

**QUARTERLY PROGRESS REPORT**  
**MARCH 1, 2003 - MAY 31, 2003**

**PROJECT TITLE:** Control of Odors from Construction and Demolition Debris Landfills

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### **1.0 Introduction**

Odors at landfills can result from both waste materials and their degradation products emitted from the landfill during routine operations and as landfill gas is produced. While many compounds can cause malodorous conditions, hydrogen sulfide has been identified as a major contributor to odors at landfill sites that receive wastes with high levels of sulfur. In particular, construction and demolition debris has been found to contain significant amounts of wallboard (the major component of wallboard is gypsum or calcium sulfate). The objective of this research is to estimate the amount and variation of H<sub>2</sub>S production at C&D landfills and to evaluate the impact of alternative cover materials to mitigate H<sub>2</sub>S emissions. Project objectives will be met by conducting a literature search, constructing a flux chamber, measuring H<sub>2</sub>S emissions at C&D landfills, evaluating the effect of alternate covers in reducing emissions, and preparing a guidance document for C&D landfill operators.

### **2.0 Work Completed This Quarter**

The SR 545 C&D Landfill was confirmed as a test site to verify applicability of the flux chamber method.

#### **2.1 Description of the landfill**

The SR 545 C&D Landfill is located in Winter Garden, Florida. The operation of the landfill began in 1991. The landfill site is 80 acres. Design capacity of landfill is 4 million yd<sup>3</sup>. About 240 to 250 trucks per day arrive at the landfill each week. The landfill receives 240,000 tons per year. Chakrabarti (2002) reported in his composition study that drywall (gypsum) is, on average, 4 % of the volume of waste at the SR 545 C&D Landfill.

#### **2.2 Landfill Visits**

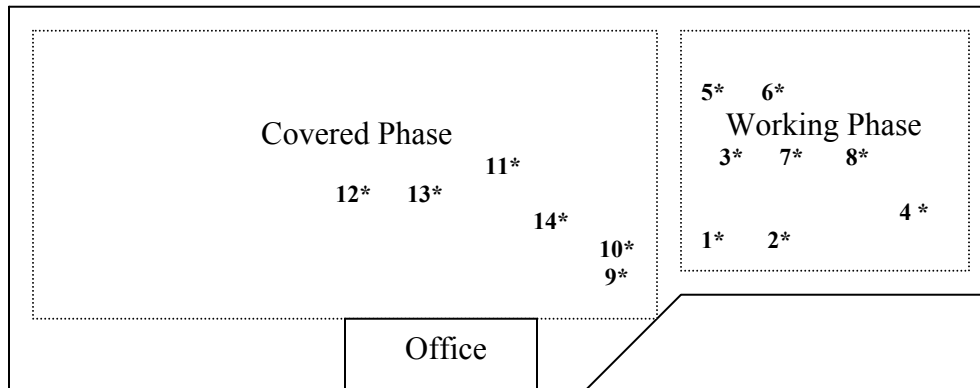
The SR 545 C&D Landfill was visited four times during this quarter. The weather can have significant effect on flux measurements. Low flux is often observed under windy condition because of a reduction of laminar boundary layer over the surface of the emission source and formation of a low-pressure area on the downside of the chamber. The weather and landfill visit dates are represented in Table 1.

Table 1: Landfill Visit Date and Weather Conditions.

Visit date	Weather
April 1	84 F, Windy
April 10	82 F, Very windy
April 17	87 F, Sunny
April 25	87 F, Very windy

### 2.3 Survey of Ambient H<sub>2</sub>S

A H<sub>2</sub>S survey was conducted during each visit to find gas emission hot spots for flux measurements. In general and as expected, the working face is more odorous than covered waste. Ambient concentrations are unstable over time and as wind direction changes. Figure 1 and Table 2 represent landfill site layout and the results of the H<sub>2</sub>S survey, respectively.



Number 1 - 14 = Locations of Flux Measurements

Figure 1: Site Layout of SR 545 Landfill and Location of Flux Measurements

Table 2: Survey results of Ambient H<sub>2</sub>S

Visit Date	Ambient H <sub>2</sub> S Conc. of Covered Waste (ppm)	Ambient H <sub>2</sub> S Conc. of Working Face (ppm)
April 1	0.004 – 0.005	0.008 - 0.013
April 10	0.002 – 0.003	0.005 - 0.013
April 17	0.002 – 0.003	0.005 - 0.006
April 25	0.001 – 0.004	0.005 - 0.009

### 2.4 Results of H<sub>2</sub>S Flux Measurement

During the first and second landfill trips, a dynamic flux chamber method was used with airflow introduced into the chamber. The results, however, were all below detection limit (BDL) of the Jerome meter even though reduced airflow rates and detention time were

used. For the rest of sampling events, the static flux chamber method was used with no air introduced while measuring the increase in concentration of the gas exiting the chamber as a function of time. Figure 1 depicts the locations of the flux measurement and Tables 3 and 4 present the dynamic and static flux results. Some locations had unstable data ranging from 0.003 to 0.100 ppm. The identified reasons for unstable data were low concentration (near the BDL of the Jerome meter), Jerome meter its annual required regeneration, and the length of tubing. After regenerating the Jerome meter and making the tubing shorter, readings became stable.

Finally two flux data sets were obtained. The data for one of them, however, were nonlinear. Figure 2 and 3 are graphs for Locations 1 and 4. The flux of the H<sub>2</sub>S for a static chamber method can be calculated following Equation 1.

$$F = V/A (dc/dt) \tag{1}$$

Where:

- F = flux of gas, ug/m<sup>2</sup>-hr
- V = chamber volume, m<sup>3</sup>
- A = area of soil surface enclosed by the chamber, m<sup>2</sup>
- dc/dt = time rate of change of gas concentration in the air within chamber, ug/m<sup>3</sup>-hr

Table 3: Results of Dynamic Flux Method

Visit Date	Location	Air Flow Rate (L/min)	Retention Time (min)	H <sub>2</sub> S Conc. (ppm)
April 1	9	10	20	BDL <sup>a</sup>
	10	10	20	BDL
	3	10	20	BDL
	5	10	20	Unstable
April 10	11	10	20	BDL
			30	BDL
			40	BDL
	6	5	15	BDL
			25	BDL
			35	BDL
			20	BDL
	6	5	30	BDL
			40	BDL
20			BDL	
April 17	7	2	35	BDL

<sup>a</sup>BDL : Below Detection Limits

Table 4: Results of Static Flux Measurement

Visit Date	Location	Time (min)	H <sub>2</sub> S Conc. (ppm)	H <sub>2</sub> S Flux. (ug/m <sup>2</sup> -hr)
April 17	2	10	Unstable	N/A
		20	Unstable	N/A
		30	Unstable	N/A
	8	10	Unstable	N/A
		20	Unstable	N/A
		30	Unstable	N/A
April 17	1	10	0.005	Non linear response, therefore the data were not used.
		20	0.015	
		30	0.110	
		40	0.100	
		50	0.120	
		60	0.110	
April 25	12	10 – 50	BDL	N/A
	13	10- 50	BDL	N/A
	14	10 – 50	BDL	N/A
	4	0	4	1.9
		10	5	
		20	5	
		30	7	
		40	7	
		50	7	
		60	9	
		70	9	
		80	10	
		90	10	

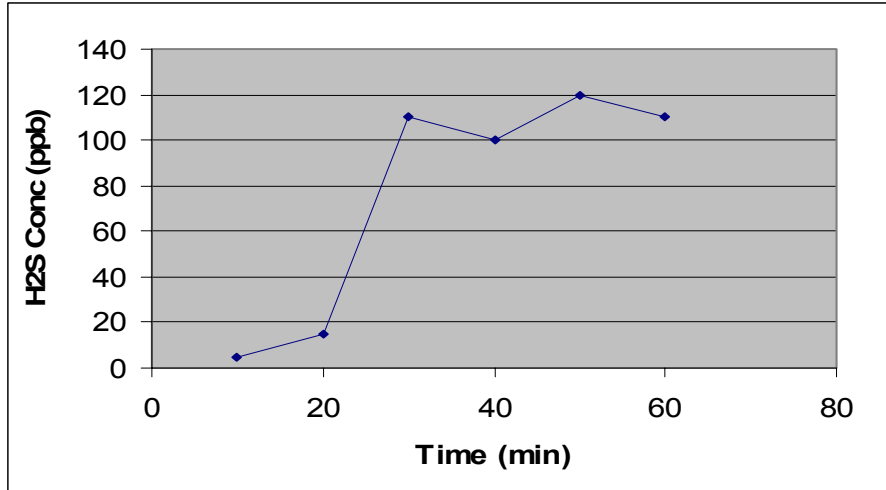


Figure 2: H<sub>2</sub>S Concentration vs. Time (Location 1)

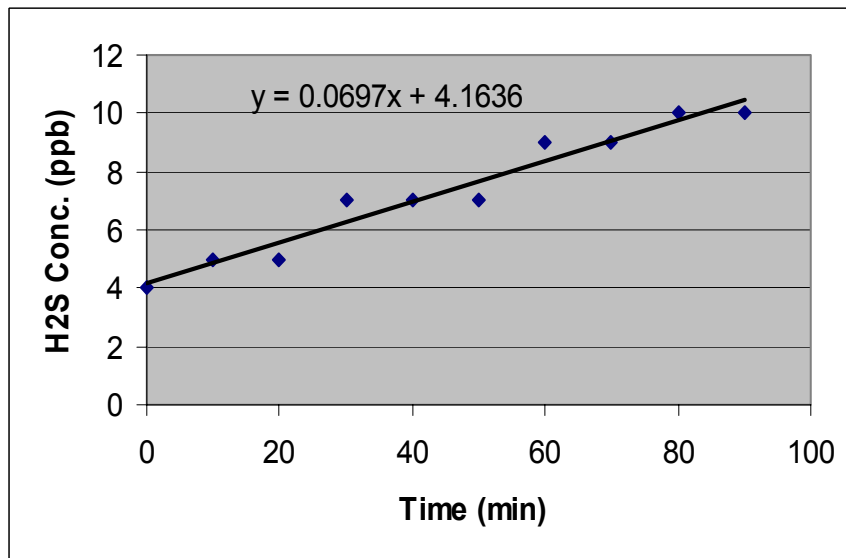


Figure 3: H<sub>2</sub>S Concentration vs. Time (Location 4)

### 3.0 Three landfill sites visited on May 14, 2003

- Pine Ridge C & D Landfill
- Keene Road C & D Landfill
- Gel Corporation Facility

#### **4.0 Work To Be Completed Next Quarter**

- Dynamic and static chamber method will be tested at other landfills
- Twenty flux measurements per landfill will be completed.
- One landfill will be chosen for evaluation of alternative cover material.