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MSD Odor Control Master Plan

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Memo

Subject: Technical Memorandum #7- Current Odor Technologies Performance Evaluation

1. Introduction

During previous phases of the Odor Control Master Plan, AECOM reviewed and compiled available data and documentation related to odor control and sampling within the Morris Forman Service Area. The purpose of this memorandum is to utilize available sampling data to evaluate the performance of the following odor control systems and technologies at the Morris Forman WQTC:

1. Biotower Odor Control (BOC)
2. Solids Handling Odor Control (SHOC)
3. Regenerative Thermal Oxidizers (RTOs)*
4. Main Equipment Building (MEB) Acid Scrubbers*
5. MEB Fugitive Dust Wet Scrubbers*
6. MEB Silo Dust Wet Scrubber*

**- Currently being installed under the Emergency Dryer Replacement Project with anticipated completion in early 2022.*

Based on the findings of the current performance evaluation, recommended action items were developed to improve the odor removal efficiency of existing odor control systems at the Morris Forman WQTC.

Please refer to **TM#1** and **TM#5** for details relating to the data review and consolidation process and subsequent current odor impact evaluation conducted prior to the development of this report

2. Design and Operational Performance Review

The WQTC is currently equipped with several odor control technologies for the treatment of foul air generated from various process areas. A summary of the WQTC existing odor control technologies is shown in **Table 2-1** including manufacturer and model, number of units, installation year and associated odor sources.

Table 2-1 Existing Odor Control Technologies Summary

Odor Control System	Manufacturer/ Model	# of Units	Year Installed	Associated Odor Source(s)
(1) BOC	Bioway Purspring 1000	(2)	2007	Aerated Influent Channel
(2) SHOC	Biorem Biofiltair	(2)	2006; Rebuilt in 2011	MEB Dewatering Area[1], Sludge Holding Tanks
(3) RTOs[2]	Gulf Coast Environmental Systems 100-95-RTO	(2)	Ongoing	MEB Dewatering Area, MEB Sludge Drying Area[1]
(4) MEB Acid Scrubbers[2]	Andritz TOP-85 DT-CB/SUMP-VT520'2 OT-DB-SS	(2)	Ongoing	MEB Dewatering Area, MEB Sludge Drying Area[1]
(5) MEB Fugitive Dust Wet Scrubbers[2]	Monroe Environmental DT-3000-SS	(2)	Ongoing	MEB Sludge Drying Area Fugitive Dust
(6) MEB Silo Wet Dust Scrubber[2]	Monroe Environmental DT-1000	(1)	Ongoing	MEB Storage Silos Fugitive Dust

[1]MEB Dewatering Area and MEB Sludge Drying Area process sludge from the Digesters as well as hauled sludge.

[2]MSD is currently in construction phases of the Emergency Dryer Replacement Project which involves installation of new RTOs, MEB Acid Scrubbers, MEB Fugitive Dust Wet Scrubbers, and MEB Silo Dust Wet Scrubber.

It is important to note that the RTOs, MEB Acid Scrubbers, MEB Fugitive Dust Wet Scrubbers, and MEB Silo Dust Wet Scrubber listed in **Table 2-1** are currently being installed under the Emergency Dryer Replacement Project. MSD anticipates that the new systems will be commissioned in early 2022.

Existing equipment specifications and reports were evaluated to identify key design parameters for each of the existing odor technologies and is summarized in

Table 2-2. The project team also compiled previous performance testing results and expected performance parameters to assess current operational performance. As of 2021, performance testing data was available for the Bioway BOC system (**Section 2.1.1**) and the Biorem SHOC system (**Section 2.1.2**).

Table 2-2 Existing Odor Control System Design Summary

Odor Control System	Inlet Conditions			Expected Performance
	Total Peak Capacity (cfm)	Average/ Peak H_2S (ppmv)	Average/ Peak Odor Conc. (ou)	
(1) BOC	20,000	60 (average) /150 (peak)	N/A	N/A
(2) SHOC	9,200	150 / 200	<6,000 / 15,000	99% H_2S Reduction; 90% TRS Reduction
(3) RTOs[1]	10,000	N/A	N/A	99% or less than 10 ppmv Removal Efficiency
(4) MEB Acid Scrubbers[1]	3,000	N/A	N/A	N/A
(5) MEB Fugitive Dust Wet Scrubbers[1]	6,000	N/A	N/A	95% Removal Efficiency
(6) MEB Silo Dust Wet Scrubber[1]	1,000	N/A	N/A	99.9% Removal of dust 2.0 microns or larger

[1]To be updated following ongoing improvements project
N/A= Data not available from previous reports and manufacturer specifications.

2.1.1 *BOC Performance Evaluation*

MSD conducted performance testing of the BOC system in 2008. The study focused on H_2S removal efficiency and odor reduction efficiency. Performance data results are summarized in **Table 2-3** including inlet and outlet H_2S levels and odor concentrations during the 2008 monitoring period. H_2S measuring instrumentation did not have the ability to record H_2S values exceeding 2 ppm, therefore the peak H_2S values during the monitoring period are unknown and average values may be skewed.

Table 2-3 BOC Performance Data Summary, 2008

Location	H_2S Concentration (ppb)			Odor Concentration (D/T)		
	Inlet	Outlet	% Reduction	Inlet	Outlet	% Reduction
BOC Unit #1	29,347	182	99.4%	13,000	4,600	65%
BOC Unit #2	31,112	155	99.5%	8,700	6,200	28%
Average:	**63,337**	**169**	**99.4%**	**10,850**	**5,400**	**47%**

*- Sampling Day #2 was utilized for evaluation due to high peak loading conditions on Day #1

The 2008 performance testing results showed that average H_2S removal efficiency was approximately 99.4% between the two BOC units. However, odor reduction was generally poor with an average odor concentration of 5,400 D/T and an average odor reduction of 47%. Outlet odor emissions were likely impacted by alternate reduced sulfur compounds, amines, aldehydes, or VOCs which were not sampled during the 2008 performance tests.

MSD is currently considering the replacement of the existing BOCs under the Rehabilitation and Replacement of Primary Sedimentation Basins Project. The proposed process airflow for the new system is 16,500 cfm.

2.1.2 *SHOC Performance Evaluation*

MSD has conducted several performance tests at the SHOC since the system was commissioned in 2006. The following sampling data was evaluated:

1. RSC and H_2S Sampling, September 2008
2. RSC and H2S Sampling, November 2012
3. RSC Sampling, April 2013

Table 2-4 summarizes the results of the SHOC sampling data listed above, including observed outlet RSC concentrations and associated percent (%) reduction at the SHOC units. The TRS concentration represents the sum of MM, DMS, and DMDS.

Table 2-4 SHOC TRS Performance Data Summary

Sampling Location	Outlet Conc. (ppb)					% Reduction				
	H_2S	MM	DMS	DMDS	TRS	H_2S	MM	DMS	DMDS	TRS
September 2008										
SHOC Unit #1	116	266	1932	37	**2235**	99.9%	99.0%	52.8%	96.1%	**93.1%**
SHOC Unit #2	116	376	1742	144	**2262**	99.9%	98.6%	57.4%	84.7%	**93.0%**
November 2012										
SHOC Unit #1,	<5	262	35	13	**310**	99.9%	92.3%	39.7%	63.9%	**65.3%**
SHOC Unit #2	<5	106	34	4.4	**144**	99.9%	96.9%	41.4%	87.8%	**75.3%**
April 2013										
SHOC Unit #1	-	483	262	146	**100**	-	88.4%	86.3%	95.0%	**89.9%**
SHOC Unit #2	-	<3	29	4.4	**40**	-	99.4%	88.9%	97.0%	**95.1%**

H_2S=Hydrogen Sulfide
MM= Methyl Mercaptan
DMS= Dimethyl Sulfide
DMDS= Dimethyl Disulfide
TRS=Total Reduced Sulfur; Sum of MM, DMDS, and DMS.

Available sampling data shows that both SHOC units met expected performance targets for H_2S percent reduction with 99.9% at both units, exceeding the expected performance level of 99%. SHOC Unit #1 did not meet the 90% TRS reduction threshold during any of the performance tests, with observed values ranging from 65.3% to 89.9% TRS removal. SHOC Unit #2 met the 90% TRS reduction performance level during the September 2020 and April 2013 sampling periods but fell significantly below expected levels during the November 2012 performance test with 65.3% TRS removal.

Table 2-5 shows the observed H_2S percent reduction versus the expected performance levels provided by the equipment manufacturer.

Table 2-5 SHOC Observed vs. Target H_2S and TRS % Removal

Location	H_2S % Reduction		TRS % Reduction	
	Observed	Target	Observed	Target
SHOC Unit #1	99.9%	99%	65.3%-93.1%	90%
SHOC Unit #2	99.9%	99%	75.3%-95.1%	90%
*-Percent removal targets are based on manufacturer performance data for expected performance.				

The SHOC system was also analyzed for outlet odor concentration (D/T) in July 2008. The sampling results showed the SHOC outlet to have an odor concentration in D/T of 4,100 during the first round of sampling and 5,700 in the second round of sampling. Based on previous dispersion modelling the recommended SHOC outlet concentration was 2,000 D/T and was predicted to have no offline impact to the community. The 2008 performance tests showed that the target SHOC outlet concentration of 2,000 D/T is not considered achievable based on current SHOC operations.

Based on the findings of previous performance data evaluation, the following conclusions were made regarding the existing SHOC system:

- SHOC system odor concentrations from July 2008 performance tests exceeded the target odor concentration of 2,000 D/T defined in previous air dispersion modelling reports
- SHOC Unit #2 has shown better operating performance than SHOC Unit #1 in terms of RSC removal
- 99% H2S reduction target was met during previous performance tests for both SHOC units
- 90% TRS reduction target was not met during the November 2012 performance test for both BOC units and during the April 2013 performance test for Unit #1

2.1.3 *MEB Odor Control Systems Performance Evaluation*

The RTOs, MEB Acid Scrubbers, MEB Fugitive Dust Wet Scrubbers, and MEB Silo Dust Wet Scrubber are currently being installed under the Emergency Dryer Replacement Project. The odor removal efficiency of these systems will be evaluated following the construction completion during the commissioning.

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3. Conclusions and Recommendations

3.1 Conclusions

Available performance data was compiled and evaluated for each existing odor control system at the WQTC. Systems which are currently being rehabilitated or will be impacted by ongoing improvements projects were omitted from this performance evaluation. These systems include the RTOs, MEB Acid Scrubbers, MEB Fugitive Dust Wet Scrubbers, and MEB Silo Dust Wet Scrubber and will be evaluated after the Emergency Dryer Replacement project construction has been completed.

Table 3-1 summarizes available performance data from previous reports including average H_2S, odor and TRS removal efficiency for each existing odor control system. A performance rating was included to indicate whether each performance efficiency target was met.

Table 3-1 Current Odor Technologies Performance Evaluation Summary

Odor Control System	Average Odor Conc. (D/T)	Average Odor Conc. % Reduction	Average H_2S Conc. % Reduction	Average TRS Conc. % Reduction	Performance Rating(s)
(1) BOC	Unit 1: 4,600 Unit 2: 6,200	Unit 1: 65% Unit 2: 28%	Unit 1: 99.4% Unit 2: 99.5%	N/A	• Odor Removal: Poor • H_2S Removal: Meets target removal efficiency (99% reduction)
(2) SHOC	4,100-,5700	N/A	99.9%	Unit 1: 65.3%-93.1% Unit 2: 75.3%-95.1%	• H_2S Removal: Meets target removal efficiency (99% reduction) • TRS Removal: Does not consistently meet target removal efficiency (90%)
N/A= Performance data not available					

Available performance data showed that the BOC and SHOC systems met performance targets in terms of H_2S removal; however relatively high outlet odor concentrations were observed at both systems. In addition, the SHOC system did not meet TRS removal targets during multiple performance tests (November 2012, April 2013) which may be attributed to the presence of additional reduced sulfur compounds.

3.2 Recommendations

The following action items are proposed to improve the odor removal efficiency of the existing BOC and SHOC units:

- Evaluate the options for upgrading the current SHOC and BOC odor control technologies
- Consider replacing the BOC system under the Primary Sedimentation Basin Rehabilitation project (construction anticipated in 2022)
- Perform an air sampling program at all odor process sources after the completion of the current projects
- Predict community impact from the odor process sources by using air dispersion modelling and assess whether MSD's target odor concentration of 20 D/T at offline receptors is exceeded