Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 24-18

ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES DURING 2023

June 2024

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 2023

By

Weizhe An
Environmental Research Scientist

Ali Oskouie
Senior Environmental Research Scientist

Monitoring and Research Department
Edward W. Podczerwinski, Director

June 2024

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

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
ppmv	parts per million 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 authors wish to acknowledge the assistance of the Monitoring and Research (M&R) Department and Maintenance and Operations (M&O) Department personnel in conducting 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, Bryan Allen, and Ms. Gabriela Krochmal of the Wastewater Capital Planning and Research Section, 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. Two SDAs, 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 leased by others. The M&R Department staff made subjective observations regarding the type and intensity of any odor perceived and recorded instantaneous hydrogen sulfide (H_2S) measurements using a handheld monitor at each monitoring site.

There were ten locations monitored at the Calumet Water Reclamation Plant (WRP) SDS. There were fifteen locations monitored at the Harlem Avenue Solids Management Area (HASMA), Marathon and 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 2023, three very strong odors were observed at the Calumet WRP SDS, six very strong odors were observed at the HASMA, Marathon and Vulcan SDAs, and LASMA SPS, 17 strong odors were observed at the Calumet WRP SDS, and 33 strong odors were observed at HASMA, Marathon and Vulcan SDAs, and LASMA SPS. At all the sites that were monitored by the M&R Department, the observations that were characterized as faint to no odor were 75 percent at the Calumet WRP SDS and 74 percent at HASMA, Marathon and Vulcan SDAs, and LASMA SPS.

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 below the detection limit of 3 parts per billion by volume (ppbv) with occasional high values. The average level of H_2S at the monitoring locations ranged from <3.0 to 7.94 ppbv.

TABLE 1: STRONG AND VERY STRONG ODOR OBSERVATIONS FOR 2023

Facility (Station Number)	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
Calumet WRP SDS			
CASLMA West Cell #1 Gate (01)	0	1	
CALSMA West Drying Cell #4 @ Scale House (02)	3	0	
CALSMA East Southwest Corner of Cell #5 (19)	2	0	
CALSMA East Southeast Corner of Cell #5 (20)	2	0	
CALSMA East Northeast Corner of Cell #8 (21)	2	0	
CALSMA East Northwest Corner of Cell #8 (22)	2	1	
CALSMA East, East of Cell #1 (23)	4	0	
CALSMA East, West of Cell #1 (25)	2	1	
Total	17	3	458
HASMA, Marathon and Vulcan SDAs, and LASMA SPS			
HASMA-East (01)	1	0	
HASMA Center (02)	2	0	
Vulcan Construction Shaft (04)	3	1	
Vulcan Northwest (05)	6	1	
Vulcan TARP Well (06)	8	0	
LASMA Lagoon 24 (11)	6	3	
LASMA Lagoon 30 (12)	4	0	
LASMA Cell 1E-1W (13)	0	1	
Marathon Northeast (18)	2	0	
Marathon Southwest (19)	1	0	
Total	33	6	764

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 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 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 visited 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, and the number of odor complaints in 2023. Monitoring activities were conducted as described in this report.

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

TABLE 2: ODOR MONITORING PROGRAM FOR 2023

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	M&R	Yes	1	1
HASMA, Marathon Vulcan SDAs, and LASMA SPS	15	1990	12	1	M&R	Yes	0	0

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 personnel.

In 2023, one odor complaints were received at the Calumet WRP SDS, which was verified, and no odor complaints were received at the HASMA, Marathon and Vulcan SDAs, and LASMA SPS.

This report presents the odor monitoring data for the year 2023. 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 2023

The results of the various odor monitoring programs at each of the monitored sites for 2023 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 M&R Department personnel conducted odor monitoring, and observed a few episodes of significant 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. In M&R Department monitoring records, the Calumet WRP SDS had 75 percent of the total observations characterized as faint to no odor. The occurrence of strong odors at the drying areas, which also include the non-operational centrifuge building located at the East SDA, was infrequent. The majority of the observations were described as faint to no odor. There were three very strong odor observations and 17 strong odor observations out of 458 total observations in M&R Department monitoring records. 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 three percent of the time on a monthly basis. Strong odors were observed under 16 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 0 to 35 percent. The easily noticeable odors were more frequent during the months of May through October, and highest frequency was observed during June 2023, at 35 percent.

The average H_2S levels ranged from 1.23 ppbv to 7.94 ppbv. The highest H_2S levels ranged from 7 to 142 ppbv. The mean and maximum values at all locations are shown in Table 4 with the method for calculating averages described in the footnote. The highest value observed (142 ppbv) was at Calumet SMA Location 19 Southwest Corner of Cell 5 on July 11, 2023.

There was one odor complaint related to the Calumet WRP SDS during 2023, which were verified. The odor complaint happened at 8:00 a.m. on October 3, 2023, near 126 E. 124th Pl, Chicago, IL. The odor complaint was near Location 2 (CALSMA West Drying Cell #4) of Calumet WRP SDS. It coincided that M&R Department personnel conducted a Calumet WRP odor patrol on the same day shortly after the odor complaint happened The observation from the odor patrol showed that there was an easily noticeable odor and the H_2S concentration was 3.49 ppbv at this location. The wind direction was from south-southwest, and the odor complaint was in the downwind of Location 2. It was possible that the odor complaint was caused by odor from the Calumet WRP SDS.

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 74 percent of the total observations characterized as faint to no odor. The occurrence of strong odors at these facilities was infrequent. Most of the observations were described as faint to no odor. There were 6 very strong and 33 strong odor observations out of 764 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 monthly. Strong odors were observed under 11 percent of the time monthly. The easily noticeable odor observations ranged from 1.3 to 36.7 percent during this period. The easily noticeable odors were highest during September 2023, at 36.7 percent.

The average H_2S levels at the various locations around these SDAs and SPS ranged from 1 ppbv to 2.84 ppbv. The highest H_2S levels at the various locations around these SDAs and SPS ranged from 4.89 to 39.2 ppbv. The mean and maximum values at all locations are shown in Table 5 with the method for calculating averages described in the footnote. The highest value of 39.2 ppbv was detected () at Vulcan Construction Shaft on February 15, 2023.

There were no odor complaints related to the HASMA, Vulcan SDA, and Marathon SDA and LASMA SPS during 2023.

TABLE 3: ODOR MONITORING RESULTS FOR 2023

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	458	3	17	95	343	75%
HASMA, Marathon, Vulcan SDAs, and LASMA SPS	M&R	764	6	35	161	562	74%

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 – 2023

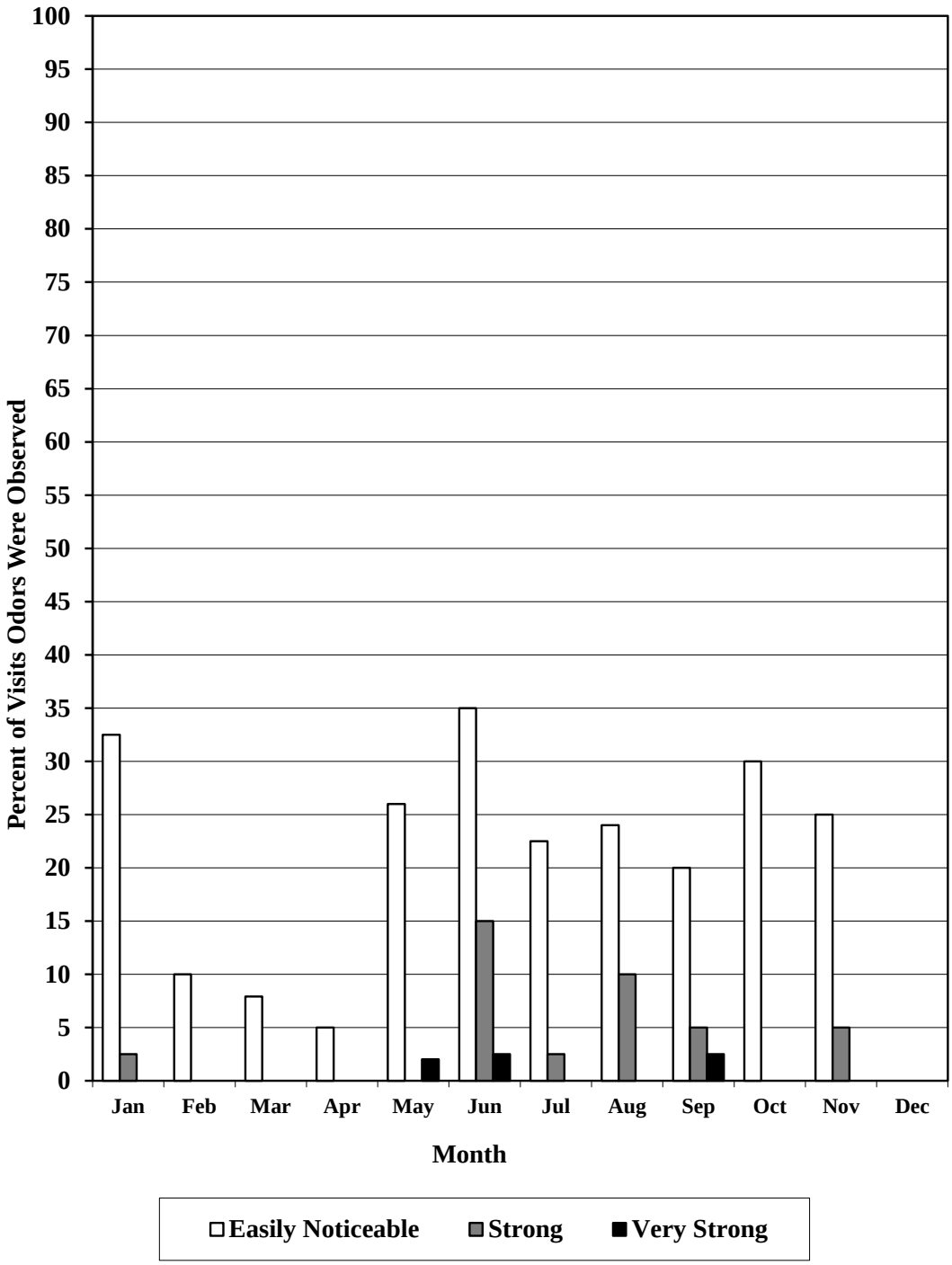

TABLE 4: HYDROGEN SULFIDE READINGS AT THE CALUMET SOLIDS DRYING SITE FOR 2023

Location[2]	Hydrogen Sulfide, ppbv[1]		
	Mean[3]	Percent of Readings Below the Detection Limit	Maximum
CALSMA W Cell 1 Gate (1)	7.94	52.17%	137
CALSMA W Cell 4 @ Scale House (2)	1.63	71.11%	15.2
N. of CALSMA W. At N. Gate (3)	1.23	71.11%	7.00
CALSMA E. SW Corner of Cell 5 (19)	6.59	58.70%	142
CALSMA E. SE Corner of Cell 5 (20)	2.24	54.35%	10.1
CALSMA E. NE Corner of Cell 8 (21)	3.39	65.22%	72.8
CALSMA E. NW Corner of Cell 8 (22)	2.21	67.39%	18.5
CALSMA E., E. of Cell 1 (23)	2.16	58.70%	17.2
CALSMA E., S. of Cell 1 (24)	1.48	69.57%	7.24
CALSMA E., W. of Cell 1 (25)	1.54	69.57%	8.54

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 Jerome's is 3 ppbv but may 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 Royal Society of Chemistry, Analytical Methods Committee Technical Brief No. 5, Apr 2001.)

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 – 2023

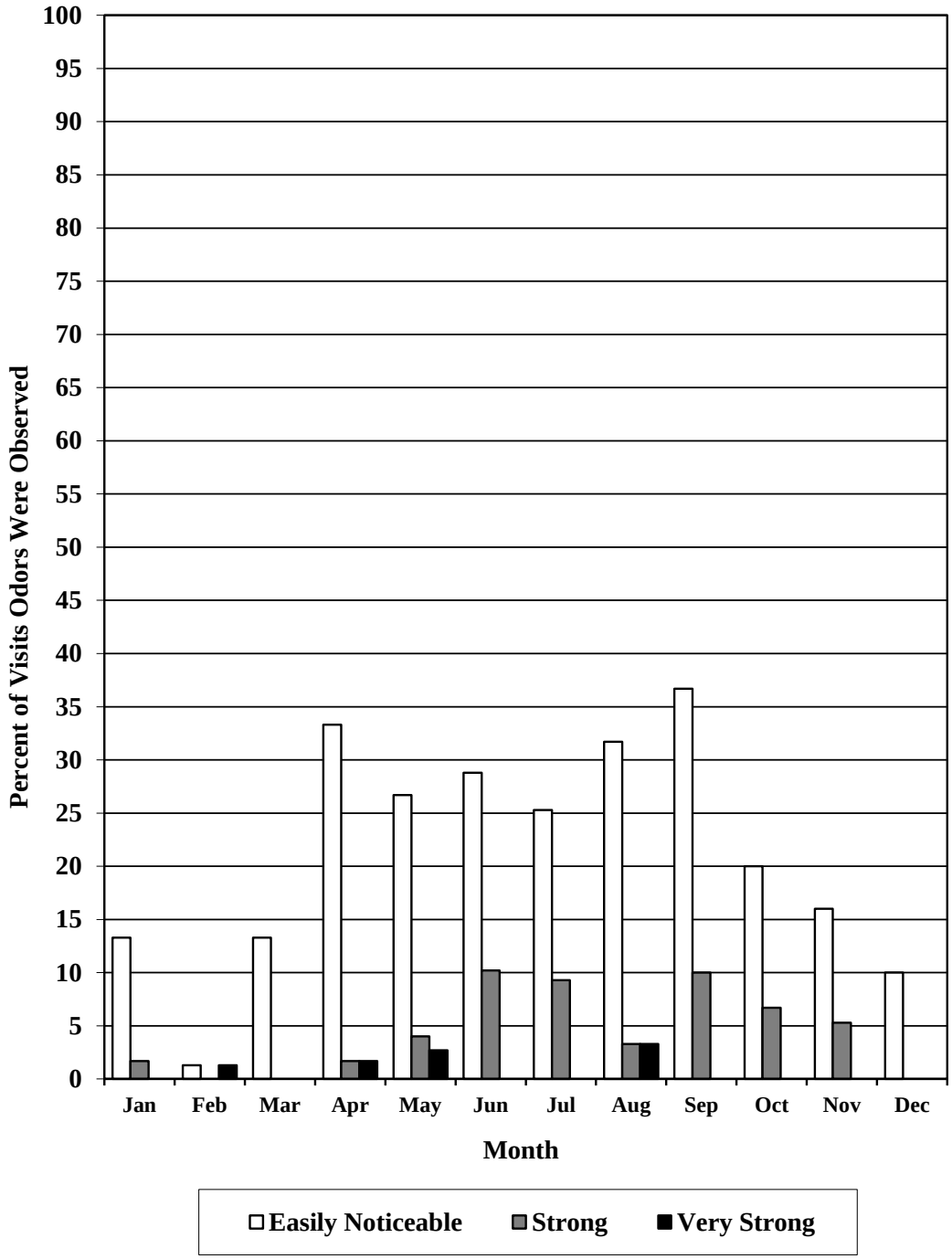

TABLE 5: HYDROGEN SULFIDE READINGS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN SOLIDS DRYING AREAS, MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE FOR 2023

Location[2]	Hydrogen Sulfide, ppbv [1]		
	Mean[3]	Percent of Readings Below the Detection Limit	Maximum
HASMA E. (1)	1.90	54.90%	5.51
HASMA Center (2)	1.25	72.55%	4.90
Vulcan NE (3)	1.62	62.75%	5.34
Vulcan Construction Shaft (4)	2.42	60.78%	39.2
Vulcan NW (5)	2.48	40.00%	7.00
Vulcan TARP Well (6)	2.43	43.14%	7.85
LASMA Lagoon 24 (11)	2.84	41.18%	9.26
LASMA Lagoon 20 (12)	1.54	62.75%	7.39
LASMA Cell 1E-1W (13)	1.55	64.71%	10.0
LASMA Cell 2E-2W (14)	1.57	62.75%	6.88
LASMA Cell 3E-3W (15)	1.50	66.67%	5.96
LASMA Cell 4E-4W (16)	1.26	70.59%	5.52
LASMA Cell 5E-5W (17)	1.52	64.71%	4.89
Marathon NE (18)	1.49	64.71%	5.52
Marathon SW (19)	1.00	76.47%	5.92

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 Jerome's is three ppbv but may be displayed as zero ppbv on the meter. If the measurement was below the detection limit, the value displayed was used to calculate the mean whether it was zero or another number between zero and three. (The Royal Society of Chemistry, Analytical Methods Committee Technical Brief No. 5, Apr 2001.)

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.