Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

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ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES DURING 2016

September 2017

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ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES DURING 2016

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CS	construction site
District	Metropolitan Water Reclamation District of Greater Chicago
H_2S	hydrogen sulfide
HASMA	Harlem Avenue Solids Management Area
LASMA	Lawndale Avenue Solids Management Area
M&O	Maintenance and Operations
M&R	Monitoring and Research
ppbv	parts per billion by volume
RASMA	Ridgeland Avenue Solids Management Area
SDA	solids drying area
SDS	solids drying site
SPS	solids processing site
WRP	water reclamation plant

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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. The Ridgeland Avenue Solids Management Area (RASMA) and Stony Island SDA were removed from the odor monitoring program as they no longer are used by the District and the land is now leased by others. Both 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 during odor monitoring. 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 9 to 17. The frequency of monitoring varied from one to two 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.

During 2016, four very strong odors were observed at the Vulcan South, Lawndale Avenue Solids Management Area (LASMA) Lagoon #30, and Marathon. At all the sites that were monitored, the observations were characterized as faint to no odor from 78 to 95 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 or very 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 ranged from <3.0 to 13.4 parts per billion by volume (ppbv) at the SDS, SDAs, and SPS.

TABLE 1: STRONG AND VERY STRONG ODOR OBSERVATIONS – 2016

Facility (Station Number)	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
Calumet WRP SDS			
Drying Cell #1 SW (14)	1		
Hopper Building (15)	1		
Drying Cell #8 NE (17)	1	0	
	Total 3	0	884
HASMA, Marathon, and Vulcan SDAs, and LASMA SPS			
HASMA (1)	1		
Vulcan South (2)	1	1	
Vulcan North (3)	3		
Vulcan CS (4)	3		
Vulcan TARP Well (5)	1		
LASMA Lagoon #16 (7)	1		
LASMA Lagoon #24 (8)	2		
LASMA Lagoon #30 (9)	3	1	
Cell 1E – 1W (10)	2		
Cell 2E – 2W (11)	1		
Cell 3E – 3W (12)	2		
Cell 4E – 4W (13)	1		
Cell 5E – 5W (14)	1		
Marathon (15)	2	2	
Marathon West (16)	5	0	
	Total 29	4	608

Note: DS = Drop shaft.
HASMA = Harlem Avenue Solids Management Area.
LASMA = Lawndale Avenue Solids Management Area.
CS = Construction Site.
SDA = Solids Drying Area.
SDS = Solids Drying Site.
SPS = Solids Processing Site.

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 27 years. The program was initiated by the M&R Department to monitor the solids processing and drying sites at LASMA, Harlem Avenue Solids Management Area (HASMA), Marathon, and Vulcan Construction Site (CS) in 1990, and was expanded to the Calumet Water Reclamation Plant (WRP) SDS in 1992 and to RASMA and Stony Island SDA in 2001 as part of the District's SDA operating permits. Odor monitoring for RASMA and Stony Island SDA was terminated as they are no longer used as biosolids drying sites and the land is leased by others.

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 0 to 5, corresponding to no odor, very faint, faint, easily noticeable, strong, and very strong. In addition to the subjective evaluation of odors in terms of intensity and character, 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 as part of a mandate by the IEPA for odor management at the District's drying facilities. This data can also be used to study the trends in odor levels associated with solids drying and processing operations and to correlate odor levels with conditions related to solids drying and processing operations or changing conditions within the facility that in turn can be used for applying deodorizing agents or designing facilities for composting of biosolids.

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 by Department personnel, and the number of odor complaints.

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

The number of monitoring locations at each facility varies (9 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 one or two days per week.

In 2016, two odor complaints were received at the Calumet WRP SDS. One of the complaints received was verified.

This report presents the odor monitoring data for the year 2016. The odor monitoring data have been reviewed and summarized in terms of frequency of occurrence, locations of possible odor sources, and H_2S levels.

TABLE 2: ODOR MONITORING PROGRAM FOR 2016

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 WRP SDS	9	1992	12	1 2	M&R M&O	Yes No	2	1
HASMA, Marathon, Vulcan SDAs, and LASMA SPS	17	1990	12	1 to 2	M&R	Yes	0	0

Note: HASMA = Harlem Avenue Solids Management Area.
LASMA = Lawndale 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.

RESULTS OF ODOR MONITORING AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES IN 2016

The results of the various odor monitoring programs at each of the monitored sites for 2016 are summarized in Table 3. The results have been divided into two major groups: significant odors, which include the very strong, strong, and easily noticeable odors, and insignificant odors, which are either no odors, very faint, or faint.

A general observation drawn from the table is that at the Calumet WRP SDS, where both M&R and M&O Department personnel conducted odor monitoring, M&O Department personnel observed a lower percentage of odors detected. This may be due to the fact that M&O Department personnel are exposed to the specific areas on a daily basis, which can result in olfactory desensitization, as compared to the M&R Department personnel who visit the sites occasionally. Thus, M&O Department personnel may not differentiate especially well between significant and insignificant odors.

Calumet Water Reclamation Plant Solids Drying Site

The Calumet WRP SDS consists of the East SDA, located east of the Calumet 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 2016. Strong odors were observed at the SDS in May and June. Strong odors were observed under three percent of the time on a monthly basis. Easily noticeable odors occurred between 2 and 15 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 March 2016.

The average H_2S levels were between <3.0 and 6.9 ppbv, as shown in Table 4. The highest value observed (98 ppbv) was at the West Drying Cell #1 @ Gate.

Two odor complaints were received with regard to the Calumet WRP SDS during 2016, one of which was verified.

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

The HASMA facility consists of HASMA, LASMA, Vulcan SDA, and Marathon, located near the intersection of South Harlem Avenue and the Chicago Sanitary and Ship Canal, north bank of the Canal. The HASMA, Vulcan SDA, and Marathon SDAs and the LASMA SPS had 78 percent of the total observations characterized as faint to no odor. There were four very strong and twenty-nine strong odor observations out of 608 total observations. The very strong and strong odor observations were spread among the various locations (HASMA, Vulcan South, Vulcan North, Vulcan CS, Vulcan TARP Well, LASMA Lagoon #16, LASMA Lagoon #24, LASMA Lagoon #30,

TABLE 3: ODOR MONITORING RESULTS FOR 2016

Facility	Departments Participating	Total Number of Observations	Number of Observations Significant Odors Detected			Number Insignificant Odors[1]	Percent Insignificant Odors
			Very Strong	Strong	Easily Noticeable		
Calumet WRP SDS	M&R	373	0	1	41	331	89%
	M&O	511	0	2	26	483	95%
HASMA, Marathon, Vulcan SDAs, and LASMA SPS	M&R	608	4	29	99	476	78%

Note: HASMA = Harlem Avenue Solids Management Area.
LASMA = Lawndale 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]Insignificant odors are all observations of faint, very faint, or no odor.

FIGURE 1: PERCENT MONTHLY ODOR OBSERVANCES AT THE CALUMET SOLIDS DRYING SITE – 2016

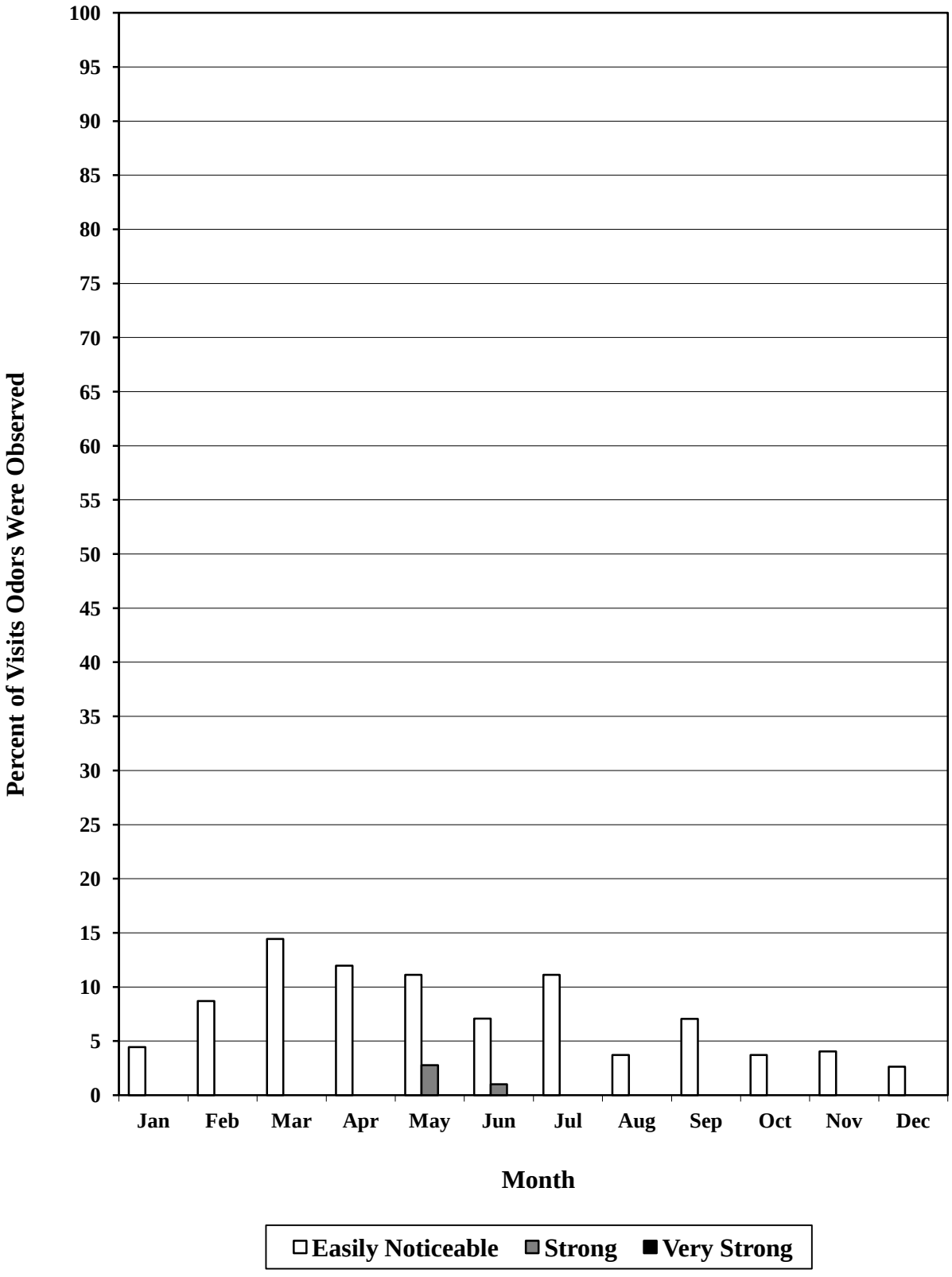


TABLE 4: HYDROGEN SULFIDE READINGS AT THE CALUMET SOLIDS DRYING SITE – 2016

Location[2]	Hydrogen Sulfide, ppbv[1]		
	Mean[3]	Percent of Readings Below the Detection Limit	Maximum
East Drying Cell #1 SW (14)	3.7	38%	12
Hopper Building (15)	4.0	44%	29
East Drying Cell #8 NW (16)	5.3	31%	18
East Drying Cell #8 NE (17)	6.9	26%	88
Truck Scale/Centrifuge (18)	4.6	32%	26
East Drying Cell #1 SE (19)	6.0	24%	52
West Drying Cell #1 @ Gate (20)	5.1	45%	98
West Drying Cell #4 (21)	4.0	38%	17
Bituminous Road @ Gate (22)	<3.0	60%	6

[1]ppbv = Parts per billion by volume.
[2]Numbers in parentheses correspond to Station numbers in Figure AI-1.
[3]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 could display 0~3 ppbv on the meter. If the measurement was below the detection limit, the value displayed was used to calculate the mean whether it was 0 or some other number in between 0 and 3.

Cell 1E–1W, Cell 2E–2W, Cell 3E–3W, Cell 4E–4W, Cell 5E–5W, Marathon, and Marathon West) depending upon the activity at the time.

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 (February through August) when solids processing and drying are being carried out. The easily noticeable odor observations ranged from 0 to 36 percent during this time period.

The average H_2S levels at the various locations around these SDAs and SPS ranged from <3.0 to 13.4 ppbv as shown in Table 5. The highest value observed (106 ppbv) was at LASMA Lagoon 30.

No odor complaints were received in 2016 with regard to these solids drying and processing facilities.

Odor Reduction Trial at Calumet Water Reclamation Plant Solids Drying Site

In August and September 2016, the District applied Planet Breeze, an odor reduction chemical, to eliminate odors at the Calumet WRP West SDA. Planet Breeze was injected to the loading rack from Lagoon 14 when lagoon solids were trucked to the West SDA. The dosing rate was about 1 (chemical) to 30,000 (sludge) by volume.

There are three monitoring locations in the West SDA, Drying Cell #1 (Location 20), Drying Cell #4 (Location 21), and Bituminous Road (Location 22). The range and maximum H_2S levels in September 2015 and September 2016 are shown in Table 6. Both the maximum and range of H_2S readings were lower in September 2016 than in September 2015. There were no H_2S monitoring completed in August 2015 for comparison.

The odor strength was recorded in August and September of 2015 and 2016 as shown in Table 7. The odor strength was milder in August and September 2016 than the corresponding months of 2015.

These comparisons show Planet Breeze may be effective in reducing odors in sludge drying areas. The District will continue testing and applying chemicals in sludge drying areas to reduce odor.

FIGURE 2: PERCENT MONTHLY ODOR OBSERVANCES AT THE HARLEM AVENUE SOLID MANAGEMENT AREA, VULCAN SOLIDS DRYING AREAS, MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2016

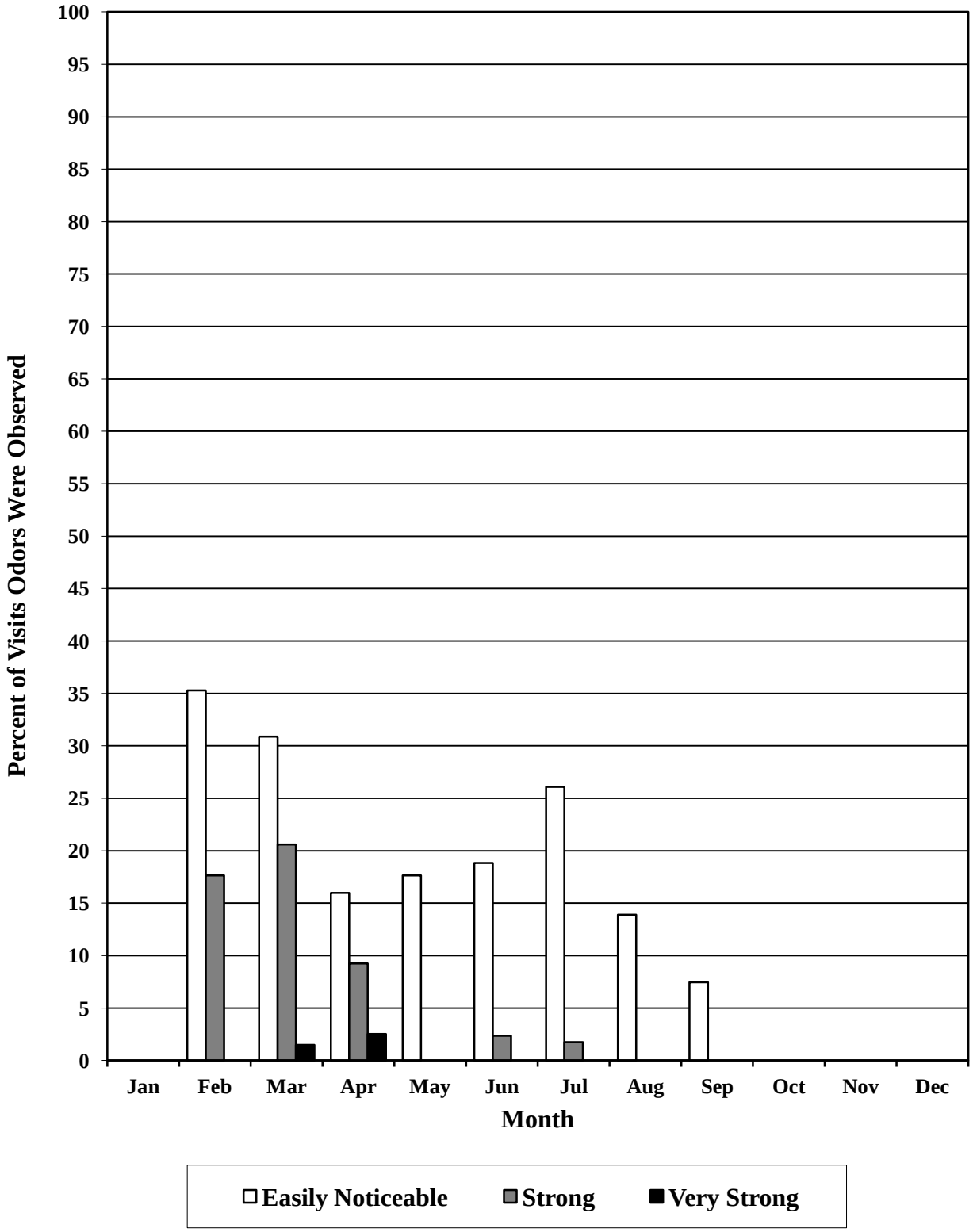


TABLE 5: HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN SOLIDS DRYING AREAS, MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2016

Location	Hydrogen Sulfide, ppbv[1]		
	Mean[2]	Percent of Readings Below the Detection Limit	Maximum
HASMA (1)[3]	<3.0	57%	7
HASMA Center (1.5)	3.0	46%	17
Vulcan CS South (2)	<3.0	47%	6
Vulcan CS North (3)	4.9	29%	21
Vulcan CS TARP Drop Shaft (4)	3.4	49%	14
Vulcan CS TARP Well (5)	3.8	31%	21
LASMA Lagoon 1 (6)	3.5	28%	8
LASMA Lagoon 16 (7)	4.0	31%	20
LASMA Lagoon 24 (8)	8.3	8%	43
LASMA Lagoon 30 (9)	13.4	19%	106
LASMA Cell 1E-1W (10)	6.3	17%	27
LASMA Cell 2E-2W (11)	6.5	26%	35
LASMA Cell 3E-3W (12)	5.8	28%	51
LASMA Cell 4E-4W (13)	5.7	25%	23
LASMA Cell 5E-5W (14)	4.7	22%	22

TABLE 5 (Continued): HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN CONSTRUCTION SITE, MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2016

Location	Hydrogen Sulfide, ppbv[1]		
	Mean[2]	Percent of Readings Below the Detection Limit	Maximum
Marathon (15)	12.3	26%	50
Marathon West (16)	8.5	20%	78

Note: HASMA = Harlem Avenue Solids Management Area.
LASMA = Lawndale Avenue Solids Management Area.
CS = Construction Site.
TARP = Tunnel and Reservoir Plan.

[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 could be displayed as 0 ppbv on the meter. If the measurement is below the detection limit, the value displayed was used to calculate the mean whether it was 0 or some other number in between 0 and 3.

[3]Numbers in parentheses correspond to Station numbers in Figure AI-2.

TABLE 6: RANGE AND MAXIMUM HYDROGEN SULFIDE LEVELS IN SEPTEMBER 2015 AND SEPTEMBER 2016 AT THE CALUMET WATER RECLAMATION PLANT WEST SOLIDS DRYING AREA

	Drying Cell #1	Drying Cell #4	Bituminous Road
September 2015 Range	4–5	4–7	<3–4
September 2016 Range	≤3	<3–5	≤3
September 2015 Maximum	5	7	4
September 2016 Maximum	3	5	3
September Maximum Percent Reduction	40%	29%	25%

TABLE 7: ODOR STRENGTH AT CALUMET WATER RECLAMATION PLANT WEST SOLIDS DRYING AREA IN AUGUST AND SEPTEMBER 2015 AND SEPTEMBER 2016

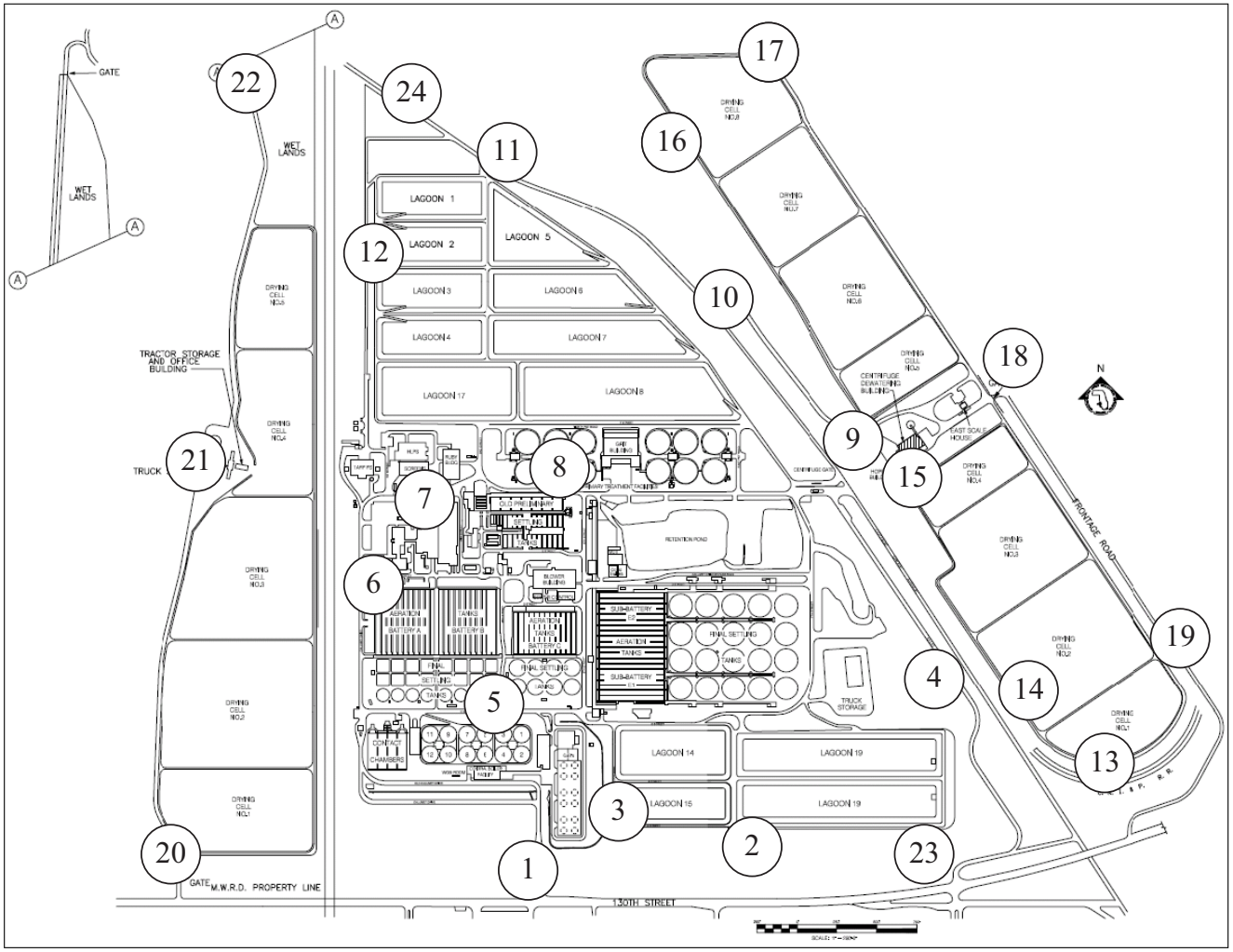
	Easily Noticeable Odor* Count	Total Number of Observations
August 2015 Odor	3	5
August 2016 Odor	1	9
August Percent Odor Reduction	67%	
September 2015 Odor	3	9
September 2016 Odor	2	8
September Percent Odor Reduction	33%	

*None of the three locations had strong or very strong odors recorded in August or September of 2015 and 2016.

APPENDIX AI

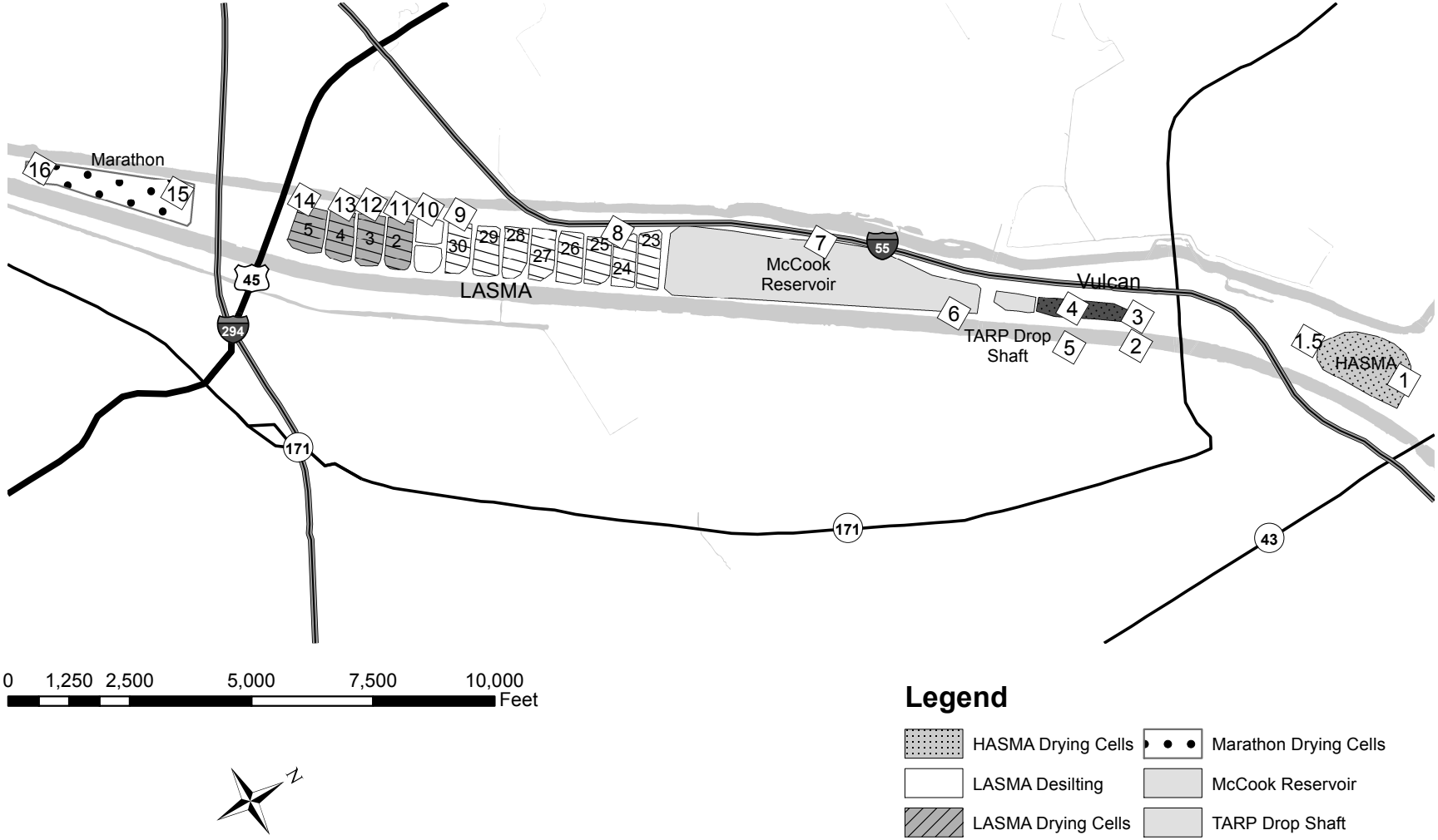
LOCATION OF ODOR MONITORING STATIONS AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO SOLIDS DRYING AREAS AND SOLIDS PROCESSING SITES

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 SOLID MANAGEMENT AREA, VULCAN AND MARATHON SOLID DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLID PROCESSING SITE*



*Numbers indicate odor monitoring locations.