Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 14-22

ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES DURING 2013

July 2014

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-2803 (312) 751-5600

ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES DURING 2013

By

Ali K. Oskouie
Senior Environmental Research Scientist

Monitoring and Research Department
Thomas C. Granato, Director

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DISCLAIMER

Mention of proprietary equipment in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

SUMMARY

The Metropolitan Water Reclamation District of Greater Chicago (District) has maintained a program of monitoring odors at one solids drying site (SDS), one solids processing site (SPS), and five solids drying areas (SDAs) since 1990. Both the Monitoring and Research (M&R) Department and Maintenance and Operations (M&O) Department personnel made subjective observations regarding the type and intensity of any odor perceived. The M&R Department staff recorded instantaneous hydrogen sulfide (H_2S) measurements using a handheld monitor at each monitoring site. The number of locations at each facility varied from 4 to 17. The frequency of monitoring varied from one to three days per week at the SDS, SDAs, and SPS. Each odor observation was characterized as very strong, strong, easily noticeable, faint, very faint, or no odor. In this report, only data from the solids drying sites, drying areas, and processing site are presented.

During 2013, no very strong odors were observed at the SDS, SDAs, and SPS. At all the solids drying and processing sites that were monitored, the observations were characterized as faint to no odor from 74 to 99 percent of the time.

At each of the SDS, SDAs and SPS, there are specific locations which have noticeable odors. A summary of locations which had occasional strong odors is presented in Table 1.

The H_2S levels generally followed a pattern similar to the odor observations with occasional high values. The average level of H_2S ranges from 2.1 to 13.1 ppbv (parts per billion by volume) at the SDS, SDAs, and SPS.

TABLE 1: STRONG AND VERY STRONG ODOR OBSERVATIONS – 2013

Facility (Station Number)	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
Calumet SDS			
East Drying Cell #1 SW (14)	4		
East Drying Cell #8 NW (16)	3		
East Drying Cell #8 NE (17)	4		
East Drying Cell #1 SE (19)	1		
Truck Scale/Centrifuge (18)	3		
West Drying Cell #1 at Gate (20)	3		
West Drying Cell #4 (21)	2	0	
	Total 20	0	858
HASMA, Marathon, and Vulcan SDAs, and LASMA SPS			
HASMA (1)	10		
Vulcan North (3)	2		
Vulcan TARP DS (4)	2		
LASMA Lagoon #24 (8)	1		
LASMA Cell 2E – 2W (11)	1		
Marathon (15)	1		
Marathon West (16)	1	0	
	Total 18	0	1,236
RASMA SDA[1]	0	0	
	Total 0	0	152

TABLE 1 (Continued): STRONG AND VERY STRONG ODOR OBSERVATIONS – 2013

Facility (Station Number)	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
Stony Island SDA			
Entrance @ 122nd St. (1)	2		
NE Corner Cell #5 (2)	0	0	
	Total 2	0	207

[1]RASMA was not used as a biosolids drying site during 2013.
DS = Drop shaft.
HASMA = Harlem Avenue Solids Management Area.
LASMA = Lawndale Avenue Solids Management Area.
RASMA = Ridgeland Avenue Solids Management Area.
SDA = Solids Drying Area.
SDS = Solids Drying Site.
SPS = Solids Processing Site.
TARP = Tunnel and Reservoir Plan.

INTRODUCTION

The M&R Department in conjunction with the M&O Department has been conducting an odor monitoring program at various District solids drying and processing facilities for the past 24 years. The program was initiated by the M&R Department to monitor the solids processing and drying sites at the Lawndale Avenue Solids Management Area (LASMA), Harlem Avenue Solids Management Area (HASMA), Marathon, and Vulcan in 1990, and was expanded to the Calumet SDS in 1992 and to the Ridgeland Avenue Solids Management Area (RASMA) and Stony Island SDAs in 2001 as part of the District's Solids Drying Area Permits.

At each location a similar procedure is followed to monitor odors. M&R Department personnel, and at some facilities M&O Department personnel, visit various locations at each facility on a regular basis. The odor monitoring personnel make subjective observations regarding the character and intensity of odors at each of the stations. The odor intensities are ranked on a scale of no odor, very faint, faint, easily noticeable, strong, and very strong. In addition to the subjective odor measurements, the ambient air is sampled and analyzed for H_2S concentration using a Jerome Model 631-X H_2S analyzer.

The objective of this program is to collect and maintain a database of odor levels within and around each solids drying and processing facility. This data can be used to study the trends in odor levels associated with solids drying and processing operations and to correlate odor levels to conditions related to solids drying and processing operations or changing conditions within the facility.

A summary of the odor monitoring program for the solids drying and processing facilities is presented in Table 2. This table includes a brief description of the program with regard to when the monitoring commenced at each facility, the number of monitoring locations, the frequency of the monitoring, who conducts the monitoring, if H_2S is measured, and odor complaints.

Maps showing the odor monitoring locations are presented in Appendix AI.

The number of monitoring locations at each facility varies from 4 to 17, depending upon the size of the facility and the history of odor episodes at those facilities. The solids drying and processing facilities are monitored from one to three days per week.

In 2013, odor complaints were received at the Calumet and HASMA SDSs. The three complaints received were all verified.

This report presents the odor monitoring data for the year 2013. The odor monitoring data in terms of frequency of occurrence, locations of possible odor sources, and H_2S levels have been reviewed and summarized.

TABLE 2: ODOR MONITORING PROGRAM FOR 2013

Facility	Number of Locations Monitored	Year Began	Months of Year	Days per Week	Departments Participating	H_2S Measured	Number of Odor Complaints	Number of Complaints Verified
Calumet SDS	9	1992	12	2 2	M&R M&O	Yes	2	2
HASMA, Vulcan, and Marathon SDAs, and LASMA SPS	17	1990	12	3	M&R	Yes	1	1
RASMA SDA	4	2001	12	1 to 2	M&R	Yes	0	0
Stony Island SDA	4	2001	12	1	M&R	Yes	0	0

Note: HASMA = Harlem Avenue Solids Management Area
LASMA = Lawndale Avenue Solids Management Area
RASMA = Ridgeland Avenue Solids Management Area
SDA = Solids Drying Area.
SDS = Solids Drying Site.
SPS = Solids Processing Site.
M&R = Monitoring and Research Department.
M&O = Maintenance and Operations Department.

ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES IN 2013

The results of the various odor monitoring programs at each of the monitored sites for 2013 are summarized in Table 3. The results have been divided into two major groups: detected odors, which include the very strong, strong, and easily noticeable odors, and nondetected odors, which are either faint, very faint, or no odors.

A general observation drawn from the table is that at the Calumet SDS, where both M&R and M&O Department personnel conducted odor monitoring, the M&O Department personnel show a lower percentage of odors detected. This may be due to the fact that the M&O Department personnel are exposed to the specific area on a daily basis as compared to the M&R Department personnel which can result in olfactory desensitization. Thus, they may not differentiate especially well between faint and easily noticeable odors.

Calumet Solids Drying Site

The Calumet SDS consists of the East SDA, located east of the Calumet Water Reclamation Plant (WRP), and the West SDA, located west of the Calumet WRP. The occurrence of strong odors at the drying areas, which also includes the non-operational centrifuge building located at the East SDA, was infrequent. The majority of the observations were described as faint to no odor. No very strong odors were detected in 2013. Strong odors were observed at the SDS in March through June, August, and December. Strong odors were observed mostly under five percent of the time on a monthly basis except for May and August. Easily noticeable odors occurred between 2 and 27 percent of the time on a monthly basis throughout the various locations. Figure 1 presents the monthly frequency of occurrence of the easily noticeable, strong, and very strong odor observations. The easily noticeable odors were highest during August 2013.

The average H_2S levels were between 6.1 and 8.7 ppbv, as shown in Table 4. The highest value observed (73 ppbv) was at East Drying Cell #1 SE.

Two odor complaints were received with regard to the Calumet SDS during 2013.

Harlem Avenue Solids Management Area, Vulcan, and Marathon Solids Drying Areas, and Lawndale Avenue Solids Management Area Solids Processing Site

The HASMA, Vulcan, and Marathon SDAs and the LASMA SPS had 74 percent of the total observations characterized as faint to no odor. There were no very strong and 18 strong odor observations out of 1,236 total observations. The strong odor observations were spread among the various locations (HASMA, Vulcan, LASMA Cell 2E-2W, Lagoon 24, and Marathon) depending upon the activity at the time.

TABLE 3: ODOR MONITORING RESULTS FOR 2013

Facility	Departments Participating	Total Number of Observations	Number of Observations Odors were Detected			Number Non-Detects[1]	Percent Non-Detects
			Very Strong	Strong	Easily Noticeable		
Calumet SDS	M&R	530	0	17	108	405	76
	M&O	328	0	3	13	312	95
HASMA, Vulcan, and Marathon SDAs, and LASMA SPS	M&R	1,236	0	18	301	917	74
RASMA SDA[2]	M&R	152	0	0	2	150	99
Stony Island SDA	M&R	207	0	2	4	201	97

Note: HASMA = Harlem Avenue Solids Management Area.
LASMA = Lawndale Avenue Solids Management Area.
RASMA = Ridgeland Avenue Solids Management Area.
SDA = Solids Drying Area.
SDS = Solids Drying Site.
SPS = Solids Processing Site.
M&R = Monitoring and Research Department.
M&O = Maintenance and Operations Department.

[1]Non-detects are all observations of faint, very faint, or no odor.

[2]RASMA SDA was not used as a biosolids drying site during 2013.

FIGURE 1: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE CALUMET WATER RECLAMATION PLANT SOLIDS DRYING SITES – 2013

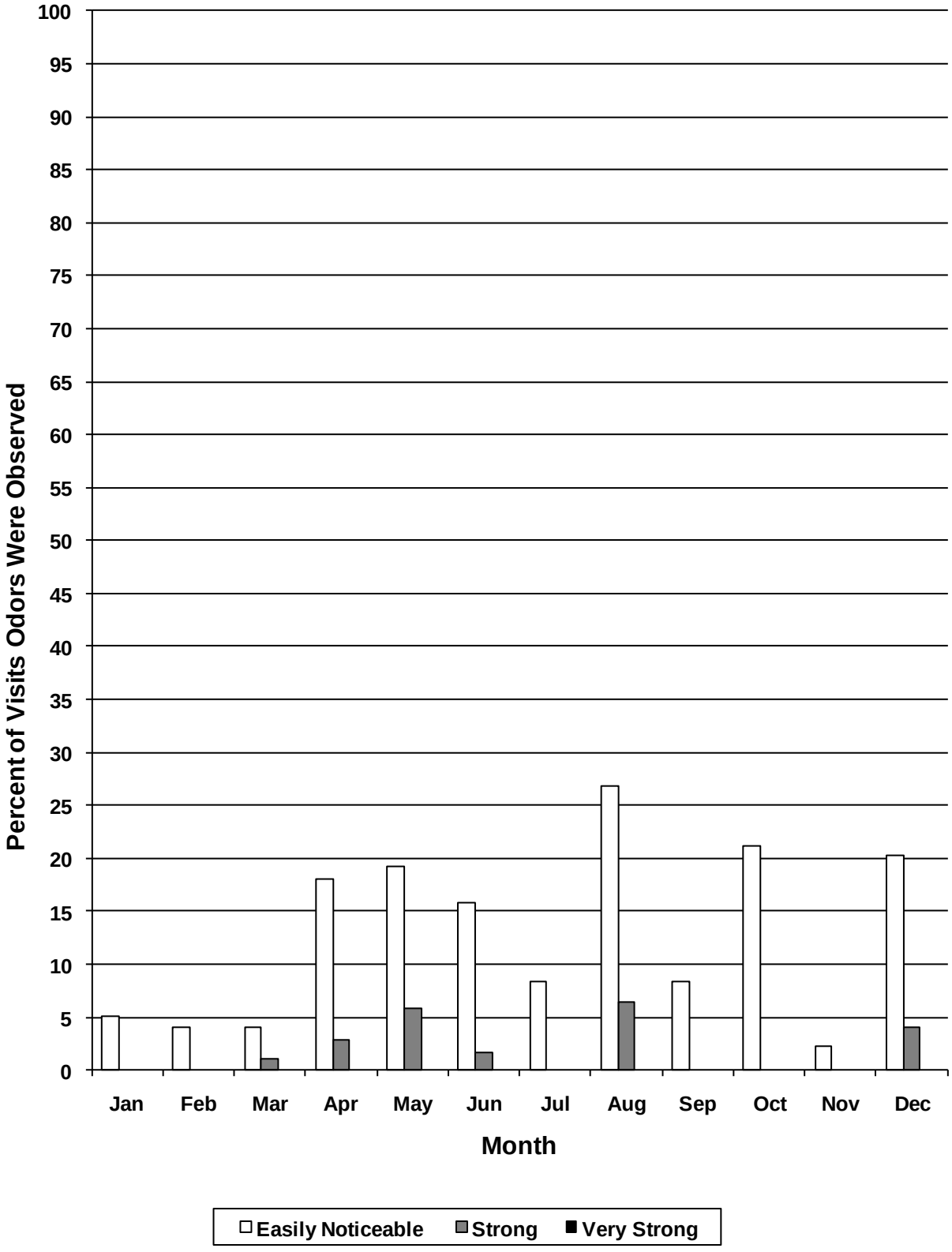


TABLE 4: HYDROGEN SULFIDE READINGS AT THE CALUMET SOLIDS DRYING SITES – 2013

Location	Hydrogen Sulfide, ppbv[1]		
	Mean[2]	Minimum[3]	Maximum
East Drying Cell #1 SW (14)[4]	7.6	0	46
Hopper Building (15)	6.5	0	41
East Drying Cell #8 NW (16)	8.4	0	60
East Drying Cell #8 NE (17)	8.7	0	50
Truck Scale/Centrifuge (18)	7.9	0	37
East Drying Cell #1 SE (19)	8.2	0	73
West Drying Cell #1 @ Gate (20)	8.1	0	63
West Drying Cell #4 (21)	7.5	0	20
Bituminous Road @ Gate (22)	6.1	0	16

[1]ppbv = Parts per billion by volume.
[2]Mean values are calculated using the average of all recordings by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but is displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the calculation.
[3]Minimum values are based on actual values displayed by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but is displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the minimum determination.
[4]Numbers in parentheses correspond to Station numbers in Figure AI-1.

The percentage of observations at which easily noticeable, strong, and very strong odors were observed was plotted by month and is presented in Figure 2. The frequency of observed odors is generally highest during the spring through the summer months (March through August) when solids processing and drying is being carried out. The easily noticeable odor observations ranged from 28 to 52 percent during this time period.

The average H_2S levels at the various locations around these SDAs and SPS ranged from 7.0 to 13.1 ppbv as shown in Table 5.

One odor complaint was received in 2013 with regard to these solids drying and processing facilities.

Ridgeland Avenue Solids Management Area and Stony Island Solids Drying Areas

The RASMA SDA was not used as a biosolids drying site during 2013, however, odor monitoring was performed. A monthly summary of the observations at the RASMA SDA of easily noticeable, strong, and very strong odors during 2013 is presented in Figure 3, expressed as frequency of occurrence.

The Stony Island SDA had 97 percent of the observations characterized as faint to no odor, with two strong odor observations in 2013. The easily noticeable odors accounted for approximately two percent of the total observations.

A monthly summary of the observations at the Stony Island SDA of easily noticeable, strong, and very strong odors during 2013 is presented in Figure 4 expressed as frequency of occurrence.

The average H_2S levels around the RASMA and Stony Island SDAs, as shown in Table 6, varied from 2.1 to 2.3 ppbv and 5.3 to 5.9 ppbv, respectively.

No odor complaints were received in 2013 with regard to the RASMA and Stony Island SDAs.

FIGURE 2: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, MARATHON SOLIDS DRYING AREAS AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2013

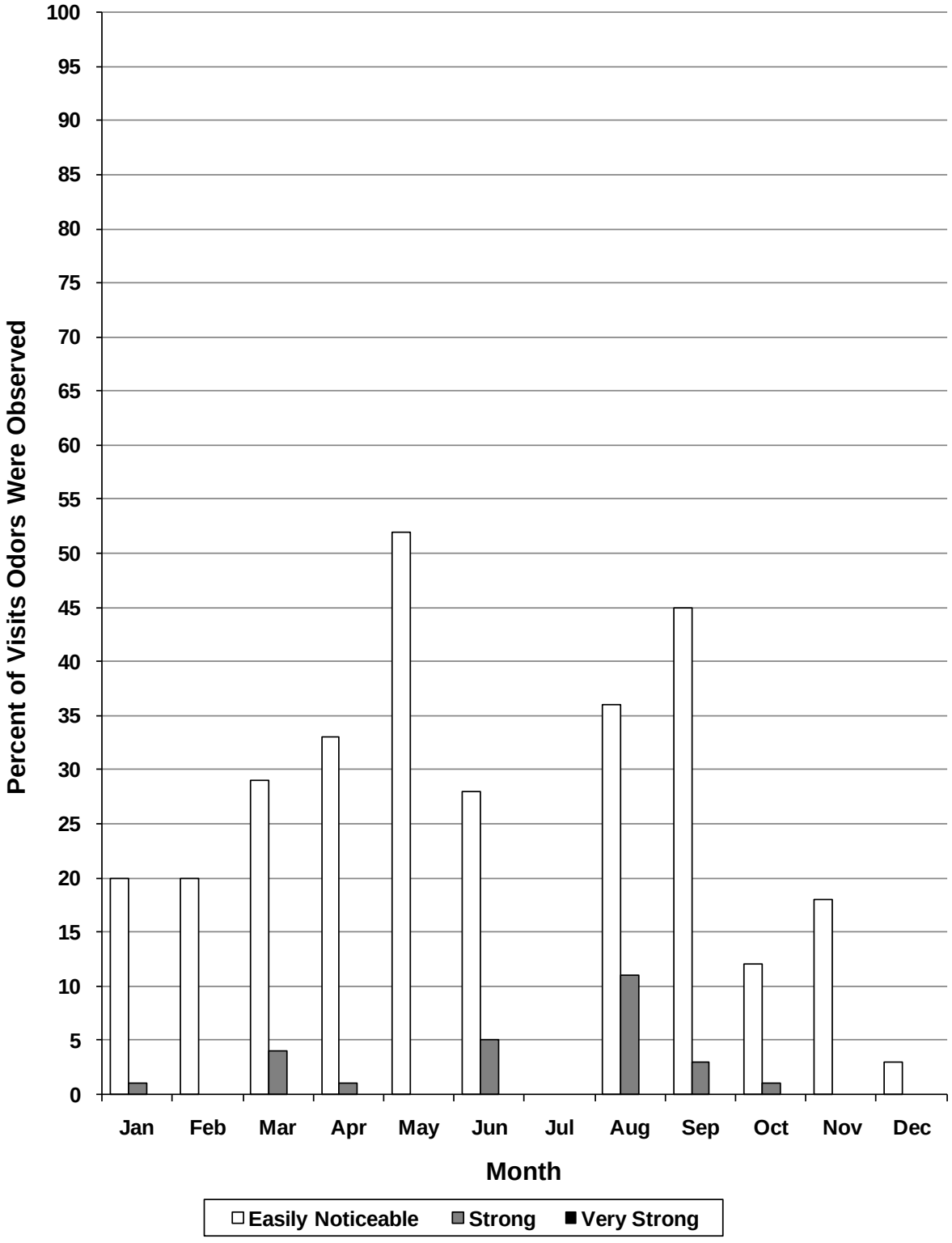


TABLE 5: HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2013

Location	Hydrogen Sulfide, ppbv[1]		
	Mean[2]	Minimum[3]	Maximum
HASMA (1)[4]	8.7	0	31
HASMA Center (1.5)	9.3	0	39
Vulcan South (2)	7.0	0	14
Vulcan North (3)	9.9	0	51
Vulcan TARP Drop Shaft (4)	7.8	0	25
Vulcan TARP Well (5)	8.9	0	67
LASMA Lagoon 1 (6)	7.0	0	16
LASMA Lagoon 16 (7)	7.8	0	29
LASMA Lagoon 24 (8)	13.1	0	64
LASMA Lagoon 30 (9)	9.3	0	42
LASMA Cell 1E-1W (10)	8.9	0	29
LASMA Cell 2E-2W (11)	9.9	0	59
LASMA Cell 3E-3W (12)	9.2	0	26
LASMA Cell 4E-4W (13)	9.4	0	42
LASMA Cell 5E-5W (14)	9.2	0	41

TABLE 5: HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2013

Location	Hydrogen Sulfide, ppbv[1]		
	Mean[2]	Minimum[3]	Maximum
Marathon (15)	10.4	0	54
Marathon West (16)	10.2	0	36

[1]ppbv = Parts per billion by volume.
[2]Mean values are calculated using the average of all recordings by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but is displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the calculation.
[3]Minimum values are based on actual values displayed by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but is displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the minimum determination.
[4]Numbers in parentheses correspond to Station numbers in Figure AI-2.

TABLE 6: HYDROGEN SULFIDE READINGS AT THE RIDGELAND AVENUE SOLIDS MANAGEMENT AREA AND STONY ISLAND SOLIDS DRYING AREA – 2013

Location	Hydrogen Sulfide, ppbv[1]		
	Mean[2]	Minimum[3]	Maximum
RASMA			
SW Parking Area (1)[4]	2.1	0	12
North of Cell 2W (2)	2.3	0	13
NE Corner Cell 5E (3)	2.2	0	15
South of Cell 5 (4)	2.3	0	13
Stony Island			
Entrance 122nd St (1)[5]	5.7	0	14
NE Corner Cell 5 (2)	5.8	0	15
South End Cells 4 & 7 (3)	5.9	1	14
West Side of Cell 3 (4)	5.3	0	12

[1]ppbv = Parts per billion by volume.

[2]Mean values are calculated using the average of all recordings by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but is displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the calculation.

[3]Minimum values are based on actual values displayed by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but is displayed as 0 ppbv on the meter. If the measurement is below the detection limit, 0 ppbv is used in the minimum determination.

[4]Numbers in parentheses correspond to Station numbers in Figure AI-3.

[5]Numbers in parentheses correspond to Station numbers in Figure AI-4.

FIGURE 3: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE RIDGELAND AVENUE SOLIDS MANAGEMENT AREA – 2013

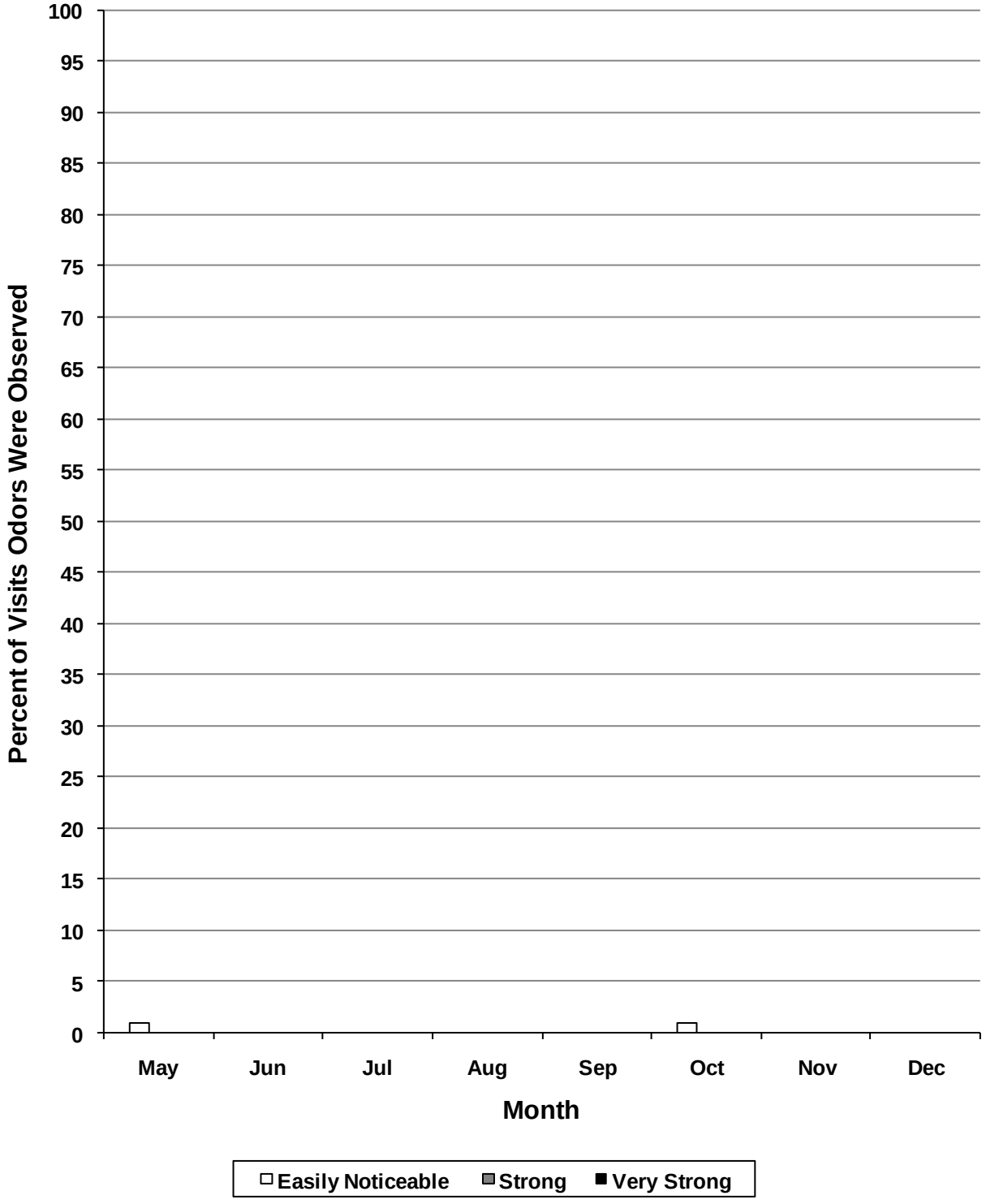
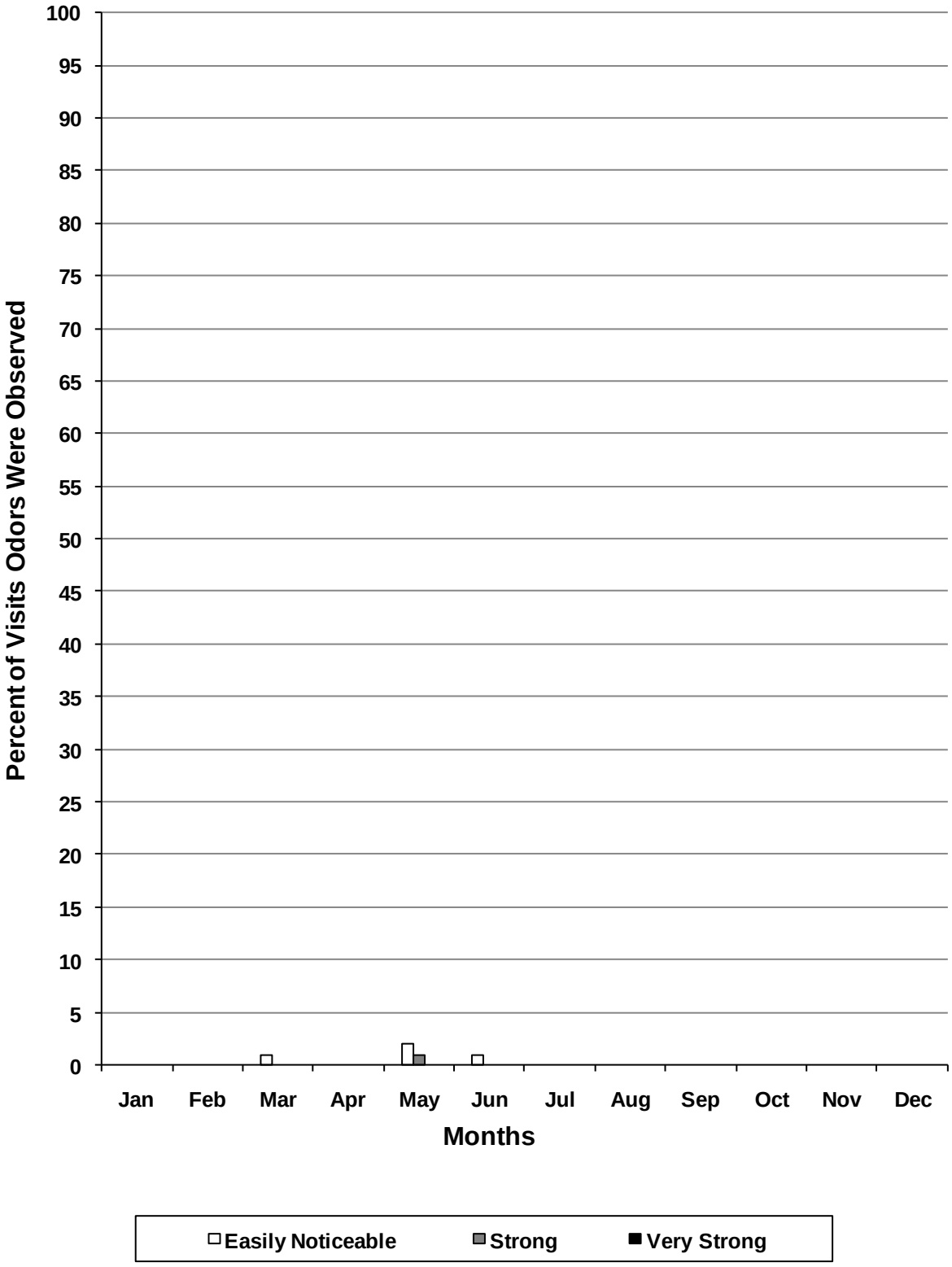


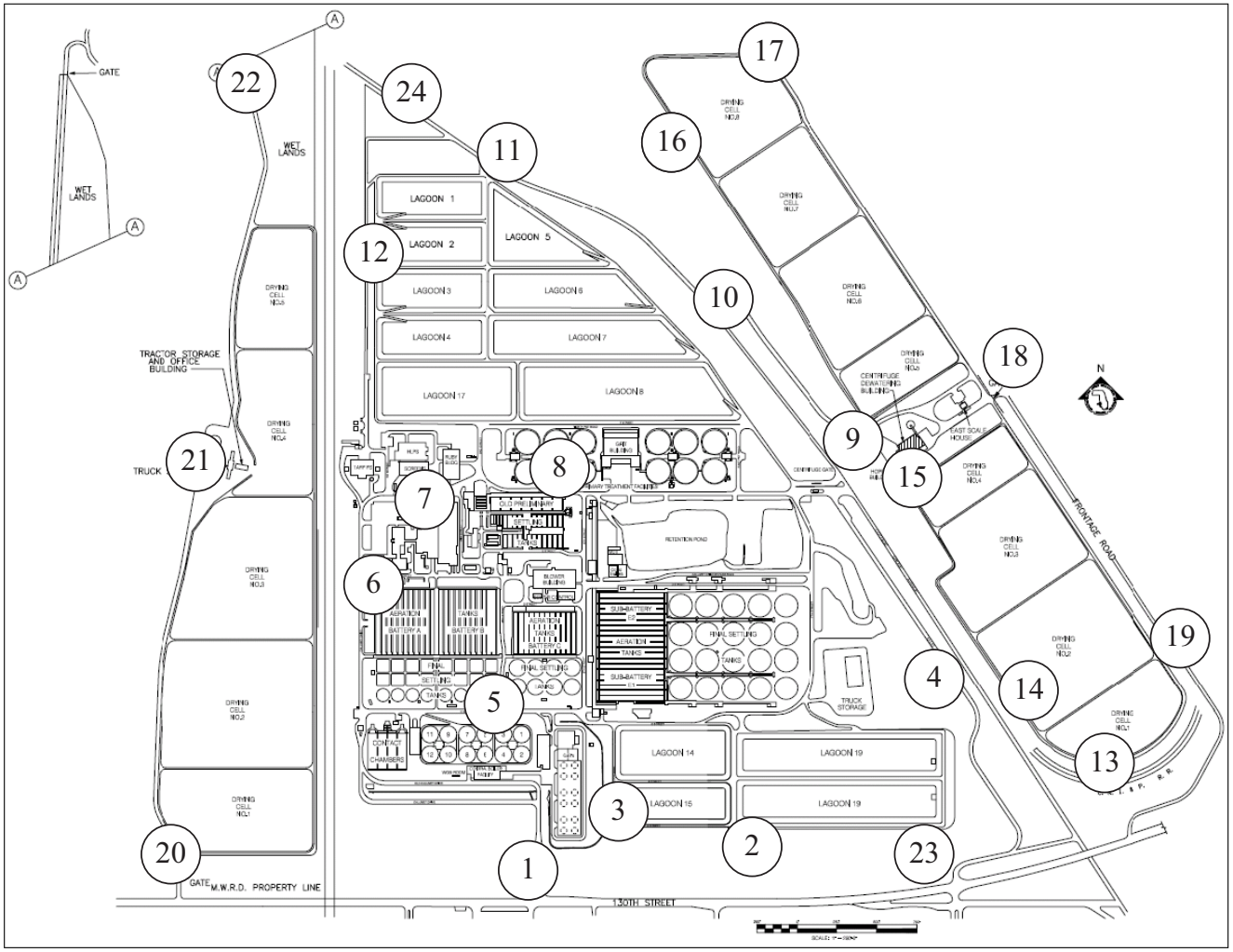
FIGURE 4: PERCENT OF AVERAGE MONTHLY ODOR OBSERVANCES AT THE STONY ISLAND SOLIDS DRYING AREA – 2013



APPENDIX AI

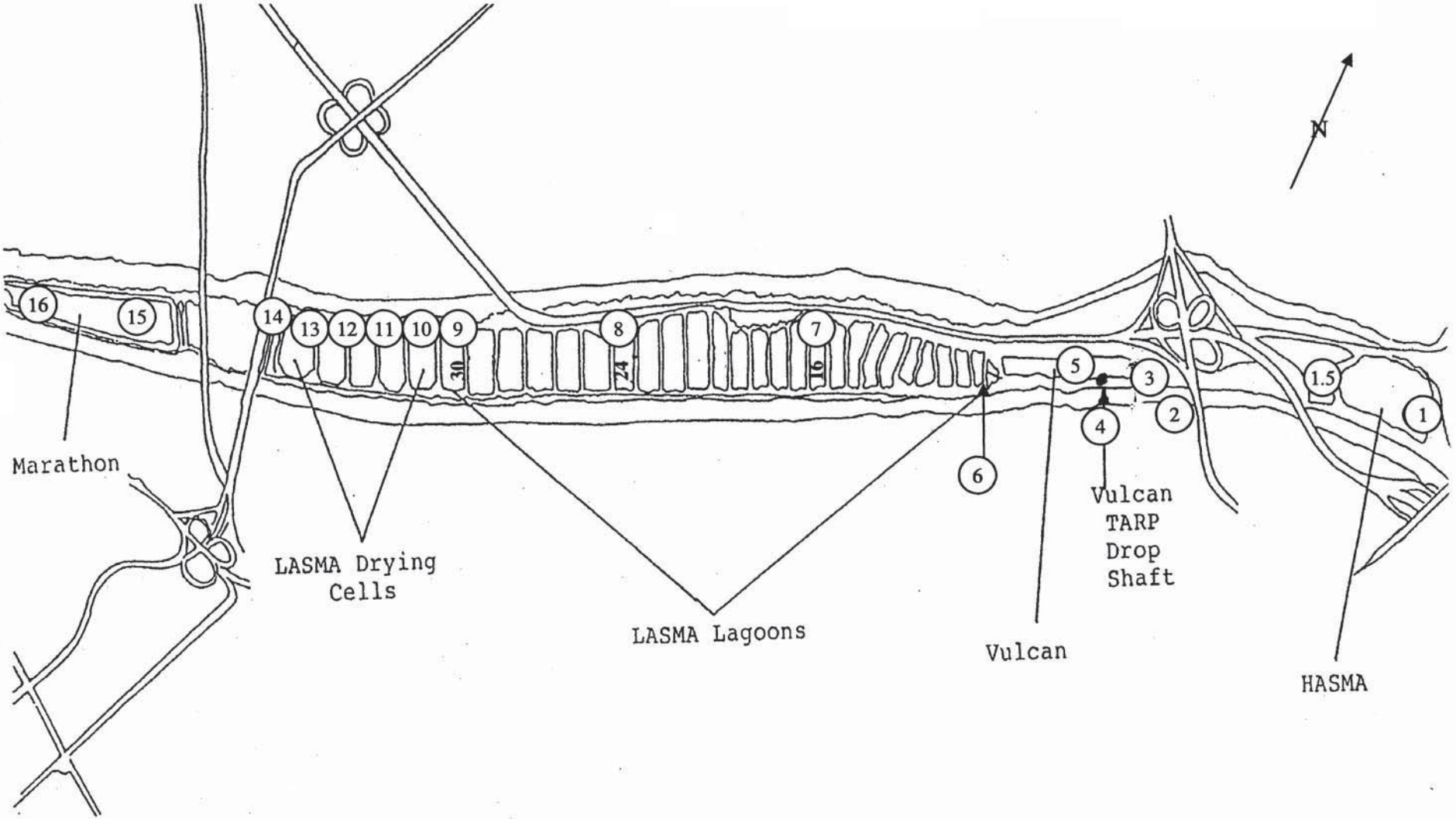
LOCATION OF ODOR MONITORING STATIONS AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO SOLIDS DRYING AREAS AND SOLIDS PROCESSING SITES

FIGURE AI-1: CALUMET WATER RECLAMATION PLANT AND CALUMET WATER RECLAMATION PLANT SOLIDS DRYING AREAS*



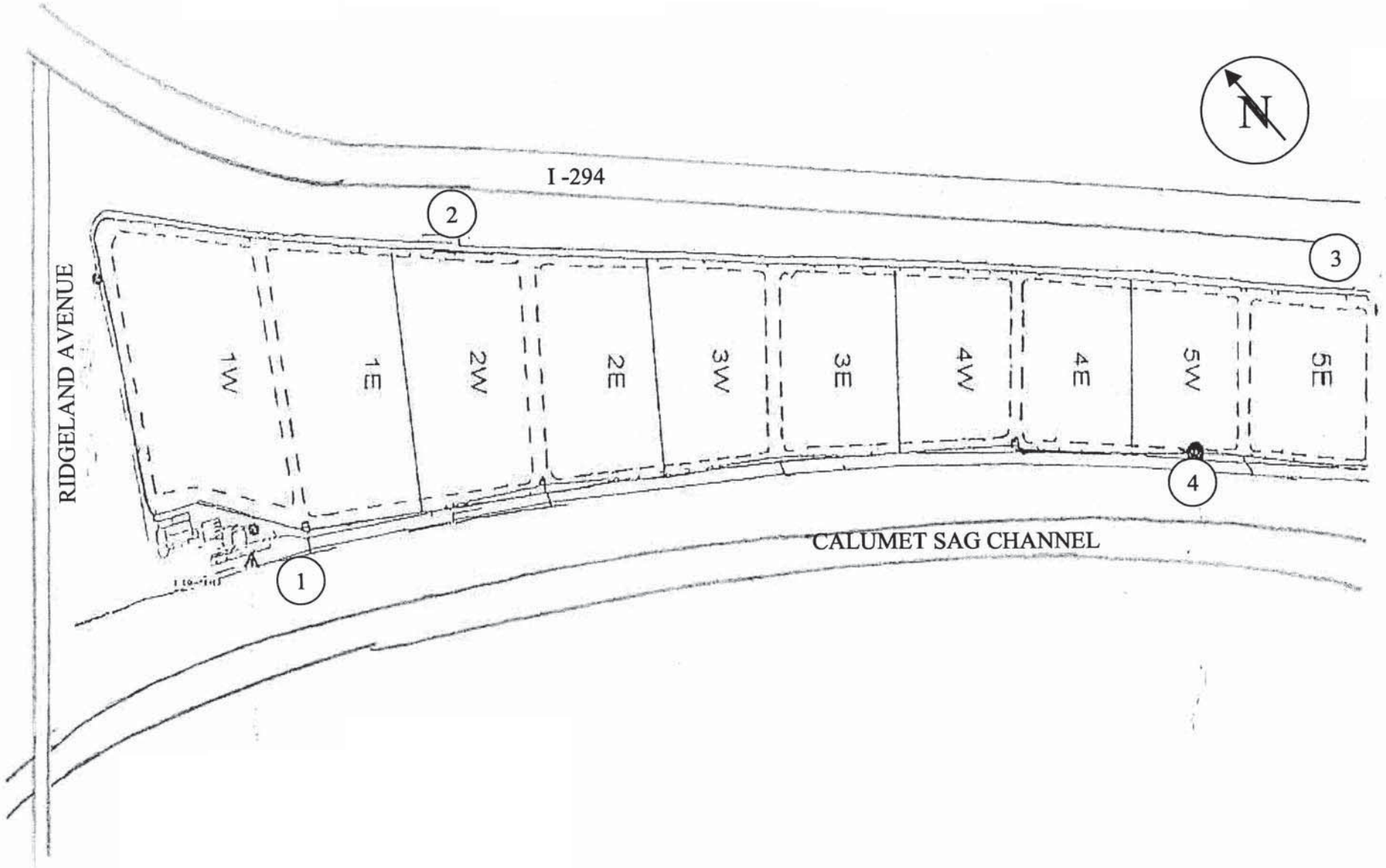
*Numbered circles (14–22) indicate odor monitoring locations for Solids Drying Areas.

FIGURE AI-2: HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, AND MARATHON SOLIDS DRYING SITES AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE*



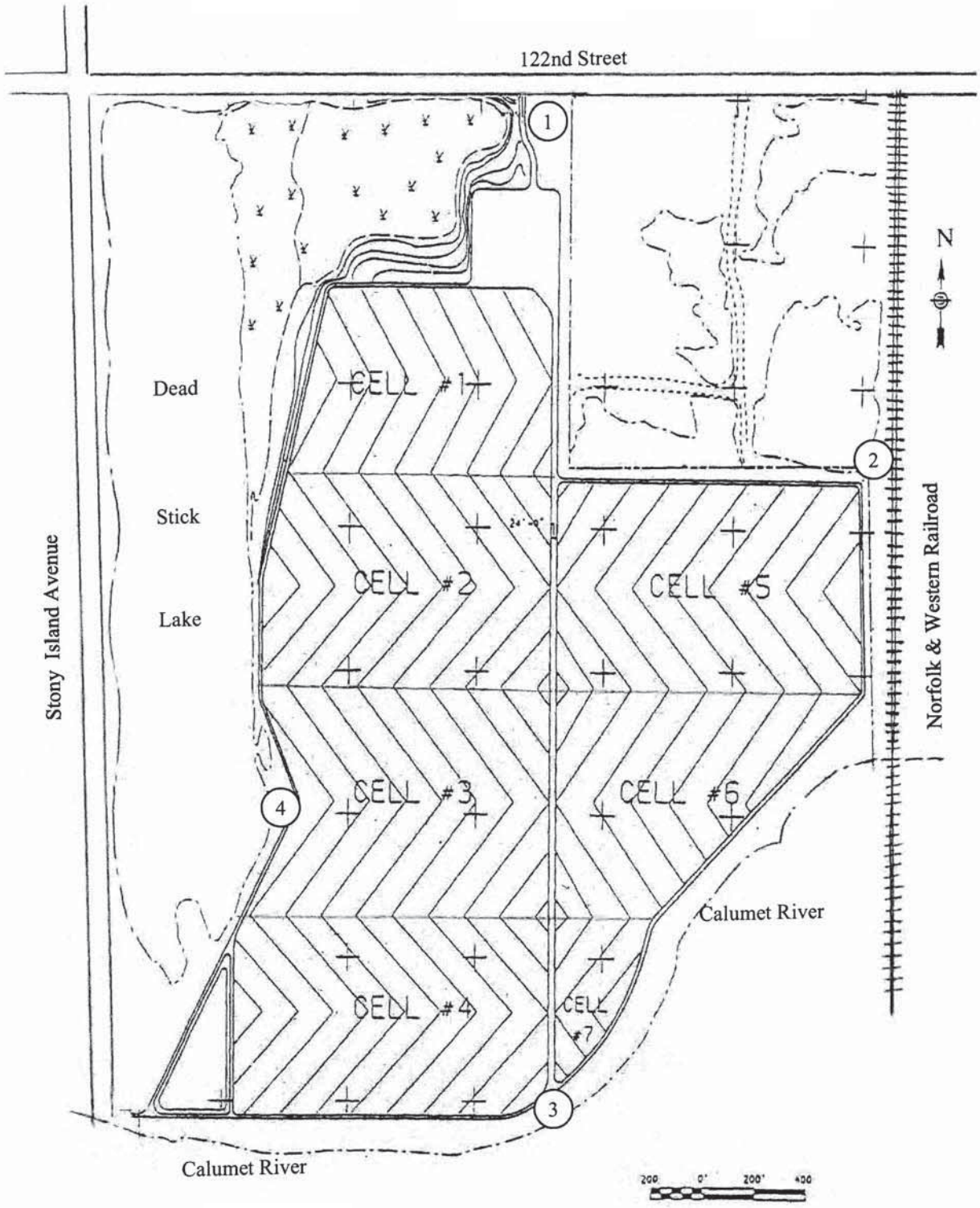
*Numbered circles indicate odor monitoring locations.

FIGURE AI-3: RIDGELAND AVENUE SOLIDS MANAGEMENT AREA SOLIDS DRYING AREA*



*Numbered circles indicate odor monitoring locations.

FIGURE AI-4: STONY ISLAND SOLIDS DRYING AREA*



*Numbered circles indicate odor monitoring locations.