

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 20-07

***ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER
RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING
AND SOLIDS PROCESSING FACILITIES DURING 2019***

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ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER
RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND
SOLIDS PROCESSING FACILITIES DURING 2019

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LIST OF ACRONYMS

CS	construction site
District	Metropolitan Water Reclamation District of Greater Chicago
H ₂ S	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

ACKNOWLEDGMENTS

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Thanks are also due to Ms. Laura Franklin, Administrative Specialist, for her diligence in proofreading and formatting this report.

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 also recorded instantaneous hydrogen sulfide (H₂S) measurements using a handheld monitor at each monitoring site. Nine locations were monitored at the Calumet Water Reclamation Plant (WRP) SDS. Seventeen locations were monitored at the Harlem Avenue Solids Management Area (HASMA), the Marathon SDA, the Vulcan SDA, and the Lawndale Avenue Solids Management Area (LASMA) SPS. The frequency of monitoring is one day 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 2019, one very strong odor was observed at the Calumet WRP SDS; seven very strong odors were observed at the HASMA, the Marathon SDA, the Vulcan SDA, and the LASMA SPS; two strong odors were observed at the Calumet WRP SDS; and ten strong odors were observed at HASMA, the Marathon SDA, the Vulcan SDA, and the LASMA SPS. At all the sites that were monitored by the M&R Department, the observations characterized as faint to no odor were 85 percent at the Calumet WRP SDS and were 79 percent at the HASMA, the Marathon SDA, the Vulcan SDA, and the LASMA SPS. At the Calumet WRP SDS, which was monitored by the M&O Department, the observations characterized as faint to no odor were 100 percent.

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 H₂S levels generally followed a pattern similar to the odor observations, with occasional high values. The average level of H₂S ranged from <3.0 to 10.99 parts per billion by volume (ppbv) at the SDS, SDAs, and SPS.

TABLE 1: STRONG AND VERY STRONG ODOR OBSERVATIONS – 2019

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		
Drying Cell #8 NE (17)	1	1	
	Total 2	1	360
HASMA, Vulcan SDA, Marathon SDA, and LASMA SPS			
HASMA (1)		2	
HASMA Center (1.5)		1	
Vulcan SDA South (2)	2		
Vulcan SDA North (3)	1	1	
Vulcan SDA CS (4)		1	
Vulcan SDA TARP Well (5)	1		
Lagoon #1 (6) ¹	1	1	
Lagoon #24 (8)	1		
Cell 3E - 3W (12)	1	1	
Cell 4E - 4W (13)	1		
Cell 5E - 5W (14)	2		
	Total 10	7	154

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

¹Lagoon #1 does not exist any more. The space was converted to McCook Reservoir, but the odor monitoring location remained the same. The odor likely originated from McCook Reservoir instead of the solids areas.

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 29 years. The program was initiated by the M&R Department to monitor the solids processing and drying sites at the LASMA, the HASMA, the Marathon SDA, and the Vulcan SDA in 1990, and was expanded to the Calumet WRP SDS in 1992 and to RASMA and the Stony Island SDA in 2001 as part of the District's SDA operating permits. Odor monitoring for RASMA and the 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. The 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 H₂S concentration using Jerome Model 631-X and Model J605 H₂S analyzers. The monitoring range of the Model 631-X is 3 ppbv to 50 ppmv. The monitoring range of the Model J605 is 3 ppbv to 10 ppmv.

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 permit requirement by the Illinois Environmental Protection Agency for odor management at the District's biosolids 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. Composting operations commenced at HASMA in 2014 and at the Calumet WRP SDS in 2018.

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 H₂S is measured by Department personnel, and the number of odor complaints in 2019. The monitoring activities were carried out as the program described in this report. However, not all the data collected in 2019 was used in preparation of this report because a subset of data did not meet the minimum expected quality standards, which were implemented this year.

Maps showing the odor monitoring locations are presented in [Appendix AI](#).

The number of monitoring locations at each facility varies from 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 day per week.

In 2019, four odor complaints at the Calumet WRP SDS, and four odor complaints at the HASMA, the Marathon SDA, and the Vulcan SDA, and the LASMA SPS were received and verified.

This report presents the odor monitoring data for the year 2019. The odor monitoring data has been reviewed and summarized in terms of frequency of occurrence, locations of possible odor sources, and H₂S levels.

TABLE 2: ODOR MONITORING PROGRAM FOR 2019

Facility	Number of Locations Monitored	Year Began	Months of Year	Days per Week	Departments Participating	H ₂ S Measured	Number of Odor Complaints	Number of Complaints Verified
Calumet WRP SDS	9	1992	12	1 Varies	M&R M&O	Yes No	4	4
HASMA, Vulcan SDA, Marathon SDA, and LASMA SPS	17	1990	12	1	M&R	Yes	4	4

Note: HASMA = Harlem Avenue Solids Management Area.
 LASMA = Lawndale Avenue Solids Management Area.
 SDA = Solids Drying Area.
 SDS = Solids Drying Site.
 SMA = Solids Management Area.
 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 2019

The results of the various odor monitoring programs at each of the monitored sites for 2019 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 comprise no odors, very faint, or faint odors.

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 did not observe significant odors detected while M&R Department personnel observed one-time significant odors. 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. It is noted that M&O Department personnel may not differentiate odor strength well especially between significant and insignificant odors.

The M&R Department implemented a quality assurance program for all the data collected in 2019 this year. For assuring the data quality, a new tool known as "Networkfleet" was utilized to spot check the authenticity of the 2019 data. Networkfleet is an internet application that can track the District vehicle routes and stops with a Global Positioning System (GPS). A review of data revealed that some data were documented on the field log sheets, but the vehicle used did not stop at the corresponding monitoring locations. According to the M&R Department quality of work policy, such data would not meet the quality standards. With an abundance of caution, it was determined to exclude the suspicious data in preparation of this report to maintain the quality of this report.

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. In M&R Department monitoring records, the Calumet WRP SDS had 85 percent of the total observations characterized as faint to no odor. In M&O Department monitoring, the Calumet WRP SDS had 100 percent of the total observations characterized as faint to no odor. The occurrence of strong odors at the drying areas, which also include the nonoperational centrifuge building located at the East SDA, was infrequent. The majority of the observations were described as faint to no odor. Only one very strong odor was detected in 2019, which happened at Drying Cell #8 NE (Location 17) on October 24, 2019. There were two strong odor observations out of 141 total observations in M&R Department monitoring records. The two strong odors were observed at Drying Cell #1 SW on April 8, 2019, and Drying Cell #8 NE on July 9, 2019.

Strong odors were observed under twelve percent of the time on a monthly basis. Figure 1 presents the monthly frequency of occurrence of the easily noticeable, strong, and very strong odor observations. The easily noticeable odor observations ranged from 0 to 33.33 percent during this time period. The easily noticeable odors were highest during February 2019, which was 33.33 percent.

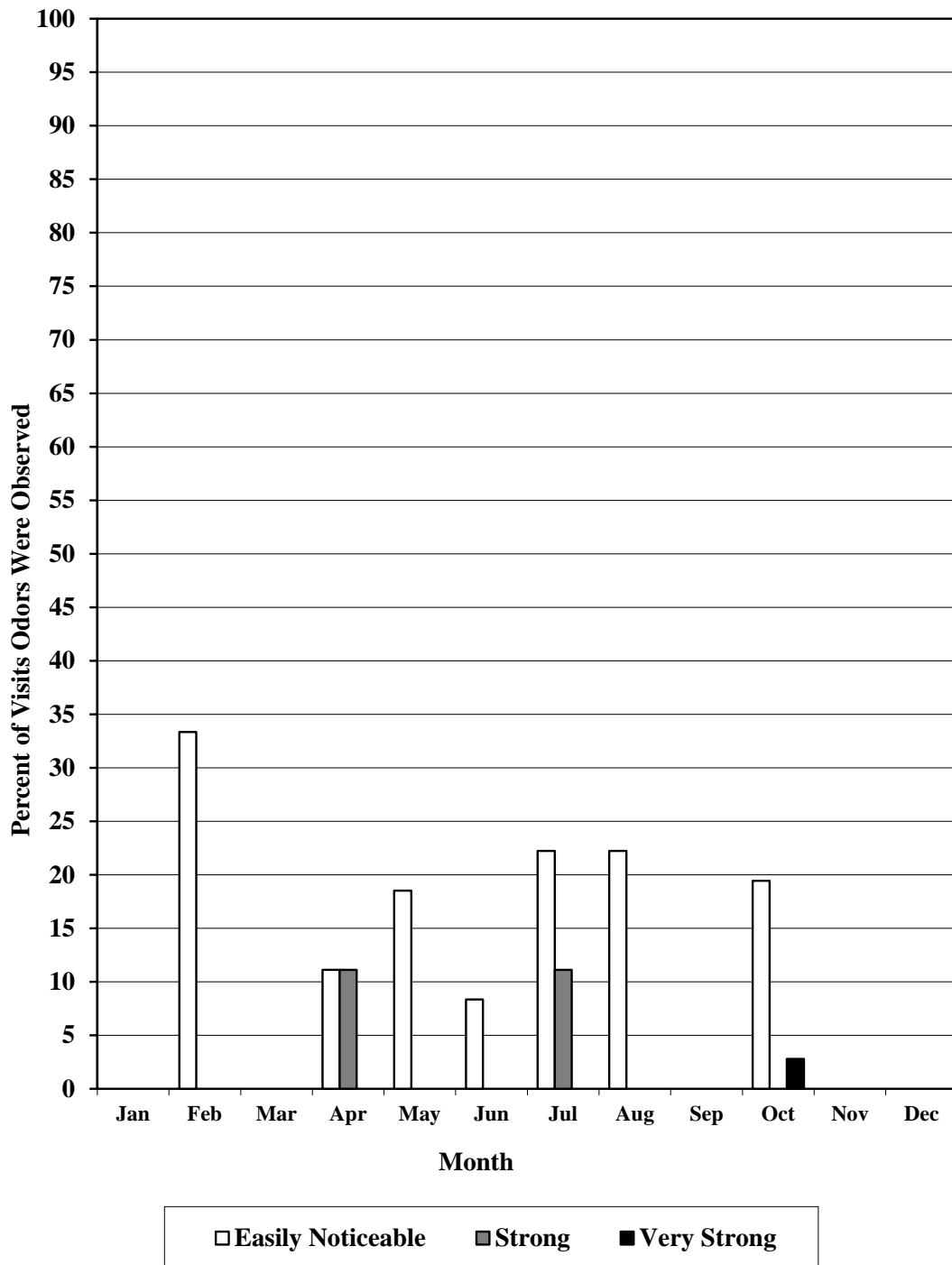
TABLE 3: ODOR MONITORING RESULTS FOR 2019

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	171	1	2	23	145	85%
	M&O	189	0	0	0	189	100%
HASMA, Vulcan SDA, Marathon SDA, and LASMA SPS	M&R	154	7	10	15	122	79%

5

Note: HASMA = Harlem Avenue Solids Management Area.
 LASMA = Lawndale Avenue Solids Management Area.
 SDA = Solids Drying Area.
 SDS = Solids Drying Site.
 SMA = Solids Management Area
 SPS = Solids Processing Site.
 M&R = Monitoring and Research Department.
 M&O = Maintenance and Operations Department.
¹Insignificant odors are all observations of faint, very faint, or no odor.

FIGURE 1: PERCENT MONTHLY ODOR OBSERVANCES AT THE CALUMET SOLIDS DRYING SITE – 2019*



*No data available in March or September due to exclusion of the noncredible data.

TABLE 4: HYDROGEN SULFIDE READINGS AT THE CALUMET SOLIDS DRYING SITE FOR 2019

Location ²	Hydrogen Sulfide, ppbv ¹		
	Mean ³	Percent of Readings Below the Detection Limit	Maximum
East Drying Cell #1 SW (14)	6.01	53%	49
Hopper Building (15)	2.84	63%	20
East Drying Cell #8 NW (16)	4.75	53%	30
East Drying Cell #8 NE (17)	5.58	58%	27
Truck Scale/Centrifuge (18)	5.10	58%	42
East Drying Cell #1 SE (19)	4.89	47%	33
West Drying Cell #1 @ Gate (20)	1.71	79%	7
West Drying Cell #4 (21)	3.86	58%	28
Bituminous Road @ Gate (22)	2.06	63%	6

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-1](#).

³Mean 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.

The average H₂S levels were between <3.0 and 6.01 ppbv. The highest H₂S levels ranged from 6 to 49 ppbv. Both are shown in [Table 4](#). The highest value observed (49 ppbv) was at Drying Cell #1 SW on June 21, 2019. The H₂S levels generally followed a pattern similar to the odor observations. For example, a very strong odor was detected at Drying Cell #8 NE (Location 17) on October 24, 2019. The H₂S level was 27 ppbv at the same time.

Four odor complaints were received on June 21, June 26, July 29, and November 16, 2019, and verified with regard to the Calumet WRP SDS during 2019. Among the four odor complaints, the June 21 odor complaint happened to be the scheduled odor monitoring day and routine odor monitoring was conducted from 9:30 a.m. to 11:10 a.m. The odor complaint happened at 4:45 pm. At the odor monitoring time, the monitoring location that is nearest to the odor complaint location had faint odor and H₂S levels were below the detection limit.

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

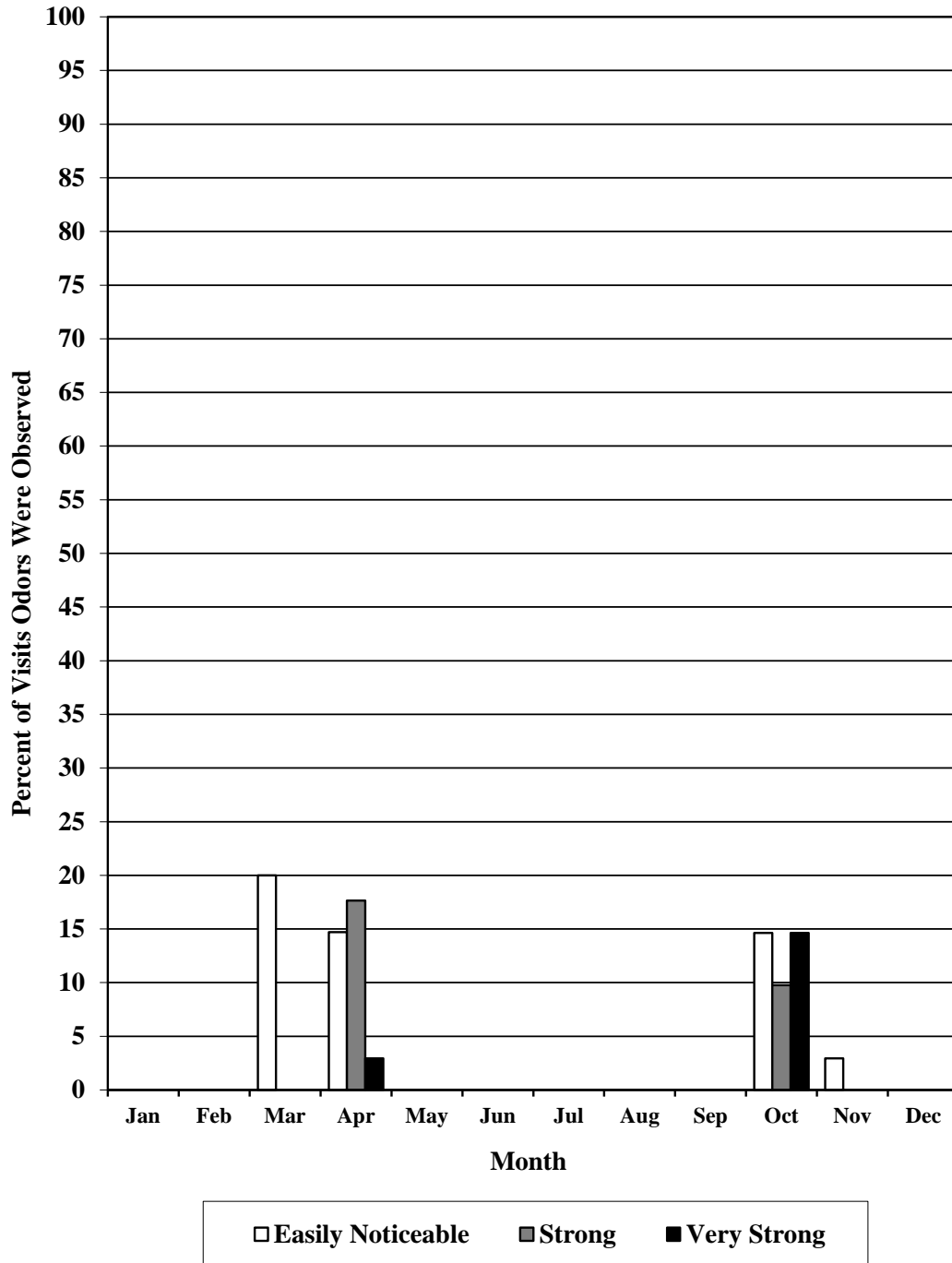
The HASMA facility consists of the HASMA, the LASMA SPS, the Vulcan SDA, and the Marathon SDA, located near the intersection of South Harlem Avenue and the Chicago Sanitary and Ship Canal, on the north bank of the Canal. The HASMA, the Vulcan SDA, the Marathon SDA and the LASMA SPS had 79 percent of the total observations characterized as faint to no odor. The occurrence of strong odors at these facilities was infrequent. The majority of the observations were described as faint to no odor. There were 7 very strong and 10 strong odor observations out of 154 total observations. The very strong and strong odors were observed in April and October, and were spread among the various locations (HASMA, HASMA Center, Vulcan SDA South, Vulcan SDA North, Vulcan SDA Construction Site, Vulcan SDA TARP Well, Lagoon #1, Lagoon #24, Cell 3E - 3W, Cell 4E - 4W, and Cell 5E - 5W) 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](#). Very strong odors were observed under 15 percent of the time on a monthly basis. Strong odors were observed under 18 percent of the time on a monthly basis. The easily noticeable odor observations ranged from 0.00 to 20.00 percent during this time period. The easily noticeable odors were highest during March 2019, which was 20.00 percent.

The average H₂S levels at the various locations around these SDAs and SPS ranged from <3.0 to 10.99 ppbv. The highest H₂S levels at the various locations around these SDAs and SPS ranged from 5 to 55 ppbv. Both are shown in [Table 5](#). The highest value observed (55 ppbv) was at the Vulcan SDA North on October 21, 2019. The H₂S levels generally followed a pattern similar to the odor observations. For example, a very strong odor was detected at the Vulcan SDA North (Location 3) on October 21, 2019. The H₂S level was 55 ppbv at the same time.

Four odor complaints were received on June 14, June 15, June 21, and August 20, 2019, related to these solids drying and processing facilities and were verified.

FIGURE 2: PERCENT MONTHLY ODOR OBSERVANCES AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN SOLIDS DRYING AREA, MARATHON SOLIDS DRYING AREA, AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2019*



*No data available in January, May, June, July, August, September, or December due to exclusion of the noncredible data.

TABLE 5: HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN SOLIDS DRYING AREA, MARATHON SOLIDS DRYING AREA, AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE FOR 2019

Location ²	Hydrogen Sulfide, ppbv ¹		
	Mean ³	Percent of Readings Below the Detection Limit	Maximum
HASMA (1) ³	2.15	64%	9
HASMA Center (1.5)	6.36	36%	34
Vulcan SDA South (2)	2.88	45%	7
Vulcan SDA North (3)	10.99	29%	55
Vulcan SDA CS (4)	6.92	45%	51
Vulcan SDA TARP Well (5)	10.61	29%	47
LASMA Lagoon 1 (6) ⁴	5.24	45%	22
LASMA Lagoon 16 (7) ⁴	2.04	73%	6
LASMA Lagoon 24 (8)	2.80	55%	8
LASMA Lagoon 30 (9)	2.84	60%	8
LASMA Cell 1E-1W (10)	4.61	60%	29
LASMA Cell 2E-2W (11)	2.51	70%	12
LASMA Cell 3E-3W (12)	2.33	60%	7
LASMA Cell 4E-4W (13)	3.98	60%	25
LASMA Cell 5E-5W (14)	2.09	60%	5

TABLE 5 (Continued): HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN SOLIDS DRYING AREA, MARATHON SOLIDS DRYING AREA, AND LAWNSDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE FOR 2019

Location ²	Hydrogen Sulfide, ppbv ¹		
	Mean ³	Percent of Readings Below the Detection Limit	Maximum
Marathon SDA (15)	3.96	60%	21
Marathon SDA West (16)	2.24	70%	8

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

Lagoon #16 (7) does not exist any more. The space was converted to McCook Reservoir. The odor may be originated from McCook Reservoir instead of solids areas.

¹ppbv = Parts per billion by volume.

²Numbers in parentheses correspond to Station numbers in [Figure AI-2](#).

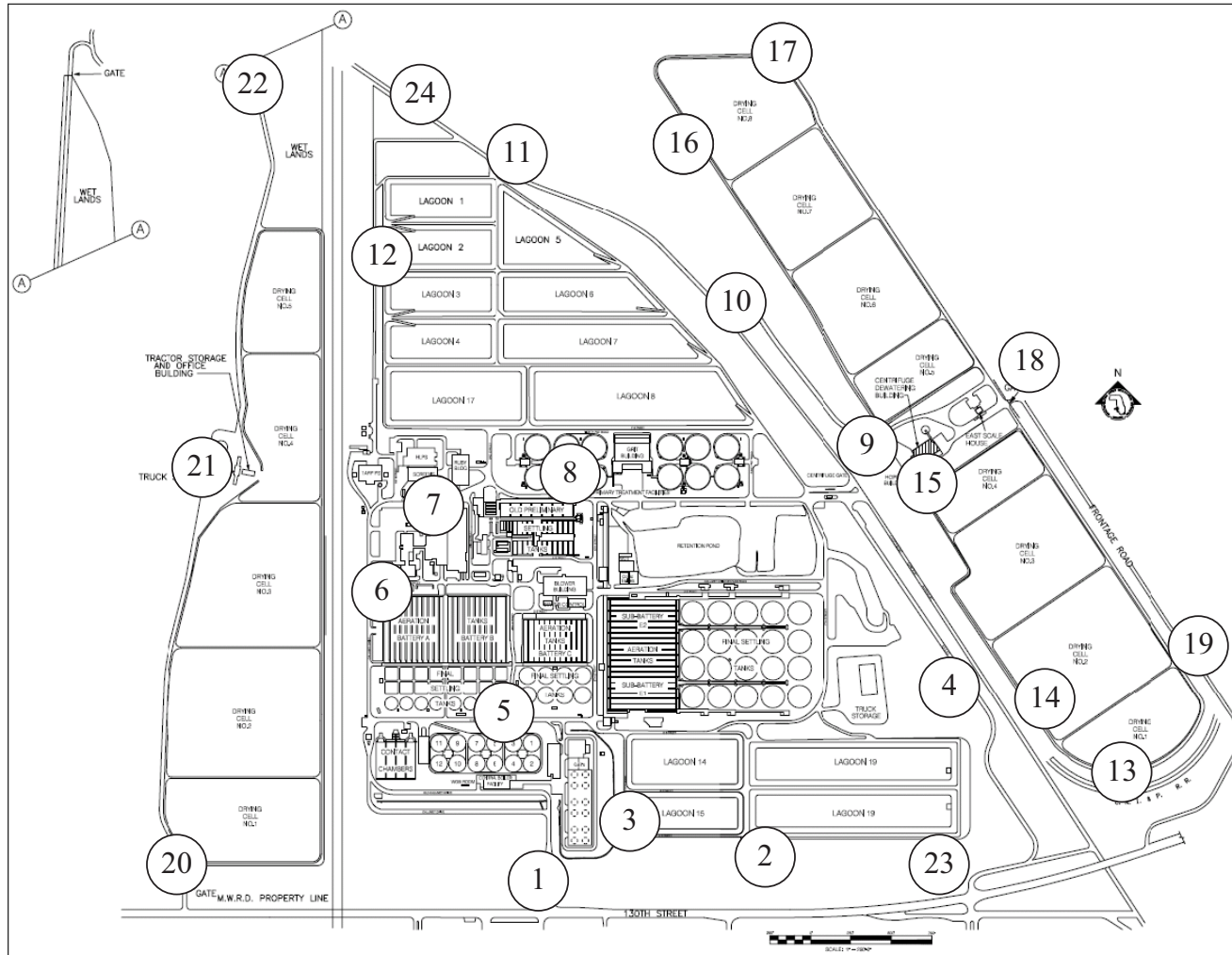
³Mean values are calculated using the average of all recordings by the Jerome hydrogen sulfide analyzer. The detection limit for the Jeromes is 3 ppbv, but could be displayed as 0 ppbv on the meter. If the measurement is below the detection limit, the value displayed was used to calculate the mean whether it was 0 or some other number in between 0 and 3.

⁴Lagoon 1 and Lagoon 16 do not exist any more. The space was converted to McCook Reservoir Stage 1, but the odor monitoring location remained the same. The hydrogen sulfide detected likely originated from the McCook Reservoir instead of the solids areas.

APPENDIX I

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

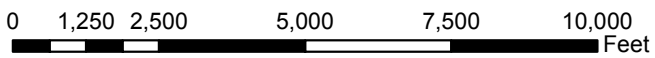
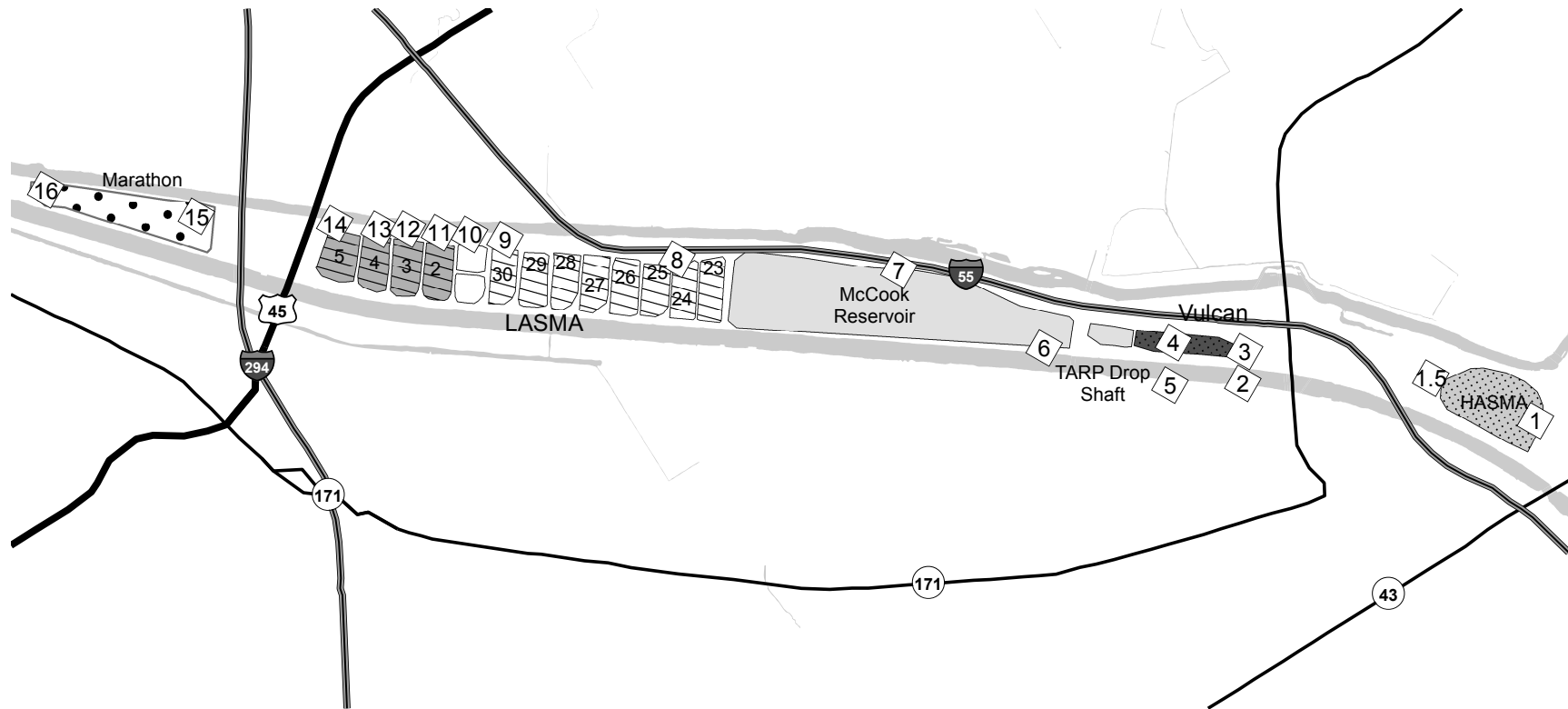
FIGURE AI-1: CALUMET WATER RECLAMATION PLANT AND CALUMET WATER RECLAMATION PLANT SOLIDS DRYING AREAS*












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

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

AI-2



Legend

-  HASMA Drying Cells
-  LASMA Desilting
-  LASMA Drying Cells
-  LASMA Lagoon
-  Marathon Drying Cells
-  McCook Reservoir
-  TARP Drop Shaft
-  Vulcan Drying Cells
-  Monitoring Location

*Numbers indicate odor monitoring locations.