

## Background

Odor problems represent a growing concern at many landfills disposing of construction and demolition (C&D) debris. Reduced sulfur compounds have been identified as the primary source of odor generated by these facilities. H<sub>2</sub>S is the predominant RSC observed. The formation of H<sub>2</sub>S gas results from the biological conversion of sulfate contained in gypsum drywall products. In 1996, the US EPA estimated that approximately 120 million metric tons of C&D debris was generated. However, as per NAHB data, 5-30% of this debris corresponds to gypsum drywall. The first study included collecting gas samples from different waste sites and analyzing for H<sub>2</sub>S and other RSC such as methyl mercaptan and carbon-disulfide. The second study dealt with examining the range of H<sub>2</sub>S concentrations within a C&D debris landfill due to different waste compositions. The relationship between the H<sub>2</sub>S generation from the presence of concrete and drywall was also examined in this study.

## Research Objectives

- Estimating magnitude of gas emissions from the Construction and Demolition debris landfills.
- Impact of different waste composition on the concentration of H<sub>2</sub>S from C&D debris landfills.
- Effect of concrete on H<sub>2</sub>S generation and migration.

## Materials and Methods

### Gas sample collection:

Samples were collected from ten different C&D landfill sites in Florida using three methods:

- Sample from existing gas collection well system.
- Installing soil vapor wells to collect the gas for repeated sampling in subsequent visits.
- Measurement of gas using Soil Vapor probes.



▪Simulation of C&D landfills using PVC columns inside the laboratory



## Results and Discussion

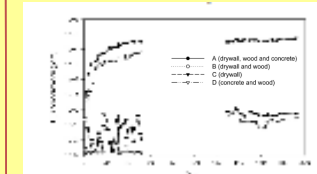
Site	Ambient Hydrogen Sulfide (ppm)					
	N	N+	Min	Max	Ave	Median
A	19	5	<0.003	0.39	0.0415	<0.003
B	100	18	<0.003	0.11	0.003	<0.003
C	7	5	<0.003	0.39	0.115	0.05
D	60	24	<0.003	2.4	0.193	0.007
E	61	41	<0.003	0.6	0.039	0.004
F	24	17	<0.003	0.12	0.008	0.004
G	24	2	<0.003	3.5	0.147	<0.003
H	22	6	<0.003	0.27	0.037	<0.003
I	27	23	<0.003	>50	4.02	0.61
J	27	21	<0.003	>50	2.74	0.008

Site	Soil Vapor Hydrogen sulfide (ppm)					
	N	N+	Min	Max	Ave	Median
A	21	19	<0.003	470	26.3	0.013
B	116	77	<0.003	920	8.1	0.007
C	8	8	0.013	12000	3019	24.74
D	26	25	<0.003	7000	2110	1800
E	72	62	<0.003	2500	35.6	0.02
F	24	16	<0.003	49	5.85	0.004
G	24	19	<0.003	0.64	0.068	0.005
H	22	20	<0.003	3300	151	0.025
I	23	22	<0.003	11000	1186	22.5
J	26	26	<0.003	530	26.2	0.35

• Ambient H<sub>2</sub>S readings ranged from <0.03 ppm to 50 ppm.

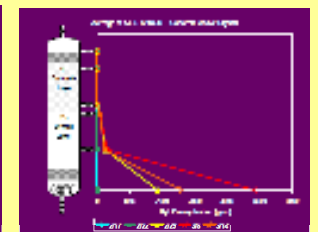
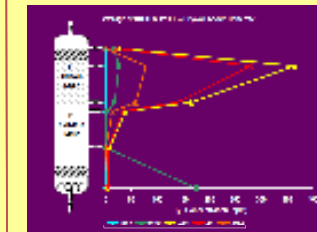
• Soil Vapor H<sub>2</sub>S readings ranged from < 0.03 ppm up to 12000 ppm inside the landfills.

## Impact of Different Waste Compositions on H<sub>2</sub>S production



H<sub>2</sub>S concentrations vs. time for packed columns.

## Effect of Concrete on H<sub>2</sub>S generation



➤ Figure 1. Column packed with drywall layer above concrete layer. The gas concentrations tend to be higher.

➤ Figure 2. Column packed with concrete layer above drywall layer. The gas concentrations tend to be lower.

## Conclusion

➤ H<sub>2</sub>S gas within C&D debris landfills was measured at levels up to 12000 ppm. This poses a risk to workers potentially exposed these gases. Precaution should be taken.

➤ Ambient H<sub>2</sub>S levels above ground level (3 to 50 ppm) were much lower than those measured inside the landfill (12000 ppm).

➤ H<sub>2</sub>S generation is affected by the presence of co-disposed wood and concrete. The H<sub>2</sub>S concentrations in columns containing wood and drywall lagged behind those columns containing drywall alone. But eventually reached similar levels.

➤ Concrete increased pH inside the landfill making it less favorable for the sulfur reducing bacteria. This in turn resulted in decreased H<sub>2</sub>S concentrations.

## Acknowledgements

This research was sponsored by the Florida Center for Solid and Hazardous waste Management .

## Selected References

- Fairweather,R.,Barlaz,M.,1998.Hydrogen sulfide production during decomposition of landfill inputs.J Environ.Eng.,353-361
- Flynn,B.,1998.Invisible threat odors and landfill gas from C&D waste. Waste Age,91-97.
- Townsend,T;Chadik,P;Bitton,G et al,Gypsum Drywall impacts on odor production at landfills: Science and Control Strategies; Report 00-09;Florida center for Solid and Hazardous Waste Management,2000