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 2020

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ODOR MONITORING PROGRAM AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO'S SOLIDS DRYING AND SOLIDS PROCESSING FACILITIES DURING 2020

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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

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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 also recorded instantaneous hydrogen sulfide (H_2S) measurements using a handheld monitor at each monitoring site.

Due to the COVID-19 pandemic, odor monitoring program fieldwork was suspended from mid-March 2020 to mid-August 2020. During this period, the M&R Department switched from paper-based data collection to the use of iPad applications. In addition, the monitoring locations were slightly adjusted. One monitoring location was added at the Calumet Water Reclamation Plant (WRP) SDS, and some locations at the Harlem Avenue Solids Management Area (HASMA), Marathon, the Vulcan SDAs, and the Lawndale Avenue Solids Management Area (LASMA) were changed. Maps of the old and new monitoring locations can be seen in Appendices AI and AII, respectively. The number systems for the old locations and new locations were summarized in Table 1. 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. The data for the two monitoring periods was merged for further analysis at the corresponding locations.

During 2020, seven very strong odors were observed at the Calumet WRP SDS, seven very strong odors were observed at the HASMA, Marathon, Vulcan SDA, and LASMA SPS, 11 strong odors were observed at the Calumet WRP SDS, and 12 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 82 percent at the Calumet WRP SDS and 87 percent at HASMA, Marathon, Vulcan SDAs, and LASMA SPS. At the Calumet WRP SDS, which was monitored by the M&O Department, the observations characterized as faint to no odor were 96 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 2.

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 14.93 ppbv at the SDS, SDAs, and SPS.

TABLE 1: LOCATION NUMBERS UNDER THE OLD AND NEW NUMBERING SYSTEMS

Facility	New Location Numbers	Old Location Numbers
Calumet WRP SDS	1	20
	2	21
	3	22
	19	15
	20	18
	21	17
	22	16
	23	19
	24*	**
	25	14
HASMA, Marathon, and Vulcan SDAs and LASMA SPS	1	1
	2	1.5
	3	2
	4	5
	5	3
	6	4
	11	8
	12	9
	13	10
	14	11
	15	12
	16	13
	17	14
	18	15
	19	16

Note: New location numbers were used in this report.
*New location.
**Not monitored.

TABLE 2: STRONG AND VERY STRONG ODOR OBSERVATIONS FOR 2020

Facility (Station Number)	Number of Strong Odor Observations	Number of Very Strong Odor Observations	Total Number of Observations
Calumet WRP SDS			
CALSMA E. SE Corner of Cell 5 (20)	3		
CALSMA E. NW Corner of Cell 8 (22)	1	1	
CALSMA E., E. of Cell 1 (23)	2	2	
CALSMA E., S. of Cell 1 (24)	3	2	
CALSMA E., W. of Cell 1 (25)	2	2	
Total	11	7	370
HASMA, Marathon, and Vulcan SDAs, and LASMA SPS			
HASMA E. (1)	1		
HASMA Center (2)	2		
Vulcan NE (3)		1	
Vulcan Construction Shaft (4)	1		
Vulcan NW (5)	3	1	
Vulcan TARP Well (6)		3	
LASMA Lagoon 24 (11)	2	1	
LASMA Lagoon 20 (12)	1	1	
LASMA Cell 1E-1W (13)	1		
Marathon NE (15)	1		
Total	12	7	370

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 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 ppmv. The monitoring range of the Model J605 is 3 ppbv to 10 ppmv.

Due to the COVID-19 pandemic, the odor monitoring program was suspended from mid-March 2020 to mid-August 2020. During this period, the M&R Department switched from paper-based data collection to the use of iPad applications. 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 3. 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 2020. Monitoring activities were carried out as described in this report. However, not all the data collected before August 2020 was used in preparation of this report because a subset of data did not meet the minimum expected quality standards which were implemented in August 2020.

Maps showing the odor monitoring locations are presented in Appendices AI and AII.

TABLE 3: ODOR MONITORING PROGRAM FOR 2020

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 before suspension 10 after suspension	1992	12	1 Varies	M&R M&O	Yes No	16	4
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 nine 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.

In 2020, 16 odor complaints were received at the Calumet WRP SDS, four of which were verified, while ten were unverified, one was not investigated in time and one was investigated, but unfinished. In 2020, no odor complaints at the HASMA, Marathon, and Vulcan SDA, and LASMA SPS were received.

This report presents the odor monitoring data for the year 2020. 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 2020

The results of the various odor monitoring programs at each of the monitored sites for 2020 are summarized in Table 4. 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 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 2020. A new tool called Networkfleet was utilized to spot-check the authenticity of the 2020 data. Networkfleet is an internet application that can track the District vehicle routes and stops using the Global Positioning System. 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 does not meet 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 82 percent of the total observations characterized as faint to no odor. In M&O Department monitoring, the Calumet WRP SDS had 96 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 seven very strong odor observations and 11 strong odor observations out of 235 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.

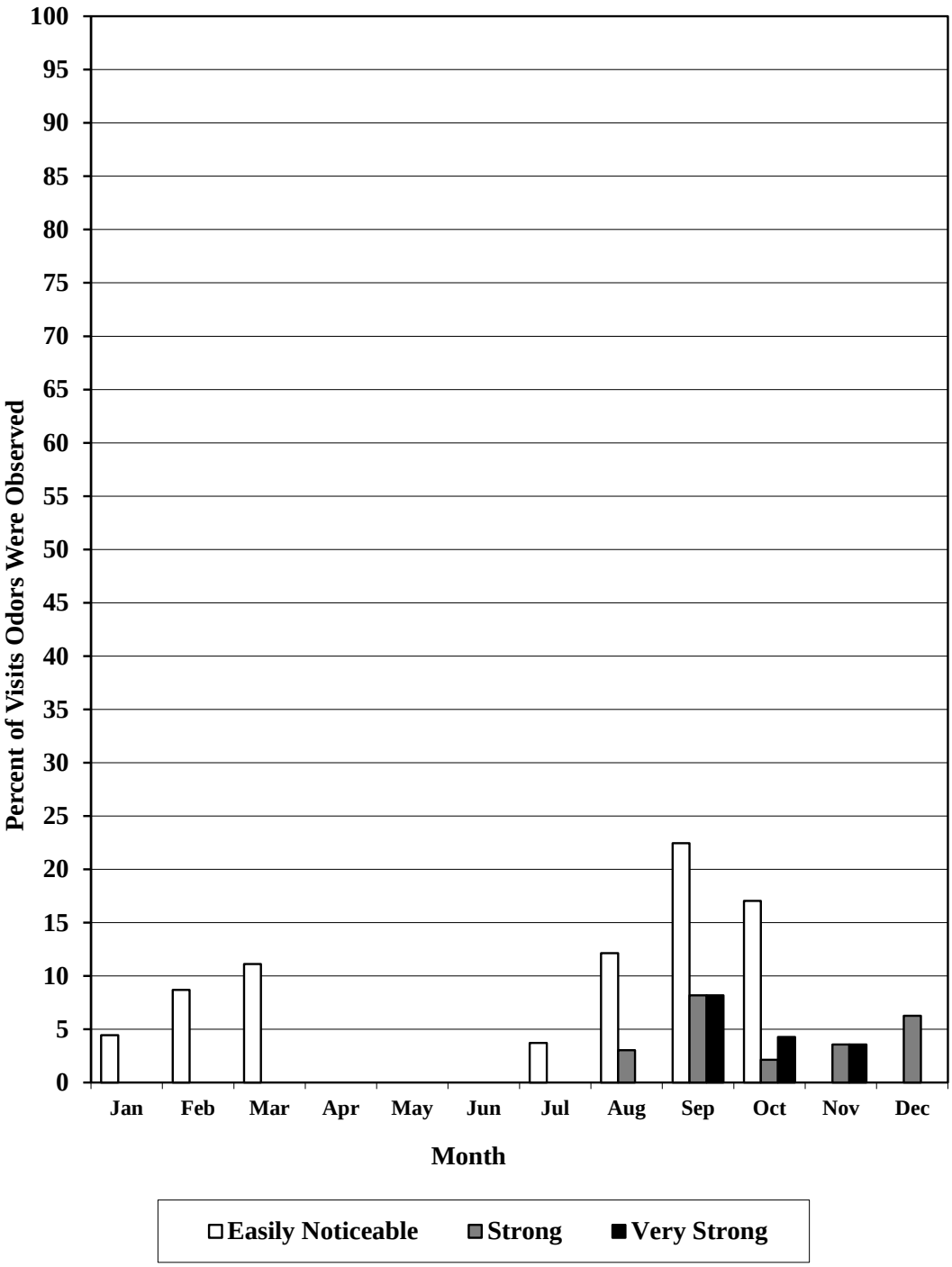
Very strong odors were observed under nine percent of the time on a monthly basis. Strong odors were observed under nine percent of the time on a monthly basis. Figure 1 presents the monthly frequency of occurrence of the easily noticeable, strong, and very strong odor

TABLE 4: ODOR MONITORING RESULTS FOR 2020

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	235	7	11	25	192	82%
	M&O	135	0	0	6	129	96%
HASMA, Marathon, Vulcan SDAs, and LASMA SPS	M&R	370	7	12	30	321	87%

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 – 2020*



*No data available from April to June due to COVID-19 suspension.

observations. The easily noticeable odor observations during this period ranged from 0 to 22.4 percent. The easily noticeable odors were highest during September 2020, at 22.7 percent.

The average H_2S levels were between <3.0 and 5.07 ppbv. The highest H_2S levels ranged from 5 to 46 ppbv. Both are shown in Table 5. The highest value observed (46 ppbv) was at Calumet SMA Location 2 West Cell 4 at the Scale House on September 11, 2020.

There were 16 odor complaints related to the Calumet WRP SDS during 2020, four of which were 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 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 87 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 seven very strong and 12 strong odor observations out of 370 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 six percent of the time on a monthly basis. Strong odors were observed under 10 percent of the time on a monthly basis. The easily noticeable odor observations ranged from 0 to 20 percent during this time period. The easily noticeable odors were highest during September 2020, at 20 percent.

The average H_2S levels at the various locations around these SDAs and SPS ranged from <3.0 to 14.93 ppbv. The highest H_2S levels at the various locations around these SDAs and SPS ranged from 8 to 317 ppbv. Both are shown in Table 6. The highest value observed (317 ppbv) was at Marathon SW on October 19, 2020.

There were no odor complaints related to these solids drying and processing facilities in 2020.

TABLE 5: HYDROGEN SULFIDE READINGS AT THE CALUMET SOLIDS DRYING SITE FOR 2020

Location[2]	Hydrogen Sulfide, ppbv[1]		
	Mean[3]	Percent of Readings Below the Detection Limit	Maximum
CASLMA W Cell 1 Gate (1)	2.68	74%	8
CALSMA W Cell 4 @ Scale House (2)	5.07	62%	46
N. of CALSMA W. At N. Gate (3)	2.25	77%	5
CALSMA E. SW Corner of Cell 5 (19)	3.57	58%	12
CALSMA E. SE Corner of Cell 5 (20)	3.71	68%	17
CALSMA E. NE Corner of Cell 8 (21)	3.85	54%	16
CALSMA E. NW Corner of Cell 8 (22)	4.97	44%	25
CALSMA E., E. of Cell 1 (23)	2.85	76%	8
CALSMA E., S. of Cell 1 (24)	3.31	71%	15
CALSMA E., W. of Cell 1 (25)	4.87	50%	29

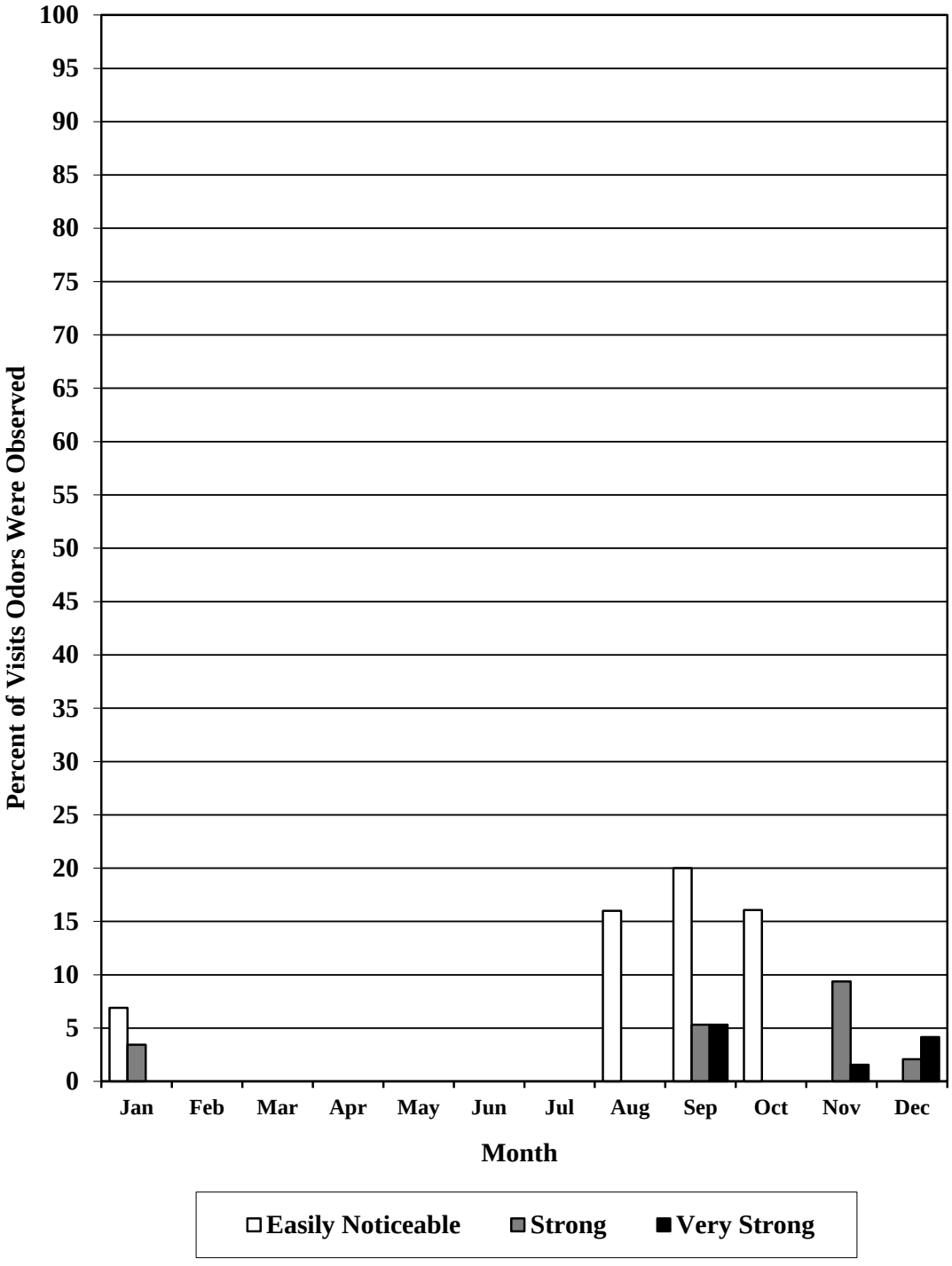
Note: CALSMA = Calumet Solids Management Area.

[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: ODOR MONITORING LOCATIONS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN AND MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 1990 THROUGH SPRING 2020*



*No data available from April to July due to COVID-19 suspension.

TABLE 6: 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 2020

Location[2]	Hydrogen Sulfide, ppbv [1]		
	Mean[3]	Percent of Readings Below the Detection Limit	Maximum
HASMA E. (1)	7.15	65%	110
HASMA Center (2)	2.73	73%	10
Vulcan NE (3)	9.09	48%	155
Vulcan Construction Shaft (4)	4.36	56%	23
Vulcan NW (5)	5.55	54%	48
Vulcan TARP Well (6)	5.25	58%	30
LASMA Lagoon 24 (11)	5.01	44%	24
LASMA Lagoon 20 (12)	13.12	48%	141
LASMA Cell 1E-1W (13)	2.97	70%	10
LASMA Cell 2E-2W (14)	3.15	65%	13
LASMA Cell 3E-3W (15)	3.17	67%	10
LASMA Cell 4E-4W (16)	2.99	74%	8
LASMA Cell 5E-5W (17)	2.87	70%	10
Marathon NE (18)	8.13	50%	133
Marathon SW (19)	14.93	72%	317

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.

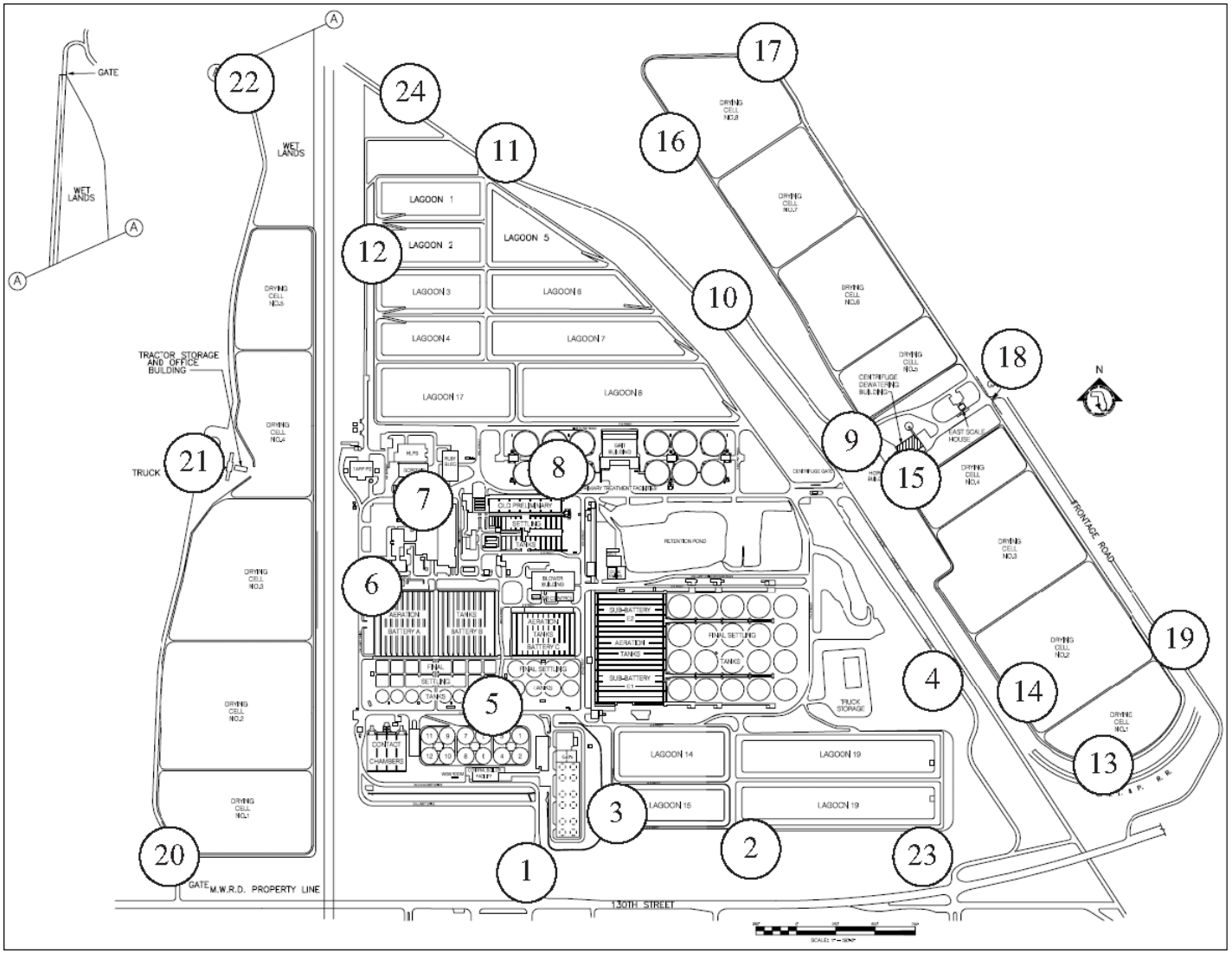
[2]Numbers in parentheses correspond to Station numbers in Figure AI-2.

[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

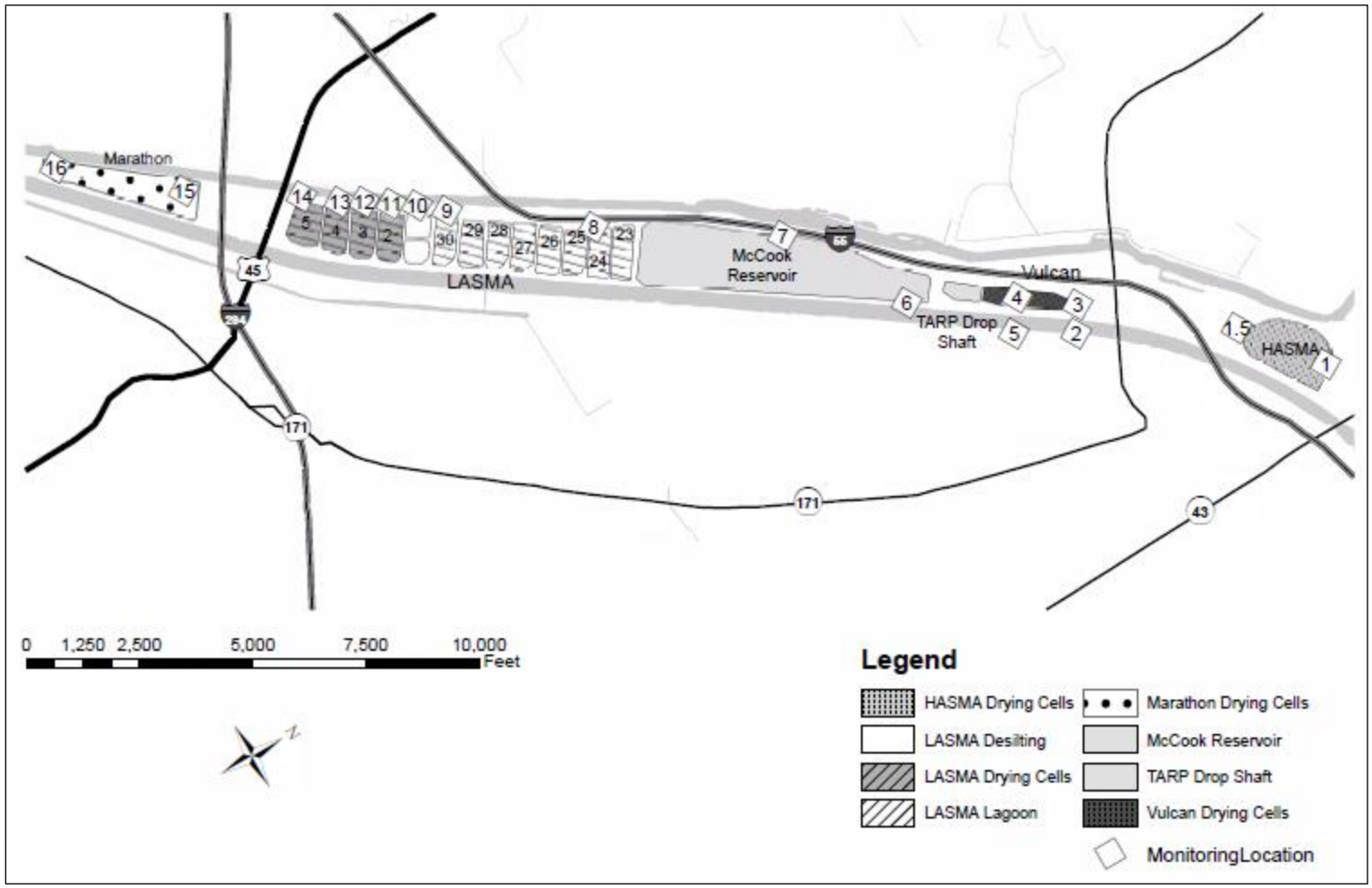
LOCATION OF ODOR MONITORING STATIONS AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO SOLIDS DRYING AREAS AND SOLIDS PROCESSING SITES – 1990 THROUGH SPRING 2020

FIGURE AI-1: ODOR MONITORING LOCATIONS AT THE CALUMET WATER RECLAMATION PLANT AND CALUMET SOLIDS DRYING SITES – 1990 THROUGH SPRING 2020



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

FIGURE AI-2: ODOR MONITORING LOCATIONS AT THE HARLEM AVENUE SOLIDS MANAGEMENT AREA, VULCAN AND MARATHON SOLIDS DRYING AREAS, AND LAWNDALE AVENUE SOLIDS MANAGEMENT AREA SOLIDS PROCESSING SITE – 1990 THROUGH SPRING 2020



*Numbers indicate odor monitoring locations.

APPENDIX AII

LOCATION OF ODOR MONITORING STATIONS AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO SOLIDS DRYING AREAS AND SOLIDS PROCESSING SITES – SUMMER 2020 TO PRESENT

FIGURE AII-1: ODOR MONITORING LOCATIONS AT THE CALUMET WATER RECLAMATION PLANT AND SOLIDS DRYING SITES – SPRING 2020 TO PRESENT*

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

FIGURE AII-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 – SPRING 2020 TO PRESENT*

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

FIGURE AII-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 – SPRING 2020 TO PRESENT*

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