of the undersigned.

Sincerely,

Dennis P. Gillespie
Project Scientist
SCS ENGINEERS

William M. Held
Project Manager
SCS ENGINEERS

James J. Walsh, P.E.
Project Director
SCS ENGINEERS

DPG/WMH/JJW:rae

Encl.

cc: Mike Dolan, Laidlaw Bridgeton
Larry Giroux, Laidlaw, Bridgeton

STATE OF MISSOURI
Mel Carnahan, Governor • David A. Shorr, Director
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176 Jefferson City, MO 65102-0176

March 8, 1994

CERTIFIED MAIL #P 199 806 820
RETURN RECEIPT REQUESTED

Mr. Larry Giroux
Laidlaw Waste Systems (Bridgeton), Inc.
2340 S. Arlington Heights Road
Arlington Heights, IL 60005

RE: Landfill Fire Mitigation; Westlakes Landfill, Permit 0118912, in St. Louis County

Dear Mr. Giroux:

The SWMP (Solid Waste Management Program) has recently reviewed your request of a project for Landfill Fire Mitigation at the Westlakes Landfill renamed Laidlaw Waste Systems (Bridgeton), Inc., Permit 0118912, in St. Louis County. The proposal was prepared by SCS Engineers, dated January 10, 1994 and was received February 17, 1994. This project was received without an engineer's seal, but nevertheless was considered because of the potential threat to human health and safety of landfill personnel and the surrounding community. The SWMP has reviewed this request for this condition that does not appear to present a serious threat to the state of Missouri's public health and environment. The SWMP concurs with the proposed plan with the following conditions:

1. The document entitled Proposal, Landfill Fire Mitigation, Laidlaw Bridgeton Sanitary Landfill, Bridgeton, Missouri dated December 10, 1993 and revised January 10, 1994 shall be revised and submitted under the seal of a professional engineer registered in Missouri within thirty (30) days of receipt of this letter.

2. Any change in the operation and/or design of this facility other than that which has been described in the application and approved in this permit is considered by the department to be a modification of the permit and prior written approval must be obtained.

3. Three copies of the report, as part of Task 4 in the referenced document, on data from field observations and evaluations and recommendations for fire mitigation shall be sent to the SWMP. The report shall be reviewed and approved by a professional engineer registered in the state of Missouri.

4. Three copies of the report, as part of Task 5 in the referenced document, on mitigative action, its success, and its prospects for maintenance in the future shall be sent to the SWMP. The report shall be reviewed and approved by a professional engineer registered in the state of Missouri.

5. Laidlaw shall include all reports on continuing monitoring and maintenance efforts for control of the fire as part of the quarterly gas monitoring report to be sent to the SWMP.

This concurrence is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management Law, nor should this be construed as a waiver for other regulatory requirements.

This concurrence is not to be construed as compliance with any existing local ordinances or zoning requirements, nor does it supersede any local permitting and/or zoning requirements.

Should you have any questions, please contact me at (314) 751-5401.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Frank J. Dolan

Frank J. Dolan, P.E.
Environmental Engineer

FD:lf

c: James J. Walsh, SCS Engineers
Joe Trunko, St. Louis Regional Office
Kathrina M. Donegan, St. Louis County Dept. of Health

Midwest Environmental Consultants, P.C.

Consulting Engineers Air - Water - Waste

March 8, 1994

Mr. Warner D. Sherman, II
Chief, Special Projects Unit
Solid Waste Management Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Re: Request For Waiver, Bridgeton Sanitary Landfill, Permit #118912, St. Louis County

Dear Mr. Sherman:

Per our telephone conversation of March 7, 1994, Midwest Environmental Consultants, P.C., on behalf of Laidlaw Waste Systems, Inc., is requesting a waiver for composite liner requirements for the Bridgeton Sanitary Landfill. In accordance with the letter dated February 14, 1994 from Mr. Harold T. Morton to "Landfills That Received Extensions to Subtitle D Through April 8, 1994" this waiver is required to be submitted to your office by March 8, 1994.

As you know, the Bridgeton Sanitary Landfill is an inward gradient design and essentially the entire permitted footprint has been covered with refuse for several years. The site is a quarry fill with all of the base covered. Only the road in the pit along the west wall and the remaining near vertical sidewalls have not been covered with refuse at this time. Laidlaw Waste Systems, Inc. is requesting a waiver from constructing a composite liner system in the areas which, as of yet, have not received refuse. This includes the access road and near vertical walls. This waiver would allow the permitted footprint to be completed as designed. As we discussed, this waiver is justifiable because (1) construction of the liner would not be environmentally helpful, and (2) the liner would not be constructable being that the footprint has been covered with over 100 feet of refuse at its lowest point. As you know, this landfill has an operational leachate collection system in place.

522 E. Capitol Avenue • Jefferson City, Missouri 65101
(314) 636-9454 FAX (314) 761-4200

Attached for your files is a copy of a site plan which our firm submitted in a revised closure and post-closure plan dated July 1992 to your office. The permitted disposal area, the approximate area where refuse has been placed, the access road, and the vertical to near vertical walls are shown.

We appreciate your consideration of this request. Should you have any questions, please do not hesitate contacting our office.

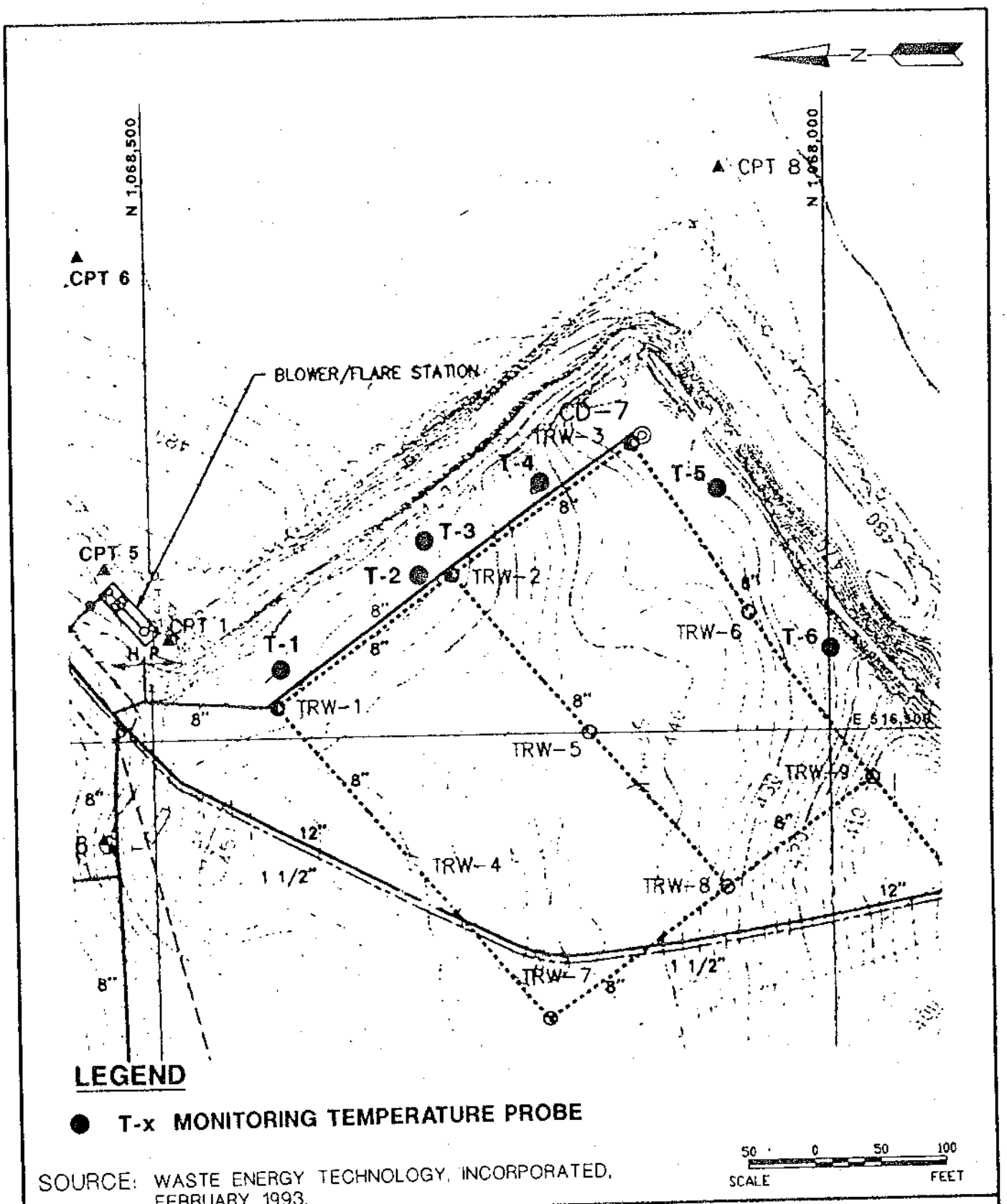
Sincerely,

Lee D. Tharp, P.E.
President

cf

attachment

c: Mr. Larry Giroux, Laidlaw Waste Systems, Inc.
Mr. Dennis Wike, Laidlaw Waste Systems, Inc.
Mr. John Workman, Laidlaw Waste Systems, Inc.



SOURCE: WASTE ENERGY TECHNOLOGY, INCORPORATED, FEBRUARY 1993.

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS, INC.
2060 READING ROAD SUITE 200 CINCINNATI, OHIO 45202
PH. (513) 421-6353 FAX NO. (513) 421-2647

PROJ. NO.	CADD FILE:	DATE:	SCALE:
0593034.00	59304300	MARCH 1994	AS SHOWN

EXHIBIT 1

MONITORING TEMPERATURE PROBE LOCATIONS

LAIDLAW WASTE SYSTEMS (WEST LAKE), INC.
BRIDGETON SANITARY LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI 63044

APPENDIX A

BORING AND BACKFILL LOGS

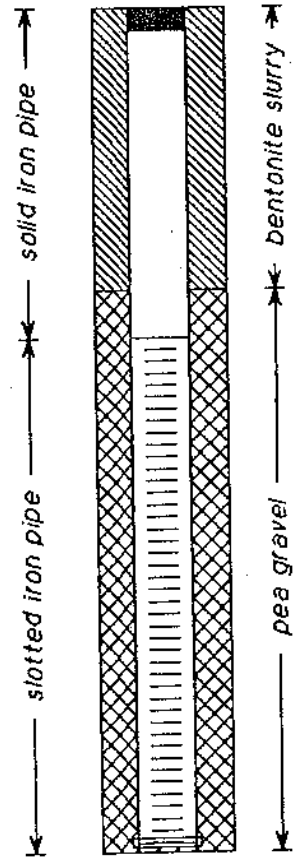
Client: Laidlaw
Location: Bridgeton, Missouri
Date Drilled: 3/11/94
Drilled by: United Geosciences

Total borehole depth: 18 ft.
Logged by: Dennis Gillespie

TEMPERATURE PROBE T-1
Project No: 0583034.00

SCS ENGINEERS

DEPTH (ft.)	LANDFILL DESCRIPTION	SYMBOL LOG	Well Construction
0	Brown and gray cover.		
5	REFUSE, moderate decomposition, moist, cool, (not warm or hot).		
10			
15			
20	Boring terminated at 18 ft on 3/11/94; Boring backfilled on 3/11/94. Boring is vertical.		
25			
30			



Client: Laidlaw
Location: Bridgeton, Missouri
Date Drilled: 3/9/94
Drilled by: United Geosciences

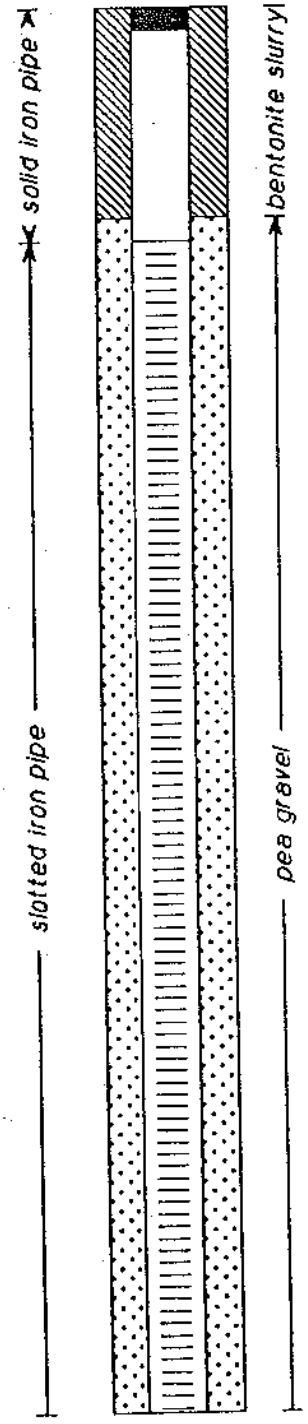
Total borehole depth: 50 ft.
Logged by: Dennis Gillespie

TEMPERATURE PROBE T-2
Project No: 0593034.00

SCS ENGINEERS

Well Construction

DEPTH (ft.)	LANDFILL DESCRIPTION	SYMBOL LOG
	Brown and gray cover.	
5	REFUSE, low to moderate decomposition, moist, warm (100 to 130 degrees F).	
10		
15		
20		
25		
30		



Client: Laidlaw
Location: Bridgeton, Missouri
Date Drilled: 3/9/94
Drilled by: United Geosciences

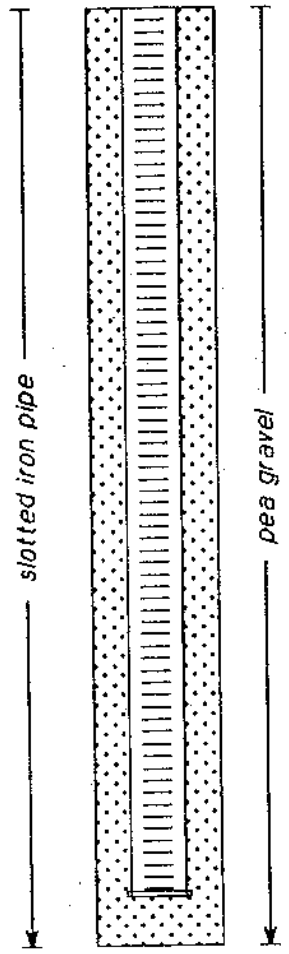
Total borehole depth: 50 ft.
Logged by: Dennis Gillespie

TEMPERATURE PROBE T-2
Project No: 0593034.00

SCS ENGINEERS

Well Construction

DEPTH (ft.)	LANDFILL DESCRIPTION	SYMBOL LOG
35	REFUSE, moderate decomposition, moist, warm to hot (130 to 170 degrees F).	
40		
45	REFUSE, moderate to high decomposition, moist to wet, warm.	
50	Boring terminated at 50 ft on 3/10/94, and backfilled on 3/10/94. Boring is vertical.	
55		
60		



Client: Laidlaw
Location: Bridgeton, Missouri
Date Drilled: 3/10/94
Drilled by: United Geosciences

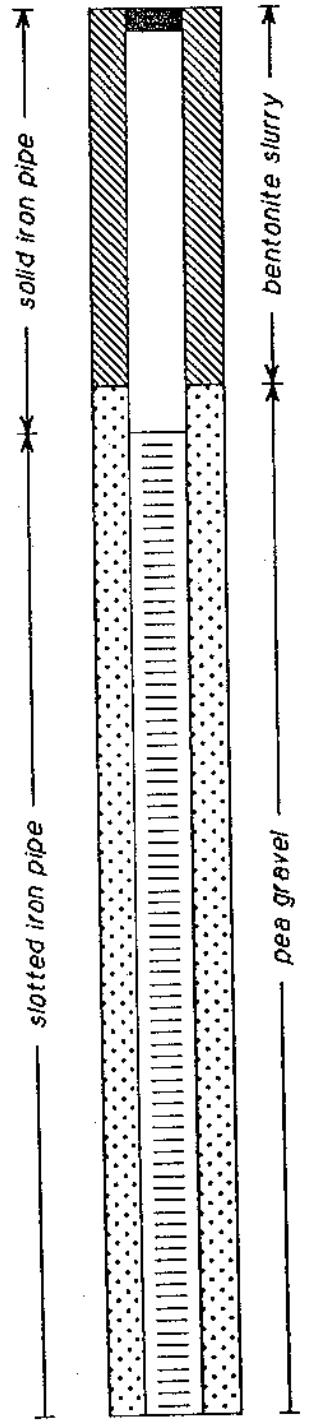
Total borehole depth: 40 ft.
Logged by: Dennis Gillespie

TEMPERATURE PROBE T-3
Project No: 0593034.00

SCS ENGINEERS

Well Construction

DEPTH (ft.)	LANDFILL DESCRIPTION	SYMBOL LOG
0	Brown and gray cover.	
5		
10		
15		
20	REFUSE, moderate decomposition, moist, warm.	
25		
30		



Client: Laidlaw
Location: Bridgeton, Missouri
Date Drilled: 3/10/94
Drilled by: United Geosciences

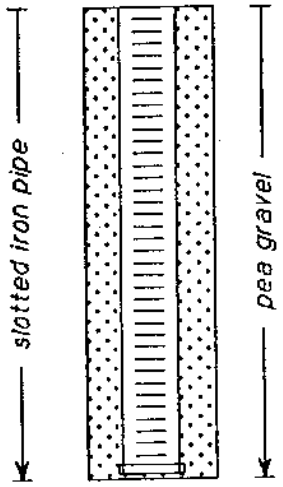
Total borehole depth: 40 ft.
Logged by: Dennis Gillespie

TEMPERATURE PROBE T-3
Project No: 0593034.00

SCS ENGINEERS

Well Construction

DEPTH (ft.)	LANDFILL DESCRIPTION	SYMBOL LOG
35	Rock along quarry wall, boring terminated.	
40	Boring completed at 40 ft on 3/10/94; Boring backfilled on 3/10/94. Boring drilled at an angle of 20 degrees from vertical.	
45		
50		
55		
60		



Client: Laidlaw
Location: Bridgeton, Missouri
Date Drilled: 3/11/94
Drilled by: United Geosciences

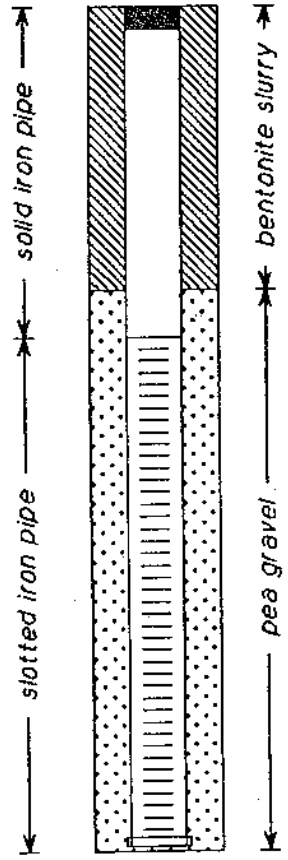
Total borehole depth: 18 ft.
Logged by: Dennis Gillespie

TEMPERATURE PROBE T-4
Project No: 0593034.00

SCS ENGINEERS

Well Construction

DEPTH (ft.)	LANDFILL DESCRIPTION	SYMBOL LOG
	Brown and gray cover.	
5	REFUSE, moderate decomposition, moist, cool (not warm or hot).	
10		
15		
20	Boring terminated at 18 ft on 3/11/94; Boring backfilled on 3/11/94. Boring is vertical.	
25		
30		



Client: Laidlaw
Location: Bridgeton, Missouri
Date Drilled: 3/11/94
Drilled by: United Geosciences

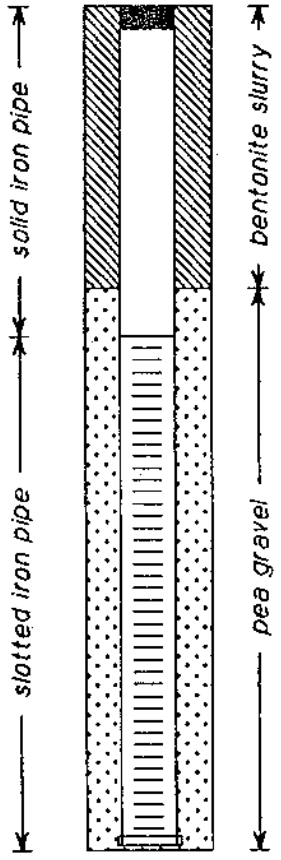
Total borehole depth: 18 ft.
Logged by: Dennis Gillespie

TEMPERATURE PROBE T-5
Project No: 0593034.00

SCS ENGINEERS

Well Construction

DEPTH (ft.)	LANDFILL DESCRIPTION	SYMBOL LOG
	Brown and gray cover	
5	REFUSE, moderate decomposition, moist, cool (not warm or hot).	
10		
15		
	Boring terminated at 18 ft on 3/11/94; Boring backfilled on 3/11/94. Boring vertical.	
20		
25		
30		



Client: Laidlaw
Location: Bridgeton, Missouri
Date Drilled: 3/9/94
Drilled by: United Geosciences

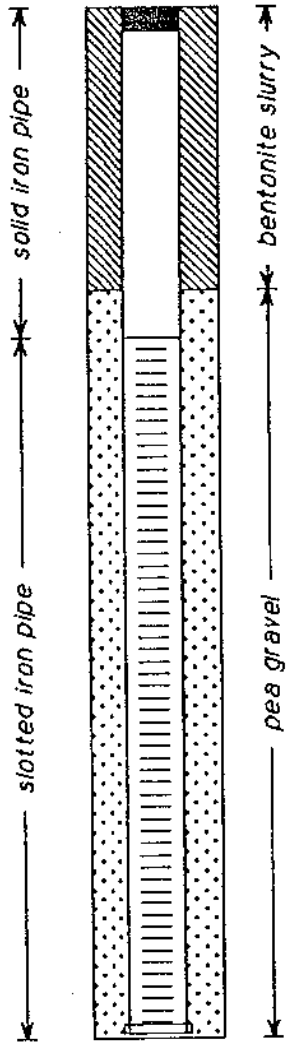
Total borehole depth: 18 ft.
Logged by: Dennis Gillespie

TEMPERATURE PROBE T-6
Project No: 0593034.00

SCS ENGINEERS

Well Construction

DEPTH (ft.)	LANDFILL DESCRIPTION	SYMBOL LOG
0	Brown and gray dirt.	
5		
	Fly ash.	
	REFUSE, moderate decomposition, moist, cool.	
10		
15		
20		
	Boring terminated in rock along quarry wall on 3/9/94; Boring backfilled on 3/10/94. Boring was emplaced at an angle of approximately 30 degrees from vertical.	
25		
30		



APPENDIX B

TEMPERATURE, PRESSURE AND GAS READINGS

Monitoring Well Data -- Bridgeton Sanitary Landfill, Bridgeton, Missouri

Date of Monitoring Data: March 14, 1994

SCS Job Number: 0593034

Depth (ft) versus Temperature (F)
Below top of well

Monitoring Personnel: Steve Martin, Laidlaw

Depth (ft)	Well Number					
	T 1	T 2	T 3	T 4	T 5	T 6
2	81	109	70	70	62	53
4	81	117	74	75	65	53
6	87	123	89	81	70	55
8	92	126	108	90	78	59
10	95	126	128	100	84	79
12	97	126	134	104	93	78
14	99	126	137	112	102	94
16	101	127	134	116	107	98
18	104	127	127	120	109	102
20	106	127	126	125	110	101
22		127	123			
24		127	122			
26		127	122			
28		127	119			
30		127	116			
32		128	113			
34		129	112			
36		129	112			
38		132	111			
40		132	108			
42		133	107			
44		133				
46		133				
48		133				
50		132				
Lowest Temperature	81	109	70	70	62	53
Average Temperature	94	127	114	99	88	77
Highest Temperature	106	133	137	125	110	102
Ambient Temperature	60	60	66	57	50	48

Monitoring Well Data -- Bridgeton Sanitary Landfill, Bridgeton, Missouri

Date of Monitoring Data: March 15, 1994

SCS Job Number: 0593034

Depth (ft) versus Temperature (F)
Below top of well

Monitoring Personnel: Steve Martin, Laidlaw

Depth (ft)	Well Number					
	T 1	T 2	T 3	T 4	T 5	T 6
2	82	102	101	77	69	63
4	82	108	107	75	69	65
6	87	116	116	84	76	65
8	93	123	119	94	84	69
10	96	126	131	101	91	76
12	97	126	136	106	97	92
14	100	126	138	113	104	98
16	102	127	138	118	107	101
18	105	127	134	123	109	102
20	107	127	135	126	110	102
22		127	135			
24		127	132			
26		127	130			
28		127	129			
30		127	127			
32		128	124			
34		128	120			
36		129	115			
38		130	113			
40		132	110			
42		133	108			
44		134				
46		134				
48		134				
50		133				
Lowest Temperature	82	102	101	75	69	63
Average Temperature	95	126	124	102	92	83
Highest Temperature	107	134	138	126	110	102
Ambient Temperature	71	57	53	64	51	49

Monitoring Well Data -- Bridgeton Sanitary Landfill, Bridgeton, Missouri

Date of Monitoring Data: March 16, 1994

SCS Job Number: 0593034

Depth (ft) versus Temperature (F)
Below top of well

Monitoring Personnel: Steve Martin, Laidlaw

Depth (ft)	Well Number					
	T 1	T 2	T 3	T 4	T 5	T 6
2	68	106	52	56	52	36
4	73	116	69	62	61	40
6	81	122	83	73	71	46
8	90	124	110	83	79	54
10	95	124	124	94	86	64
12	98	125	134	101	94	80
14	99	126	142	107	100	89
16	102	126	142	113	106	95
18	104	127	141	119	109	99
20	106	127	141	123	110	100
22		127	140			99
24		128	139			99
26		128	138			
28		128	138			
30		128	136			
32		129	130			
34		129	126			
36		129	116			
38		129	113			
40		132	112			
42		133	110			
44		134				
46		134				
48		134				
50		133				
Lowest Temperature	68	106	52	56	52	36
Average Temperature	92	127	121	93	87	75
Highest Temperature	106	134	142	ERR	110	100
Ambient Temperature	51	41	36	40	32	34

Monitoring Well Data -- Bridgeton Sanitary Landfill, Bridgeton, Missouri

Date of Monitoring Data: March 17, 1994

SCS Job Number: 0593034

Depth (ft) versus Temperature (F)
Below top of well

Monitoring Personnel: Steve Martin, Laidlaw

Depth (ft)	Well Number					
	T1	T2	T3	T4	T5	T6
2						
4						
6						
8						
10						
12						
14						
16						
18						
20						
22						
24						
26						
28						
30						
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						
Lowest Temperature						
Average Temperature						
Highest Temperature						
Pressure (in. of water)	+0.1	+0.2	+0.0	+0.0	+0.0	+0.0
Methane (% by volume)	64.8	59.5	55.1	63.1	60.5	50.4
Carbon Dioxide (% by volume)	34.4	40.1	42.4	36.3	39.4	40.2
Oxygen (% by volume)	0.8	0.3	0.1	0.3	0.1	2.5
Nitrogen (% by volume)	0	0	2.8	0	0	6.7
Carbon Monoxide (ppm by volume)	15	15	15	15	10	5

File
#0-8319

STATE OF MISSOURI
Mel Carnahan, Governor • David A. Shorr, Director
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176 Jefferson City, MO 65102-0176

May 4, 1994

CERTIFIED MAIL P #P 199 806 872
RETURN RECEIPT REQUESTED

Mr. Larry Giroux
Landfill Manager
Laidlaw Waste Systems (Bridgeton), Inc.
13570 St. Charles Rock Road
Bridgeton, MO 63044

RE: Subtitle D Liner Waiver and Fire Mitigation Report for West Lake (Bridgeton) Sanitary Landfill, Solid Waste Disposal Area Operating Permit Number 118912, St. Louis County

Dear Mr. Giroux:

A request for liner waiver, submitted on behalf of the Westlakes, Laidlaw Waste Systems, Inc., (Bridgeton) Sanitary Landfill (Permit Number 118912) was filed with the Missouri Department of Natural Resources on March 8, 1994 by Lee D. Tharp, P.E. of Midwest Environmental Consultants, P.C. The department also received the Task 4 Report, Assessment of Results/Recommendation for Future Actions, Subsurface Combustion at Laidlaw Bridgeton Landfill. The proposal requests waiving the requirement for composite liners on the ramp leading into the landfill and the side walls of the landfill. The task report notes the location of a fire along one of the same side walls, and provides recommendations on remedial measures.

The liner waiver and fire mitigation proposal are hereby approved as submitted on the documents listed below.

1. The letter dated and received March 8, 1994 from Lee D. Tharp, P.E. of Midwest Environmental Consultants, P.C. to Mr. Warner D. Sherman II, Solid Waste Management Program, which requests waiver from composite liner requirements for portions of the landfill.

2. The letter dated and received March 18, 1994 from Lee D. Tharp, P.E. of Midwest Environmental Consultants, P.C. to Mr. Warner D. Sherman II, Solid Waste Management Program, which provides further information on the landfill.

3. "Proposal, Landfill Fire Mitigation, Laidlaw Bridgeton Sanitary Landfill, Bridgeton, Missouri" from Larry Lowry, P.E. dated April 1, 1994 and received by the department on April 5, 1994.

4. Letter from Dennis P. Gillespie, William M. Held and James J. Walsh of SCS Engineers to Dennis Wike of Laidlaw Waste Systems, Inc. dated March 29, 1994, and copy received in a letter to Frank J. Dolan, P.E. from James J. Walsh, on March 30, 1994. This letter reported on investigations of the landfill fire.

This approval is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management Law; nor should this be construed as a waiver for other regulatory requirements. This approval is not to be construed as compliance with any existing local ordinances or zoning requirements; nor does it supersede any local permitting and/or zoning requirements. The design, construction and operation of the landfill and related landfill appurtenances shall conform to all applicable water quality laws, rules, regulations, and permits which are enforced by the department's Water Pollution Control Program. The SWMP reserves the right to require any modifications to the landfill that are necessary to protect human health or the environment.

In addition, the permittee shall report on the efforts to mitigate the current and any future landfill fire, in the task reports noted in reference 3 and with the gas monitoring reports submitted to the department thereafter. The permittee shall report on the effectiveness of the current soil liner to control gas migration out of the landfill in the task reports.

If landfill gas cannot be controlled by the soil liner, the permittee shall submit an additional modification request for the liner showing how the landfill gas shall be controlled, within 90 days of the final task report or of any gas monitoring report showing explosive gases beyond the liner of the landfill.

The department reserves the right to revoke, suspend, or modify this approval and/or permit number 118912 after due notice:

1. If it is found that the holder of the permit is in violation of the Missouri Solid Waste Management Law or Rules.

2. For failure to operate in accordance with the approved plans, specifications, and operating procedures.

3. For failure to comply with any and all conditions of the permit.

4. For creating a public nuisance, health hazard, or causing environmental pollution.

5. If it is found that additional construction or alteration of the solid waste disposal area is necessary to comply with any and all rules promulgated under and in accordance with the Missouri Solid Waste Management Law.

Should you have any questions, please contact the Solid Waste Management Program at (314) 751-5401.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Jim Hull
Chief, Eng/Pln Section

c: Joe Trunko, St. Louis Regional Office
Jim Bell, SWMP Enforcement Section
Lee D. Tharp, P.E., Midwest Environmental Consultants, P.C.
James J. Walsh, SCS Engineers

ST. LOUIS COUNTY HEALTH DEPARTMENT
WASTE MANAGEMENT SECTION

SANITARY LANDFILL SURVEILLANCE RECORD

Date: 4-27-94 Days/Week Open: 6
Name of Facility: Laidlaw Waste Systems (Sanitary)
Permit No.: 0419 Expires: 6-22-94
Owner: Laidlaw Waste Systems, Inc.
Address: 13570 St. Charles Rock Road
Bridgeton, MO 63044

Estimated amount of solid waste coming through gate.
Compacted Loads 37,500 yds./wk. _____ tons/wk.
Noncompacted Loads _____ yds./wk. _____ tons/wk.

Estimated volume of remaining landfill covered by approved engineering plans. _____ acre(s) 10 years

Ordinance 13,320 Chapter 607
Compliance Status

Check all sections: SAT-Satisfactory; UNS-Unsatisfactory; * - Area(s) requiring additional attention.

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
FACILITY PLAN				
720.0	Operations comply with facility plan.	X		
SOLID WASTE HANDLING				
730.5	Bulky waste crushed and pushed to bottom of cell.	X		
730.6	Demolition and construction waste, tree stumps, etc. pushed to bottom of cell.	N/A		
730.7	Dead animals under 40 lbs. covered immediately.	X		
730.8	Dead animals over 40 lbs. placed in pit and covered with 4 ft. of compacted soil.	X		
730.9	Water treatment plant sludges incorporated into active face and covered immediately.	X		
	Quantity of sludges does not interfere with normal active face operation.	X		
730.10	Incinerator and air pollution control residues incorporated into working face and prevented from becoming airborne.	X		
SOLID WASTE EXCLUDED				
730.4	Responsible supervisor present.	X		
760.0	Entrance sign posted listing wastes not accepted.	X		
SAFETY				
730.25	Fire extinguishers provided on all equipment.	X		
730.26	Provisions made for extinguishing fires.	X		
730.27	Communications equipment met standard.	X		
730.28	Scavenging prohibited.	X		
730.29	Controlled access limited to operating hours.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
WATER QUALITY				
730.11	Surface water courses diverted.	X		
	Grading promotes surface water runoff without excessive erosion.	X		
	Grading does not exceed 33 1/3%.	X		
	Surface water courses and runoff control 20 year rainfall.	X		
730.12	Minimum 15 feet between waste and maximum water table.	X		
730.13	Water quality protection secure (ie. liner, bedrock).	X		
730.14	Leachate and treatment systems used where necessary.	X		
730.15	Ground/surface water not contacting waste.	X		
730.36	All drinking water sources within 1/4 mile sampled annually.	X		
COVER MATERIAL				
730.3	Minimum of 6 inches approved cover applied daily.	X		
	Minimum 15 day stockpile of daily cover.	X		
730.32	Intermediate cover (min. 1 ft. after compaction) applied to all areas idle more than 60 days.	X		
730.33	Final cover (min. 2 ft. after compaction) applied to completed areas.	X		
COMPACTION				
730.1	Solid waste spread in layers not to exceed 2 ft. and reduced to smallest volume.	X		
730.2	Waste confined to smallest practical area			

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
AIR QUALITY				
730.16	No open burning without permission.	X		
GAS CONTROL				
730.17	Decomposition gas control implemented.		*	
730.18	Gases vented to prohibit explosive or toxic accumulations.	X		
AESTHETICS				
730.20	Litter control devices used properly.	X		
	Litter collected and secured daily.	X		
730.21	Blowable waste covered promptly.	X		
730.22	Vegetation and natural windbreaks used where necessary.	X		
730.23	Salvaged materials stored or removed daily.	X		
730.34	Final vegetation planted and graded as required.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
VECTORS				
730.19	Vector control programs implemented.	X		
RECORDS				
730.35	Records maintained to cover: a. Major problems and complaints.	X		
	b. Monitoring of leachate, gas, ground, and surface water sampling and analyses.	X		
	c. Vector control efforts.	X		
	d. Dust and litter control efforts.	X		
	e. Quantity of waste handled.	X		
BONDING				
690.1	Operating bond adequate.	X		
CLOSURE				
790.1	Final cover and vegetation provided.	X		

Weather Conditions: Clear, sunny 65° and breezy with low humidity.

Observed With: Mike Dolan, Laidlaw Waste Systems, Inc.

Consulted With: Mike Dolan, Laidlaw Waste Systems, Inc.

Additional Remarks/Comments: UNSATISFACTORY ITEMS

There were no unsatisfactory items to be noted at the time of inspection.

COMMENTS

The landfill looked very good. Dirt cover was very good and all areas were being contoured properly. A good dirt/rock seal is being maintained at the quarry walls and no waste was noted to be protruding.

Roadways throughout the landfill were being maintained in very good condition and dusting was being controlled through the use of a newly acquired water truck and a newly implemented wet down schedule. The roadways accessing the active face in Pit #3 have been reinforced with additional material and compaction. The access roadway to the dirt borrow area has also been reworked to allow better access to the area during wet weather. This action which has allowed faster access time for the dirt trucks and this, an increased availability of soil cover materia Better compaction operations have enhanced the appearance of the landfill, improved contouring, and have decreased passive gas migration through the soil cover.

cc:

Signature of Inspector

Signature of Section Chief

A new fence has recently been installed around Pit #3 for better safety and security.

The present gas system is being reevaluated to assure that the entire surface of the landfill is within the influence of the existing gas extraction system. The gas burner was operational and operating at near maximum capacity. One burner head was having maintenance performed at the time of the inspection. The next set of laterals is being scheduled for installation with some possible as built changes relating to lateral sloping to eliminate line blockage and substituting stronger piping to reduce line collapse.

The fire in Pit #2 has been controlled and is believed to have been extinguished. Recent temperature checks along the quarry wall (where the fire was noted previously) indicated the temperature had dropped over 200 degrees. Another slurry injection in a series of 5 injections is scheduled for next week. These final injections are to confirm total remediation of the fire.

In pit #2, along the quarry wall next to the haul road, additional cover material had been applied to the insufficient cover that was previously noted. Areas of insufficient cover have received additional material and the entire surface area of Pit #2 is scheduled to be redressed after all equipment is removed from the fire remediation.

Paper was being hand picked from the entire landfill surface area at the time of the inspection.

Leachate levels are being kept within permitted limits. This is due to the interim pumping schedule recently initiated. A new computer program to track pump hours - pump breakdowns - maintenance cost - down time - repair time, etc. is being introduced to provide for greater pump efficiency through a preventative maintenance program.

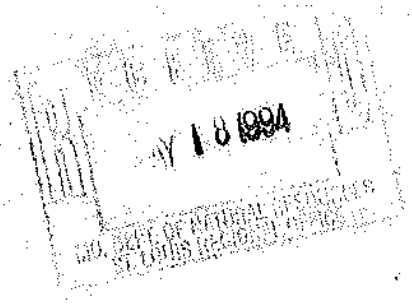
Ponding surface water has been eliminated through better contours being maintained and dryer weather conditions.

ST/BB/kmw

cc: Larry Giroux, Laidlaw - Operations Mgr.
John Boonstra, Laidlaw - Regional Division Mgr.
Joe Trunko, MDNR - SLRO
Richard Houchin, Bridgeton City Hall

Signature of Inspector

Signature of Section Chief


MAY 18 1994

St. Louis County (SW)
West Lake SLF

Mel Carnahan, Governor • David A. Shorr, Director
STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
St. Louis Regional Office
10805 Sunset Office Drive, Suite 100 St. Louis, MO 63127-1017
(314)822-0101
FAX (314)822-0943

June 22, 1994

Mr. Larry Giroux
Laidlaw Waste Systems, Inc.
13570 St. Charles Rock Road
Bridgeton, MO 63044

Dear Mr. Giroux:

Enclosed is a report of an inspection conducted by Mr. Joe Trunko of my staff. The report contains recommendations which the inspector has determined are warranted based on his findings at the facility.

Please review the report and implement the recommendations presented. Should you have any questions or comments, please contact Mr. Joe Trunko at (314) 822-0101.

Sincerely,

ST. LOUIS REGIONAL OFFICE

Robert S. P. Eck
Regional Director

RSPE/JLT/mc

Enclosures

c: SWP
Mr. Brad Bomanz, St. Louis County Health Dept., Solid Waste
Mr. Dave Berger, Executive Director, Region L

Weather Conditions: Clear, sunny, 80 degrees and breezy with moderate humidity.

Observed With: Mike Dolan, Laidlaw Waste Systems, Inc.

Consulted With: Mike Dolan, Laidlaw Waste Systems, Inc.

Additional Remarks/Comments:

UNSATISFACTORY ITEMS

1A - Leachate levels reported for the month of May are high due to equipment breakdown and lack of parts for a timely repair. (Section 730.14)

COMMENTS

1A - Institute maintenance program and/or acquire additional pumps as backup.

The landfill looked very good. Dirt cover was very good and all areas were being contoured properly. A good dirt/rock seal is being maintained at the quarry walls and no waste was noted to be protruding.

Roadways throughout the landfill were being maintained in very good condition and dusting was being controlled through the use of a newly acquired water truck. The roadways accessing the active face in Pit #3 have been reinforced with additional material and compaction. The access roadway to the dirt borrow area has also been reworked to allow better access to the area during wet weather. Improved compactor operation has enhanced the appearance, provided for better contours and increased exclusion of gas migration through daily cover.

The present gas system is being reevaluated to ensure that the entire surface of the landfill is within the influence of the existing gas extraction system. The main gas burner was operational and operating at near maximum capacity. Both secondary burners were down. One was not operational due to an unscheduled shift of the active face -- the other due to reduced volumes of methane. The next set of gas collection laterals is being scheduled for installation with the incorporation some possibly as built changes relating to lateral sloping to eliminate line blockage and the substitution of stronger piping to reduce line collapse.

The fire in Pit #2 has been controlled and, based upon thermal readings,believed to have been extinguished. The area is on a routine monitoring schedule to ensure reoccurrence of the fire will not take place.

Ponding surface water has been eliminated through the maintenance of better contours maintained and drier weather conditions.

cc: Larry Giroux, Laidlaw - Operations Mgr.
John Boonstra, Laidlaw - Regional Division Mgr.
Joe Trunko, MDNR - SLRO
Richard Houchin, Bridgeton City Hall

SANITARY LANDFILL INSPECTION REPORT

FACILITY

West Lake (Bridgeton) Sanitary Landfill
Laidlaw Waste Systems, Inc.
St. Louis County
MDNR Permit #118912

INTRODUCTION

On June 8, 1994, the above referenced facility was inspected for compliance with regulations pursuant to the Missouri Solid Waste Management Law. Mr. Joe Trunko represented the Missouri Department of Natural Resources (MDNR), St. Louis Regional Office. Messrs. Larry Giroux and Mike Dolan represented Laidlaw Waste Systems, Inc.

Prior to the inspection, a meeting was conducted between representatives of Laidlaw Waste Systems, Inc., the Solid Waste Program (SWP), the Division of Geology and Land Survey and the St. Louis County Department of Health. The meeting concerned the hydrogeologic investigation that has been proposed for this facility, as required by the Subtitle D regulations. Following the meeting, a tour of the landfill was made, at which time the inspection was conducted.

UNSATISFACTORY FEATURES

None.

COMMENTS

Overall operations at the landfill were satisfactory. The active face was being maintained to a small area. An observation of the previous days active face indicated that adequate daily cover had been applied.

Laidlaw has begun using a synthetic daily cover (Cormier 1440 woven polyethylene liner). Use of this material was approved by the SWP on 1/5/93. Condition no.2 of the approval requires that two copies of the final bid specifications for the material used and two copies of a detailed operations manual that specifies the guidelines for use of the cover be submitted to the SWP.

Laidlaw submitted a request to the SWP for approval to use soil contaminated with gasoline as daily cover. The SWP terminated its review of the request due to the failure of Laidlaw to obtain St. Louis County approval. In the meeting referenced above, use of this soil as daily cover for a trial period was discussed. Should Laidlaw wish to pursue the use of this material as daily cover for a trial period, a written request should be submitted to the SWP. Approval by the St. Louis County Department of Health must be obtained before the request will be reviewed by the SWP.

Condition 6.D of permit #118912 requires that the leachate in the collection sumps be maintained at a level less than 30 feet above the base of the sumps. The leachate sump reports submitted to this office for the months of February, March and April have shown compliance with this limit except for one reading taken at LCS 1 in April (46 feet). Mr. Dolan stated that the 58 h.p. pump utilized in this sump had malfunctioned. A backup pump was installed in the sump. However, operational problems were encountered with that pump as well. A pump was not operating in LCS1 at the time of the inspection. Mr. Dolan stated that a replacement pump as well as several backups were on order.

On September 29, 1993, Laidlaw requested a modification to construct and operate the storm water retention plan that was submitted to the Department on September 14, 1993. This plan was approved by the SWP on 5/4/94. Construction of settling basin #1 is scheduled to begin by the end of June.

A drainage ditch located near the asphalt plant was cleared of debris. As a result, much of the runoff from the closed landfills is now being diverted into the pond located next to the asphalt plant. The asphalt plant utilizes this water in their operation. Mr. Giroux stated that due to the decrease in stormwater flow from this area, the size of settling basin #2 may be decreased. Revised plans will be submitted to the SWP if a modification to the design of the basin is finalized.

A request for a waiver of the Subtitle D liner requirement for the quarry sidewalls and the ramp leading into the quarry was submitted to the SWP on 3/8/94. The liner waiver was approved by the SWP on 5/4/94.

The underground fire that was located in the former wet weather area appears to have been brought under control. A bentonite slurry has been used to seal the area between the quarry wall and waste, thus minimizing the entry of oxygen to the area of the fire. Laidlaw continues to monitor this area and additional slurry is applied as needed. Mr. Dolan stated that the gas collection trenches in this area would not be activated until Laidlaw was sure that the fire was extinguished.

The gas flare located in the quarry pit was not operating at the time of the inspection. The flare was disconnected as a result of preparations to install the next level of gas collection laterals. Evaluation and monitoring of the current gas collection system by Laidlaw has indicated that additional modifications to the gas system will be required in order for it to adequately handle the gas being generated by the landfill.

As required by 10 CSR 80-3.010(11)(C)3., owners/operators of all sanitary landfills must implement a routine methane monitoring program to ensure that methane is not allowed to exceed 5% LEL for methane at the property boundary or 25% LEL in buildings on the landfill. Laidlaw is currently monitoring all the buildings at the landfill with continual gas monitors. Gas migration at the landfill boundaries is being monitored through the use of a punch probe. Laidlaw is working on the development of a regular gas monitoring program, which will include gas monitoring wells at the landfill perimeter. Laidlaw must ensure that monitoring is provided for all layers of rock at the quarry walls that could provide a pathway for gas migration.

During the inspection, the inactive area north of the flare was observed (former permit area #118906). Subsidence of the fill in this area has created several depressed sections. Cracks in the soil cover in these areas creates the potential for gas to vent to the atmosphere, thus causing additional odors. Laidlaw has made some attempts to fill and seal these areas.

RECOMMENDATIONS

1. Two copies of the following information must be submitted to the Solid Waste Program: the final bid specifications for the Cormier woven polyethylene liner; a detailed operations manual specifying the guidelines for use of the liner.

2. Continue with efforts to improve the operation of the leachate collection system. Actions must be taken to ensure that the pumps located in the leachate collection sumps remain operational and that adequate backup pumps and/or service contracts for the existing pumps are provided. Please submit a brief report to this office that describes the actions Laidlaw has pursued to insure that the leachate levels in the collection sumps remain in compliance with condition 6.D of permit 118912.

3. Ensure that methane monitoring is conducted on the north and east sides of the permitted landfill. A report summarizing the results of any methane monitoring conducted at the landfill must be submitted to the St. Louis Regional Office at least on a quarterly basis.

4. Continue with efforts to recover and regrade the subsided areas in the inactive section of the landfill.

Questions concerning this report should be addressed to the undersigned.

PREPARED BY:

Joseph L. Trunko

Joseph L. Trunko
Environmental Specialist II

JLT/mc

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY

SANITARY LANDFILL INSPECTION CHECKLIST

TYPE OF INSPECTION ▶ Class 2

I GENERAL INFORMATION

DATE OF INSPECTION: 6-8-94	DAYS/WEEK OPEN:	TIME OF ARRIVAL: 10:00 a.m.	
WEATHER: Partly Cloudy ; dry			TEMPERATURE: 80° F
FACILITY NAME: West Lake (Bridgeton) Sanitary Landfill		COUNTY: St. Louis	PERMIT NUMBER: 118912
OWNER: Laidlaw Waste Systems, Inc.			TELEPHONE NUMBER: (314) 739-1919
ADDRESS: 13570 St. Charles Rock Road	CITY: Bridgeton	STATE: Mo	ZIP CODE: 63044
OPERATOR: Same as owner			TELEPHONE NUMBER: "
ADDRESS: "	CITY: "	STATE: "	ZIP CODE: "

II REMAINING LIFE OF LANDFILL

A. Estimated quantity of waste accepted, 35,000 (yards or tons/week)

B. Estimated life of remaining landfill 29 years.

C. Fixed operating term date, 11-8-95.

AREA SERVED

A. Cities: Various Municipalities

B. Counties: St. Louis, St. Charles, St. Louis City.

NOTE ▶ Check all subsections: SAT-Satisfactory or UNS-Unsatisfactory. If necessary, describe "UNS" violations under "Remarks."

		SAT	UNS
10 CSR 80-2.020 PERMIT ISSUANCE, SPECIAL OPERATING PERMITS, AND PERMIT EXEMPTIONS		✓	
(5)(E)	SITE CONSTRUCTED AND OPERATED PER APPROVED TERMS AND CONDITIONS OF PERMIT.		
10 CSR 80-2.060 CERTIFIED SOLID WASTE TECHNICIANS		✓	
(2)(A)	CERTIFIED SOLID-WASTE TECHNICIAN.		
10 CSR 80-3.010 SANITARY LANDFILLS DESIGN AND OPERATION		✓	
(2) SOLID WASTE ACCEPTED	(2)(C)1. BULKY SOLID WASTE CRUSHED ON SOLID GROUND.	✓	
(2)(C)2.	SMALL DEAD ANIMALS COVERED IMMEDIATELY.		
(3) SOLID WASTE EXCLUDED AND SPECIAL WASTE APPROVALS		✓	
(3)(C)1.	THE DISPOSAL OF SPECIAL WASTE APPROVED IN THE PERMIT IN ACCORDANCE WITH APPROVED PLANS.	✓	
(3)(C)2.A.	WRITTEN APPROVAL FOR SPECIAL WASTE NOT APPROVED IN PERMIT.	✓	
(3)(C)2.B.	APPROVED SPECIAL WASTE DISPOSED OF PROPERLY.	✓	
(3)(C)3.	SIGN POSTED AT ENTRANCE LISTING EXCLUDED WASTES.	✓	
(3)(C)4.	PROCEDURE FOR SCREENING AND REMOVAL OF EXCLUDED WASTES.	✓	
(3)(C)5.	LARGE DEAD ANIMALS PLACED IN PIT AND COVERED WITH FOUR FEET OF COMPACTED SOIL.	✓	
(3)(C)6.	EXCLUDED WASTES LISTED IN SUBSECTION (3)(A) OF THIS RULE NOT ACCEPTED FOR DISPOSAL.	✓	
(4) SITE SELECTION	(4)(C)1. SITE ACCESSIBLE IN ALL WEATHER CONDITIONS. TEMPORARY ROADS PROVIDED TO WORKING FACE.	✓	
(4)(C)2.	IF ACCESS ROADS ARE FLOODED, ALTERNATE SANITARY LANDFILL AVAILABLE.	✓	
	NAME: Numerous St. Louis Co. Landfills	✓	
(5) DESIGN	(5)(C)1. CONSTRUCTION AND OPERATION OF THE SITE IN ACCORDANCE WITH PLANS AND SPECIFICATIONS.	✓	
(5)(C)2.	MINIMUM 50-FOOT BUFFER ZONE MAINTAINED.	✓	
(5)(C)3.	OPERATING MANUAL AVAILABLE.		
(6) SURVEY CONTROL		✓	
(6)(C)1.	BOUNDARY MARKERS, BENCHMARKS, HORIZONTAL CONTROL STATIONS, & CONSTRUCTION STAKES CLEARLY MARKED & IDENTIFIED.	✓	
(6)(C)2.	MISSING OR DISPLACED BENCHMARKS OR HORIZONTAL CONTROL STATIONS REESTABLISHED.	✓	
(6)(C)3.	MISSING OR DISPLACED CONSTRUCTION STAKES REESTABLISHED.	✓	
(6)(C)4.	MONUMENTS AND BOUNDARY MARKERS PLACED PRIOR TO RECEIVING AUTHORIZATION TO OPERATE.	✓	
(6)(C)5.	CONSTRUCTION STAKES MARKING THE ACTIVE AREA PLACED PRIOR TO DEPOSITION OF WASTE.		
(7) WATER QUALITY		✓	
(7)(C)1.	SURFACE WATERCOURSES & RUNOFF PROPERLY DIVERTED. CONSTRUCTION & GRADING TO PROMOTE RUNOFF WITHOUT EXCESSIVE EROSION.	✓	
(7)(C)2.	CONTACT BETWEEN WATER AND SOLID WASTE MINIMIZED.	✓	
(7)(C)5.	LEACHATE GENERATED ON-SITE CONTROLLED ON-SITE AND NOT ALLOWED TO DISCHARGE OFF SITE OR DISCHARGE INTO WATERS OF THE STATE.		
(8) GROUND-WATER MONITORING		✓	
(8)(C)1.B.	GROUND-WATER-MONITORING WELLS OPERATIONAL PRIOR TO ACCEPTANCE OF WASTE.		
(9) AIR QUALITY		✓	
(9)(C)	BURNING OF SOLID WASTE PROHIBITED UNLESS A BURNING PERMIT IS OBTAINED.		

			SAT	UNS
(10) GAS CONTROL	(10)(C)1.	DECOMPOSITION GAS CONTROL SYSTEMS IMPLEMENTED AS NECESSARY. *	✓	
(10)(C)2.A.		METHANE NOT ALLOWED TO CONCENTRATE IN BUILDINGS ON-SITE ABOVE 25 PERCENT LEL FOR METHANE. *	✓	
(10)(C)2.B.		METHANE NOT ALLOWED TO CONCENTRATE IN THE SOIL AT THE PROPERTY BOUNDARY ABOVE 5 PERCENT LEL FOR METHANE. *	✓	
(10)(C)3.		DECOMPOSITION GAS MONITORING RESULTS SUBMITTED TO THE DEPARTMENT AS REQUIRED BY PERMIT. *	✓	
(11) VECTORS	(11)(C)	VECTOR CONTROL PROGRAMS IMPLEMENTED WHEN NECESSARY.	✓	
(12) AESTHETICS			✓	
(12)(C)1.		LITTER CONTROL DEVICES UTILIZED AS NEEDED. LITTER COLLECTED & INCORPORATED INTO THE ACTIVE CELL AT THE END OF EACH DAY OR PLACED IN CONTAINERS.	✓	
(12)(C)2.		WASTES EASILY MOVED BY WIND COVERED AS NECESSARY.	✓	
(12)(C)3.		ON-SITE VEGETATION CLEARED ONLY AS NECESSARY.	✓	
(12)(C)4.		SALVAGED MATERIALS REMOVED DAILY OR STORED IN AESTHETICALLY ACCEPTABLE CONTAINERS.	✓	
(13) COVER	(13)(C)1.	DAILY COVER APPLIED.	✓	
(13)(C)2.		INTERMEDIATE COVER APPLIED.	✓	
(13)(C)3.		FINAL COVER APPLIED.	✓	
(13)(C)4.		FINAL SIDE SLOPES NOT TO EXCEED 33.3 PERCENT.	✓	
(13)(C)5.		VEGETATION ESTABLISHED WITHIN 180 DAYS OF APPLICATION OR REGRADING OF COVER.	✓	
(13)(C)6.		REGRADING AND RECOVERING AS NECESSARY. *	✓	
(14) COMPACTION	(14)(C)1.	SOLID-WASTE HANDLING EQUIPMENT ON-SITE AND OPERATED AS NECESSARY.	✓	
(14)(C)1.A.		SOLID WASTE TO BE COMPACTED, SPREAD IN LAYERS NO MORE THAN 2 FEET THICK, & CONFINED TO SMALLEST PRACTICAL AREA.	✓	
(14)(C)1.B.		WASTE COMPACTED TO SMALLEST PRACTICAL VOLUME.	✓	
(14)(C)1.C.		COVER COMPACTED AS MUCH AS PRACTICAL.	✓	
(14)(C)2.		PREVENTIVE MAINTENANCE PERFORMED ON EQUIPMENT.	✓	
(14)(C)3.		SOLID WASTE NOT DISPOSED OF IN WATER.	✓	
(15) SAFETY	(15)(C)1.	FIRE EXTINGUISHERS PROVIDED.	✓	
(15)(C)2.		ALL FIRES IN WASTES BEING DELIVERED AT THE WORKING FACE OR WITHIN EQUIPMENT EXTINGUISHED.	✓	
(15)(C)3.		COMMUNICATIONS EQUIPMENT AVAILABLE.	✓	
(15)(C)4.		SCAVENGING PROHIBITED.	✓	
(15)(C)5.		CONTROLLED ACCESS TO SITE BY ESTABLISHED ROADWAYS & LIMITED TO HOURS WHEN OPERATING PERSONNEL ARE ON DUTY.	✓	
(15)(C)6.		TRAFFIC CONTROLLED AND DIRECTED TO DISTINGUISH DISPOSING POINTS.	✓	
(15)(C)7.		SITE DUST CONTROLLED. (water truck)	✓	
(16) RECORDS	(16)(C)1.A.	RECORDS OF MAJOR PROBLEMS AND COMPLAINTS.	✓	
(16)(C)1.B.		MONITORING RECORDS	✓	
		A. LEACHATE SAMPLING AND ANALYSES, B. GAS SAMPLING AND ANALYSES, C. GROUND- AND SURFACE-WATER ANALYSES.	✓	
(16)(C)1.C.		RECORDS OF VECTOR-CONTROL EFFORTS.	✓	
(16)(C)1.D.		RECORDS OF DUST- AND LITTER-CONTROL EFFORTS.	✓	
(16)(C)1.E.		RECORDS OF QUANTITY OF WASTE HANDLED.	✓	
(16)(C)1.F.		RECORDS OF DESCRIPTION, SOURCES, AND VOLUME OF SPECIAL WASTES LISTED IN SUBSECTION (3)(A).	✓	
OTHER DESIGN SPECIFICATIONS				
(7)(C)3.		LEACHATE COLLECTION SYSTEM PROPERLY INSTALLED AND OPERATED.	✓	
(7)(C)4.		LINER CONSTRUCTED BY APPROVED DESIGN SPECIFICATION.	✓	
(8)(C)1.A.		GROUNDWATER MONITORING WELLS INSTALLED.	✓	
(13)(C)7.		BORROW AREAS RECLAIMED.	✓	

REMARKS

* — please review comments & recommendations sections of the written inspection report.

TO THE OWNER/OPERATOR:
This inspection of your facility has been conducted under the authority of Sec. 260.225.1 (9) RSMo. The department representative has marked those items found in violation of the applicable environmental laws and regulations adopted thereunder pertaining to your facility. Your signature below or that of your agent acknowledges that you have been notified of the deficiencies and have received recommendations and specific time frames for corrective action(s). If future inspections determine these violations persist, the Department may proceed with more formal enforcement procedures as authorized under Sections 260.230 and 260.240 RSMo, including but not limited to the assessment of penalties up to $1000 per day for each day, or part thereof, the violation occurred. If any questions occur following your receipt of this inspection report, please contact the inspector named below.

COMPLIANCE EVALUATION
- ☑ Facility in Compliance
- ☐ Facility Not in Compliance
  - ☐ Notice of Violation Issued: ____ / ____ / ____
  - ☐ Return to Compliance By : ____ / ____ / ____
  - ☐ Follow-up Visit Scheduled: ____ / ____ / ____

SIGNATURE OF INSPECTOR	OFFICE	COPY RECEIVED BY
Joseph L. Lynch	St. Louis Regional	By mail
OFFICE ADDRESS	**TELEPHONE**	**TITLE**
10805 Sunset Office Dr., St. Louis, Mo 63127	(314) 522-4901	—

MO 780-0354 (3-90)

Midwest Environmental Consultants, P.C.

Consulting Engineers Air - Water - Waste

RECEIVED

JUL 05 1994

SWMP

POSTED

July 5, 1994

Mr. Warner Sherman
Chief, Special Projects Unit
Solid Waste Management Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Re: Request for a six-month Trial Use Period of Alternate Daily Cover at the Bridgeton Sanitary Landfill

Dear Mr. Sherman:

On behalf of Laidlaw Waste Systems, Inc. our firm is submitting a request to use alternate daily cover for a six-month trial use period at Laidlaw's Bridgeton Sanitary Landfill. The proposed alternate daily cover material is petroleum hydrocarbon contaminated soil.

We have submitted this request to the St. Louis County Department of Community Health and have received approval for the trial period. The written approval will be finalized this week, however, please feel free to contact Ms. Sue Taylor for confirmation.

Should you have any questions please do not hesitate contacting this office.

Sincerely,

Lee D. Tharp, P.E.
President

as

cc: Ms. Sue Taylor, St. Louis County
Mr. Larry Giroux, Laidlaw Waste Systems, Inc.
Mr. Mike Dolan, Laidlaw Waste Systems, Inc.
Mr. Brad Pollock, Midwest Environmental Consultants, St. Louis

522 E. Capitol Avenue • Jefferson City, Missouri 65101
(314) 636-9454 FAX (314) 761-4200

File
40-8402

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MEMORANDUM

DATE: July 7, 1994

TO: Steve Sturgess, Chief, Project Management Unit, Superfund Section, HWP

THROUGH: Warner D. Sherman II, Chief, Special Projects Unit, SWMP

FROM: Frank J. Dolan, P.E., Environmental Engineer, Special Projects Unit, SWMP

SUBJECT: RI/FS Work Plan For West Lake Site, Bridgeton, MO; revised February 28, 1994

The work plan for the investigation of radiological waste releases at the Westlake Site includes activities within a portion of the sanitary landfill operating under the Missouri Solid Waste Disposal Area Operating Permit Number 118912. In a meeting on June 8, 1994, with the Landfill operator, Laidlaw Waste Systems (Bridgeton), Inc., discussion of placement of wells and borings in the sanitary landfill included the potential for fire and disruption of the methane gas recovery system around the site called Area 1 in the work plan.

There appears to be a misunderstanding concerning the material to be encountered in any boring along the south and west sides of Area 1. Records in the Solid Waste Management Program indicate that those locations were used as a sanitary landfill, not for construction/demolition waste.

In the past eight months, Laidlaw has had a fire fed by combustible gases from the landfill along a quarry wall near Area 1. In the drilling program associated with the work plan, a large diameter auger is proposed for use. If demolition fill is encountered; that may be an appropriate auger. If sanitary wastes or gases from the sanitary landfill are encountered, use of a technique that allows combustible gases to come into contact with air or oxygen may cause a fire or explosion. Disrupting the cap of the landfill may also cause operational problems with the methane gas recovery system in use in the sanitary landfill.

In section seven of the work plan, landfill location standards under state regulation should include standards promulgated under Missouri Solid Waste Management Law (Table 7-1B). A copy of 10 CSR 80-2.030 is attached for reference on excavations of closed landfills. Disrupting the cap of the landfill should be

considered in the light of the information to be gained versus the damage that may be done to the landfill operating system.

Laidlaw is undertaking hydrogeologic investigations to satisfy state and federal requirements under Subtitle D of RCRA. All wells and borings are to, at a minimum, meet the standards for well logging and data collection needed for the RI/FS work plan. This conformance to standards is being used so that data may be shared between the two efforts.

Please keep the Special Projects Unit informed of any meeting or correspondence that we may share information about this site.

WDS:fdf

Attachment

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

RECEIVED

NOV 04 1994

SWMP

POSTED

October 31, 1994

Mr. Joe Trunko
St. Louis Regional Office
Missouri Department of Natural Resources
10805 Sunset Office Drive, Suite 100
St. Louis, Mo. 63127-1017

Re: Bridgeton Landfill, Permit Number 118912, Gas Monitoring

Dear Mr. Trunko:

Enclosed are the results of our gas monitoring program for the third quarter monitoring period. The monitoring was conducted in accordance with our previously submitted monitoring plan and our letter of April 8, 1994. A summary of the results follows:

Perimeter monitoring: Bar punch monitoring was conducted at the property line at the locations indicated on the enclosed map. The additional locations written on the map were randomly selected for additional monitoring. All bar punch tests were conducted by driving a 3/8 inch rod 3 feet into the soil, removing the rod and inserting a hose connected to a GEM-500 gas extraction monitor. All bar punch monitoring showed zero methane migration.

Continuous Monitoring: We have installed GHD 2000 gas monitors in five separate onsite buildings. These monitors are set to alert occupants should gas levels reach 5-15% of the LEL, well below the 25% Missouri standard. There has never been an event indicated by our alarm system suggesting concentrations of methane approaching the 25% standard.

Also, I am updating you as to the status of our underground fire and any future fires. The existing fire, which at one time we believed to be extinguished, is now believed to have reignited. Due to settlement from the installation of Sed Pond #1 the fissure has opened up. We plan to regrout the fissure which should result in sealing off the air, thus extinguishing the fire.

Further, I would like to notify you of another possible fire, adjacent to Taussig Road, about half way between St. Charles Rock Road and the Methane Flare. We have seen some smoke and are currently developing a plan to investigate and remediate if necessary.

If you have any questions regarding our monitoring program and procedures, please call.

Sincerely,

Larry Giroux
General Manager

CC: Mr. Frank Dolan, MDNR
Mr. Brad Bomanz, St. Louis County DOH

LG:jg

ST. LOUIS COUNTY HEALTH DEPARTMENT
WASTE MANAGEMENT SECTION

SANITARY LANDFILL SURVEILLANCE RECORD

Date: 12/01/94 Days/Week Open: 6
Name of Facility: Laidlaw Waste Systems
Permit No.: 418 Expires: 6-22-95
Owner: Laidlaw Waste Systems
Address: 13570 St. Charles Rock Road
Bridgeton, MO 63044

Estimated amount of solid waste coming through gate.
Compacted Loads 37,500 yds./wk. _____ tons/wk.
Noncompacted Loads _____ yds./wk. _____ tons/wk.

Estimated volume of remaining landfill covered by approved engineering plans. _____ acre(s) 10 years

Ordinance 13,320 Chapter 607
Compliance Status

Check all sections: SAT-Satisfactory; UNS-Unsatisfactory; * - Area(s) requiring additional attention.

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
FACILITY PLAN				
720.0	Operations comply with facility plan.		X	
SOLID WASTE HANDLING				
730.5	Bulky waste crushed and pushed to bottom of cell.	X		
730.6	Demolition and construction waste, tree stumps, etc. pushed to bottom of cell.	X		
730.7	Dead animals under 40 lbs. covered immediately.	X		
730.8	Dead animals over 40 lbs. placed in pit and covered with 4 ft. of compacted soil.	X		
730.9	Water treatment plant sludges incorporated into active face and covered immediately.	X		
	Quantity of sludges does not interfere with normal active face operation.	X		
730.10.	Incinerator and air pollution control residues incorporated into working face and prevented from becoming airborne.	X		
SOLID WASTE EXCLUDED				
730.4	Responsible supervisor present.	X		
760.0	Entrance sign posted listing wastes not accepted.	X		
SAFETY				
730.25	Fire extinguishers provided on all equipment.	X		
730.26	Provisions made for extinguishing fires.	X		
730.27	Communications equipment met standard.	X		
730.28	Scavenging prohibited.	X		
730.29	Controlled access limited to operating hours.	X		
730.30	Traffic directed to designated disposal points.	X		
730.31	Dust control adequate.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
WATER QUALITY				
730.11	Surface water courses diverted.	X		
	Grading promotes surface water runoff without excessive erosion.		X	
	Grading does not exceed 33 1/3%.	X		
	Surface water courses and runoff control 20 year rainfall.	X		
730.12	Minimum 15 feet between waste and maximum water table.	X		
730.13	Water quality protection secure (ie. liner, bedrock).	X		
730.14	Leachate and treatment systems used where necessary.	X		
730.15	Ground/surface water not contacting waste.	X		
730.36	All drinking water sources within 1/4 mile sampled annually.	X		
COVER MATERIAL				
730.3	Minimum of 6 inches approved cover applied daily.	X		
	Minimum 15 day stockpile of daily cover.	X		
730.32	Intermediate cover (min. 1 ft. after compaction) applied to all areas idle more than 60 days.	X		
730.33	Final cover (min. 2 ft. after compaction) applied to completed areas.	X		
COMPACTION				
730.1	Solid waste spread in layers not to exceed 2 ft. and reduced to smallest volume.	X		
730.2	Waste confined to smallest practical area on working face.	X		
730.24	Adequate equipment maintained and operated.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
AIR QUALITY				
730.16	No open burning without permission.	X		
GAS CONTROL				
730.17	Decomposition gas control implemented.	X		
730.18	Gases vented to prohibit explosive or toxic accumulations.	X		
AESTHETICS				
730.20	Litter control devices used properly.	X		
	Litter collected and secured daily.	X		
730.21	Blowable waste covered promptly.	X		
730.22	Vegetation and natural windbreaks used where necessary.	X		
730.23	Salvaged materials stored or removed daily.	X		
730.34	Final vegetation planted and graded as required.	X		

Section Number	Satisfactory Compliance Operating Procedure	SAT	*	UNS
VECTORS				
730.19	Vector control programs implemented.	X		
RECORDS				
730.35	Records maintained to cover: a. Major problems and complaints.	X		
	b. Monitoring of leachate, gas, ground, and surface water sampling and analyses.	X		
	c. Vector control efforts.	X		
	d. Dust and litter control efforts.	X		
	e. Quantity of waste handled.	X		
BONDING				
690.1	Operating bond adequate.	X		
CLOSURE				
790.1	Final cover and vegetation provided.	X		

Weather Conditions: Clear, sunny 60° and windy.

Observed With: Brad Bomanz, DOH

Consulted With: Same

Additional Remarks/Comments: UNSATISFACTORY ITEMS/RECOMMENDATIONS

Leachate levels in LCS 2 and LCS 1 are in violation of Missouri DNR Operations permit which requires levels not to exceed 30 feet above the base of the pump. Remediation efforts implemented since the last inspection were successful in achieving compliance at the end of October. Recent violation for LCS 1 is attributed to an accident which resulted in damage to a section of the well that allowed trash to enter the well. Pumping of LCS 1 can not resume until the trash is removed. Bids are being obtained to remove the trash. Non-compliance in LCS 2 may be due to overloading from LCS 3 and LCS 4 which are pumped to LCS 2 prior to discharge to the lagoon. This item was discussed in depth with Mr. Larry Giroux. Laidlaw believes sediment accumulation may be part of the problem in maintaining compliance levels in LCS 1. A fan will be purchased that will suspend sediment into the leachate allowing the pump to remove both the leachate and the sediment. Please inform DOH when pumping of LCS 1 resumes and continue to submit monthly monitoring reports.(720.0)

cc:

CONTINUED ON PAGE 2

Signature of Inspector

Signature of Section Chief

Settlement is occurring along the East wall of Pit 1 causing several fizzures. Laidlaw is concerned that there may be a fire in this area. Please keep DOH informed of the investigation into this matter. Additional cover is needed over the fissures and the area recontoured. (730.11)

Ponding is occuring in the southwest portion of Pit 3 near LCS 4. Remove this excess surface water and regrade the area to allow diversion of surface water. (730.11)

COMMENTS

Gas tests have confirmed that the fire which recently reignited in Pit 2 is no longer active. Settlement from the retention basin caused fissures along the pit wall. These areas will be regrouted.

The location of the active face in pit prohibited the compactor from being able to move past the base of the lift and effectively push and shred the waste. This resulted in a large active face and less than desirable compaction methods but should be a temporary situation.

The commingled lead contaminated soils from the Federal Couthouse (City Block 205S) site remain tarped and bermed. Currently there are no stockpiles of petroleum contaminated soils to be utilized as alternative daily cover. When stockpiling this material begins, the soils will be placed at the southern end of Pit 3 and identified with appropriate signage. Some petroleum contaminated soils were placed at the active face near the clean fill for use at the end of the day.

All other special wastes from the Couthouse site are being incorporated into the active face.

The new access road to Pit 3 has been completed. Dust control was good and the roadways well maintained.

Signature of Inspector

Signature of Section Chief

cc: Larry Giroux, Laidlaw - Operations Mgr.
John Boonstra, Laidlaw - Regional Division Mgr.
Bob Eck, MDNR-SLRO
Richard Houchin, Bridgeton City Hall

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

RECEIVED

MAR 31 1995

SWMP

March 29, 1995

Mr. Jim Bell
Chief, Enforcement Section
Solid Waste Management Section
P.O. Box 176
Jefferson City, Missouri 65102

Re: Bridgeton Landfill, Permit Number 118912, Gas Monitoring

Dear Mr. Bell:

Enclosed are the results of our gas monitoring program for the 1st quarter monitoring period. A summary of the results follows:

Perimeter monitoring: Bar punch monitoring was conducted at the property boundary at the locations indicated on the enclosed map. The additional locations written on the map were randomly selected for additional monitoring. All bar punch tests were conducted by driving a 3/8 inch rod 3 feet into the soil, removing the rod and inserting a hose connected to a GEM-500 gas extraction monitor. All bar punch monitoring showed zero methane migration.

Continuous Monitoring: We have installed GHD 2000 gas monitors in five separate onsite buildings. These monitors are set to alert occupants should gas levels reach 5-15% of the LEL, well below the 25% Missouri standard. There has never been an event indicated by our alarm system suggesting concentrations of methane approaching the 25% standard.

I would like to take the opportunity to update you as to the status of our underground fire. The original fire, which we believe had reignited, shows no signs of activity. This fire appears to be related to the TRW gas collection wells. At the present time these wells are not active and the fire does not appear to show any activity. We will continue to monitor the fissure along the quarry wall for any signs of combustion. In a previous letter from Mr. Larry Giroux, LWS to Mr. Joe Trunko MDNR St. Louis Region, dated October 31, 1994, their was mentioned a possibe new fire. At the present time their is no sign of this fire. We will continue to regrout and monitor these areas as necessary.

If you have any questions concerning our monitoring program and procedures, please do not hesitate to contact me at 739-1919.

Sincerely;

Brad Pollock

Brad Pollock
Operations Manager

cc: Mr. Terry Hoevelkamp, MDNR St. Louis Region
Mr. Brad Bomanz, St. Louis County DOH

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

June 30, 1995

Mr. Jim Bell
Chief, Enforcement Section
Solid Waste Management Section
P.O. Box 176
Jefferson City, Missouri 65102

Re: Bridgeton Landfill, Permit Number 118912, Gas Monitoring

Dear Mr. Bell:

Enclosed are the results of our gas monitoring program for the 2nd quarter monitoring period. A summary of the results follows:

Perimeter monitoring: Bar punch monitoring was conducted at the property boundary at the locations indicated on the enclosed map. The additional locations written on the map were randomly selected for additional monitoring. All bar punch tests were conducted by driving a 3/8 inch rod 3 feet into the soil, removing the rod and inserting a hose connected to a GEM-500 gas extraction monitor. All bar punch monitoring showed zero methane migration.

Continuous Monitoring: We have installed GHD 2000 gas monitors in five separate onsite buildings. These monitors are set to alert occupants should gas levels reach 5-15% of the LEL, well below the 25% Missouri standard. There has never been an event indicated by our alarm system suggesting concentrations of methane approaching the 25% standard.

The underground fire which was located along the northern quarry wall, immediately north of Sed-Basin 1, shows no signs of activity.

If you have any questions concerning our monitoring program and procedures, please do not hesitate to contact me at 739-1919.

Sincerely;

Brad Pollock

Brad Pollock
Operations Manager

cc: Mr. Terry Hoevelkamp, MDNR St. Louis Region
Mr. Brad Bomanz, St. Louis County DOH

FIGURE 3.5.1

LAIDLAW WASTE SYSTEMS

EXPLOSIVE GAS MONITORING FIELD DATA SHEET

Site: Brigdeton Landfill

Personnel: Dan Dessent Date: 6/29/95

METEOROLOGIC DATA: Attach data from preceding days (Optional)
Ambient Temperature: 78° Barometric Pressure: 29.6 R (inches Hg.)
Measurement Sta.: ☐ NOAA: _____ ☒ On-site ☐ Other: _____

MONITORING LOCATION TYPE: (Use separate Field Data Sheets for each type of data)
Monitoring Probe: ☐
Borehole Probe: ☒
Continuous Monitor: ☐
Hand Held (Ambient): ☐

FIELD INSTRUMENTATION: (Attach calibration data)
LEL Meter: Mod. No.: Gen 500 S/N: 279 Calib. Date/Time: 6/29/95 3:15 pm
Pressure Gauge: Mod. No.: _____ S/N: _____ Calib. Date/Time: __/__/__ __:__
Water Level Met: Mod. No.: _____ S/N: _____ Calib. Date/Time: __/__/__ __:__
Other: _____ Mod. No.: _____ S/N: _____ Calib. Date/Time: __/__/__ __:__

LOCATION IDENTIFICATION:	#1 3:55 pm	#2 4:02 pm	#3 4:12 pm	#4 4:22 pm	#5 4:40 pm	#6 4:45 pm
Monitoring Probe Construction:						
Total Depth (feet):	3 feet	3 feet	3 feet	3 feet	3 feet	3 feet
Depth to Top of Screen (feet):	CH4 0 O2 20.5%	CH4 0 O2 19.9%	CH4 0 O2 20.5%	CH4 0 O2 20.5%	CH4 0 O2 20.6%	CH4 0 O2 20.7%
Monitoring Probe Condition:						
Clearly Labeled?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Prot. Csg. in Good Condition?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Concrete Pad Intact?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Padlock Functional?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Inner casing properly capped?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Sample fitting in Good Condition?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

I certify that these data were obtained in accordance with applicable regulatory and project protocols:
Signature: _____ Date: __/__/__

FIGURE 3.5.1

LAIDLAW WASTE SYSTEMS

EXPLOSIVE GAS MONITORING FIELD DATA SHEET

Site: RRingerton Landfill

Personnel: Tim Johnson Date: 6/29/95

METEOROLOGIC DATA: Attach data from preceding days (Optional)

Ambient Temperature: 78° Barometric Pressure: 29.6 R (inches Hg.)

Measurement Sta.: ☐ NOAA: _____ ☑ On-site ☐ Other: _____

MONITORING LOCATION TYPE: (Use separate Field Data sheets for each type of data)

Monitoring Probe: ☐

Borehole Probe: ☑

Continuous Monitor: ☐

Hand Held (Ambient): ☐

FIELD INSTRUMENTATION: (Attach calibration data)

LEL Meter: Mod. No.: Gem 500 S/N: 279 Calib. Date/Time: 6/29/95 3:15

Pressure Gauge: Mod. No.: _____ S/N: _____ Calib. Date/Time: __/__/__ __:__

Water Level Met: Mod. No.: _____ S/N: _____ Calib. Date/Time: __/__/__ __:__

Other: _____ Mod. No.: _____ S/N: _____ Calib. Date/Time: __/__/__ __:__

LOCATION IDENTIFICATION:	#7 4:52					
Monitoring Probe Construction:						
Total Depth (feet):	3 Feet					
Depth to Top of Screen (feet):	CH4 0 O2 20.6%					
Monitoring Probe Condition:						
Clearly Labeled?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Prot. Csg. In Good Condition?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Concrete Pad Intact?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Padlock Functional?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Inner casing properly capped?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Sample fitting in Good Condition?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

I certify that these data were obtained in accordance with applicable regulatory and project protocols:

Signature: _____ Date: __/__/__

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

JUN 16 1995

SWMP

June 13, 1995

Mr. Matt Morasch
Solid Waste Management Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Dear Mr. Morasch:

Recently, Laidlaw Waste Systems conducted an internal environmental audit at it's Bridgeton sanitary landfill (a.k.a. Westlake Sanitary Landfill, Permit # 118912). A discrepancy noted in the audit was a variation between the permitted gas management system and the one actually being used. In order to ensure that your office is aware of the steps being taken to control landfill gas (LFG) and alleviate odors at this site, the following description of our current system is given.

The methane control system at the Bridgeton Landfill was installed to help alleviate odors assumed to originate from the site. The originally installed system collected LFG from two separate areas. The first area is the northern inactive portion of the current permit (118912). The second area consist of the currently active 33 acre pit. Both areas were designed to be connected to a blower/flare station consisting of the following components.

1) One John Zink Enclosed Ground Flare (Design max. flow of 2,500 cfm).
2) Two Lamson Model 810 centrifugal blowers (Design capacity of 1,900 cfm each).
3) One vertical condensate knockout tank.

The northern area consist of 10 vertical wells numbered W-1 through W-10, and 6304 ft. of buried HDPE collection lines. Recently, we have experienced problems with the collection lines at the juncture with the condensate knockout tank due to differential settlement. In order to prevent this problem from occurring in the future, we are planning to place the 121 ft of 18" HDPE pipe which is currently part of the system, above ground. This will allow us to more effectively monitor this portion of the collection system and prevent future problems.

Due to failure of the piping system in the southern area, this portion of the site is no longer connected to the blower/flare station mentioned above. LFG in the southern area is currently handled by the following system.

1) One portable blower/flare station (Design max. flow of 1000 cfm).

13570 ST. CHARLES ROCK ROAD, BRIDGETON, MISSOURI 63044 (314) 739-1919

LAIDLAW WASTE SYSTEMS (BRIDGETON), INC.
SANITARY LANDFILL

PERMIT CONSOLIDATION
ENGINEERING REPORT

June 1995

Prepared for:
LAIDLAW WASTE SYSTEMS (BRIDGETON), INC.
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI

Prepared by:
MIDWEST ENVIRONMENTAL CONSULTANTS, P.C.
522 EAST CAPITOL AVENUE
JEFFERSON CITY, MISSOURI

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Appendix 2 - Zoning Designations

Appendix 3 - Tonnage Fee Reports

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Figure 2 - General Highway Map for St. Louis County

Figure 3 - Flow Schematic of Permitted Leachate Management System

I. INTRODUCTION

Laidlaw Waste Systems (Bridgeton), Inc. owns and operates a sanitary landfill in Bridgeton, Missouri. The site is located approximately 0.75 miles north of Interstate 70 and immediately south of St. Charles Rock Road. This landfill operates under two separate permits: (1) the Missouri Department of Natural Resources (MDNR) Solid Waste Disposal Area Operating Permit No. 118912 which was issued on November 18, 1985 and (2) the St. Louis County Department of Health (DOH) Permit No. 0418.

The purposes of this document are as follows:

(1) Provide a comprehensive summary of the terms and conditions of the sanitary landfill's current permits.

(2) Prepare a master plan (site plan sheets) of all known appurtenances.

(3) Compare current operations to current regulations.

(4) Provide a history of the site.

In conjunction with this document, a set of engineering plan sheets has also been developed. The plan sheets are as follows:

Title Sheet
1. Quarter Mile Zoning and Land Use Map
2. Utilities and Property Map
3. Historic Development Plan
4. Existing Conditions
5. Original Bottom Contours and Leachate Collection
6. Permitted Gas Management System
7. Leachate Treatment System Design
8. Leachate Holding Lagoon Design
9. Intermediate Stormwater Management Plan (not available)
10. Final Development Plan
11. Cross Sections - I
12. Cross Sections - II
13. Cross Sections - III

14. Cross Sections - IV
15. Borrow Area Plan
16. Environmental Monitoring Plan
17. Leachate Collection System Details
18. Intermediate Stormwater Management Details (not available)
19. Miscellaneous Details
20. Permitted Gas System Details - I
21. Permitted Gas System Details - II
22. Permitted Gas System Details - III
23. Permitted Gas System Details - IV
24. Historical Details - I
25. Historical Details - II
26-39. As Built Gas Collection System (I-XIV)

This document along with the above-listed plan sheets are based primarily on the original conditions and documents of permit #118912. However, permit addendums and other significant historical correspondence documents also played a vital role in assembling this document and are therefore contained in Appendix 1. Other important sources of information in the preparation of this document include record searches, personnel interviews, and site inspections.

Throughout this document Laidlaw Waste Systems (Bridgeton), Inc. will simply be referred to as Laidlaw and the sanitary landfill that operates under the MDNR Solid Waste Disposal Area Operating Permit #118912 will be referred to as Bridgeton SLF.

II. SITE INFORMATION

This section provides detailed site information for the Bridgeton SLF. The specific topics addressed are site location, land use and zoning, site history, utilities, and site access and control.

A. Site Location

The landfill is located in U.S. Survey 131, Township 47 North, Range 5 East in St. Louis County, Missouri. This landfill is located approximately 0.75 miles north of U.S. Highway 70 and immediately south of St. Charles Rock Road. The landfill site is located entirely within the City of Bridgeton.

The applicable portions of the St. Charles Quadrangle United States Geological Survey (U.S.G.S.) Map and the General Highway Map for St. Louis County prepared by the Missouri Highway and Transportation Department are displayed as Figures 1 and 2 respectively.

B. Land Use and Zoning

The City zoning for the site and surrounding land within 1/4 mile of the site is shown on Plan Sheet 1. As can be seen from this plan sheet, the site includes the following zoning designations:

Regular Zoning Districts:

R-1: One Family Dwelling District

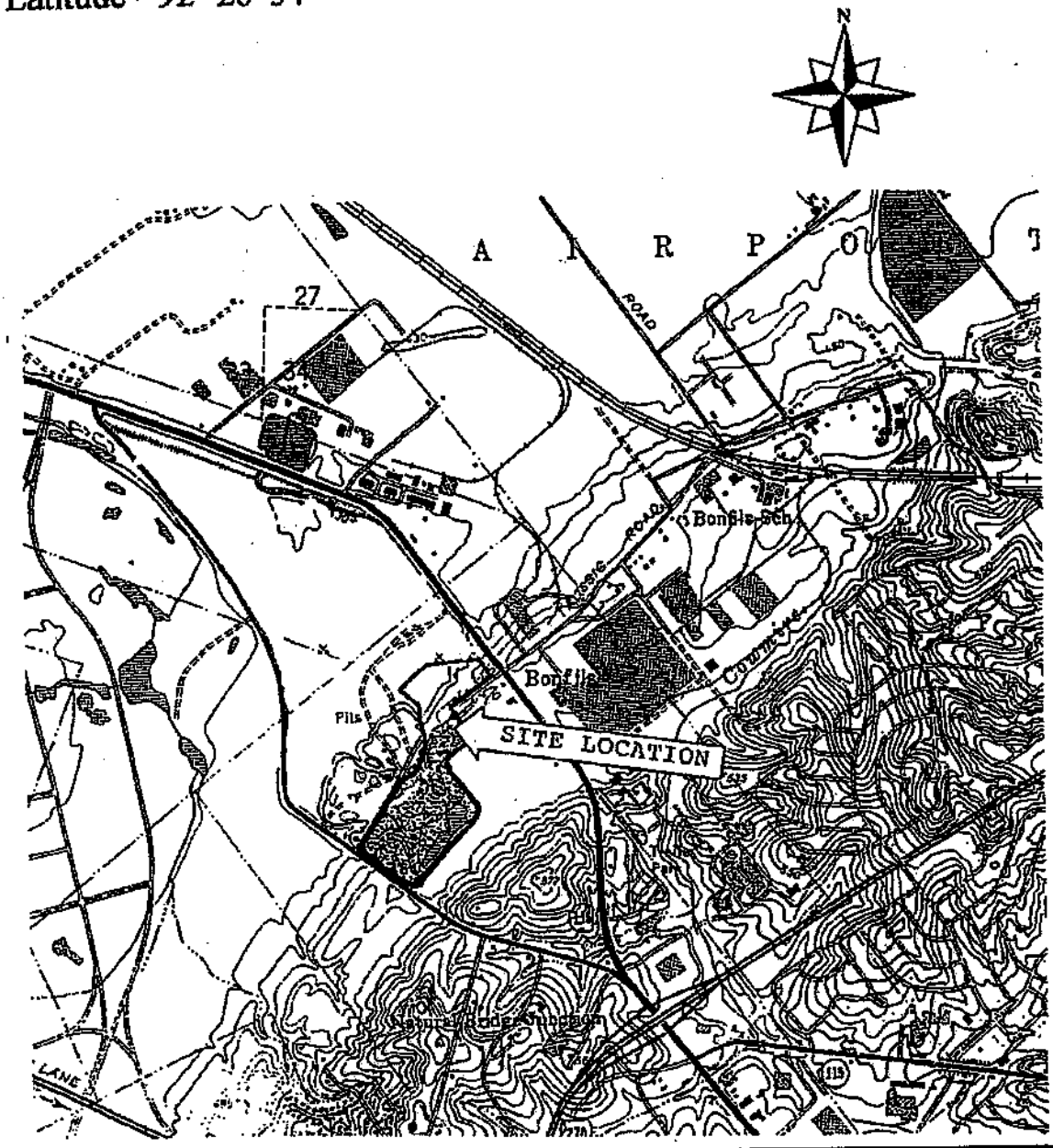
R-3: One Family Dwelling District

Project: Laidlaw Waste Systems (Bridgeton), Inc.
Permit Consolidation
Site Location Map
Project Number: 940130-004 **Date:** 6/95

Midwest Environmental Consultants, P.C.

Figure 1
Scale: 1"= 2000'
United States Geological Survey St. Charles, MO Quadangle

Longitude - 38° 46' 12"
Latitude - 92° 26' 34"

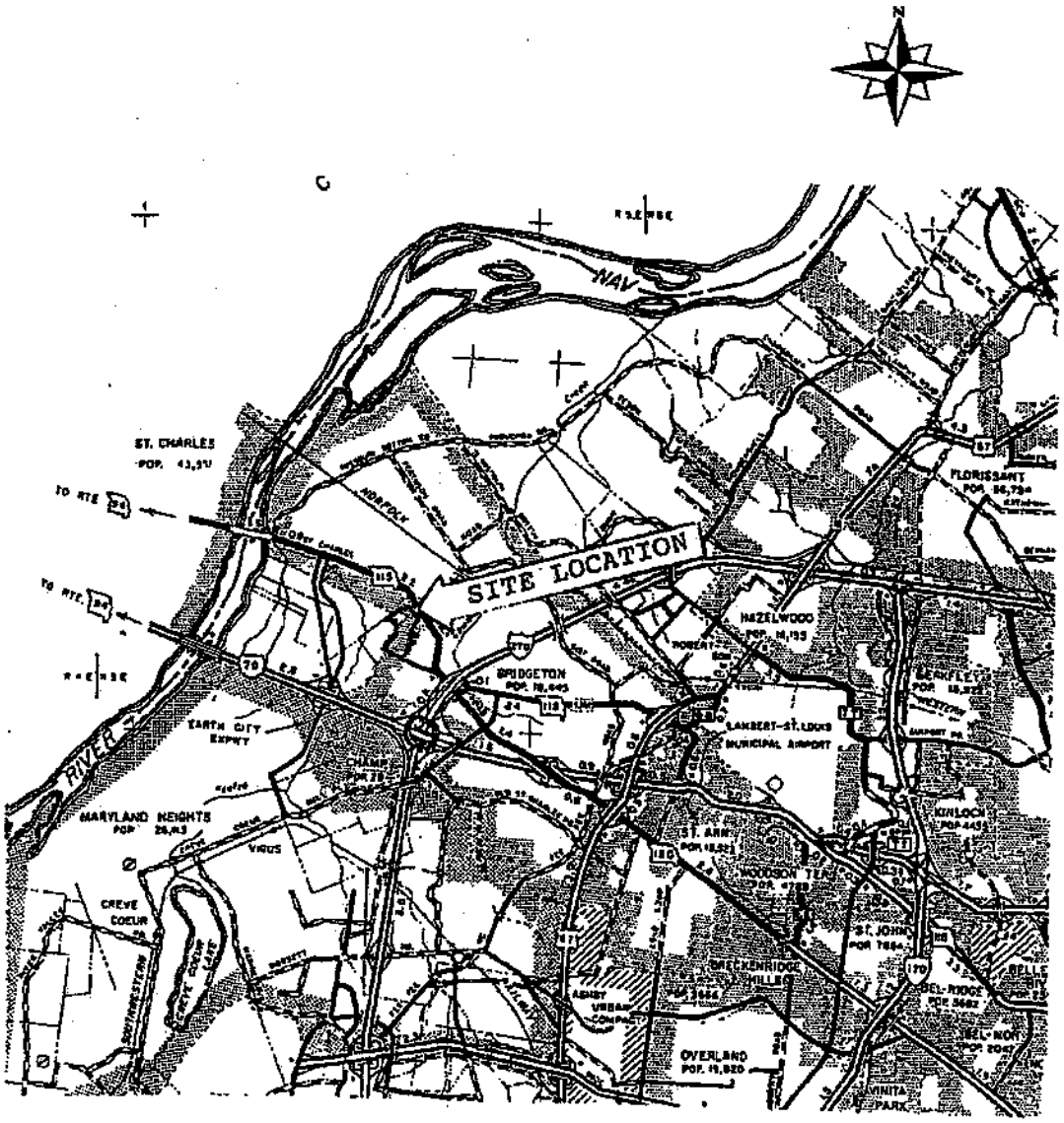


Project: Laidlaw Waste Systems (Bridgeton), Inc.
Permit Consolidation
Site Location Map
Project Number: 940130-004 **Date:** 6/95

Midwest Environmental Consultants, P.C.

Figure 2
Scale: 1"= 2 miles
General Highway Map for St. Louis County

Longitude - 38° 46' 12"
Latitude - 92° 26' 34"



B-3: Travel/Entertainment Services District

B-4: General Commercial District

M-1: Manufacturing District, Limited

M-2: Manufacturing District

Special Zoning Districts:

B-5(f): Planned Commercial District: West Lake Quarry Tract

M-3(g): Planned Manufacturing District: Northwest Industrial Park - 13575 St. Charles Rock Road

M-3(n): Planned Manufacturing District: West Lake Quarry Tract

See Appendix 2 for specific land use information for the above-listed zoning designations.

The property line depicted on Plan Sheet 1 (Land Use and Zoning Map), as well as all the other plan sheets which show the site's property line, assumes that Old St. Charles Rock Road is not abandoned. However, if Old St. Charles Rock Road is officially abandoned then the property line along the southern boundary would extend to the center line of Old St. Charles Rock Road.

C. Site History

It is estimated that the site has been utilized as a quarry since the early 1930s. On April 23, 1952, the Office of Zoning Enforcement of St. Louis County granted permission to V.R. Cruse and L.E. Trump, owners of the property, to operate a sanitary landfill. It is

assumed that the above-mentioned persons were full or partial owners of West Lake Quarry.

In a May 16, 1969 letter from H. Clifford Mitchell, P.E. (the Assistant Commissioner of Environmental Health Services for the St. Louis County Health Department) to Mr. William A Richter (Attorney) it was stated that prior to 1964 the facility was only authorized to accept combustible material (see Appendix 1). Following the closure of the Wade Landfill on Highway 67, the site was authorized to accept all forms of non hazardous solid waste. West Lake Landfill, Inc. became a separate entity from West Lake Quarry on its date of incorporation on February 16, 1962.

Prior to coming under state regulatory authority in the early 1970s, West Lake Landfill, Inc. had six separate disposal areas on the site. These areas, referred to as Areas 1-6, are shown on Plan Sheet 3. Subsequent to MDNR Formation, MDNR issued two permits for Areas 1-6. These were permit #218903 and permit #118903. It is not known exactly when each area was filled or with what each area is filled. However, based on the engineering report prepared by Rogers and Associates, Inc. in March 1974 and the accompanying plan sheets prepared by The Elbring Company, the following comments can be offered:

- Areas 1, 2, 3, 4 and 5 have all been used for both sanitary and demolition fill.
- Areas 2 and 4 were to be closed and completed at the time of the writing of the above-mentioned report.

- Areas 1, 3, 5, and 6 were originally used as sanitary fill areas; however, following the above-mentioned report they were to be sealed off with 24 inches of clay and used for demolition fill only. These areas were subsequently permitted under permit #218903.

- Area 6 is a partial and integral portion of Area 5 which had been completed as a fill area at the time of the writing of the above-mentioned report.

- No provisions were made for the collection of leachate. The engineering report states that it was confined to the fill areas by clay lining and cover of the refuse cells.

- Lateral gas movement from sanitary fill beneath demolition fill was to be controlled by gas vents. These vents were to be round openings filled with graded crushed limestone (see Plan Sheet 25 for detail).

The site came under state regulatory authority when the MDNR was formed in 1974. The site consists of a total of approximately 214 acres of which 52 acres are currently permitted under permit #118912. Since the inception of the MDNR, a total of approximately 86.5 acres either has been used or is currently in use as a sanitary landfill. In total, the site has received five separate MDNR sanitary landfill operating permits and two MDNR demolition landfill operating permits. The site's sanitary and demolition landfill permit history is summarized in Table 1 and the location of each permit area is shown on Plan Sheet 3.

Table 1
Bridgeton Site
Solid Waste and Demolition Landfill Permit History

No.	Type	Acreage	Issue Date	Consultant
218903[1]	Demolition	27	1/27/76	Rogers & Associates
118903	Sanitary	25	1/27/76[2]	Rogers & Associates
Addendum	3.5 acre expansion	3.5	5/23/78	Paul H. Himebaugh
118906	Sanitary	13	1/22/79	Paul H. Himebaugh
118908	Sanitary	6	8/27/80	Reitz & Jens, Inc.
118909	Sanitary	9	8/20/81	Reitz & Jens, Inc.
218912	Demolition	22	9/19/84	Burns & McDonnell
118912[3]	Sanitary	52	11/18/85	Burns & McDonnell

[1]Permit #218903 includes Areas 1, 3, 5, and 6.
[2]Actual Authorization was granted on 8/27/74.
[3]Permit #118912 supersedes permits #118909 and #118906; it represented a 33-acre expansion from the area permitted under permits #118909 and #118906.

According to permit #118912, there is a total of 52 acres available for landfill disposal. However, according to strict interpretation of the engineering report, there is only a total of 49 acres included in permit #118912. These 49 acres are comprised of the following areas:

Area (acres)	Description
13	Originally permitted area under permit #118906.
3	Expansion area under permit #118909 (permit #118909 was for a total area of 9 acres; however, 6 of these acres were originally permitted under permit #118906).
33	Expansion area under permit #118912.
49	Total

The acreage issue is further complicated by the fact that the permit boundary, which is implicitly shown on Drawing 2, Revision 3 of Burns & McDonnell's permit drawings (final revision date: July 27, 1987), measures approximately 54.1 acres instead of the 52

acres stated in the permit. Acreages are listed on this drawing for the three areas (Area 1, Area 2, and Northern Closure Area) that comprise the permitted area. These acreages total 52 acres; however, as previously stated they measure approximately 54.1 acres.

In an effort to further explore this issue the permitted area or assumed approximation was measured on the followings drawings:

Acreage	Drawing
54.0	Foth & Van Dyke; Bridgeton Sanitary Landfill; Figure 1; April 1993.
59.0	Paul H. Himebaugh, Consulting Engineer; Location & Area Maps with final Contours; West Lake Landfill, Inc.; Plate 1; Revision December 19, 1978. (The permit boundary south of permit #118906 was approximated based on the quarry wall.)

A contributing factor to this discrepancy is the fact that permit #118906 is listed as 13 acres on the issued permit, but measures 14.7 acres on the actual permit drawings. It is believed that Burns & McDonnell's permit boundary does not accurately reflect this portion of the permit boundary for permit #118912.

In addition to having multiple existing and closed sanitary and demolition landfills, the Bridgeton SLF is also a Superfund site as designated by the United States Environmental Protection Agency in 1990. This designation encompasses the entire site. Two areas on the site (totaling approximately 36.5 acres) that possess low-level radioactive wastes are collectively known as Operating Unit (OU)-1. The remainder of the site (that is, the entire site with the exception of the 36.5 acres known as OU-1) is referred to as OU-2.

Although further explanation of these areas is beyond the scope of this document, the two areas of OU-1 are shown on Plan Sheet 3.

In 1988 Laidlaw purchased all landfilling operations and associated properties from West Lake Landfill, Inc. and the name was legally changed to Laidlaw Waste Systems (Bridgeton), Inc., Sanitary Landfill. West Lake Quarries, Inc. possesses a license agreement and still operates the Red-Bird Ready-Mix plant; however, all quarrying operations have ceased at the site.

The site currently operates under permit #118912 which was issued on November 18, 1985. However, there have been a significant number of addendums issued since this date. In order to provide necessary thoroughness and detail all of these addendums along with the original permit letter and other significant correspondence are contained in Appendix 1. All permit addendums are summarized in the following listing.

Date: November 18, 1985
RE: Permit Issuance, Permit Number 118912
Conditions:

1. This permit, Solid Waste Disposal Area Operating Permit #118912, encompasses the proposed expansion area and additional solid waste fill by West Lake Landfill, Inc. over the disposal areas permitted under Solid Waste Disposal Area Operating Permit Numbers 118906 and 118909 issued to West Lake Landfill, Inc. This document supersedes and replaces the previous permits and permit documents.
2. West Lake Landfill, Inc. shall establish and maintain an escrow fund for the purpose of providing post-closure care and maintenance of the landfill. The amount and manner of maintaining this fund shall be as described in the approved permit documents.
   A. Fifty percent of the first yearly cost of this fund shall be deposited in this fund prior to acceptance of solid waste.
   B. The existence and maintenance of this fund shall be verified to the MDNR by the permittee prior to acceptance of solid waste. The maintenance of this fund shall be verified to the department annually prior to the anniversary date of establishment of the fund, in writing, by the financial institution wherein this fund is deposited.

3. An environmental assessment of the entire landfill site shall be initiated by West Lake Landfill, Inc. or any successor or assign ("hereinafter West Lake") immediately after the issuance of this permit. This assessment, including hydrogeologic investigation, shall be completed by November, 1986, and shall be used as the basis for the development of a monitoring program and feasibility study to assess necessary remedial action. The conclusions of the feasibility study shall be submitted to the MDNR within two years after the issuance of this permit. Implementation of necessary remedial action will be undertaken by West Lake in accordance with reasonable design and construction scheduling. Additional groundwater monitoring requirements will be required, based on review of the hydrogeologic investigation and feasibility study.
4. Initial training of the waste inspector (spotter) shall be provided so that he/she is able to adequately perform the duties as described in the permit documents. At a minimum, the initial training for this employee shall include:
   A. Familiarization with 10 CSR 80-3.010(3), solid waste excluded.
   B. Identification and recognition of unacceptable wastes, as described in 10 CSR 80-3.010(3).
   C. Familiarization with the necessary procedures to obtain approval of special waste disposal requests.
   D. Provision of a list of all special wastes approved for disposal by the MDNR.
5. Intermediate cover is not required until the fill is above the quarry rim, as proposed in the approved permit documents.
6. Leachate and sludge from leachate treatment shall be collected, treated and disposed of as per the approved permit documents.
   A. Leachate shall be treated and disposed of in accordance with all applicable water quality laws, rules, regulations, and policies as enforced by the Water Pollution Control Program, MDNR.
   B. West Lake Landfill, Inc. shall two times a year test the leachate and leachate treatment sludge for hazardous waste characteristics pursuant to 10 CSR 25-4.010 (2 through 5) and submit the results of such tests within 60 days to the MDNR. If hazardous wastes are detected in the leachate or sludge, West Lake Landfill, Inc. shall implement proper handling of such hazardous wastes in accordance with the Missouri Hazardous Waste Management law, Rules and Regulations.
   C. Sludge from the on-site leachate treatment system is acceptable for disposal at the landfill, unless tested to be a characteristic hazardous waste as per Condition #6B.
   D. Static leachate levels in the collection sumps in the unfilled area of the quarry, as shown in the approved permit documents, will be maintained at a level less than 30 feet above the base of the sump. The leachate level shall be checked monthly, recorded and made available upon MDNR request.
   E. Static leachate levels in the previously filled areas of the quarry, as shown on the approved permit documents, shall be maintained at a level less than 50 feet above the base of the sump. The leachate level shall be checked monthly, recorded and made available upon MDNR request.
7. A. Groundwater monitoring shall be required as per the document entitled Monitoring Program for the West Lake Landfill, Inc. Sanitary Landfill. The wells shall be sampled within 30 days of issuance of the permit. The first sample will be used as a

background sample and should be analyzed for the extended list of parameters, as if it were an annual analysis.

B. Three groundwater monitoring wells have been installed in the area of the grout curtain in the northeast corner of the large quarry. Two wells were installed during the placement of the initial grout curtain and were designated as groundwater monitoring wells (GWMW) #4/III and (GWMW) #14/III in the application for operating permit. The third well was installed during the placement of grout curtain #2 and was designated as groundwater monitoring well (GWMW) #17/IV in the application for operating permit. The water level in these wells shall be monitored monthly, recorded, and made available upon department request.

C. All three wells will be monitored, unless the department is requested to reevaluate the monitoring program. If requested and approved, one or more of the wells can be eliminated from the sampling program if hydraulic communication between the wells is verified.

D. Additional sampling points may be added to the monitoring program depending on the results of the hydrogeologic investigation (see Condition #4).

8. The following previously approved special wastes are approved for disposal under permit #118912:
   A. Fly ash derived from a coal burning industrial boiler, generated by McDonnell Douglas Corporation; 400 tons per month; approved November 1, 1984.
   B. Incinerator ash derived from municipal refuse incineration, generated by McDonnell Douglas Corporation; 800 cubic yards per month; approved November 1, 1984.
9. Each eight inch lift of the twelve-foot wide pad in the northeast corner should be tested for soil density to confirm that a minimum compaction of 90 percent of the standard proctor density is obtained.
10. All surface water discharges shall be made in accordance with all applicable air quality laws, rules, regulations, and policies as enforced by the Water Pollution Control Program, MDNR.
11. Methane gas shall be vented or burned in accordance with all applicable air quality laws, rules, regulations, and policies as enforced by the Water Pollution Control Program, MDNR.
12. Department review and approval of any planned final use is required prior to implementing a designated, commercial, final use of the site.
13. Within six months of the data of issuance of the permit, two copies of a final, comprehensive engineering report shall be submitted to the Waste Management Program. This report shall incorporate all present design and operating information into one reference manual detailing the final approved plans and specifications for the design and operation of the proposed sanitary landfill. This report shall incorporate all information required by regulation, eliminate all contradictory information, and include all revisions and additions to the original application for operating permit, as approved.

Date: March 13, 1987

Addendum: Expanded Gas Collection System and Utilization of Gas in Asphalt Plant (expansion consisted of nine collection wells, approximately 3,015 feet of collection pipe, a moisture removal unit, a blower building, and a waste gas flare)

Conditions: Continue to comply with all local requirements and maintain all necessary local permits and approvals.

Date: June 19, 1987
Addendum: Spray Irrigation of Treated Leachate
Conditions:
1. Land irrigation of the leachate shall cease after September 30, 1987.
2. Runoff of the treated leachate is not to enter surface drainage ditches.
3. Application rates shall be based on approved documents.
4. Land application of treated leachate shall conform to all applicable water quality laws, rules and permits enforced by the MDNR's WPCP.

Date: February 8, 1988
Addendum: Revised Chimney Drain Design (rock replaced with polyethylene drainage net that has geotextile bonded to both sides)
Conditions: None

Date: November 28, 1988
Addendum: Change of Ownership
Conditions: Refer to Appendix 3.

Date: May 10, 1989
Addendum: Revised Groundwater Monitoring Report Forms and Addition of TOX and TOC to Annual Sampling List
Condition: Failure to comply with any aspect of this program may be viewed as a violation of a condition of the solid waste disposal area permit.

Date: November 21, 1989
Addendum: Extended Operating Hours
Conditions:
1. Continued application of daily cover.
2. No operational difficulties traceable to the extension of operating hours.

Date: July 13, 1990
Addendum: Leachate Collection Sump (LCS-4) added and drain redirected.
Conditions: Conditions pursuant to the permit addendum are to comply with conditions specified in permit number 118912.

The department reserves the right to revoke, suspend or modify this addendum and/or permit number 118912 after due notice:
1. If it is found that the holder of the permit is in violation of the Missouri Solid Waste Management Law, or the Missouri Solid Waste Management Rules;
2. For failure to operate in accordance with the approved plans, specifications and operating procedures;
3. For failure to comply with any and all conditions of the permit;

4. For creating a public nuisance, health hazard or causing environmental pollution; or
5. If it is found that additional construction or alteration of the solid waste disposal area is necessary to comply with any and all rules promulgated in accordance with the Missouri Solid Waste Management Law.

Date: July 23, 1990
RE: MDNR request that an NPDES permit application be submitted for the demolition landfill.

Date: January 11, 1991
Addendum: Changes in Groundwater Monitoring Program
Condition: Submit by April 1, 1991 well abandonment procedures, well as-builts, boring logs and a background sample for each newly constructed well.

Date: July 31, 1992
Addendum: Modify Gas Collection System from a Passive to an Active System
Conditions:
1. Submit certification stating that implementation was in accordance with plans and specifications.
2. Meet requirements of sections 260.226 and 260.227, RSMo 1990 as applied to existing sanitary landfills to indicate any changes made as a result of this permit addendum. Also, submit revised closure/post-closure plans and cost estimates.
3. Obtain compliance with all applicable NPDES permits.

Date: September 9, 1992
RE: MDNR request for a financial assurance instrument to be submitted for both the sanitary and the demolition landfills. The deadline was 60 days from receipt of this letter.

Date: November 20, 1992
Addendum: Revised Closure/Post-Closure Plan
Conditions:
1. Submit certification stating that implementation was in accordance with plans and specifications.
2. Revise post-closure plans to reflect the additional costs for continued operational, maintenance, and incidental costs for operating pumps.
3. As part of the financial assurance for post-closure care, set up a separate funded irrevocable escrow or trust fund to cover the cost of perpetual care.

Date: January 5, 1993
Addendum: Use of Alternate Daily Cover
Conditions:
1. The Solid Waste Management Program must be notified of the day the trial period will begin;
2. Please submit two copies of the final bid specifications for the material to be used and two copies of a detailed operations manual specifying the final guidelines for the use of

the geotextile daily cover;
3. Upon completion of the six month trial period, please submit two copies of a detailed report, including but not limited, to daily records of whether or not the panel was used, weather conditions, unforeseen operational problems, notes on the performance and status of the geotextile, any reportable increase in leachate generated, conclusions and recommendations from the use of the geotextile daily cover.

Date: February 10, 1993
Addendum: Relocation of Gas Flare
Conditions:
1. Submit certification stating that implementation was in accordance with plans and specifications.
2. Meet requirements of sections 260.226 and 260.227, RSMo 1990 as applied to existing sanitary landfills to indicate any changes made as a result of this permit addendum. Also, submit revised closure/post-closure plans and cost estimates.
3. Obtain compliance with all applicable NPDES permits.
4. Submit as-built drawings.

Date: October 8, 1993
Addendum: Subtitle D Extension
Conditions:
1. Remain in compliance with all permit conditions.
2. Develop filling progression to promote stormwater drainage in order to minimize infiltration and leachate generation, while maintaining effective soil erosion control.
3. Limit the landfill to the permitted horizontal and vertical boundaries while maintaining sideslopes of 33 percent or less. Limit accepted wastes to flood debris and other solid wastes.

Operating and Closure Requirements:
1. Establish survey controls within 60 days upon receipt of this addendum letter.
2. Obtain compliance with all applicable NPDES permits as a result of any changes resulting from this extension.
3. Place three feet of final cover upon closure. Provide certification by a professional engineer of final cover depth on 50-foot centers.
4. Establish vegetation on disposal area and borrow area within 180 days after placement of final cover.
5. Submit the following within 60 days upon receipt of this addendum letter: (1) revised closure/post-closure plans and cost estimates, and (2) revised financial assurance instrument, if necessary.
6. Submit the following by June 9, 1994 (if the facility was closed by April 9, 1994):
   - Final grades and as-builts drawings which include associated landfill appurtenances to show proper final development of this landfill in accordance with this extension.
   - Details concerning the types and depth of final cover verified on 50-foot centers and vegetation establishment.

- Submit a topographic boundary survey designating the entire permitted acreage including final grades and associated landfill appurtenances in accordance with 10 CSR 80-3.010(16)(C)2.

Date: October 28, 1993
Addendum: Modified life of permit to be for the anticipated life of the facility.
Conditions: None.

Date: March 8, 1994
Addendum: Landfill fire mitigation
Conditions:
1. Apply a professional engineer's seal to document entitled "Proposal, Landfill Fire Mitigation, Laidlaw Bridgeton Sanitary Landfill, Bridgeton, Missouri" within 30 days.
2. Seek prior written approval for any changes in operation and/or design other than those described in the application and approved in permit.
3. Submit three copies of report to the SWMP.
4. The quarterly gas monitoring report to be sent to the SWMP is to include all reports on continuing monitoring and maintenance efforts for control of the fire.

Date: May 4, 1994
Addendum: Subtitle D liner waiver on the ramp leading into the landfill and the side walls of the landfill. Also, fire mitigation proposal approved.
Conditions:
1. Report on efforts to mitigate the current and any future landfill fire.
2. Report on the effectiveness of the current soil liner to control gas migration out of the landfill.
3. Submit an additional modification request for the liner showing how the landfill gas shall be controlled if the landfill cannot be controlled by the soil liner.

Date: May 4, 1994
Addendum: Interim stormwater detention basins and a gas condensate line.
Conditions:
1. Submit certification within 30 days of completion.
2. Submit to St. Louis Regional Office two copies of as-built drawings within 60 days of completion of construction if gas condensate line is located different from location shown in drawing.
3. Notify St. Louis Regional Office of all permits for storm water discharges.

Date: August 30, 1994
Addendum: Use of petroleum contaminated soil as an alternative daily cover for a six (6) month trial period.
Conditions:
1. The petroleum contaminated soil is approved for use only as daily cover material and shall not be used for intermediate cover or final cover.
2. The beneficial use of petroleum contaminated soils as daily cover materials shall follow

disposal and testing practices as outlined in the solid waste technical bulletins entitled Special Waste Technical Bulletin (dated January 1992) and Disposal of Soil Contaminated with Virgin Gasoline or Virgin Fuel Oil (dated December 1991) and shall meet the cover requirements as specified in the Missouri Solid Waste Management Law and Rules 10 CSR 80-3.010(14). Contaminated soils shall meet a classification of or be mixed with other cover soils to meet a Unified Soil Classification of CH, CL, ML, MH, or SC for daily cover.

3. The owner/operator shall screen the incoming petroleum contaminated soil for excessive or offensive odor emissions and for foreign debris or other items which would create an unsightly appearance and interfere with or limit its use as daily cover.
4. Within sixty (60) days of completion of the trial period, two copies of a detailed report must be submitted including but not limited to daily records of whether or not the alternative cover was used, weather conditions, unforeseen operational problems, any reportable increase in leachate generated, photographs, conclusions, and recommendations concerning the use of the contaminated soil as daily cover.
5. Petroleum contaminated soils shall not be used as daily cover when the following are detected:
   A. Soil contaminated with petroleum products has strong offensive odor;
   B. Soil contaminated with petroleum products contains excessive debris which would create an unsightly appearance on the landfill;
   C. Soil contaminated with petroleum products which is received during periods of excessive wet or severe inclement weather could result in contaminated surface water runoff from the active fill face when it is used as daily cover; or
   D. Soil contaminated with petroleum products does not meet the required testing limits as described in the aforementioned technical bulletins.
6. The use of soil contaminated with petroleum products shall not be used as daily cover in waste disposal cells located at the approved final waste contours or in locations where storm water runoff from the active face cannot be removed or collected through a leachate collection system for treatment.
7. Prior to use of petroleum contaminated soil as daily cover material the generator of the waste must provide lab results with a special waste disposal form on representative samples of the soil. Two copies of the testing results shall be submitted to the MDNR's St. Louis Regional Office.
8. The use of petroleum contaminated soil as daily cover material must conform to all applicable water quality laws, rules, regulations and permits which are enforced by the MDNR's Water Pollution Control Program.
9. The use of petroleum contaminated soil as daily cover material must conform to all applicable air quality laws, rules, regulations and permits which are enforced by the appropriate air pollution control regulatory agency.

Date: March 15, 1995
Addendum: Removal of cardboard near the working face of the landfill.
Conditions: MDNR reserves the right to revoke, suspend, or modify this approval and/or permit number 118912 after due notice, if the permit holder fails to maintain the facility in compliance with the state's Solid Waste Management Law and Rules, the terms and

conditions of the permit, and approved engineering plans and specifications.

Date: April 12, 1995
Addendum: Modification of operations to extract cardboard from incoming loads at the edge of the working face (St. Louis Department of Health).
Conditions: None listed.

D. Utilities

Specific information and location of all known utilities are shown on Plan Sheet 2. Utilities include storm sewers, gas lines, water lines, electrical lines, sanitary sewers, and septic tanks.

Electrical power for the facility is supplied by Union Electric (UE). The electrical demands of this facility consist of lighting, HVAC of the landfill office, the gas flare system, pumps and aerators for leachate management, and miscellaneous electrical requirements for maintenance. UE supplies 3 phase power to the facility. There have been no known problems with the power supply.

According to the engineering report (January 1986), there were no utility easements or lines located on the actual disposal site. Also, there were no known water supply wells within the 1/4-mile surrounding boundary.

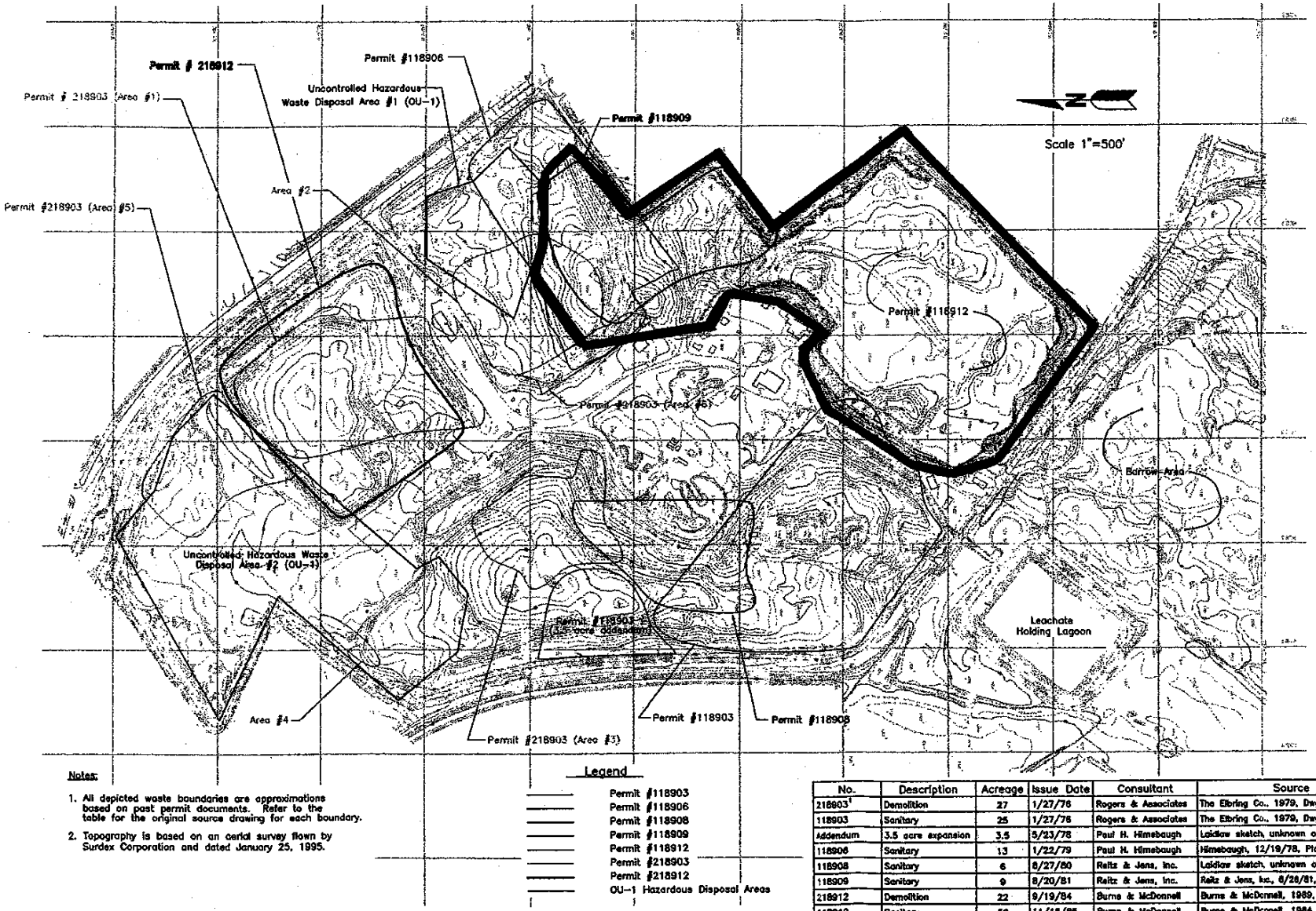
E. Site Access and Control

Access to the landfill is provided by St. Charles Rock Road, a main entrance road, and landfill service roads (see Plan Sheet 4). The site is always accessible using St. Charles Rock Road since it is not susceptible to flooding or closing due to inclement weather. The main entrance road is an all weather asphalt surface. Landfill service roads are constructed

as needed for access to the working face. All entering vehicles must pass by the landfill office and then by the scale house prior to proceeding toward the working face.

Current operating hours are from 3:00 a.m. to 4:00 p.m. Monday through Friday and from 6:00 a.m. to 1:00 p.m. on Saturday.

Figure 3
Historical Permit Limits



Notes:

1. All depicted waste boundaries are approximations based on past permit documents. Refer to the table for the original source drawing for each boundary.
2. Topography is based on an aerial survey flown by Surdex Corporation and dated January 25, 1995.

Legend

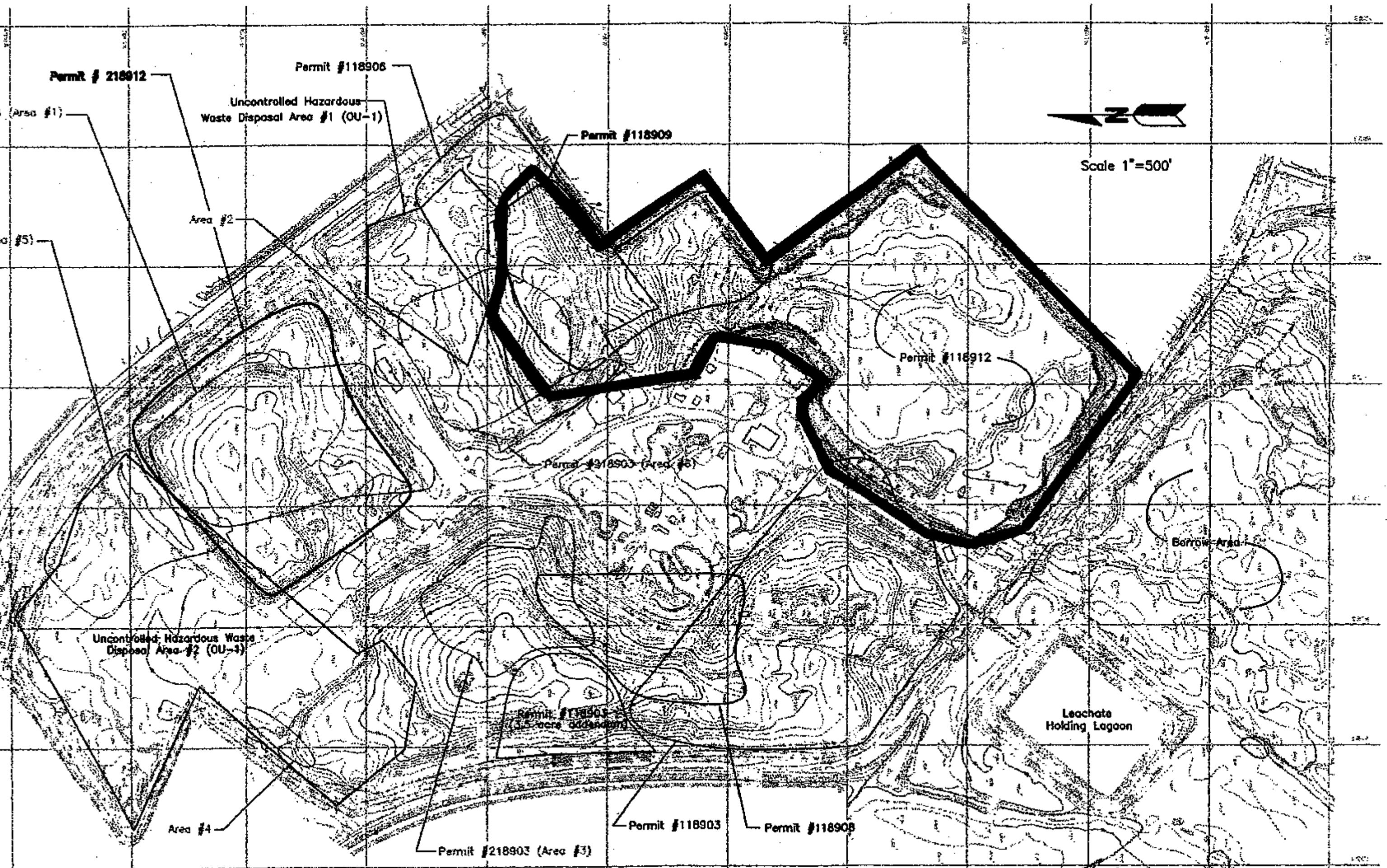
- Permit #118903
- Permit #118906
- Permit #118908
- Permit #118909
- Permit #118912
- Permit #218903
- Permit #218912
- OU-1 Hazardous Disposal Areas

No.	Description	Acreage	Issue Date	Consultant	Source
218903[1]	Demolition	27	1/27/76	Rogers & Associates	The Elbring Co., 1979, Dwg 3-1
118903	Sanitary	25	1/27/76	Rogers & Associates	The Elbring Co., 1979, Dwg 3-1
Addendum	3.5 acre expansion	3.5	5/23/78	Paul H. Himebaugh	Laidlaw sketch, unknown origin
118906	Sanitary	13	1/22/79	Paul H. Himebaugh	Himebaugh, 12/19/78, Plate 1
118908	Sanitary	6	8/27/80	Reitz & Jens, Inc.	Laidlaw sketch, unknown origin
118909	Sanitary	9	8/20/81	Reitz & Jens, Inc.	Reitz & Jens, Inc., 8/28/81, Sheet 2 of 3
218912	Demolition	22	9/19/84	Burns & McDonnell	Burns & McDonnell, 1989, Dwg 2
118912	Sanitary	52	11/18/85	Burns & McDonnell	Burns & McDonnell, 1984, Dwg 4
OU-1, Area 1	Hazardous Waste	8.3	N/A	N/A	Burns & McDonnell, 1989, Dwg 1A
OU-2, Area 2	Hazardous Waste	30.2	N/A	N/A	Burns & McDonnell, 1989, Dwg 1A

[1] Includes Areas 1, 3, 5, and 6. These areas received sanitary waste fill prior to receiving MDNR Demolition Permit No. 218903. Areas 2 and 4 were denied permitting by MDNR, however, they also received waste fill prior to permit denial by MDNR.

Project: Laidlaw Waste Systems (Bridgeton), Inc.
Facility Upgrade And Permit Modification

Figure 3
Historical Permit Limits



Legend

- Permit #118903
- Permit #118906
- Permit #118908
- Permit #118909
- Permit #118912
- Permit #218903
- Permit #218912
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218912	Demolition	22	9/19/84	Burns & McDonnell	Burns & McDonnell, 1989, Dwg 2
118912	Sanitary	52	11/18/85	Burns & McDonnell	Burns & McDonnell, 1984, Dwg 4
OU-1, Area 1	Hazardous Waste	6.3	N/A	N/A	Burns & McDonnell, 1989, Dwg 1A
OU-2, Area 2	Hazardous Waste	30.2	N/A	N/A	Burns & McDonnell, 1989, Dwg 1A

[1] Includes Areas 1, 3, 5, and 6. These areas received sanitary waste fill prior to receiving MDNR Demolition Permit No. 218903. Areas 2 and 4 were denied permitting by MDNR, however, they also received waste fill prior to permit denial by MDNR.

Project: Laidlaw Waste Systems (Bridgeton), Inc.
Facility Upgrade And Permit Modification

Project Number: 940130-004 Date: 12/95

MIDWEST ENVIRONMENTAL CONSULTANTS, P.C.

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

September 29, 1995

Mr. Jim Bell
Chief, Enforcement Section
Solid Waste Management Section
P.O. Box 176
Jefferson City, Missouri 65102

Re: Bridgeton Landfill, Permit Number 118912, Gas Monitoring

Dear Mr. Bell:

Enclosed are the results of our gas monitoring program for the 3rd quarter monitoring period. A summary of the results follows:

Perimeter monitoring: Bar punch monitoring was conducted at the property boundary at the locations indicated on the enclosed map. The additional locations written on the map were randomly selected for additional monitoring. All bar punch tests were conducted by driving a 3/8 inch rod 3 feet into the soil, removing the rod and inserting a hose connected to a GEM-500 gas extraction monitor. All bar punch monitoring showed zero methane migration.

Continuous Monitoring: We have installed GHD 2000 gas monitors in five separate onsite buildings. These monitors are set to alert occupants should gas levels reach 5-15% of the LEL, well below the 25% Missouri standard. There has never been an event indicated by our alarm system suggesting concentrations of methane approaching the 25% standard.

The underground fire which was located along the northern quarry wall, immediately north of Sed-Basin 1, shows no signs of activity.

If you have any questions concerning our monitoring program and procedures, please do not hesitate to contact me at 739-1919.

Sincerely;

Brad Pollock

Brad Pollock
Operations Manager

cc: Mr. Terry Hoevelkamp, MDNR St. Louis Region
Mr. Brad Bomanz, St. Louis County DOH

gassept

File Westlake

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

RECEIVED
OCT 06 1995
SWMP

October 3, 1995

Mr. Brad Bomanz, Waste Specialist III
St. Louis County Department of Health
Waste Management Section
111 South Meramec Avenue
Clayton, Missouri 63105

Dear Mr. Bomanz:

The purpose of this letter is to update you on recent events at the Bridgeton Sanitary Landfill concerning underground combustion. This site has historically experienced evidence of underground fires in two locations. The first being located adjacent to the quarry wall in the immediate vicinity of sed-basin 1. This area is monitored daily and there has been no evidence of further combustion in this area. The second and most recent location of underground combustion was located in the vicinity of the gas collection well W-4 which is located in the northern inactive area. This area is also monitored on a daily basis and again, no further evidence of combustion has been observed.

As part of the Remedial Investigation and Feasibility Study (RIFS) for Operable Unit 1 (OU1), soil borings were conducted in the area immediately west of W-4; the closest boring being approximately 75 feet from this well. During the course of the excavation of this material, it was reported to Laidlaw by McLaren Hart that some of the material appeared to have elevated temperatures; the highest temperature recorded being 140°F. According to the report prepared for Laidlaw by SCS Engineers in the remediation of the underground fire located near sed-basin 1, this is considered to be in the normal temperature range for deep landfills such as Bridgeton. It should be noted that no physical evidence of combustion was present: that is, no blackened or charred material and no smoke.

Due to the close proximity of this boring to an area with a history of underground combustion we are currently conducting temperature investigations in the well field. With the exception of W-2, all ten wells have been investigated by using a Type K Thermocouple thermometer attached to a 100 ft. cable. This device allows for quick temperature readings at different depths. As the attached table shows, some of the wells contain temperatures above the 140°F mark. At the present time we do not believe that these temperatures are an indication of present combustion and in fact may still be in what can be considered normal temperature ranges. We are continuing to research and investigate these findings and will keep you informed as to our progress.

ltrmtpdt

Should you have any questions concerning this matter please do not hesitate to contact me at 739-1919.

Sincerely,

Brad Pollock

Brad Pollock
Operations Manager

c: Mr. Larry Giroux, LWS
Mr. Doug Borro, LWS
Mr. John Workman, P.E., LWS
Mr. Dennis Wike, LWS
Mr. Lee Tharp, P.E., MEC
Mr. Ward Herst, CPHG, CEM, Golder Associates
Mr. David Heinze, McLaren Hart
Mr. Frank Dolan, P.E., MDNR-SWMP

fireupdt

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

January 31, 1996

RECEIVED
FEB 13 1996
SWMP

Mr. Jim Bell
Chief, Enforcement Section
Solid Waste Management Section
P.O. Box 176
Jefferson City, Missouri 65102

Re: Bridgeton Landfill, Permit Number 118912, Gas Monitoring

Dear Mr. Bell:

Enclosed are the results of our gas monitoring program for the 4th quarter monitoring period. A summary of the results follows:

Perimeter monitoring: Bar punch monitoring was conducted at the property boundary at the locations indicated on the enclosed map. The additional locations written on the map were randomly selected for additional monitoring. All bar punch tests were conducted by driving a 3/8 inch rod 3 feet into the soil, removing the rod and inserting a hose connected to a GEM-500 gas extraction monitor. All bar punch monitoring showed zero methane migration.

Continuous Monitoring: We have installed GHD 2000 gas monitors in five separate onsite buildings. These monitors are set to alert occupants should gas levels reach 5-15% of the LEL, well below the 25% Missouri standard. There has never been an event indicated by our alarm system suggesting concentrations of methane approaching the 25% standard.

The underground fire which was located along the northern quarry wall, immediately north of Sed-Basin 1, shows no signs of activity.

If you have any questions concerning our monitoring program and procedures, please do not hesitate to contact me at 739-1919.

Sincerely;

Brad Pollock
Operations Manager

cc: Mr. Terry Hoevelkamp, MDNR St. Louis Region
Mr. Brad Bomanz, St. Louis County DOH

gasdec

LAIDLAW

LAIDLAW WASTE SYSTEMS INC.

July 1, 1996

RECEIVED

JUL 05 1996

SWMP

Mr. Jim Bell
Chief, Enforcement Section
Solid Waste Management Section
P.O. Box 176
Jefferson City, Missouri 65102

Re: Bridgeton Landfill, Permit Number 118912, Gas Monitoring

Dear Mr. Bell:

Enclosed are the results of our gas monitoring program for the 2nd quarter monitoring period. A summary of the results follows:

Perimeter monitoring: Bar punch monitoring was conducted at the property boundary at the locations indicated on the enclosed map. The additional locations written on the map were randomly selected for additional monitoring. All bar punch tests were conducted by driving a 3/8 inch rod 3 feet into the soil, removing the rod and inserting a hose connected to a GEM-500 gas extraction monitor. All bar punch monitoring showed zero methane migration.

Continuous Monitoring: We have installed GHD 2000 gas monitors in five separate onsite buildings. These monitors are set to alert occupants should gas levels reach 5-15% of the LEL, well below the 25% Missouri standard. There has never been an event indicated by our alarm system suggesting concentrations of methane approaching the 25% standard.

The underground fire which was located along the northern quarry wall, immediately north of Sed-Basin 1, shows no signs of activity.

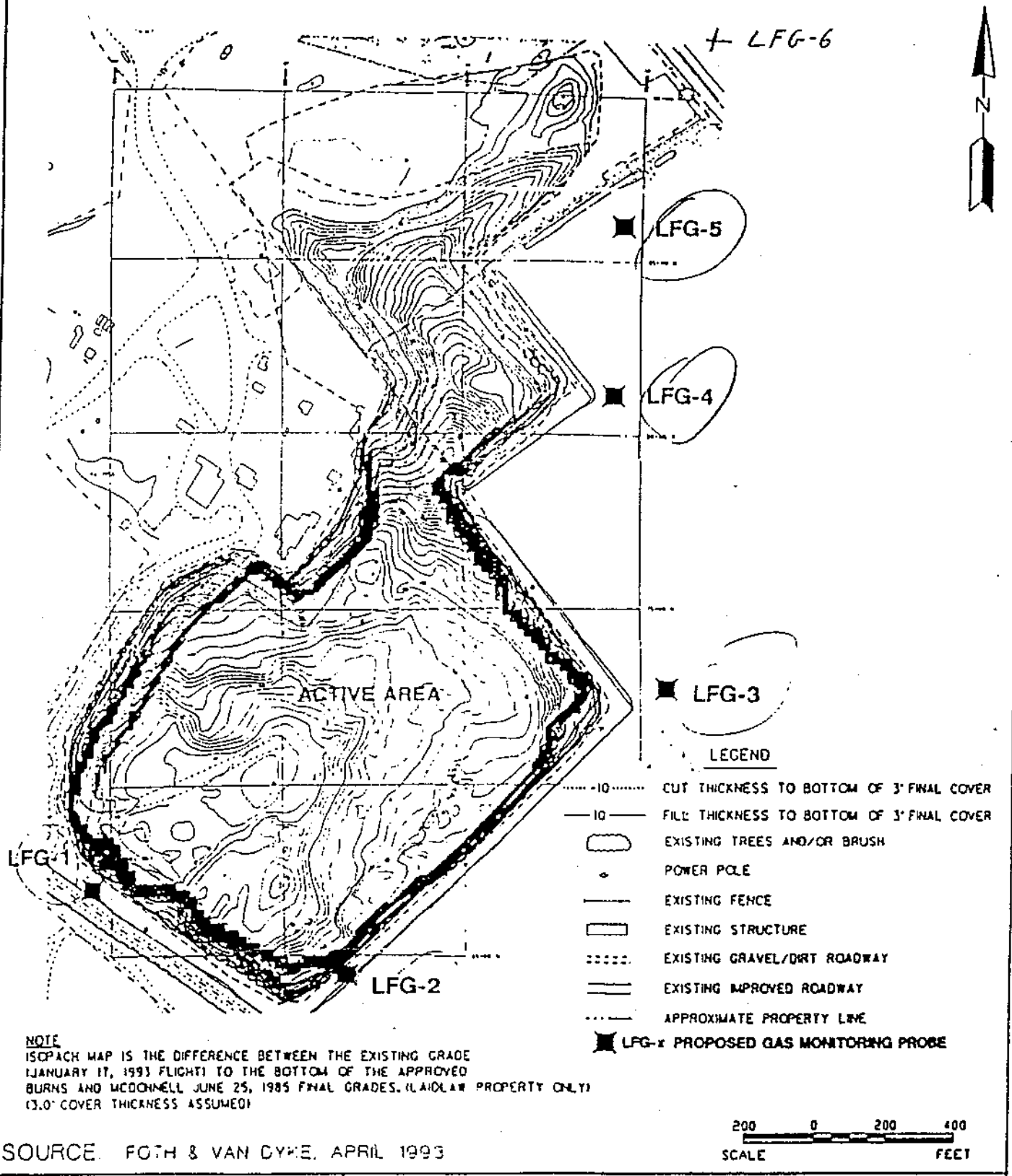
If you have any questions concerning our monitoring program and procedures, please do not hesitate to contact me at 739-1919.

Sincerely;

Larry Sirotux
Sr. Division General Manager

cc: Mr. Terry Hoevelkamp, MDNR St. Louis Region
Mr. Brad Bomanz, St. Louis County DOH

gasdec



SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
2060 READING ROAD SUITE 200 CINCINNATI, OHIO 45202
PH. (513) 421-5353 FAX NO. (513) 421-2847

PROJ. NO	DATE	SCALE
05930300.01	SEPTEMBER 1993	AS SHOWN

FIGURE 2.1.3

PROPOSED GAS PROBE PLAN

LAIDLAW WASTE SYSTEMS (WEST LAKE), INC.
BRIDGETON SANITARY LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI 63044

FIGURE 3.5.1

LAIDLAW WASTE SYSTEMS

EXPLOSIVE GAS MONITORING FIELD DATA SHEET

Site: BRIDGETON SLF

Personnel: Tim Johnson Date: 6/28/96

METEOROLOGIC DATA: Attach data from preceding days (Optional)
Ambient Temperature: 93° Barometric Pressure: 29.10 (Inches Hg.)
Measurement Sta.: ☐ NOAA: _____ ☑ On-site ☐ Other: _____

MONITORING LOCATION TYPE: (Use separate Field Data Sheets for each type of data)
Monitoring Probe: ☐
Borehole Probe: ☑
Continuous Monitor: ☐
Hand Held (Ambient): ☐

FIELD INSTRUMENTATION: (Attach calibration data)
LEL Meter: Mod. No.: Gem 500 S/N: Gem 140 Calib. Date/Time: 6/28/96 8:42 AM
Pressure Gauge: Mod. No.: _____ S/N: _____ Calib. Date/Time: ___/___/___ ___:___
Water Level Mat: Mod. No.: _____ S/N: _____ Calib. Date/Time: ___/___/___ ___:___
Other: _____ Mod. No.: _____ S/N: _____ Calib. Date/Time: ___/___/___ ___:___

LOCATION IDENTIFICATION:	LFG 1	LFG 2	LFG 3	LFG 4	LFG 5	LFG 6
Monitoring Probe Construction:						
Total Depth (feet):	3' BARhole	3' BARhole	3' BARhole	3' BARhole	3' BARhole	3' BARhole
Depth to Top of Screen (feet):	NA	NA	NA	NA	NA	NA
Monitoring Probe Condition:	NA	NA	NA	NA	NA	NA
Clearly Labeled?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Prot. Csg. in Good Condition?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Concrete Pad Intact?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Padlock Functional?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Inner casing properly capped?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Sample fitting in Good Condition?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

I certify that these data were obtained in accordance with applicable regulatory and project protocols:
Signature: Tim Johnson Date: 6/28/96

CALIBRATION: COMPRESSED GAS FROM LANDFILL CONTROL TEC,
50.0% METHANE
35.0% CARBON DIOXIDE
BALANCE - NITROGEN
5.0% OXYGEN
BALANCE - CARBON DIOXIDE

FIGURE 3.5.1

LAIDLAW WASTE SYSTEMS

EXPLOSIVE GAS MONITORING FIELD DATA SHEET

Site: BRIDGETON SLF

Personnel: Tim JOHNSON Date: 6/28/96

METEOROLOGIC DATA: Attach data from preceding days (Optional)

Ambient Temperature: 93° Barometric Pressure: 29.10 (inches Hg.)

Measurement Sta.: ☐ NOAA: _____ ☒ On-site ☐ Other: _____

MONITORING LOCATION TYPE: (Use separate Field Data Sheets for each type of data)

Monitoring Probe: ☐

Barhole Probe: ☒

Continuous Monitor: ☐

Hand Held (Ambient): ☐

FIELD INSTRUMENTATION: (Attach calibration data)

LEL Meter:	Mod. No.: Gem 500	S/N: Gem 1440	Calib. Date/Time: 6/28/96	8:42 AM
Pressure Gauge:	Mod. No.:	S/N:	Calib. Date/Time: / /	:
Water Level Mel:	Mod. No.:	S/N:	Calib. Date/Time: / /	:
Other:	Mod. No.:	S/N:	Calib. Date/Time: / /	:

LOCATION IDENTIFICATION:	LFG 7					
Monitoring Probe Construction:						
Total Depth (feet):	3' BARhole					
Depth to Top of Screen (feet):	N/A					
Monitoring Probe Condition:	N/A					
Clearly Labeled?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Prot. Csg. In Good Condition?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Concrete Pad Intact?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Padlock Functional?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Inner casing properly capped?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Sample fitting in Good Condition?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

I certify that these data were obtained in accordance with applicable regulatory and project protocols:

Signature: Tim Johnson Date: 6/28/96

FIGURE 3.5.1 (CONTINUED)

LAIDLAW WASTE SYSTEMS — **EXPLOSIVE GAS MONITORING FIELD DATA SHEET – page 2 of 2**

Site: BRIDGETON SLF

Personnel: Tim JOHNSON Date: 6/28/96

LOCATION IDENTIFICATION:	LFG 1	LFG 2	LFG 3	LFG 4	LFG 5	LFG 6
Field Measurements:						
1. Turn on instrument and wait for Main Menu Screen to appear.						
2. Select 2 – Read Gas Level						
3. Select 2 – No, unless data is to be stored						
4. Gas Levels Screen will appear.						
5. Press Key 5 – Pump to turn pump on and draw a gas sample						
Wait at least 45 seconds and record data:	CH_4% 0% CO_2% 0% O_2% 21.0 Balance 78.79	CH_4% 0% CO_2% 0% O_2% 20.07 Balance 79.78	CH_4% 0% CO_2% 0% O_2% 20.1 Balance 79.81	CH_4% 0% CO_2% 0% O_2% 21.0 Balance 79.9	CH_4% 0% CO_2% 0% O_2% 20.3 Balance 79.69	CH_4% 0% CO_2% 0% O_2% 20.1 Balance 78.62
6. Select Key 1 to display LEL Screen and record data:	Gas % 0% LEL % 0%	Gas % 0% LEL % 0%	Gas % 0% LEL % 0%	Gas % 0% LEL % 0%	Gas % 0% LEL % 0%	Gas % 0% LEL % 0%
7. Select 0 – Exit to return to read Gas Levels Screen.	9:00 AM	9:11 AM	9:22 AM	9:30 AM	9:35 AM	9:38 AM
8. Select Key–1 Continue.						
9. Select 3 – Zero. Pressures follow instructions. Be sure to disconnect hoses before zeroing pressure (Key–1).						
10. Select Key–0 Exit. Record:	Static Pressure Dif Pressure (If applicable)	Static Pressure Dif Pressure (If applicable)	Static Pressure Dif Pressure (If applicable)	Static Pressure Dif Pressure (If applicable)	Static Pressure Dif Pressure (If applicable)	Static Pressure Dif Pressure (If applicable)
11. Select Key–0 Exit until General Utilities Screen reappears.						
12. To continue monitoring, start at Step 5. To quit, exit using Key–0.						

Dif. = Differential Pressure

This is a quick reference guide and not intended as a substitute for the Operations Manual for the GEM–500.

FIGURE 3.5.1 (CONTINUED)

LAIDLAW WASTE SYSTEMS — **EXPLOSIVE GAS MONITORING**

FIELD DATA SHEET – page 2 of 2

Site: BRIDGETON SLF

Personnel: Tim Johnson Date: 6/28/96

LOCATION IDENTIFICATION:	LFG 7					
Field Measurements:						
1. Turn on instrument and wait for Main Menu Screen to appear.						
2. Select 2 – Read Gas Level.						
3. Select 2 – No, unless data is to be stored.						
4. Gas Levels Screen will appear.						
5. Press Key 5 – Pump to turn pump on and draw a gas sample. Wait at least 45 seconds and record data:	CH_4 % 0% CO_2 % 12% O_2 % 21.0 Balance 79.9	CH_4 % CO_2 % O_2 % Balance	CH_4 % CO_2 % O_2 % Balance	CH_4 % CO_2 % O_2 % Balance	CH_4 % CO_2 % O_2 % Balance	CH_4 % CO_2 % O_2 % Balance
6. Select Key 1 to display LEL Screen and record data:	Gas % 0% LEL % 0%	Gas % LEL %	Gas % LEL %	Gas % LEL %	Gas % LEL %	Gas % LEL %
7. Select 0 – Exit to return to read Gas Levels Screen.	9:50 AM					
8. Select Key–1 Continue.						
9. Select 3 – Zero. Pressures follow instructions. Be sure to disconnect hoses before zeroing pressure (Key–1).						
10. Select Key–0 Exit. Record:	Static Pressure — Dif Pressure (if applicable)	Static Pressure Dif Pressure (if applicable)	Static Pressure Dif Pressure (if applicable)	Static Pressure Dif Pressure (if applicable)	Static Pressure Dif Pressure (if applicable)	Static Pressure Dif Pressure (if applicable)
11. Select Key–0 Exit until General Utilities Screen reappears.						
12. To continue monitoring, start at Step 5. To quit, exit using Key–0.						

Dif. = Differential Pressure

This is a quick reference guide and not intended as a substitute for the Operations Manual for the GEM–500.

BRIDGETON
Landfill Authority

RECEIVED
OCT 08 1997
SWMP

October 6, 1997

Mr. Jim Bell
Chief, Enforcement Section
Solid Waste Management Section
P.O. Box 176
Jefferson City, Missouri 65102

Re: Bridgeton Landfill, Site Operating Permit Number 118912 Third Quarter Gas Monitoring

Dear Mr. Bell:

Enclosed please find the Landfill Gas Monitoring report for gas migration, performed by Bridgeton Landfill associates. Temperatures are continuously being monitored in the twelve gas wells located in the northern inactive portion of the permitted area. There is currently no activity or evidence of fire located adjacent to the quarry wall in the vicinity of the TRW wells.

Should you have any questions, please do not hesitate to call, (314) 739-1919 extension 109.

Sincerely,

Jacinta Douma
Technical Administrative Assistant

cc: Brad Bomanz, St. Louis County Department of Health
Terry Hoevelkamp, MDNR St. Louis Region

13570 St. Charles Rock Rd. • Bridgeton, MO 63044 • 314/739-1919 • Fax 314/739-2588

West Lake Dm

St. Louis County
Department of Health

November 26, 1997

RECEIVED
DEC 1 1997
SWMP

Mr. Matt Kingsley
Laidlaw Waste Systems, Inc.
13570 St. Charles Rock Road
Bridgeton, MO 63044

Dear Mr. Kingsley:

The St. Louis Department of Health (DOH), Waste Management Section, has completed its review of the two volume "Facility Upgrade and Permit Modification" dated December 1996 and received March 6, 1997. The submittal was prepared by Midwest Environmental Consultants, P. C., on behalf of Laidlaw Waste Systems (Bridgeton), Inc. DOH is also in receipt of the Missouri Department of Natural Resources' July 7, 1997 comments on this two volume submittal. Comments which follow are in addition to those stated by MDNR.

Item	Page	Comment
1)	10	Please update information on DOH license issuance. The '97-'98 annual license was issued on June 11, 1997.
2)	14	Section *"A. Current Operations"* states that currently approved operating hours are 12:00 a.m., Sunday to 4:00 p.m., Friday (24 hour operation) and from 6:00 a.m. to 1:00 p.m., Saturday. These operational hours do not align with the hours approved in a letter from DOH to Laidlaw Bridgeton Landfill dated April 6, 1996. Operating hours in the currently approved facility plan are 12:00 a.m., Monday to 4:00 p.m., Friday (24 hour operation) and from 6:00 a.m. to 1:00 p.m., Saturday. Please correct the text to indicate the latter or request any changes as a request to modify.
3)	14	Section *"A Current Operations":* It is stated that "the operating schedule may be revised as needed to meet the demand of the service area". Please be advised that significant changes may require written notification to DOH and this department's subsequent approval.

Buzz Westfall
County Executive

Paula Livingston-Thomas
DDS, MPH
Director

111 S. Meramec Avenue
Clayton, Missouri 63105

Phone: (314) 854-6000
Fax: (314) 854-6435
TDD: (314) 854-6446

4) 19 Section *"A Airport Safety":* It is stated that the landfill is in compliance with respect to 10 CSR 80.3.010(4) pertaining to airports. Given the proposed expansion of the St. Louis International Airport, please discuss what impact the proposed vertical elevations of the landfill and the proposed airport expansion boundaries will have on operations and compliance with these regulations.

5) 27 Section *"3. Waste Screening"* refers to a Waste Exclusion Plan dated October 1993. Please provide this department a copy of this document for our file.

6) 36 There is concern for the proposed increase in leachate levels. These concerns have been shared with MDNR and the Division of Geologic Land Survey (DGLS) to whom St. Louis County has deferred technological review and approval.

In section entitled *"Leachate Head and Generation"*, please include the specifics on how the leachate head will be calculated, the method, and equipment used to test leachate depth. Test data is to be collected, recorded, and submitted on all wells for the same sampling event date.

12) 46 The modification submittal states that the existing flare station is depicted on Plan Sheet 7. Plan Sheet 6, however, depicts this information, while plan sheet 7 depicts the proposed gas system. Please make the necessary correction to the text to reference these documents.

13) DOH questions the information presented as the lowest base area of Pit 3. Historically, the southwest area of Pit 3, the vicinity of LCS4, has been the lowest portion of the landfill and served as the stormwater collection point for many years during the early filling stages of Pit 3. The plan submittal indicates the lowest base elevation in Pit 3 as being located near LCS2. This issue must be resolved to accurately address any change in leachate levels.

14) 47 Relative to the installation of the new gas system, pipe diameters were not specified. Please provide such details for an effective review of the gas collection system. As-builts shall be provided the department and may reflect slight deviations from the proposed engineering plan.

15) 48 The current status of gas collection in Pit 2 was not addressed. Please discuss and present how the new system will properly address landfill gas generated in this area and minimize the occurrence of a subterranean fire.

16) Please be reminded that the St. Louis County Air Pollution Engineering Section must review and approve any modifications to the existing landfill gas flare system (ground flare and portable flares).

17) 57 Section *L.1 "Daily, Intermediate, and Final Cover"*: The stated alternate methods of daily cover have not been approved by the Department of Health. DOH approval is very specific in its letter of April 6, 1996, as referenced in Appendix 11. A variance from this approval must be submitted in writing.

18) A statement shall be included at the beginning of the two volume document, which indicates that Laidlaw Waste Systems, Inc. shall submit to DOH a request for all modifications, all monitoring and supporting data, and all correspondence as it relates to the construction, of the landfill. Where applicable, such information shall be forwarded to DOH concurrently with that forwarded to MDNR.

DOH is obligated under Chapter 607 to review and approve all construction, operations, closure and postclosure activities at the landfill.

19) 1 Section 1, *"Introduction"*: The first sentence of the second paragraph shall be changed to include the following: "...and the St. Louis County Waste Management Code, Chapter 607."

20) 2 Section 1, *"General Site Description"*: The first sentence of the second paragraph shall be modified to read as follows: "The Bridgeton Sanitary Landfill has MDNR Permit No. 118912 and DOH License No. 418 on a 214 acre..."

21) 6 Section B. *"Gas Control System"*: Reference to a single flare is made. It is unclear as to the proposed status of the many portable flares now in use. Please address the continued use and ultimate disposition of all flares now in use.

DOH is requesting that Laidlaw Waste Systems, Inc. address the enclosed comments in writing to the Waste Management Section. Should you have any questions regarding the comments provided, please contact me at 854-6919 or Brad Bomanz at 854-6249.

Sincerely,

Susan R. Taylor, Supervisor
Waste Management Section

SRT/eh

cc: Lee Tharp, Midwest Environmental Consultants
Chuck Ketring, Laidlaw Waste Systems, Inc.
Scott Waltrip, MDNR-SWMP
Conn Roden, Director, Division of Environmental Protection, DOH
Joan Bradford, Manager, Office of the Solid Waste Coordinator

STATE OF MISSOURI

Matt Blunt, Governor • Doyle Childers, Director

DEPARTMENT OF NATURAL RESOURCES

www.dnr.mo.gov

SEP 12 2008

RECEIVED
SEP 15 2008
By

CERTIFIED MAIL #: 7007-3020-0003-2221-3901
RETURN RECEIPT REQUESTED

Mr. Allen Steinkamp
Environmental Manager
Allied Waste Industries, Inc.
13570 St. Charles Rock Road
Bridgeton, MO 63044

RE: Telephone Conference with the Environmental Protection Agency Regarding the West Lake Landfill Site and the Bridgeton Landfill, Solid Waste Disposal Area Permit Number 118912, St. Louis County

Dear Mr. Steinkamp:

This letter is intended to provide details of a recent telephone conference call the Missouri Department of Natural Resources held with the U.S. Environmental Protection Agency (EPA) on August 22, 2008, regarding the West Lake Landfill Site in Bridgeton. The purpose of the call was to discuss any potential conflicts and overlap between the Bridgeton Landfill closure activities administered by the department's Solid Waste Management Program (SWMP), and the selected remedies outlined in the Records of Decision for Operable Unit 2 (OU-2 ROD) and Operable Unit 1 (OU-1 ROD). The RODs were prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Participating in the call were Scott Waltrip, and J.P. Boessen of the department's SWMP, Shawn Muenks and Brandon Doster of the department's Hazardous Waste Program (HWP), and Dan Wall of the EPA.

During the conference call remediation and closure activities that will occur at the site in the near future as outlined in the RODs were discussed. As you know, the OU-2 ROD specifies that all of the permitted landfills within OU-2 are to be closed in accordance with the requirements of the Missouri Solid Waste Management Law and Regulations. The department's concerns with the quality of the cap constructed over approximately sixteen (16) acres of the Bridgeton Landfill in 2005, which we have described to you in previous correspondence, were also discussed. One of the specific purposes of the conference call was to ensure that any alternative approach to cap certification the SWMP may consider approving would meet the objectives of the OU-2 ROD.

An understanding was reached with the EPA that the SWMP will ultimately be responsible for evaluating the closure of all areas of OU-2 that are regulated under a solid waste disposal area permit. SWMP staff mentioned that the closure requirements for the permitted areas may vary somewhat depending on the law and regulations in effect at the time and the specific requirements of the permits, and that we will evaluate each permitted area on a case by case basis. An understanding was also reached with the EPA that any reasonable alternative capping or certification procedures for the Bridgeton Landfill that are deemed

satisfactory by the SWMP will meet the objectives of the ROD. Of course, the closure requirements for any area(s) contaminated with radioactive material will likely exceed the requirements of the solid waste law and regulations. Essentially, the EPA will defer to the department on proper closure of all permitted areas not contaminated with radioactive material.

The next phase of the CERCLA process will involve development of the Remedial Design/Remedial Action work plan (RD/RA). We understand RD negotiations have been recently initiated and negotiations for the RA work plan are expected to begin by September 30, 2008. We believe it is in everyone's best interest to wait until the RD has been finalized before you consider any further actions to evaluate the cap on the sixteen (16) acre area of the Bridgeton Landfill in question. This will help minimize potential wasted effort on your part. One thing you need to consider, for example, is that the OU-1 cap is likely to overlap a significant distance onto the cap of the Bridgeton Landfill and may reduce the area you need to retest or remediate. Other aspects of the RD/RA work plan may affect your decisions as well.

On October 23, 2007, several staff members from the SWMP met with you, Mr. Rick Walker, Operations Manager, Bridgeton Landfill Authority and Ms. Michelle Boussad, Project Manager, Aquaterra Environmental Solutions, Inc., to discuss issues concerning the Bridgeton Landfill. One of the items we discussed was a summary report that your consultants were planning to prepare to address closure of all permitted areas at the site. Based on the telephone conference with EPA, the department will need to review this report and reach an understanding with you regarding the closure requirements for each area as soon as possible. This will not only eliminate any confusion between yourself and the department, but it will be necessary during the RD process and enable us to provide meaningful input during development of the RD/RA work plan. Therefore, please submit the summary report within sixty (60) days of the date of this letter.

Please ensure that the report includes, at a minimum, the following:

1. A plan sheet showing the location of all permitted landfills at the West Lake Landfill Site, including the limits of waste for each landfill. The solid waste and CERCLA files contain similar drawings showing outlines for the numerous permitted landfills. Our understanding is that these drawings were developed using the best available information from the various permit files, but have never been field verified. Please field verify the extent of waste for each permitted area as closely as is practical, and include in the report a description of the procedures that were used to do this. For areas for which a permit was issued but no waste placement occurred, simply indicate this on the plan sheet. This plan sheet will be extremely valuable to both the CERCLA and the solid waste closure processes, and will ultimately serve as the official record of waste placement at the site.

2. For each permitted area:

   A. The dates each permit was issued and when the operator ceased accepting waste.

   B. The regulatory requirements for landfill closure, post-closure, and quality assurance/quality control (QA/QC) that were in effect when the area ceased accepting waste.

   C. Any specific closure and QA/QC requirements outlined in the permit documents.

D. A description of the existing landfill cap and any closure or QA/QC activities that were performed, based on available information.

E. A detailed proposal for any exploration that may be necessary to determine the thickness or quality of the landfill cap.

F. Proposed closure and QA/QC plans for any area identified as being deficient.

G. Proposed post-closure plans, if required.

In addition, the RODs contain institutional controls that require the responsible parties to record covenants with the county Recorder of Deeds or equivalent office. EPA will also have provisions in the Consent Decree to allow EPA and the department access to all areas of the site. The solid waste regulations contain similar requirements. We would like to develop one set of these documents to avoid creating additional work for you or the other responsible parties, as well as to minimize review time for the department. Though it would be premature for you to propose a format or specific content of these documents, please keep this in mind, particularly when developing the plan sheets described in item 1, above.

If you have any questions or comments, please contact J. P. Boessen, of my staff at (573) 751-5401 or P.O. Box 176, Jefferson City, Missouri 65102-0176.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

J. Bell

Jim Bell
Chief, Engineering Section

JB:jpbl

c: Mr. Rick Walker, Operations Manager, Bridgeton Landfill Authority
Mr. Dan Wall, Environmental Protection Agency
Ms. Michelle Boussad, Project Manager, Aquaterra
Matt Ballance, P.E., Senior Project Manager, Aquaterra
John Haasis, P.E., St. Louis County Department of Health
Brandon Doster, P.E, Hazardous Waste Program
Mr. Chris Nagel, Chief, Enforcement Section, Solid Waste Management Program
Mr. Joe Trunko, St. Louis Regional Office

APPENDIX B

HERST AND ASSOCIATES, INC. LETTER REPORT DATED OCTOBER 23, 2008

HERST & ASSOCIATES, INC.®

Global Presence
Personal Attention

Mr. Jim Bell
Chief, Engineering Section
Missouri Department of Natural Resources
1730 East Elm Street
Jefferson City, MO 65101

October 23, 2008

Dear Mr. Bell:

Historic Permitted Areas Information, Bridgeton Landfill, St. Louis County

Bridgeton Landfill Authority representatives have requested that Herst & Associates, Inc. assist in addressing various items discussed in a September 12, 2008 letter from you to Mr. Allen Steinkamp, given that Herst & Associates, Inc. is the lead consultant for CERCLA activities associated with Operable Unit 2 and has ongoing experience with environmental compliance at the recently-closed solid waste landfill area at the facility. The September 12, 2008 letter indicates that a summary report is due within 60 days (November 11), to discuss various items including closure of historic permitted areas at the facility. In response, and well in advance of the November 11 submittal deadline, Herst & Associates, Inc. is attaching a summary of historic permitted areas at the facility. The summary of historic permitted areas was previously prepared by Mr. Lee Tharpe and Midwest Environmental Consultants, PC (MEC) in 1995. Also attached is a map prepared by MEC that identifies the various permitted area boundaries.

Please review the attached information in light of the request for a summary of historic permitted areas. After completion of your review, please contact me and/or Allen Steinkamp to discuss the information.

Sincerely,

Herst & Associates, Inc.

Ward Herst
Managing Director

Cc: Dan Wall – USEPA
Allen Steinkamp – Bridgeton Landfill Authority
Rick Walker – Bridgeton Landfill Authority
Branden Doster – Hazardous Waste Program
Chris Nagel – Solid Waste Management Program
John Haasis – St. Louis County Department of Health
Joe Trunko – St. Louis Regional Office
Victoria Warren - AWIN

4630 South Highway 94 – North Outer Road
St. Charles, Missouri 63304

Telephone (636) 939-9111
Fax (636) 939-9757

LAIDLAW WASTE SYSTEMS (BRIDGETON), INC.
SANITARY LANDFILL

PERMIT CONSOLIDATION
ENGINEERING REPORT

June 1995

Prepared for:
LAIDLAW WASTE SYSTEMS (BRIDGETON), INC.
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI

Prepared by:
MIDWEST ENVIRONMENTAL CONSULTANTS, P.C.
522 EAST CAPITOL AVENUE
JEFFERSON CITY, MISSOURI

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Appendix 2 - Zoning Designations

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Appendix 6 - Certification of Distance to Nearest Drinking Water Intake (Foth & Van Dyke, February 10, 1994)

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Figure 1 - St. Charles Quadrangle U.S.G.S. Map

Figure 2 - General Highway Map for St. Louis County

Figure 3 - Flow Schematic of Permitted Leachate Management System

I. INTRODUCTION

Laidlaw Waste Systems (Bridgeton), Inc. owns and operates a sanitary landfill in Bridgeton, Missouri. The site is located approximately 0.75 miles north of Interstate 70 and immediately south of St. Charles Rock Road. This landfill operates under two separate permits: (1) the Missouri Department of Natural Resources (MDNR) Solid Waste Disposal Area Operating Permit No. 118912 which was issued on November 18, 1985 and (2) the St. Louis County Department of Health (DOH) Permit No. 0418.

The purposes of this document are as follows:

(1) Provide a comprehensive summary of the terms and conditions of the sanitary landfill's current permits.

(2) Prepare a master plan (site plan sheets) of all known appurtenances.

(3) Compare current operations to current regulations.

(4) Provide a history of the site.

In conjunction with this document, a set of engineering plan sheets has also been developed. The plan sheets are as follows:

Title Sheet
1. Quarter Mile Zoning and Land Use Map
2. Utilities and Property Map
3. Historic Development Plan
4. Existing Conditions
5. Original Bottom Contours and Leachate Collection
6. Permitted Gas Management System
7. Leachate Treatment System Design
8. Leachate Holding Lagoon Design
9. Intermediate Stormwater Management Plan (not available)
10. Final Development Plan
11. Cross Sections - I
12. Cross Sections - II
13. Cross Sections - III

14. Cross Sections - IV
15. Borrow Area Plan
16. Environmental Monitoring Plan
17. Leachate Collection System Details
18. Intermediate Stormwater Management Details (not available)
19. Miscellaneous Details
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21. Permitted Gas System Details - II
22. Permitted Gas System Details - III
23. Permitted Gas System Details - IV
24. Historical Details - I
25. Historical Details - II
26-39. As Built Gas Collection System (I-XIV)

This document along with the above-listed plan sheets are based primarily on the original conditions and documents of permit #118912. However, permit addendums and other significant historical correspondence documents also played a vital role in assembling this document and are therefore contained in Appendix 1. Other important sources of information in the preparation of this document include record searches, personnel interviews, and site inspections.

Throughout this document Laidlaw Waste Systems (Bridgeton), Inc. will simply be referred to as Laidlaw and the sanitary landfill that operates under the MDNR Solid Waste Disposal Area Operating Permit #118912 will be referred to as Bridgeton SLF.

II. SITE INFORMATION

This section provides detailed site information for the Bridgeton SLF. The specific topics addressed are site location, land use and zoning, site history, utilities, and site access and control.

A. Site Location

The landfill is located in U.S. Survey 131, Township 47 North, Range 5 East in St. Louis County, Missouri. This landfill is located approximately 0.75 miles north of U.S. Highway 70 and immediately south of St. Charles Rock Road. The landfill site is located entirely within the City of Bridgeton.

The applicable portions of the St. Charles Quadrangle United States Geological Survey (U.S.G.S.) Map and the General Highway Map for St. Louis County prepared by the Missouri Highway and Transportation Department are displayed as Figures 1 and 2 respectively.

B. Land Use and Zoning

The City zoning for the site and surrounding land within 1/4 mile of the site is shown on Plan Sheet 1. As can be seen from this plan sheet, the site includes the following zoning designations:

Regular Zoning Districts:

R-1: One Family Dwelling District

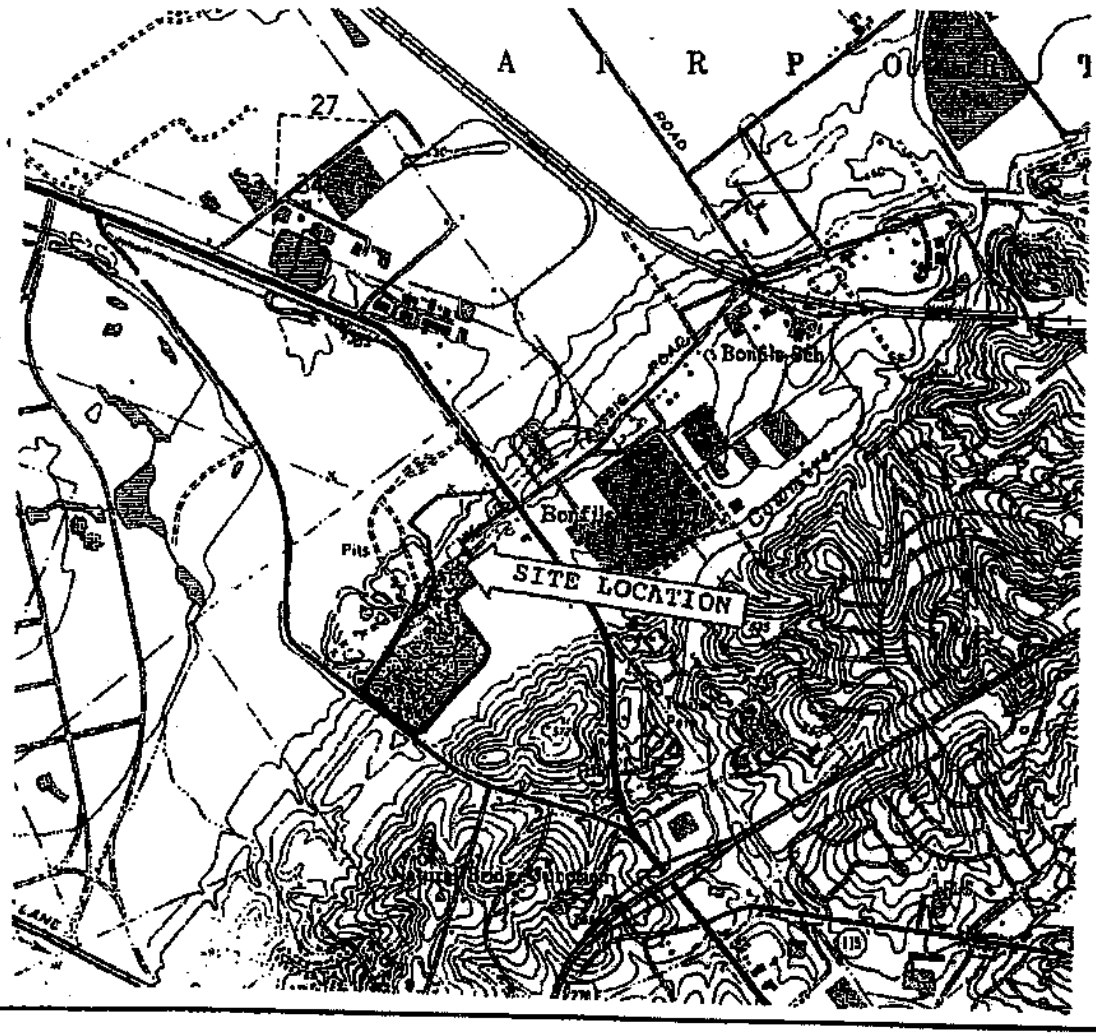
R-3: One Family Dwelling District

Project: Laidlaw Waste Systems (Bridgeton), Inc.
Permit Consolidation
Site Location Map
Project Number: 940130-004 **Date:** 6/95

Midwest Environmental Consultants, P.C.

Figure 1
Scale: 1"= 2000'
United States Geological Survey St. Charles, MO Quadangle

Longitude - 38° 46' 12"
Latitude - 92° 26' 34"

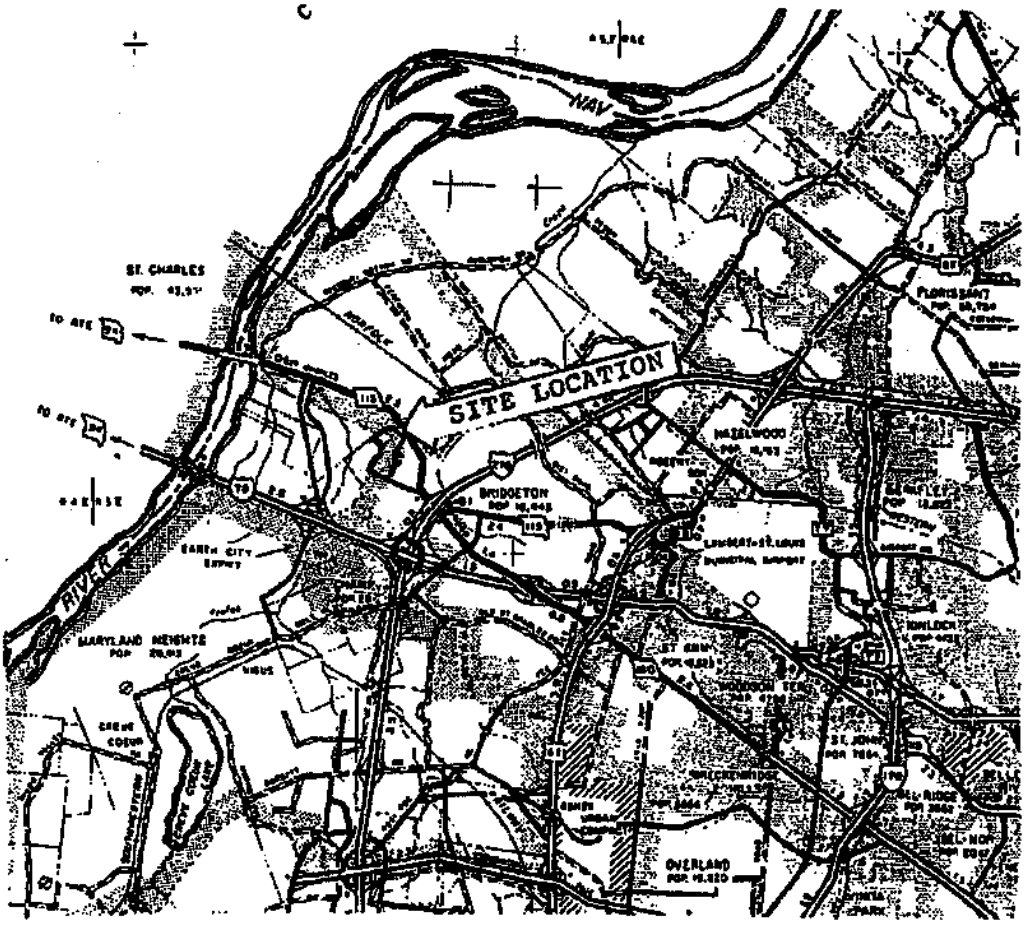


Project: Laidlaw Waste Systems (Bridgeton), Inc.
Permit Consolidation
Site Location Map
Project Number: 940130-004 **Date:** 6/95

Midwest Environmental Consultants, P.C.

Figure 2
Scale: 1"= 2 miles
General Highway Map for St. Louis County

Longitude - 38° 46' 12"
Latitude - 92° 26' 34"



B-3: Travel/Entertainment Services District

B-4: General Commercial District

M-1: Manufacturing District, Limited

M-2: Manufacturing District

Special Zoning Districts:

B-5(f): Planned Commercial District: West Lake Quarry Tract

M-3(g): Planned Manufacturing District: Northwest Industrial Park - 13575 St. Charles Rock Road

M-3(n): Planned Manufacturing District: West Lake Quarry Tract

See Appendix 2 for specific land use information for the above-listed zoning designations.

The property line depicted on Plan Sheet 1 (Land Use and Zoning Map), as well as all the other plan sheets which show the site's property line, assumes that Old St. Charles Rock Road is not abandoned. However, if Old St. Charles Rock Road is officially abandoned then the property line along the southern boundary would extend to the center line of Old St. Charles Rock Road.

C. Site History

It is estimated that the site has been utilized as a quarry since the early 1930s. On April 23, 1952, the Office of Zoning Enforcement of St. Louis County granted permission to V.R. Cruse and L.E. Trump, owners of the property, to operate a sanitary landfill. It is

assumed that the above-mentioned persons were full or partial owners of West Lake Quarry.

In a May 16, 1969 letter from H. Clifford Mitchell, P.E. (the Assistant Commissioner of Environmental Health Services for the St. Louis County Health Department) to Mr. William A Richter (Attorney) it was stated that prior to 1964 the facility was only authorized to accept combustible material (see Appendix 1). Following the closure of the Wade Landfill on Highway 67, the site was authorized to accept all forms of non hazardous solid waste. West Lake Landfill, Inc. became a separate entity from West Lake Quarry on its date of incorporation on February 16, 1962.

Prior to coming under state regulatory authority in the early 1970s, West Lake Landfill, Inc. had six separate disposal areas on the site. These areas, referred to as Areas 1-6, are shown on Plan Sheet 3. Subsequent to MDNR Formation, MDNR issued two permits for Areas 1-6. These were permit #218903 and permit #118903. It is not known exactly when each area was filled or with what each area is filled. However, based on the engineering report prepared by Rogers and Associates, Inc. in March 1974 and the accompanying plan sheets prepared by The Elbring Company, the following comments can be offered:

- Areas 1, 2, 3, 4 and 5 have all been used for both sanitary and demolition fill.
- Areas 2 and 4 were to be closed and completed at the time of the writing of the above-mentioned report.

- Areas 1, 3, 5, and 6 were originally used as sanitary fill areas; however, following the above-mentioned report they were to be sealed off with 24 inches of clay and used for demolition fill only. These areas were subsequently permitted under permit #218903.

- Area 6 is a partial and integral portion of Area 5 which had been completed as a fill area at the time of the writing of the above-mentioned report.

- No provisions were made for the collection of leachate. The engineering report states that it was confined to the fill areas by clay lining and cover of the refuse cells.

- Lateral gas movement from sanitary fill beneath demolition fill was to be controlled by gas vents. These vents were to be round openings filled with graded crushed limestone (see Plan Sheet 25 for detail).

The site came under state regulatory authority when the MDNR was formed in 1974. The site consists of a total of approximately 214 acres of which 52 acres are currently permitted under permit #118912. Since the inception of the MDNR, a total of approximately 86.5 acres either has been used or is currently in use as a sanitary landfill. In total, the site has received five separate MDNR sanitary landfill operating permits and two MDNR demolition landfill operating permits. The site's sanitary and demolition landfill permit history is summarized in Table 1 and the location of each permit area is shown on Plan Sheet 3.

Table 1
Bridgeton Site
Solid Waste and Demolition Landfill Permit History

No.	Type	Acreage	Issue Date	Consultant
218903[1]	Demolition	27	1/27/76	Rogers & Associates
118903	Sanitary	25	1/27/76[2]	Rogers & Associates
Addendum	3.5 acre expansion	3.5	5/23/78	Paul H. Himebaugh
118906	Sanitary	13	1/22/79	Paul H. Himebaugh
118908	Sanitary	6	8/27/80	Reitz & Jens, Inc.
118909	Sanitary	9	8/20/81	Reitz & Jens, Inc.
218912	Demolition	22	9/19/84	Burns & McDonnell
118912[3]	Sanitary	52	11/18/85	Burns & McDonnell

[1]Permit #218903 includes Areas 1, 3, 5, and 6.
[2]Actual Authorization was granted on 8/27/74.
[3]Permit #118912 supersedes permits #118909 and #118906; it represented a 33-acre expansion from the area permitted under permits #118909 and #118906.

According to permit #118912, there is a total of 52 acres available for landfill disposal. However, according to strict interpretation of the engineering report, there is only a total of 49 acres included in permit #118912. These 49 acres are comprised of the following areas:

Area (acres)	Description
13	Originally permitted area under permit #118906.
3	Expansion area under permit #118909 (permit #118909 was for a total area of 9 acres; however, 6 of these acres were originally permitted under permit #118906).
33	Expansion area under permit #118912.
49	Total

The acreage issue is further complicated by the fact that the permit boundary, which is implicitly shown on Drawing 2, Revision 3 of Burns & McDonnell's permit drawings (final revision date: July 27, 1987), measures approximately 54.1 acres instead of the 52

acres stated in the permit. Acreages are listed on this drawing for the three areas (Area 1, Area 2, and Northern Closure Area) that comprise the permitted area. These acreages total 52 acres; however, as previously stated they measure approximately 54.1 acres.

In an effort to further explore this issue the permitted area or assumed approximation was measured on the followings drawings:

Acreage	Drawing
54.0	Foth & Van Dyke; Bridgeton Sanitary Landfill; Figure 1; April 1993.
59.0	Paul H. Himebaugh, Consulting Engineer; Location & Area Maps with final Contours; West Lake Landfill, Inc.; Plate 1; Revision December 19, 1978. (The permit boundary south of permit #118906 was approximated based on the quarry wall.)

A contributing factor to this discrepancy is the fact that permit #118906 is listed as 13 acres on the issued permit, but measures 14.7 acres on the actual permit drawings. It is believed that Burns & McDonnell's permit boundary does not accurately reflect this portion of the permit boundary for permit #118912.

In addition to having multiple existing and closed sanitary and demolition landfills, the Bridgeton SLF is also a Superfund site as designated by the United States Environmental Protection Agency in 1990. This designation encompasses the entire site. Two areas on the site (totaling approximately 36.5 acres) that possess low-level radioactive wastes are collectively known as Operating Unit (OU)-1. The remainder of the site (that is, the entire site with the exception of the 36.5 acres known as OU-1) is referred to as OU-2.

Although further explanation of these areas is beyond the scope of this document, the two areas of OU-1 are shown on Plan Sheet 3.

In 1988 Laidlaw purchased all landfilling operations and associated properties from West Lake Landfill, Inc. and the name was legally changed to Laidlaw Waste Systems (Bridgeton), Inc., Sanitary Landfill. West Lake Quarries, Inc. possesses a license agreement and still operates the Red-Bird Ready-Mix plant; however, all quarrying operations have ceased at the site.

The site currently operates under permit #118912 which was issued on November 18, 1985. However, there have been a significant number of addendums issued since this date. In order to provide necessary thoroughness and detail all of these addendums along with the original permit letter and other significant correspondence are contained in Appendix 1. All permit addendums are summarized in the following listing.

Date: November 18, 1985
RE: Permit Issuance, Permit Number 118912
Conditions:

1. This permit, Solid Waste Disposal Area Operating Permit #118912, encompasses the proposed expansion area and additional solid waste fill by West Lake Landfill, Inc. over the disposal areas permitted under Solid Waste Disposal Area Operating Permit Numbers 118906 and 118909 issued to West Lake Landfill, Inc. This document supersedes and replaces the previous permits and permit documents.
2. West Lake Landfill, Inc. shall establish and maintain an escrow fund for the purpose of providing post-closure care and maintenance of the landfill. The amount and manner of maintaining this fund shall be as described in the approved permit documents.
   A. Fifty percent of the first yearly cost of this fund shall be deposited in this fund prior to acceptance of solid waste.
   B. The existence and maintenance of this fund shall be verified to the MDNR by the permittee prior to acceptance of solid waste. The maintenance of this fund shall be verified to the department annually prior to the anniversary date of establishment of the fund, in writing, by the financial institution wherein this fund is deposited.

3. An environmental assessment of the entire landfill site shall be initiated by West Lake Landfill, Inc. or any successor or assign ("hereinafter West Lake") immediately after the issuance of this permit. This assessment, including hydrogeologic investigation, shall be completed by November, 1986, and shall be used as the basis for the development of a monitoring program and feasibility study to assess necessary remedial action. The conclusions of the feasibility study shall be submitted to the MDNR within two years after the issuance of this permit. Implementation of necessary remedial action will be undertaken by West Lake in accordance with reasonable design and construction scheduling. Additional groundwater monitoring requirements will be required, based on review of the hydrogeologic investigation and feasibility study.
4. Initial training of the waste inspector (spotter) shall be provided so that he/she is able to adequately perform the duties as described in the permit documents. At a minimum, the initial training for this employee shall include:
   A. Familiarization with 10 CSR 80-3.010(3), solid waste excluded.
   B. Identification and recognition of unacceptable wastes, as described in 10 CSR 80-3.010(3).
   C. Familiarization with the necessary procedures to obtain approval of special waste disposal requests.
   D. Provision of a list of all special wastes approved for disposal by the MDNR.
5. Intermediate cover is not required until the fill is above the quarry rim, as proposed in the approved permit documents.
6. Leachate and sludge from leachate treatment shall be collected, treated and disposed of as per the approved permit documents.
   A. Leachate shall be treated and disposed of in accordance with all applicable water quality laws, rules, regulations, and policies as enforced by the Water Pollution Control Program, MDNR.
   B. West Lake Landfill, Inc. shall two times a year test the leachate and leachate treatment sludge for hazardous waste characteristics pursuant to 10 CSR 25-4.010 (2 through 5) and submit the results of such tests within 60 days to the MDNR. If hazardous wastes are detected in the leachate or sludge, West Lake Landfill, Inc. shall implement proper handling of such hazardous wastes in accordance with the Missouri Hazardous Waste Management law, Rules and Regulations.
   C. Sludge from the on-site leachate treatment system is acceptable for disposal at the landfill, unless tested to be a characteristic hazardous waste as per Condition #6B.
   D. Static leachate levels in the collection sumps in the unfilled area of the quarry, as shown in the approved permit documents, will be maintained at a level less than 30 feet above the base of the sump. The leachate level shall be checked monthly, recorded and made available upon MDNR request.
   E. Static leachate levels in the previously filled areas of the quarry, as shown on the approved permit documents, shall be maintained at a level less than 50 feet above the base of the sump. The leachate level shall be checked monthly, recorded and made available upon MDNR request.
7. A. Groundwater monitoring shall be required as per the document entitled Monitoring Program for the West Lake Landfill, Inc. Sanitary Landfill. The wells shall be sampled within 30 days of issuance of the permit. The first sample will be used as a

background sample and should be analyzed for the extended list of parameters, as if it were an annual analysis.

B. Three groundwater monitoring wells have been installed in the area of the grout curtain in the northeast corner of the large quarry. Two wells were installed during the placement of the initial grout curtain and were designated as groundwater monitoring wells (GWMW) #4/III and (GWMW) #14/III in the application for operating permit. The third well was installed during the placement of grout curtain #2 and was designated as groundwater monitoring well (GWMW) #17/IV in the application for operating permit. The water level in these wells shall be monitored monthly, recorded, and made available upon department request.

C. All three wells will be monitored, unless the department is requested to reevaluate the monitoring program. If requested and approved, one or more of the wells can be eliminated from the sampling program if hydraulic communication between the wells is verified.

D. Additional sampling points may be added to the monitoring program depending on the results of the hydrogeologic investigation (see Condition #4).

8. The following previously approved special wastes are approved for disposal under permit #118912:
   A. Fly ash derived from a coal burning industrial boiler, generated by McDonnell Douglas Corporation; 400 tons per month; approved November 1, 1984.
   B. Incinerator ash derived from municipal refuse incineration, generated by McDonnell Douglas Corporation; 800 cubic yards per month; approved November 1, 1984.
9. Each eight inch lift of the twelve-foot wide pad in the northeast corner should be tested for soil density to confirm that a minimum compaction of 90 percent of the standard proctor density is obtained.
10. All surface water discharges shall be made in accordance with all applicable air quality laws, rules, regulations, and policies as enforced by the Water Pollution Control Program, MDNR.
11. Methane gas shall be vented or burned in accordance with all applicable air quality laws, rules, regulations, and policies as enforced by the Water Pollution Control Program, MDNR.
12. Department review and approval of any planned final use is required prior to implementing a designated, commercial, final use of the site.
13. Within six months of the data of issuance of the permit, two copies of a final, comprehensive engineering report shall be submitted to the Waste Management Program. This report shall incorporate all present design and operating information into one reference manual detailing the final approved plans and specifications for the design and operation of the proposed sanitary landfill. This report shall incorporate all information required by regulation, eliminate all contradictory information, and include all revisions and additions to the original application for operating permit, as approved.

Date: March 13, 1987

Addendum: Expanded Gas Collection System and Utilization of Gas in Asphalt Plant (expansion consisted of nine collection wells, approximately 3,015 feet of collection pipe, a moisture removal unit, a blower building, and a waste gas flare)

4. For creating a public nuisance, health hazard or causing environmental pollution; or
5. If it is found that additional construction or alteration of the solid waste disposal area is necessary to comply with any and all rules promulgated in accordance with the Missouri Solid Waste Management Law.

Date: July 23, 1990
RE: MDNR request that an NPDES permit application be submitted for the demolition landfill.

Date: January 11, 1991
Addendum: Changes in Groundwater Monitoring Program
Condition: Submit by April 1, 1991 well abandonment procedures, well as-builts, boring logs and a background sample for each newly constructed well.

Date: July 31, 1992
Addendum: Modify Gas Collection System from a Passive to an Active System
Conditions:
1. Submit certification stating that implementation was in accordance with plans and specifications.
2. Meet requirements of sections 260.226 and 260.227, RSMo 1990 as applied to existing sanitary landfills to indicate any changes made as a result of this permit addendum. Also, submit revised closure/post-closure plans and cost estimates.
3. Obtain compliance with all applicable NPDES permits.

Date: September 9, 1992
RE: MDNR request for a financial assurance instrument to be submitted for both the sanitary and the demolition landfills. The deadline was 60 days from receipt of this letter.

Date: November 20, 1992
Addendum: Revised Closure/Post-Closure Plan
Conditions:
1. Submit certification stating that implementation was in accordance with plans and specifications.
2. Revise post-closure plans to reflect the additional costs for continued operational, maintenance, and incidental costs for operating pumps.
3. As part of the financial assurance for post-closure care, set up a separate funded irrevocable escrow or trust fund to cover the cost of perpetual care.

Date: January 5, 1993
Addendum: Use of Alternate Daily Cover
Conditions:
1. The Solid Waste Management Program must be notified of the day the trial period will begin;
2. Please submit two copies of the final bid specifications for the material to be used and two copies of a detailed operations manual specifying the final guidelines for the use of

the geotextile daily cover;

3. Upon completion of the six month trial period, please submit two copies of a detailed report, including but not limited, to daily records of whether or not the panel was used, weather conditions, unforeseen operational problems, notes on the performance and status of the geotextile, any reportable increase in leachate generated, conclusions and recommendations from the use of the geotextile daily cover.

Date: February 10, 1993
Addendum: Relocation of Gas Flare
Conditions:

1. Submit certification stating that implementation was in accordance with plans and specifications.
2. Meet requirements of sections 260.226 and 260.227, RSMo 1990 as applied to existing sanitary landfills to indicate any changes made as a result of this permit addendum. Also, submit revised closure/post-closure plans and cost estimates.
3. Obtain compliance with all applicable NPDES permits.
4. Submit as-built drawings.

Date: October 8, 1993
Addendum: Subtitle D Extension
Conditions:

1. Remain in compliance with all permit conditions.
2. Develop filling progression to promote stormwater drainage in order to minimize infiltration and leachate generation, while maintaining effective soil erosion control.
3. Limit the landfill to the permitted horizontal and vertical boundaries while maintaining sideslopes of 33 percent or less. Limit accepted wastes to flood debris and other solid wastes.

Operating and Closure Requirements:

1. Establish survey controls within 60 days upon receipt of this addendum letter.
2. Obtain compliance with all applicable NPDES permits as a result of any changes resulting from this extension.
3. Place three feet of final cover upon closure. Provide certification by a professional engineer of final cover depth on 50-foot centers.
4. Establish vegetation on disposal area and borrow area within 180 days after placement of final cover.
5. Submit the following within 60 days upon receipt of this addendum letter: (1) revised closure/post-closure plans and cost estimates, and (2) revised financial assurance instrument, if necessary.
6. Submit the following by June 9, 1994 (if the facility was closed by April 9, 1994):
   - Final grades and as-builts drawings which include associated landfill appurtenances to show proper final development of this landfill in accordance with this extension.
   - Details concerning the types and depth of final cover verified on 50-foot centers and vegetation establishment.

- Submit a topographic boundary survey designating the entire permitted acreage including final grades and associated landfill appurtenances in accordance with 10 CSR 80-3.010(16)(C)2.

Date: October 28, 1993
Addendum: Modified life of permit to be for the anticipated life of the facility.
Conditions: None.

Date: March 8, 1994
Addendum: Landfill fire mitigation
Conditions:
1. Apply a professional engineer's seal to document entitled "Proposal, Landfill Fire Mitigation, Laidlaw Bridgeton Sanitary Landfill, Bridgeton, Missouri" within 30 days.
2. Seek prior written approval for any changes in operation and/or design other than those described in the application and approved in permit.
3. Submit three copies of report to the SWMP.
4. The quarterly gas monitoring report to be sent to the SWMP is to include all reports on continuing monitoring and maintenance efforts for control of the fire.

Date: May 4, 1994
Addendum: Subtitle D liner waiver on the ramp leading into the landfill and the side walls of the landfill. Also, fire mitigation proposal approved.
Conditions:
1. Report on efforts to mitigate the current and any future landfill fire.
2. Report on the effectiveness of the current soil liner to control gas migration out of the landfill.
3. Submit an additional modification request for the liner showing how the landfill gas shall be controlled if the landfill cannot be controlled by the soil liner.

Date: May 4, 1994
Addendum: Interim stormwater detention basins and a gas condensate line.
Conditions:
1. Submit certification within 30 days of completion.
2. Submit to St. Louis Regional Office two copies of as-built drawings within 60 days of completion of construction if gas condensate line is located different from location shown in drawing.
3. Notify St. Louis Regional Office of all permits for storm water discharges.

Date: August 30, 1994
Addendum: Use of petroleum contaminated soil as an alternative daily cover for a six (6) month trial period.
Conditions:
1. The petroleum contaminated soil is approved for use only as daily cover material and shall not be used for intermediate cover or final cover.
2. The beneficial use of petroleum contaminated soils as daily cover materials shall follow

disposal and testing practices as outlined in the solid waste technical bulletins entitled Special Waste Technical Bulletin (dated January 1992) and Disposal of Soil Contaminated with Virgin Gasoline or Virgin Fuel Oil (dated December 1991) and shall meet the cover requirements as specified in the Missouri Solid Waste Management Law and Rules 10 CSR 80-3.010(14). Contaminated soils shall meet a classification of or be mixed with other cover soils to meet a Unified Soil Classification of CH, CL, ML, MH, or SC for daily cover.

3. The owner/operator shall screen the incoming petroleum contaminated soil for excessive or offensive odor emissions and for foreign debris or other items which would create an unsightly appearance and interfere with or limit its use as daily cover.
4. Within sixty (60) days of completion of the trial period, two copies of a detailed report must be submitted including but not limited to daily records of whether or not the alternative cover was used, weather conditions, unforeseen operational problems, any reportable increase in leachate generated, photographs, conclusions, and recommendations concerning the use of the contaminated soil as daily cover.
5. Petroleum contaminated soils shall not be used as daily cover when the following are detected:
   A. Soil contaminated with petroleum products has strong offensive odor;
   B. Soil contaminated with petroleum products contains excessive debris which would create an unsightly appearance on the landfill;
   C. Soil contaminated with petroleum products which is received during periods of excessive wet or severe inclement weather could result in contaminated surface water runoff from the active fill face when it is used as daily cover; or
   D. Soil contaminated with petroleum products does not meet the required testing limits as described in the aforementioned technical bulletins.
6. The use of soil contaminated with petroleum products shall not be used as daily cover in waste disposal cells located at the approved final waste contours or in locations where storm water runoff from the active face cannot be removed or collected through a leachate collection system for treatment.
7. Prior to use of petroleum contaminated soil as daily cover material the generator of the waste must provide lab results with a special waste disposal form on representative samples of the soil. Two copies of the testing results shall be submitted to the MDNR's St. Louis Regional Office.
8. The use of petroleum contaminated soil as daily cover material must conform to all applicable water quality laws, rules, regulations and permits which are enforced by the MDNR's Water Pollution Control Program.
9. The use of petroleum contaminated soil as daily cover material must conform to all applicable air quality laws, rules, regulations and permits which are enforced by the appropriate air pollution control regulatory agency.

Date: March 15, 1995
Addendum: Removal of cardboard near the working face of the landfill.
Conditions: MDNR reserves the right to revoke, suspend, or modify this approval and/or permit number 118912 after due notice, if the permit holder fails to maintain the facility in compliance with the state's Solid Waste Management Law and Rules, the terms and

conditions of the permit, and approved engineering plans and specifications.

Date: April 12, 1995
Addendum: Modification of operations to extract cardboard from incoming loads at the edge of the working face (St. Louis Department of Health).
Conditions: None listed.

D. Utilities

Specific information and location of all known utilities are shown on Plan Sheet 2. Utilities include storm sewers, gas lines, water lines, electrical lines, sanitary sewers, and septic tanks.

Electrical power for the facility is supplied by Union Electric (UE). The electrical demands of this facility consist of lighting, HVAC of the landfill office, the gas flare system, pumps and aerators for leachate management, and miscellaneous electrical requirements for maintenance. UE supplies 3 phase power to the facility. There have been no known problems with the power supply.

According to the engineering report (January 1986), there were no utility easements or lines located on the actual disposal site. Also, there were no known water supply wells within the 1/4-mile surrounding boundary.

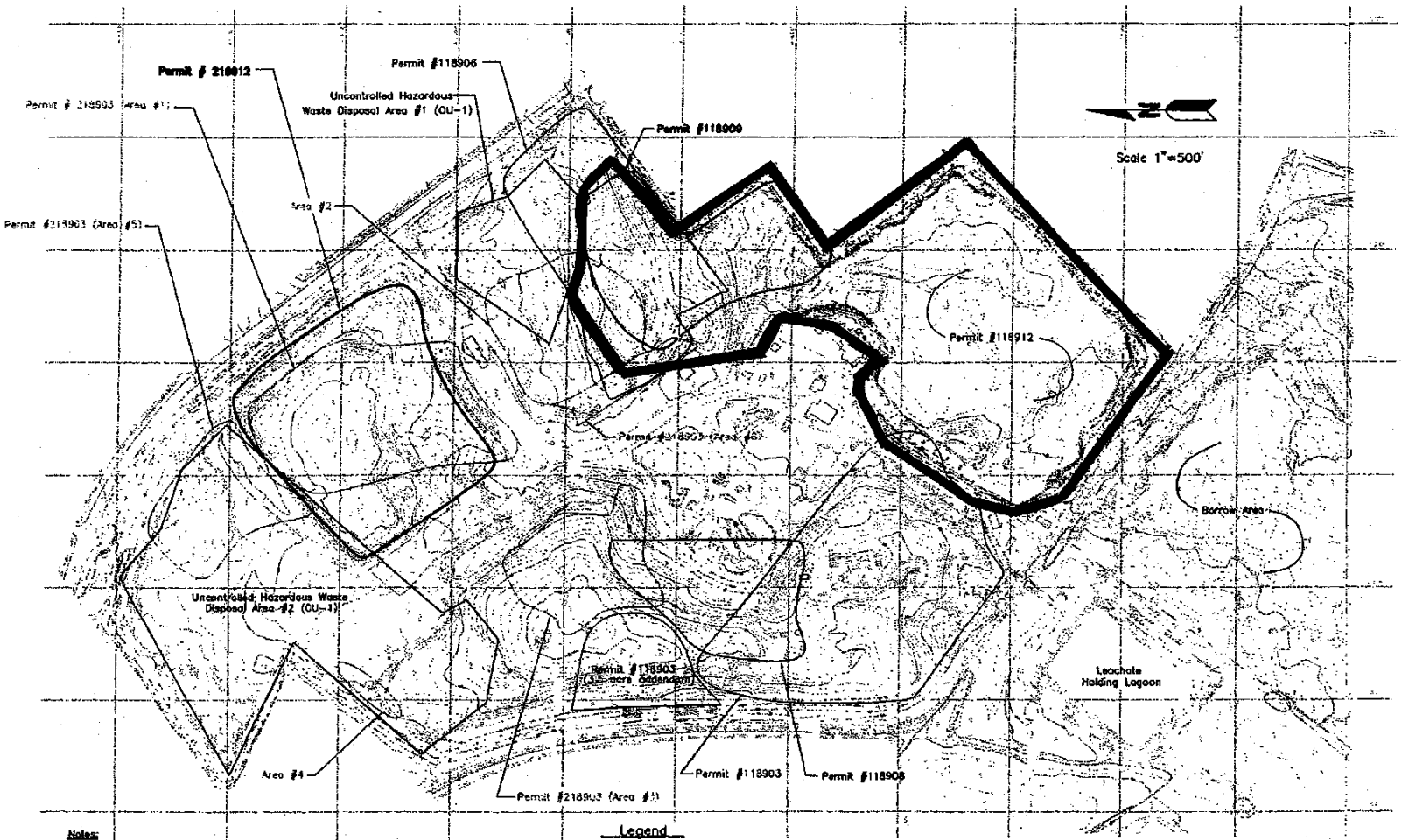
E. Site Access and Control

Access to the landfill is provided by St. Charles Rock Road, a main entrance road, and landfill service roads (see Plan Sheet 4). The site is always accessible using St. Charles Rock Road since it is not susceptible to flooding or closing due to inclement weather. The main entrance road is an all weather asphalt surface. Landfill service roads are constructed

as needed for access to the working face. All entering vehicles must pass by the landfill office and then by the scale house prior to proceeding toward the working face.

Current operating hours are from 3:00 a.m. to 4:00 p.m. Monday through Friday and from 6:00 a.m. to 1:00 p.m. on Saturday.

Figure 3
Historical Permit Limits



Notes:

1. All depicted waste boundaries are approximations based on past permit documents. Refer to the table for the original source drawing for each boundary.
2. Topography is based on an aerial survey flown by Surdex Corporation and dated January 25, 1995.

Legend

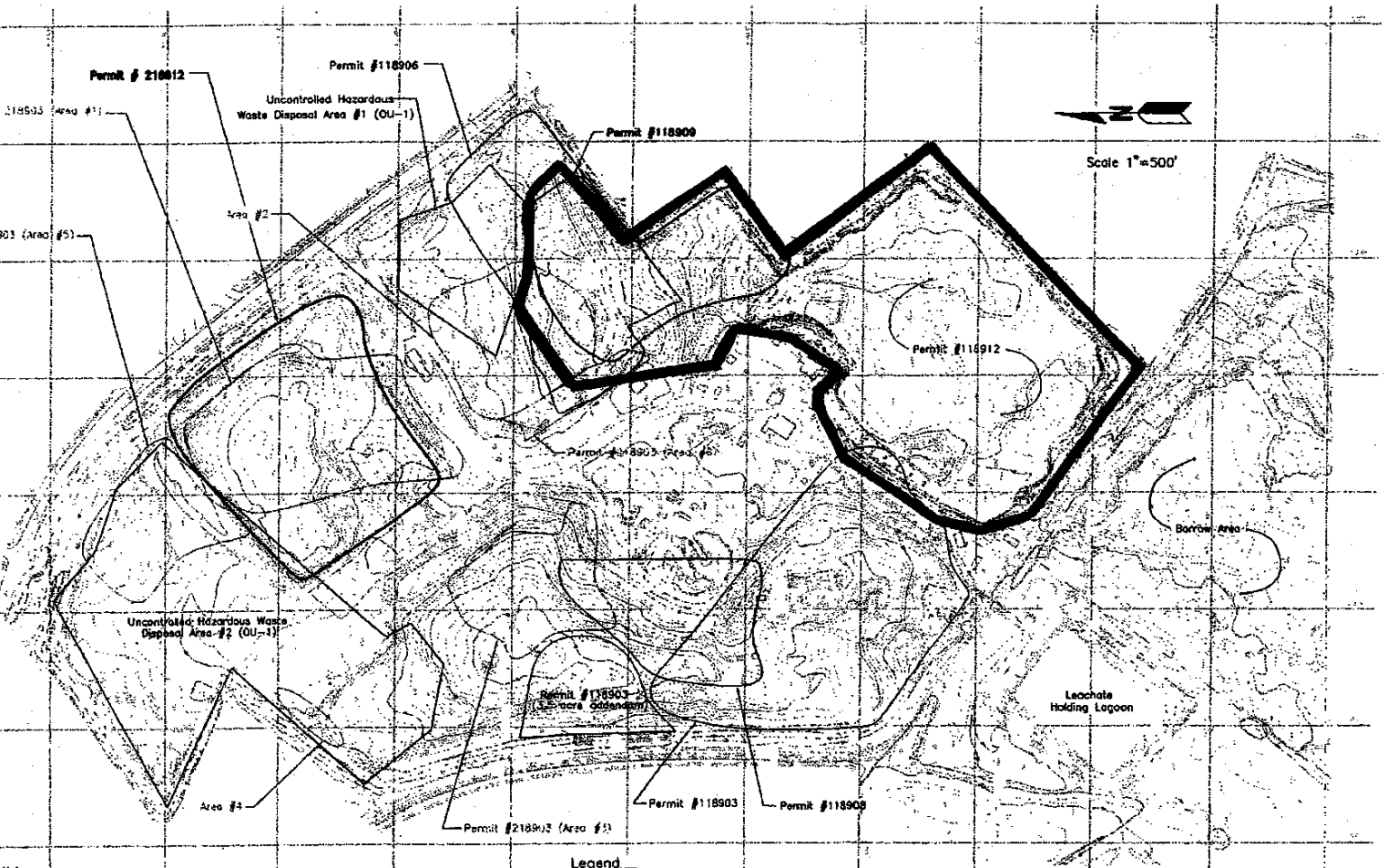
- Permit #118903
- Permit #118906
- Permit #118908
- Permit #118909
- Permit #118912
- Permit #218903
- Permit #218912
- OU-1 Hazardous Disposal Areas

No.	Description	Acreage	Issue Date	Consultant	Source
218903[1]	Demolition	27	1/27/76	Rogers & Associates	The Elbring Co., 1979, Dwg 3-1
118903	Sanitary	25	1/27/76	Rogers & Associates	The Elbring Co., 1979, Dwg 3-1
Addendum	3.5 acre expansion	3.5	5/23/78	Paul H. Himebaugh	Laidlaw sketch, unknown origin
118906	Sanitary	13	1/22/79	Paul H. Himebaugh	Himebaugh, 12/19/78, Plate 1
118908	Sanitary	6	8/27/80	Reitz & Jens, Inc.	Laidlaw sketch, unknown origin
118909	Sanitary	9	8/20/81	Reitz & Jens, Inc.	Reitz & Jens, Inc., 8/28/81, Sheet 2 of 3
218912	Demolition	22	9/19/84	Burns & McDonnell	Burns & McDonnell, 1989, Dwg 2
118912	Sanitary	52	11/18/85	Burns & McDonnell	Burns & McDonnell, 1984, Dwg 4
OU-1, Area 1	Hazardous Waste	5.3	N/A	N/A	Burns & McDonnell, 1989, Dwg 1A
OU-2, Area 2	Hazardous Waste	30.2	N/A	N/A	Burns & McDonnell, 1989, Dwg 1A

[1] Includes Areas 1, 3, 5, and 6. These areas received sanitary waste fill prior to receiving MDNR Demolition Permit No. 218903. Areas 2 and 4 were denied permitting by MDNR, however, they also received waste fill prior to permit denial by MDNR.

Project: Laidlaw Waste Systems (Bridgeton), Inc.
Facility Upgrade And Permit Modification

Figure 3
Historical Permit Limits



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118906	Sanitary	13	1/22/79	Paul H. Himebaugh	Himebaugh, 12/19/78, Plate 1
118908	Sanitary	6	8/27/80	Reitz & Jens, Inc.	Laidlaw sketch, unknown origin
118909	Sanitary	9	8/20/81	Reitz & Jens, Inc.	Reitz & Jens, Inc., 8/28/81, Sheet 2 of 3
218912	Demolition	22	9/19/84	Burns & McDonnell	Burns & McDonnell, 1989, Dwg 2
118912	Sanitary	52	11/16/85	Burns & McDonnell	Burns & McDonnell, 1984, Dwg 4
OU-1, Area 1	Hazardous Waste	6.3	N/A	N/A	Burns & McDonnell, 1989, Dwg 1A
OU-2, Area 2	Hazardous Waste	30.2	N/A	N/A	Burns & McDonnell, 1989, Dwg 1A

[1] Includes Areas 1, 3, 5, and 6. These areas received sanitary waste fill prior to receiving MDNR Demolition Permit No. 218903. Areas 2 and 4 were denied permitting by MDNR, however, they also received waste fill prior to permit denial by MDNR.

Project: Laidlaw Waste Systems (Bridgeton), Inc.
Facility Upgrade And Permit Modification

Project Number: 940130-004 Date: 12/95

MIDWEST ENVIRONMENTAL CONSULTANTS, P.C.

APPENDIX C

PHOTO LOG

Bridgeton Waste Limit Investigation
Aquaterra Project No. 3718.10

Photo #1

Photographer: Jerry Jordan

Date: 12-29-09

Description: Excavation at Point 198.

Photo #2

Photographer: Jerry Jordan

Date: 12-29-09

Description: Excavation at Point 195.

Photo #3

Photographer: Jerry Jordan

Date: 12-29-09

Description: Overlooking Permit #218903 (Area #5) facing southwest near Point 222.

Bridgeton Waste Limit Investigation
Aquaterra Project No. 3718.10

Photo #4

Photographer: Jerry Jordan

Date: 12-29-09

Description: Excavation at Point 283.

Photo #5

Photographer: Jerry Jordan

Date: 12-29-09

Description: Facing west near Point 269.

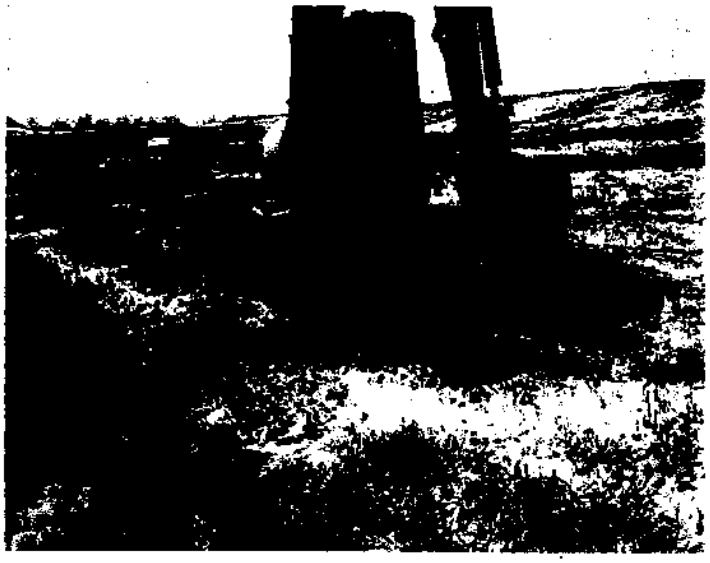

Photo #6

Photographer: Corey Rice

Date: 7-7-2010

Description: Facing northeast toward GEW-1 and St. Charles Rock Road (near Point R147).

Bridgeton Waste Limit Investigation
Aquaterra Project No. 3718.10

Photo #7

Photographer: Corey Rice

Date: 7-7-2010

Description: Facing northwest toward PGW-60 (near Point R146).

Photographer: Corey Rice

Date: 7-7-2010

Description: Overlooking Area #2 and Area #6 (near Point 361).

Photo #9

Photographer: Corey Rice

Date: 7-7-2010

Description: Facing Northeast toward PGW- 28 (near Point 390).

APPENDIX D

INVESTIGATION TABLE

Waste Limits Investigation Table
Bridgeton Landfill, LLC

LATERAL EXTENTS OF WASTE INVESTIGATION							
POINT	DEPTH TO WASTE IF ENCONTERED IN FEET	TOTAL DEPTH OF EXCAVATION IN FEET	DISTANCE FROM PERMITTED LIMITS WHERE WASTE WAS ENCOUNTERED	DEPTH TO WASTE BEYOND PERMITTED BOUNDRY	DEPTH OF EXCAVATION BEYOND PERMIT BOUNDRY IF NO WASTE	NOTES	DATE
1		3					12/30/2009
2		3.5					12/30/2009
3		3					12/30/2009
4		3.5					12/30/2009
5		3					12/30/2009
6		2' ROCK					12/30/2009
7	2		10 FT, 20 FT	3 FT, NO WASTE			12/30/2009
8		3					12/30/2009
9						LOCATED IN ROADWAY	12/30/2009
10	3						12/30/2009
11-21						PROXIMITY TO ELECTRIC AND HEADER	12/30/2009
22	3		10	NO WASTE			12/30/2009
23						PROXIMITY TO ELECTRIC	12/30/2009
24		3					2/1/2010
27		3					2/1/2010
26		3					2/1/2010
25	2.5		10	2.5			2/1/2010
28	1		10	2			2/1/2010
29		3					2/1/2010
30		3					2/1/2010
31		3					2/1/2010
32		3					2/1/2010
33		3					2/1/2010
34		3					2/1/2010
35		3					2/1/2010
36						LOCATED IN LET DOWN	2/1/2010
37		3					2/1/2010
38						CLOSE PROXIMITY TO SUMP	2/1/2010
39		4					2/1/2010
40						LOCATED IN ROAD	2/1/2010
41						LOCATED IN ROAD	2/1/2010
42						LOCATED IN ROAD	2/1/2010
43		3					2/1/2010
44		3					2/1/2010
45		3					2/1/2010
46		3					2/1/2010
47		6					2/1/2010
48		6					2/1/2010
49		6					2/1/2010
50		6					2/1/2010
51		6					2/1/2010
52		6					2/1/2010
53		6					2/1/2010
54		6					2/1/2010
55		3					2/1/2010
56		3					2/1/2010
57		3					2/1/2010
58						CLOSE PROXIMITY TO SEWER	2/1/2010
59		3					2/1/2010
60		3					2/1/2010
61						CLOSE PROXIMITY TO SEWER	2/1/2010
62						CLOSE PROXIMITY TO SEWER	2/1/2010
63		3					2/1/2010
65		3					2/1/2010
67		3					2/1/2010
68		3					2/1/2010
69		3					2/1/2010
70						CLOSE PROXIMITY TO HEADER	2/1/2010
71						CLOSE PROXIMITY TO HEADER	2/1/2010
72						CLOSE PROXIMITY TO HEADER	2/1/2010
73						CLOSE PROXIMITY TO HEADER	2/1/2010
74						CLOSE PROXIMITY TO HEADER	2/1/2010
75		3					2/2/2010
76						NO ACCESS	2/2/2010
77		3					2/2/2010
78						NO ACCESS	2/2/2010
79		3					2/2/2010
80	3		10	3			2/2/2010
81		3					2/2/2010
82		3					2/2/2010
83		3					2/2/2010
84		3					2/2/2010
85						CLOSE PROXIMITY TO ELECTRIC	2/2/2010
86						CLOSE PROXIMITY TO HEADER	2/2/2010
87						CLOSE PROXIMITY TO HEADER	2/2/2010
88		3					2/2/2010
89		3					2/2/2010
90		3					2/2/2010
91		3					2/2/2010

Waste Limits Investigation Table
Bridgeton Landfill, LLC

POINT	DEPTH TO WASTE IF ENCONTERED IN FEET	TOTAL DEPTH OF EXCAVATION IN FEET	DISTANCE FROM PERMITTED LIMITS WHERE WASTE WAS ENCOUNTERED	DEPTH TO WASTE BEYOND PERMITTED BOUNDRY	DEPTH OF EXCAVATION BEYOND PERMIT BOUNDRY IF NO WASTE	NOTES	DATE
92		3					2/2/2010
93		3					2/2/2010
94	2		10	3			2/2/2010
95						POSSIBLE ELECTRIC	2/2/2010
96	3					LIGHT ISOLATED WASTE	2/2/2010
97	3		5	3			2/2/2010
98	2.5		10	2.5			2/2/2010
99	4		10	4			2/2/2010
100		3					2/2/2010
101		3					2/2/2010
102						LOCATED IN LET DOWN	2/2/2010
103		4					2/2/2010
104		4					2/2/2010
105		4					2/2/2010
106						CLOSE PROXIMITY TO ELECTRIC	2/2/2010
107		4					2/2/2010
108	4		20	NO WASTE	6		2/2/2010
109		6					2/2/2010
110		6					2/2/2010
111		6					2/2/2010
112		6					2/2/2010
113		6					2/2/2010
114		4					2/2/2010
115		3					2/2/2010
116		3					2/2/2010
117		3					2/2/2010
118						CLOSE PROXIMITY TO UTILITY POLE	2/2/2010
119		3					2/2/2010
120		3					2/2/2010
121		3					2/2/2010
122	2		20	NO WASTE	4		2/2/2010
123		3					2/2/2010
124		3					2/2/2010
125		3					2/2/2010
126		3					2/2/2010
127	2.5		10	NO WASTE	4		2/2/2010
128		3					2/2/2010
129		3					2/2/2010
130						CLOSE PROXIMITY TO HEADER	2/2/2010
131						CLOSE PROXIMITY TO HEADER	2/2/2010
132						CLOSE PROXIMITY TO HEADER	2/2/2010
133						CLOSE PROXIMITY TO HEADER	2/2/2010
134						CLOSE PROXIMITY TO HEADER	2/2/2010
135		3					2/2/2010
136		3					2/2/2010
137		6					2/2/2010
138		3					2/2/2010
139		3					2/2/2010
140		6					2/2/2010
141		5					2/2/2010
142		3					2/2/2010
R143		3				FENCE RELOCATED 5' WEST	2/2/2010
R144		6				RELOCATED 20' WEST	2/2/2010
R145		6				RELOCATED 10' WEST	2/2/2010
R146		4				RELOCATED 20' WEST	2/2/2010
R147	1					RELOCATED TO DRAINAGE WAY DUE TO SOIL BERM	2/2/2010
R148	1					RELOCATED TO DRAINAGE WAY DUE TO SOIL BERM	2/2/2010
R149	3					RELOCATED TO DRAINAGE WAY DUE TO SOIL BERM	2/2/2010
R150	1.5					RELOCATED TO DRAINAGE WAY DUE TO SOIL BERM	2/2/2010
R151		6				RELOCATED TO DRAINAGE WAY DUE TO SOIL BERM	2/2/2010
R152	3					RELOCATED TO DRAINAGE WAY DUE TO SOIL BERM	2/2/2010
R153	2.5					RELOCATED TO DRAINAGE WAY DUE TO SOIL BERM	2/2/2010
R154	2.5					RELOCATED TO DRAINAGE WAY DUE TO SOIL BERM	2/2/2010
R155	3					RELOCATED TO INSIDE FENCE	2/2/2010
R156	2					RELOCATED TO INSIDE FENCE	2/2/2010
R157	2					RELOCATED TO INSIDE FENCE	2/2/2010
R158	2					RELOCATED TO INSIDE FENCE	2/2/2010
R159	2.5					RELOCATED TO INSIDE FENCE	2/2/2010
R160	3					RELOCATED TO INSIDE FENCE	2/2/2010
R161	2.5					RELOCATED TO INSIDE FENCE	2/2/2010
153		3.2					3/1/2010
154		3.5					3/1/2010
155		4					3/1/2010
155B		3					3/1/2010
156		4					3/1/2010
156B	1		-30	NO WASTE	4		3/1/2010
157		3.8					3/1/2010
157B		3.5					3/1/2010
158		4					3/1/2010
158B	2.5		-25	NO WASTE	4		3/1/2010
159		4					3/1/2010
159B		3.5					3/1/2010

Waste Limits Investigation Table
Bridgeton Landfill, LLC

POINT	DEPTH TO WASTE IF ENCONTERED IN FEET	TOTAL DEPTH OF EXCAVATION IN FEET	DISTANCE FROM PERMITTED LIMITS WHERE WASTE WAS ENCOUNTERED	DEPTH TO WASTE BEYOND PERMITTED BOUNDRY	DEPTH OF EXCAVATION BEYOND PERMIT BOUNDRY IF NO WASTE	NOTES	DATE
160B		3					3/1/2010
160		3.8					3/1/2010
161		3.5					3/1/2010

Waste Limits Investigation Table
Bridgeton Landfill, LLC

DEMOLITION LANDFILL - LATERAL EXTENTS OF WASTE							
POINT	DEPTH TO WASTE IF ENCONTERED IN FEET	TOTAL DEPTH OF EXCAVATION IN FEET	DISTANCE FROM PERMITTED LIMITS WHERE WASTE WAS ENCOUNTERED	DEPTH TO WASTE BEYOND PERMITTED BOUNDRY	DEPTH OF EXCAVATION BEYOND PERMIT BOUNDRY IF NO WASTE	NOTES	DATE
162-168						LOCATED INSIDE CLOSURE STAKES	12/29/2009
168-182						LOCATED IN ROADWAY, DRAINAGE STRUCTURE OR CONTAINER YARD	12/29/2009
183		3					12/29/2009
184		3					12/29/2009
185		3					12/29/2009
186		3					12/29/2009
187-190						ROADWAY	12/29/2009
191						CEMENT OUTFALL	12/29/2009
192						CEMENT OUTFALL	12/29/2009
193		3.2					12/29/2009
194		3.5					12/29/2009
195		3					12/29/2009
196		3					12/29/2009
197		3					12/29/2009
198	3		NE 20'	2		STOPPED DUE TO LANDSCAPING	12/29/2009
199-216						EXCAVATED AT POINTS INSIDE FENCE	12/29/2009
217	3						12/29/2009
218	2						12/29/2009
219	1						12/29/2009
220	2						12/29/2009
221	2		10				12/29/2009
222	2		20				12/29/2009
223	2		40				12/29/2009
224	2		40				12/29/2009
225	2.5					WATER	12/29/2009
226	2.5		40				12/29/2009
227		3					12/29/2009
228		3					12/29/2009
229		3					12/29/2009
230		3					12/29/2009
231		3					12/29/2009
232		3					12/29/2009
233		3					12/29/2009
234		3					12/29/2009
235		2' ROCK					12/29/2009
236		2' ROCK					12/29/2009
237		2' ROCK					12/29/2009
238-244						POSSIBLE ELECTRIC LINE	12/29/2009
245	3					POSSIBLE ELECTRIC LINE	12/29/2009
246	2		20		4		12/29/2009
247	2.5		6	4			12/29/2009
248-258						CONTAINER YARD	12/29/2009
259		3					12/30/2009
260		3					12/30/2009
261		3					12/30/2009
262		1' ROCK					12/30/2009
263		ROCK					12/30/2009
264		1' ROCK					12/30/2009
265		1' ROCK					12/30/2009
266		6" ROCK					12/30/2009
267		2' ROCK					12/30/2009
268		CONCRETE					12/30/2009
269		3					12/30/2009
270		3					12/30/2009
271		3					12/30/2009
272		3 MINIMAL WASTE					12/30/2009
273	3						12/30/2009
274						UNDER WATER	12/29/2009
275						UNDER WATER	12/29/2009
276						UNDER WATER	12/29/2009
277						UNDER WATER	12/29/2009
278						UNDER WATER	12/29/2009
279						UNDER WATER	12/29/2009
280	3						12/29/2009
281		3.5					12/29/2009
282		3.5					12/29/2009
283		3.5					12/29/2009
284		3					12/29/2009
285		3.5					12/29/2009
286		3.5					12/29/2009
287		4					12/29/2009
288		3.5					12/29/2009
289		4					12/29/2009
290		3.5					12/29/2009
291		3.5					12/29/2009

Waste Limits Investigation Table
Bridgeton Landfill, LLC

DEMOLITION LANDFILL - COVER THICKNESS INVESTIGATION							
POINT	DEPTH TO WASTE IF ENCONTERED IN FEET	TOTAL DEPTH OF EXCAVATION IN FEET	DISTANCE FROM PERMITTED LIMITS WHERE WASTE WAS ENCOUNTERED	DEPTH TO WASTE BEYOND PERMITTED BOUNDRY	DEPTH OF EXCAVATION BEYOND PERMIT BOUNDRY IF NO WASTE	NOTES	DATE
328		4				GRAVEL	5/5/2010
329	10					0-4' GRAVEL, 4-8' CLAY AND GRAVEL, 8-10' GRAVEL	5/5/2010
330	8					0-4' CLAY AND GRAVEL, 4-8' CLEAN FILL	5/5/2010
331	8					0-4' GRAVEL AND CLEAN FILL, 4-8' GRAVEL	5/5/2010
332	8					0-4' GRAVEL AND CLEAN FILL, 4-8' CLEAN FILL	5/5/2010
333	6					0-4' GRAVEL AND CLEAN FILL, 4-6' FILL, 6-8' WASTE	5/5/2010
334	3					NO WASTE, 0-3' GRAVEL AND CLAY	5/5/2010
335	8					0-4' CLAY AND GRAVEL, 4-8' CLEAN FILL	5/5/2010
336	7					REFUSAL 7', 0-4 GRAVEL AND CLAY, WASTE AT 5'	5/5/2010
337	8					0-4' CLAY AND GRAVEL, 4-8' CLEAN FILL	5/5/2010
338	12						5/5/2010
339	12					PERMIT 218903 (AREA #2)	5/5/2010
340	6					PERMIT 218903 (AREA #2)	5/5/2010
341	4					PERMIT 218903 (AREA #2)	5/5/2010
342	14					PERMIT 218903 (AREA #2)	5/5/2010

COVER THICKNESS INVESTIGATION							
POINT	DEPTH TO WASTE IF ENCONTERED IN FEET	TOTAL DEPTH OF EXCAVATION IN FEET	DISTANCE FROM PERMITTED LIMITS WHERE WASTE WAS ENCOUNTERED	DEPTH TO WASTE BEYOND PERMITTED BOUNDRY	DEPTH OF EXCAVATION BEYOND PERMIT BOUNDRY IF NO WASTE	NOTES	DATE
356	3					PERMIT 218903 (AREA #2)	5/5/2010
357	3					PERMIT 218903 (AREA #2)	5/5/2010
358	3					PERMIT 218903 (AREA #2)	5/6/2010
359	3					PERMIT 218903 (AREA #6)	5/6/2010
360	3					PERMIT 218903 (AREA #6)	5/5/2010
361	3					PERMIT 218903 (AREA #2)	5/5/2010
363	3					PERMIT 118906	5/5/2010
364	3					PERMIT 118906	5/12/2010
367	3					PERMIT 218903 (AREA #6)	5/6/2010
369		3				PERMIT 118906	5/12/2010
371		3				PERMIT 118906	5/12/2010
374		3				PERMIT 118906	5/12/2010
375		3				PERMIT 118906	5/12/2010
377		3				PERMIT 118906	5/6/2010
378		3				PERMIT 118906 / PERMIT 118903	5/6/2010
379		3				PERMIT 118906 / PERMIT 118903	5/6/2010
380		3				PERMIT 118906 / PERMIT 118903	5/6/2010
381		3				PERMIT 118906 / PERMIT 118903	5/6/2010
385		3				PERMIT 118906	5/12/2010
386		3				PERMIT 218903 (AREA #6)	5/12/2010
388	3					PERMIT 118912	5/6/2010
389	3					PERMIT 118912	5/6/2010
390	3					PERMIT 118912	5/6/2010
391	3					PERMIT 118912	5/6/2010
393	3					PERMIT 118912	5/6/2010
400		3				PERMIT 118912	5/12/2010
401		3				PERMIT 118912	5/12/2010
402		3				PERMIT 118912	5/12/2010
403		3				PERMIT 118912	5/12/2010
406	3					PERMIT 118906	5/6/2010

APPENDIX E

DAILY FIELD ACTIVITY LOGS

DAILY FIELD ACTIVITIES REPORT

Client Name: Bridgeton Landfill
Aquaterra Project Name: Waste Limits Investigation
Aquaterra Project Number: 3718.1
Project Location: Bridgeton, MO

Date: December 29, 2009
Start Time: 7:30 AM
Stop Time: 7:00 PM

Task: Waste Limits Investigation

Weather Information
26 °F

Contractors, Personnel, and Equipment On Site

Corey Rice - Aquaterra	Mini Excavator
Jerry Jordan - Aquaterra	

Work Areas/Boundaries
Demolition Landfill

Testing Equipment Used/Observed and Calibration/Re-Calibration Documentation

Tests Completed/Observed
Points 183-186, 193-198, 217-235, 245-247, 280-291

Work Comments/Observations and Test Results
Investigation began at Pt 198, encountered waste 3' bgs and 20' NE from boundary. No further investigation due to landscapping. No waste encountered at Pts 193-197. No excavation occured ar Pts 191-192 (located in the outfall) and Pts 187-190 (located in the roadway). No waste encountered at Pts 183-186. Pts 168-182 were located in the roadway, drainage structure, or container yard. Pts 162-168 were located insde the closure stakes, therefore excavation began at Pt 247. Waste encountered at Pts 245 - 247 and 20' from boundary. Investigation at Pts 245 - 247 did not continue due to stockpiles located near waste boundary. Pts 238 - 245 were not investigated due to close proximity of electric line. Excavation at Pts 235 - 237 was limited due to rock. No waste encountered at Pts 227 - 234. Waste encountered at Pts 217-221 and up to 40' from waste boundary, further investigation did not occur due to proximity of the OU-1 fence. No waste encountered at Pts 280-291, except at Pt 280. Pts 275-279 were not completed due to water. Pts 199-216 were not completed, excavation at pts on the inside of the fence did not encounter waste.

Material(s) Delivered to Site

Corey M. Rice
Aquaterra Personnel

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

DAILY FIELD ACTIVITIES REPORT

Client Name: Bridgeton Landfill
Aquaterra Project Name: Waste Limits Investigation
Aquaterra Project Number: 3718.1
Project Location: Bridgeton, MO

Date: December 30, 2009
Start Time: 7:30 AM
Stop Time: 5:00 PM

Task: Waste Limits Investigation

Weather Information 33 °F

Contractors, Personnel, and Equipment On Site

Corey Rice - Aquaterra	Mini Excavator
Jerry Jordan - Aquaterra	

Work Areas/Boundaries
Demolition Landfill, Area #2, Area #6, 118912

Testing Equipment Used/Observed and Calibration/Re-Calibration Documentation

Tests Completed/Observed

Points 259-273	
Points 1-23	

Work Comments/Observations and Test Results

Attempted excavation at Pts 259-273 (closure stakes), waste at Pt 272 and 273. Moved to other side of office beginning at Pt 1. No waste encountered at Pts 1-6. Encountered waste at Pt 7. Excavated at Pt 9 (located in roadway). Waste encountered at Pt 10. No excavation at Pts 11-21 due to proximity to electric and header. Encountered waste at Pt 22. No excavation at Pt 23 due to proximity to electric.

Material(s) Delivered to Site

Aquaterra Personnel

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

DAILY FIELD ACTIVITIES REPORT

Client Name: Bridgeton Landfill
Aquaterra Project Name: Waste Limits Investigation
Aquaterra Project Number: 3718.1
Project Location: Bridgeton, MO

Date: February 1, 2010
Start Time: 7:30 AM
Stop Time: 5:00 PM

Task: Waste Limits Investigation

Weather Information
32 °F

Contractors, Personnel, and Equipment On Site

Corey Rice - Aquaterra	Mini Excavator
Phil Allen - Aquaterra	

Work Areas/Boundaries
118912

Testing Equipment Used/Observed and Calibration/Re-Calibration Documentation

Tests Completed/Observed
Points 24-74

Work Comments/Observations and Test Results
Began investigation at Pt 24. No waste encountered at Pts 24-26. Waste encountered at Pt 27 and Pt 28, and 10 ft from waste boundary. No further investigation due to drainage way. No waste encountered at Pts 29-35. Pt 36 was not completed due to being located in the letdown. No waste at Pt 37. Pt 38 was not completed due proximity to sump. No waste encountered at Pt 39. Pts 40-42 were located in the road. Completed Pts 43-46, no waste encountered. Increased depth of investigation to 6 ft for Pts 47-54, no waste encountered. Completed Pts 55-57, no waste encountered. Pts 58, 61, and 62 were located near sewer line. No waste encountered at Pts 59, 60, and 63-69. Pts 70-74 were not completed due to proximity to header.

Material(s) Delivered to Site

Corey M. Rice
Aquaterra Personnel

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

DAILY FIELD ACTIVITIES REPORT

Client Name: Bridgeton Landfill
Aquaterra Project Name: Waste Limits Investigation
Aquaterra Project Number: 3718.1
Project Location: Bridgeton, MO

Date: February 2, 2010
Start Time: 7:30 AM
Stop Time: 5:00 PM

Task: Waste Limits Investigation

Weather Information 34ºF

Contractors, Personnel, and Equipment On Site

Corey Rice - Aquaterra	Mini Excavator
Phil Allen - Aquaterra	

Work Areas/Boundaries

118912, 118906

Testing Equipment Used/Observed and Calibration/Re-Calibration Documentation

Tests Completed/Observed

Points 75-161

Work Comments/Observations and Test Results

No waste at Pts 75, 77, and 79. Pts 76 and 78 were not completed due to access limitations. Waste encountered at Pt 80 and 10' from waste boundary. No waste at Pts 81-84. Pts 85-87 were not completed due to proximity to header. No waste at 88-93. Waste encountered at Pts 94, 97-99 and 10' from waste boundary. Pt 95 was not completed due to proximity to electric. No waste at Pts 100-101. Pt 102 located in letdown. No waste at Pts 103-105. Pt 106 located near electric. Completed Pts 107 and 108, waste encountered at Pt 108, no waste 20' from waste boundary. No waste at Pts 109-117. Pt 118 located near power pole. No waste at Pt 119-120. Waste encountered at Pt 122 but not 20' from waste boundary. No waste at Pt 123-126. Waste encountered at Pt 127 but not 20' from waste boundary. Waste was not encountered at Pts 128-129. Pts 130-134 were not completed due to proximity to header. No waste at 135-142. Relocated Pts 143-16, denoted 143R-161R. No waste at Pts 143R-146R. Waste encountered at Pts 147R-161R, except 151R. Pt 151R was relocated to east side of drainage way to confirm berm was constructed of soil, no waste encountered, excavated to 6' bgs.

Material(s) Delivered to Site

Aquaterra Personnel

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

DAILY FIELD ACTIVITIES REPORT

Client Name: Bridgeton Landfill
Aquaterra Project Name: Waste Limits Investigation
Aquaterra Project Number: 3718.1
Project Location: Bridgeton, MO

Date: March 1, 2010
Start Time: 7:30 AM
Stop Time: 11:00 AM

Task: Waste Limits Investigation

Weather Information

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Contractors, Personnel, and Equipment On Site

Corey Rice - Aquaterra	Mini Excavator
Claire Eubanks - Aquaterra	

Work Areas/Boundaries

118906

Testing Equipment Used/Observed and Calibration/Re-Calibration Documentation

Tests Completed/Observed

Points 153-161

Work Comments/Observations and Test Results

Began waste investigation at Pt 153, outside the fence along St. Charles Rock Road. No waste encountered at Pts 153-161. Previous investigation inside the fence encountered waste at Pts R155-R161 additional Pts 155B-160B were completed. Waste was encountered at Pt 156B and Pt. 158B, no waste encountered at additional points investigated between permit boundary and fence.

Material(s) Delivered to Site

Aquaterra Personnel

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

DAILY FIELD ACTIVITIES REPORT

Client Name: Bridgeton Landfill
Aquaterra Project Name: Waste Limits Investigation
Aquaterra Project Number: 3718.1
Project Location: Bridgeton, MO

Date: May 5, 2010
Start Time: 8:00 AM
Stop Time: 4:00 PM

Task: Cover Thickness Investigation

Weather Information 71 ºF

Contractors, Personnel, and Equipment On Site

Corey Rice - Aquaterra — Geoprobe
Operator - GeoDrill

Work Areas/Boundaries

118912, 118906, 218903 (Area #1, Area #2 and Area #6)

Testing Equipment Used/Observed and Calibration/Re-Calibration Documentation

Tests Completed/Observed

Points 328-342, 356-357, 360-363

Work Comments/Observations and Test Results

Began cover thickness investigation in contianer yard. Completed Pts 328-342, depth to waste ranged from 3-14 ft bgs. Cover consisted of gravel and clay. Moved to area upslope from transfer station. Completed Pts 356-357, and 360-363, waste encountered at 3 ft bgs.

Material(s) Delivered to Site

Corey M. Rice

Aquaterra Personnel

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

DAILY FIELD ACTIVITIES REPORT

Client Name: Bridgeton Landfill
Aquaterra Project Name: Waste Limits Investigation
Aquaterra Project Number: 3718.1
Project Location: Bridgeton, MO

Date: May 6, 2010
Start Time: 8:00 AM
Stop Time: 4:00 PM

Task: Cover Thickness Investigation

Weather Information 65 ºF

Contractors, Personnel, and Equipment On Site

Corey Rice - Aquaterra
Operator - GeoDrill

Geoprobe

Work Areas/Boundaries

118912, 118906, 218903 (Area #1, Area #2 and Area #6)

Testing Equipment Used/Observed and Calibration/Re-Calibration Documentation

Tests Completed/Observed

Points 358-359, 367, 377-381, 388-393, 406

Work Comments/Observations and Test Results

Investigation in area upslope from transfer station. Completed Pts 358-359, 367, and 406, waste was encountered at 3 ft bgs. Other Pts to be completed in this area were not accessible to truck-mounted geoprobe. Moved to area north of flare. Completed Pts 377-381, no waste was encountered to 3 ft bgs. Moved to southeast corner of 118912, completed Points 388-393, waste was encountered 3 ft bgs.

Material(s) Delivered to Site

Corey M. Rice

Aquaterra Personnel

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

DAILY FIELD ACTIVITIES REPORT

Client Name: Bridgeton Landfill
Aquaterra Project Name: Waste Limits Investigation
Aquaterra Project Number: 3718.1
Project Location: Bridgeton, MO

Date: May 12, 2010
Start Time: 7:00 AM
Stop Time: 4:00 PM

Task: Cover Thickness Investigation

Weather Information 67 ºF

Contractors, Personnel, and Equipment On Site

Corey Rice - Aquaterra	Mini Excavator

Work Areas/Boundaries
118912, 118906, 218903 (Area #6)

Testing Equipment Used/Observed and Calibration/Re-Calibration Documentation

Tests Completed/Observed
Points 364, 369-375, 385-386, 393, 400-403

Work Comments/Observations and Test Results
Cover thickness investigation using a mini excavator in areas where the truck-mounted Geoprobe could not access. No waste encountered at Pts 369-375, 385-386, 393, 400-403. Waste encountered 3 ft bgs at Pt 364.

Material(s) Delivered to Site

Corey M. Rice
Aquaterra Personnel

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.