Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 22-15

ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES DURING 2021

July 2022

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ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES DURING 2021

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July 2022

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CALSMA	Calumet Solids Management Area
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

ACKNOWLEDGMENTS

The author wishes to acknowledge the assistance of the Monitoring and Research Department and Maintenance and Operations Department personnel in carrying out odor monitoring activities at various facilities.

The efforts of the Monitoring and Research Department environmental research technicians, Messrs. Erik Gilmore, Brian Schuetz, Peter Cashaw, Dushyant Sharma, Charles Impastato, Joseph Kadich, Byran Allen, and Ms. Adaobi Okoli of the Capital Facilities Planning, Wastewater Research and New Technology Evaluation Section, and Mr. Atmane Bekri, Engineering Technician IV, of the Maintenance and Operations Department, who carried out the odor monitoring surveys and maintained the database, are greatly appreciated.

Thanks are also due to Ms. Erin Keohane, 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 are no longer used by the District, and the land is now leased by others. Personnel from both the Monitoring and Research (M&R) Department and the Maintenance and Operations (M&O) Department made subjective observations regarding the type and intensity of any odors perceived during odor monitoring. The M&R Department staff also recorded instantaneous hydrogen sulfide (H_2S) measurements using a handheld monitor at each monitoring site.

Ten locations were monitored at the Calumet Water Reclamation Plant (WRP) SDS. Fifteen locations were monitored at the Harlem Avenue Solids Management Area (HASMA), Marathon, the Vulcan SDAs, 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 2021, six very strong odors were observed at the Calumet WRP SDS, four very strong odors were observed at the HASMA, Marathon, Vulcan SDA, and LASMA SPS, 24 strong odors were observed at the Calumet WRP SDS, and 39 strong odors were observed at HASMA, Marathon, Vulcan SDAs, and LASMA SPS. At all the sites that were monitored by the M&R Department, the observations characterized as faint to no odor were 76 percent at the Calumet WRP SDS and 71 percent at HASMA, Marathon, Vulcan SDAs, and LASMA SPS. At the Calumet WRP SDS, which was also monitored by the M&O Department, the observations characterized as faint to no odor were 92 percent.

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

The H_2S levels were mostly not higher than the detection limit of 3 parts per billion by volume (ppbv), with occasional high values. The average level of H_2S ranged from <3.0 to 7.56 ppbv at the SDS, SDAs, and SPS.

TABLE 1: STRONG AND VERY STRONG ODOR OBSERVATIONS FOR 2021

Facility (Station Number)	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
Calumet WRP SDS			
CALSMA W Cell 1 Gate (1)	3	1	
CALSMA W Cell 4 @ Scale House (2)	3	1	
N. of CALSMA W. At N. Gate (3)	2		
CALSMA E. SE Corner of Cell 5 (20)	1	1	
CALSMA E. NW Corner of Cell 8 (22)	2		
CALSMA E., E. of Cell 1 (23)	3	2	
CALSMA E., S. of Cell 1 (24)	5		
CALSMA E., W. of Cell 1 (25)	5	1	
Total	24	6	779
HASMA, Marathon, and Vulcan SDAs, and LASMA SPS			
HASMA E. (1)	5		
HASMA Center (2)	3		
Vulcan Construction Shaft (4)	3		
Vulcan NW (5)	6		
Vulcan TARP Well (6)	5		
LASMA Lagoon 24 (11)	3		
LASMA Lagoon 20 (12)	6	1	
LASMA Cell 1E-1W (13)	2	1	
LASMA Cell 2E-2W (14)	1	1	
Marathon NE (15)	2		
LASMA Cell 4E-4W (16)	1	1	
LASMA Cell 5E-5W (17)	1		
Marathon NE (18)	1		
Total	39	4	713

Note: CALSMA = Calumet Solids Management Area.
HASMA = Harlem Avenue Solids Management Area.
LASMA = Lawndale Avenue Solids Management Area.
SDA = Solids Drying Area.
SDS = Solids Drying Site.
SPS = Solids Processing Site.
WRP = Water Reclamation Plant.

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 30 years. The program was initiated by the M&R Department to monitor the solids processing and drying sites at LASMA, HASMA, Marathon, and Vulcan Solids Drying Area 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, the 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 Jerome Model 631-X and Model J605 H_2S analyzers. The monitoring range of the Model 631-X is 3 ppbv to 50 parts per million by volume (ppmv). The monitoring range of the Model J605 is 3 ppbv to 10 ppmv.

The objective of the 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 H_2S is measured by Department personnel, and the number of odor complaints in 2021. Monitoring activities were carried out as described in this report.

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

TABLE 2: ODOR MONITORING PROGRAM FOR 2021

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	10	1992	12	1 Varies	M&R M&O	Yes No	10	2
HASMA, Marathon, Vulcan SDAs, and LASMA SPS	15	1990	12	1	M&R	Yes	5	1

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

The number of monitoring locations at each facility varies from 10 to 15 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 by the M&R Department and at a variable frequency by the M&O Department.

In 2021, ten odor complaints were received at the Calumet WRP SDS, two of which were verified, while eight were unverified. In 2021, five odor complaints were received at the HASMA, Marathon, and Vulcan SDA, and LASMA SPS, one of which was verified, while four were unverified. The unverified odor complaints indicate that when the District staff went to investigate the odor complaints, no odors were detected; however, unverified odor complaints do not necessarily indicate that no odors occurred, due to the time difference between the odor complaints and odor investigation.

This report presents the odor monitoring data for the year 2021. The odor monitoring data has been reviewed and summarized in terms of frequency of occurrence, locations of possible odor sources, and H_2S levels.

RESULTS OF ODOR MONITORING AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES IN 2021

The results of the various odor monitoring programs at each of the monitored sites for 2021 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 any significant odors, while M&R Department personnel observed a few episodes of significant odors. This may be due to the fact that the 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.

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 the M&R Department monitoring records, the Calumet WRP SDS had 76 percent of the total observations characterized as faint to no odor. In M&O Department monitoring, the Calumet WRP SDS had 92 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. There were five very strong odor observations and 17 strong odor observations out of 421 total observations in the M&R Department monitoring records. There was one very strong odor observation and seven strong odor observations out of 358 total observations made by M&O. The very strong and strong odors were observed in various months and were spread among the various locations depending upon the activity at the time.

Very strong odors were observed under six percent of the time on a monthly basis. Strong odors were observed under 28 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 during this period ranged from 5.0 to 37.5 percent. The easily noticeable odors were more frequent during the months of June through October, and highest frequency was observed during August 2021, at 37.5 percent.

The average H_2S levels were ranged from 1.94 ppbv to 3.73 ppbv. The highest H_2S levels ranged from 5 to 30 ppbv. Both the mean and maximum values of all observations are shown in Table 4. The highest value observed (30 ppbv) was at Calumet SMA Location 25 West of Cell 1 on July 9, 2021.

There were ten odor complaints related to the Calumet WRP SDS during 2021, two of which were verified.

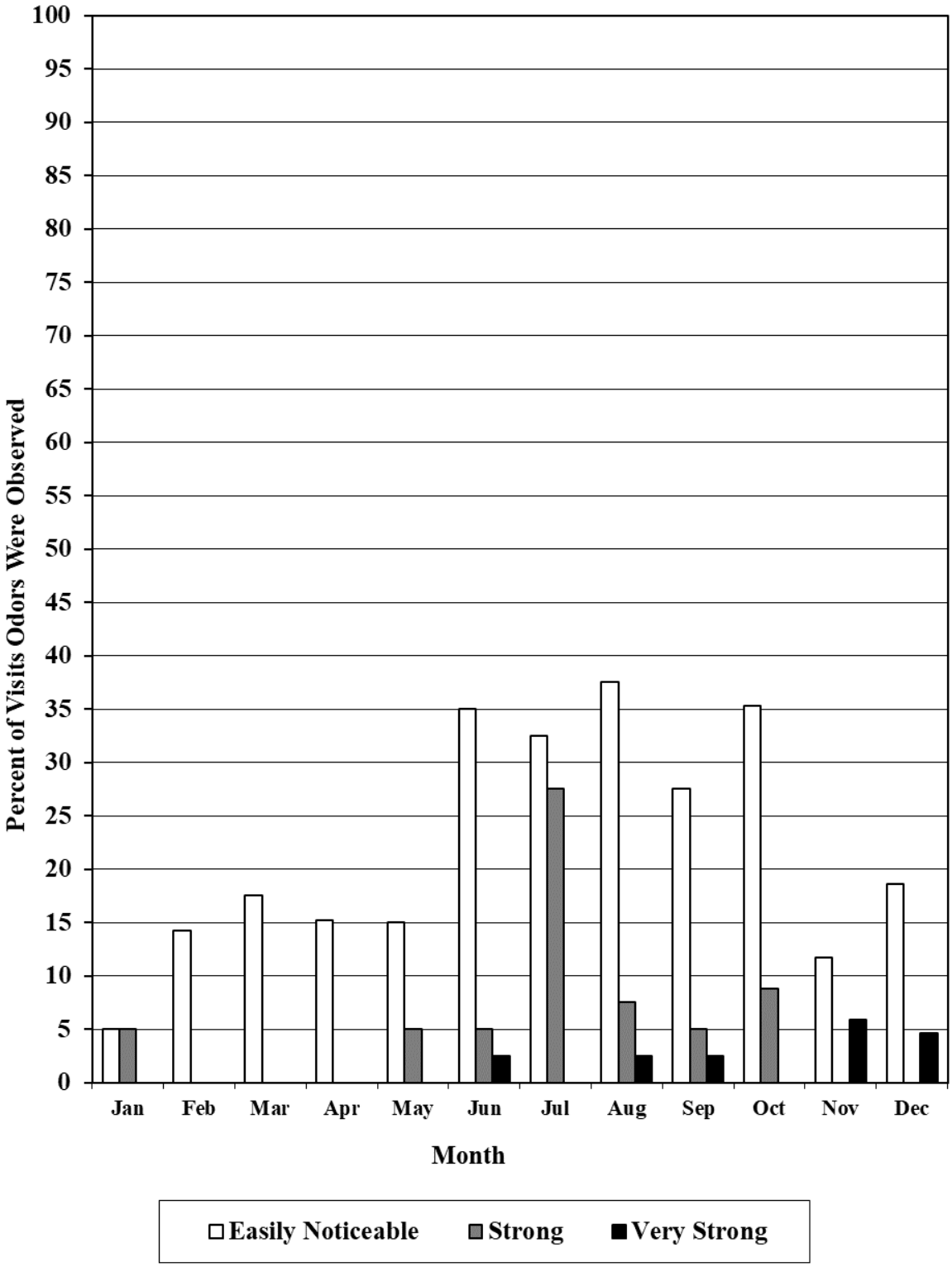
TABLE 3: ODOR MONITORING RESULTS FOR 2021

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	421	5	17	77	322	76%
	M&O	358	1	7	22	328	92%
HASMA, Marathon, Vulcan SDAs, and LASMA SPS	M&R	713	4	39	167	503	71%

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

[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 – 2021



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 SPS, Vulcan SDA, and 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, Vulcan SDA, and Marathon SDA and LASMA SPS had 71 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 four very strong and 39 strong odor observations out of 713 total observations. The very strong and strong odors were observed in various months and were spread among the various locations 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 four percent of the time on a monthly basis. Strong odors were observed under 11 percent of the time on a monthly basis. The easily noticeable odor observations ranged from 3.7 to 41.5 percent during this time period. The easily noticeable odors were highest during August 2021, at 41.5 percent.

The average H_2S levels at the various locations around these SDAs and SPS ranged from 2.08 ppbv to 7.56 ppbv. The highest H_2S levels at the various locations around these SDAs and SPS ranged from 4 to 129 ppbv. Both are shown in Table 5. The highest value observed (129 ppbv) was at the LASMA Lagoon 30 on March 3, 2021.

There were five odor complaints related to the HASMA WRP SDS during 2021, one of which was verified.

TABLE 4: HYDROGEN SULFIDE READINGS AT THE CALUMET SOLIDS DRYING SITE FOR 2021

Location[2]	Hydrogen Sulfide, ppbv[1]		
	Mean[3]	Percent of Readings Below the Detection Limit	Maximum
CALSMA W Cell 1 Gate (1)	2.61	78%	6
CALSMA W Cell 4 @ Scale House (2)	2.30	85%	8
N. of CALSMA W. At N. Gate (3)	2.11	87%	5
CALSMA E. SW Corner of Cell 5 (19)	3.73	77%	29
CALSMA E. SE Corner of Cell 5 (20)	3.02	73%	10
CALSMA E. NE Corner of Cell 8 (21)	1.95	88%	5
CALSMA E. NW Corner of Cell 8 (22)	2.05	88%	9
CALSMA E., E. of Cell 1 (23)	2.37	85%	7
CALSMA E., S. of Cell 1 (24)	1.94	93%	10
CALSMA E., W. of Cell 1 (25)	2.45	88%	30

Note: CALSMA = Calumet Solids Management Area.

[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.

FIGURE 2: PERCENT MONTHLY ODOR OBSERVANCES AT HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN SOLIDS DRYING AREAS, MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 2021

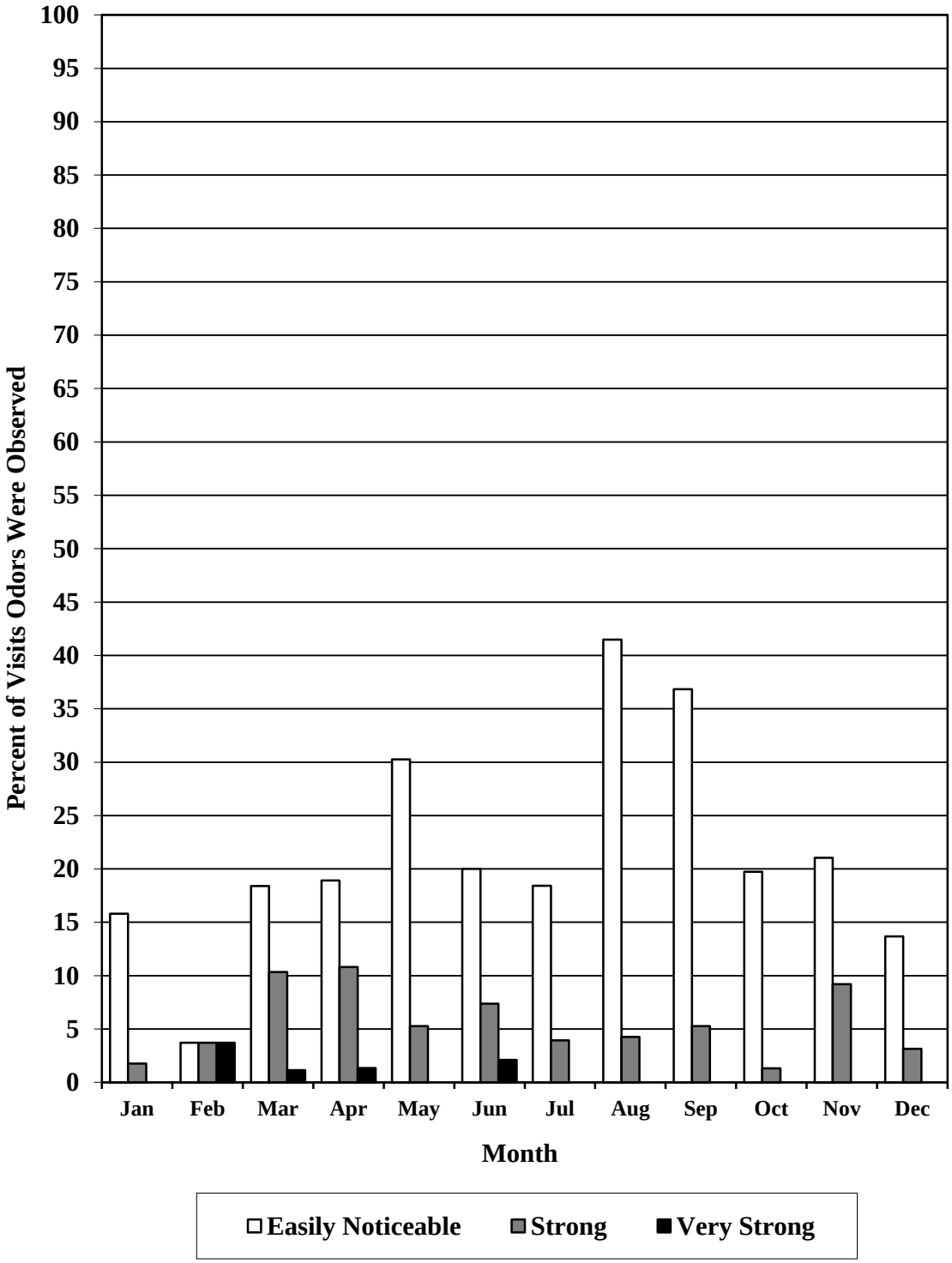


TABLE 5: HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN SOLIDS DRYING AREAS, MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE FOR 2021

Location[2]	Hydrogen Sulfide, ppbv [1]		
	Mean[3]	Percent of Readings Below the Detection Limit	Maximum
HASMA E. (1)	7.45	58%	110
HASMA Center (2)	2.65	81%	6
Vulcan NE (3)	2.80	78%	7
Vulcan Construction Shaft (4)	2.97	77%	14
Vulcan NW (5)	3.03	72%	6
Vulcan TARP Well (6)	3.21	72%	12
LASMA Lagoon 24 (11)	2.65	79%	6
LASMA Lagoon 20 (12)	7.56	58%	129
LASMA Cell 1E-1W (13)	2.58	75%	11
LASMA Cell 2E-2W (14)	2.33	89%	10
LASMA Cell 3E-3W (15)	2.22	90%	4
LASMA Cell 4E-4W (16)	2.28	88%	5
LASMA Cell 5E-5W (17)	2.34	83%	5
Marathon NE (18)	2.08	88%	4
Marathon SW (19)	4.47	93%	125

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

[1]ppbv = parts per billion by volume.

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

[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 be displayed as 0 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 between 0 and 3.

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*:* ODOR MONITORING LOCATIONS AT THE CALUMET WATER RECLAMATION PLANT AND SOLIDS DRYING SITES*

*Location 1–3 and 19–25 are odor monitoring locations for solids drying sites.

FIGURE AI-2*:* ODOR MONITORING LOCATIONS IN THE NORTHERN PORTION OF THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, AND MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITES*

*Locations 1–6 are odor monitoring locations for solids drying areas.

FIGURE AI-3*:* ODOR MONITORING LOCATIONS IN THE SOUTHERN PORTION OF THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN, AND MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITES*

*Locations 11–19 are odor monitoring locations for solids drying areas and solids processing sites.