AECOM
500 West Jefferson Street
Suite 1800
Louisville, KY 40202
aecom.com

Project name:
MSD Odor Control Master Plan

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To:
Robin Burch
MSD Project Manager
4522 Algonquin Parkway
Louisville, KY 40211

From:
Alex Carciumaru, AECOM

Reviewed by:
Amanda Foote
Janet Strickland

Date:
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Memo

Subject: Technical Memorandum #4- Review of the Planned Process Modifications

1. Introduction

As part of the Odor Control Master Plan project, AECOM has reviewed the planned process modification projects at the Morris Forman Water Quality Treatment Center (MFWQTC) and tributary collection system to support Master Plan development. Four (4) modification projects were identified and are listed below:

1. Process Modification #1 – Emergency Dryer Replacement at Morris Forman WWTP
2. Process Modification #2 – Rehabilitation and Replacement of Primary Sedimentation Basins and Related Equipment
3. Process Modification #3 – Odor Control in the Ohio River Force Main
4. Process Modification #4 – Odor Control Splitter Structure One at an MSD Pump Station

This task focused on review of the available documentation for these planned process modifications to identify and evaluate the potential impact from these projects on odor emissions and targets of the Odor Master Plan.

2. Emergency Dryer Replacement at MFWQTC

2.1 Emergency Dryer Replacement

In February 2020, the last of the four original Rotary Drum Dryers failed leaving all solids processing at Morris Forman (MFWQTC) as Dewatered Cake. Due to landfill restrictions, MSD can only dispose of

180 wet tons of Dewatered Cake per day. Higher sludge blankets are maintained in the primary and secondary treatment processes at MFWQTC.

Soon after the Dryer failure an emergency project was started to design and install two (2) new Rotary Drum Dryer Systems to replace the original units installed in 2001. These two (2) new systems are very similar to the original system, with some modifications and improvements to the equipment. Each dryer train will process 70 dry tons per hour (dtph) which should be sufficient to process the solids loading for MFWQTC. These dryer trains are currently in construction with commissioning expected in late 2021.

MSD is currently in the final design and construction phases of the Dryer Replacement Project, MSD Contract No. 16453, which was documented in the 90-percent design set. This project included replacement of dryers at the Main Equipment Building, elimination of (4) existing regenerative thermal oxidizers (RTOs) and installation of (2) new RTOs. Major improvements were made to the 6th floor of the Main Equipment Building including replacement of screw conveyors, removal of existing venturi scrubbers and installation of new acid/wet scrubber system and fans. The following documentation was used for the review and evaluation of this system:

- RFP Rotary Drum Drying System
- Building 6th Floor Conveyor Removal and Replacement Work (Draft)
- Condenser General Arrangement
- Venturi Scrubber General Arrangement
- Dryer System PID Drawings
- RTO Initial Submission
- Main ID Fan General Arrangement
- Venturi Scrubber Fan
- Preseparator & Polyclone Equipment
- Dryer Wet Scrubber
- Pellet Cooler
- Dryer System Silo Area – Dust Scrubber
- Dryer System Acid Scrubber

Based on review of the available documentation, the main odor and dust control equipment to be installed as part of this Contract includes:

1. Silo Wet Scrubber
2. Condenser
3. Thermal Oxidizer
4. Venturi Scrubber
   - Inlet Air Flow
   - Collection Efficiency
5. Wet Scrubber (Dryer Train Fugitive Dust Collection

2.1.1 *Emergency Dryer Replacement Project Review*

The following conclusions were determined based on review of the emergency dryer replacement contract documentation:

- Most of the odor and dust control systems are at the final design and early construction stage.
- The available technical documentation does not provide enough information on the air odor concentration, chemical composition, and particulate loading at the treatment units.
- The sampling port locations and numbers will have to be provided prior to the systems commissioning.
- A vapor and dust sampling program part of the Odor Master Plan will establish the performance of the installed systems and compliance with the Odor Master Plan targets.

2.2 Solids Handling Odor Control (SHOC) System

The SHOC system was supplied and installed in 2012. The odor control system includes two (2) units and each unit is supplied with a biotrickling (bioscrubber) and a biofilter with two (2) types of the media. The biotrickling (bioscrubber) is mainly for the removal of the elevated hydrogen sulfide concentrations. The biofilter two stage media is used to remove the residual H_2S and to provide the removal of the total reduced sulfur (TRS) compounds. According to available documentation (O&M manual) the system was sized to treat 9,200 cfm of foul air from the identified sources. As per discussion with MSD, the current system removal efficiency performance is not available because ambient air infiltrates under the conveyor covers between the dewatering centrifuges and wet bins. The following documentation was used for the review and evaluation of this system:

- Operation and Maintenance Manual, Rev. 0 dated August 21, 2012
- SHOC Preliminary Performance Test Data performed in May 2012
- SHOC TRS Performance Test Data collected in April 2013.
- Emergency Dryer Replacement

2.2.1 *SHOC System Project Review*

The following conclusions were determined based on review of available documentation for this system:

- To date, vapor sampling at SHOC system only evaluated H_2S concentrations. In order to evaluate and establish removal efficiency of the treatment units, the SHOC system needs another vapor sampling program that include odor and other compounds. This information is recommended to determine if adjustments or modifications are needed in order to meet the Odor Control Master Plan targets that will be set.
- The SHOC system design parameters do not include the odor intensity in the air stream from the process areas.
- Dimethyl Sulfide removal efficiency in the 2012 performance test data was significantly lower than the target set by the manufacturer.
- Dimethyl Disulfide removal efficiency in the 2012 performance test data was below the set target.
- Dimethyl Sulfide removal efficiency in the 2013 performance test data improved, but was still below the set target.

- Dimethyl Disulfide removal efficiency in the 2013 performance test data improved and was above the set target.
- A detailed investigation of the system media is recommended since the media is approaching the 10-year life cycle. The investigation should include the operation of the humification and irrigation systems.
- The irrigation and humification system operating paraments should be verified and compared with design values.
- The air flow and capture efficiency at the process areas should be measured to minimize odor emissions inside the plant.

3. Rehabilitation and Replacement of Primary Sedimentation Basins and Related Equipment

The Primary Sedimentation Basins were originally constructed with the original plant construction and commissioned in 1958. Over the years, rehabilitation has been done to the travelling bridge mechanism, raw sludge pumps, and transfer lines, but no work has been done to the tank structures. As part of MSD's Consent Decree requirements, rehabilitation and replacement of the Primary Basins must be completed by 2023 to insure reliable flows up to 350 MGD. The design is currently underway and expected to be complete in 2021.

The following documentation was reviewed and evaluated of this process modification:

- MSD Bid Proposal Contract 16460 – Sedimentation Basin Rehabilitation Project
- Primary Sedimentation Basin Rehabilitation Odor Sampling Protocol
- Odor Panel Testing Results
- H_2S Monitoring
- Additional Laboratory Analysis
- MFWQTS Primary Sedimentation Basin Rehabilitation BODR
- Preliminary Sedimentation Rehabilitation 60% Design

In 2020, MSD contracted with a design engineer to perform detailed field testing and preliminary design of odor control improvements at the primary sedimentation basins and related processes under the Rehabilitation and Replacement of Primary Sedimentation Basins Project (Contract 16460). In September 2020, a complex odor sampling program was performed to assess existing odor and RSC emissions. Sampling protocol, odor sampling results, H_2S monitoring results, and additional laboratory results from the October 2020 sampling period were reviewed and findings are provided in the sections below.

Based on the findings of the field sampling, the design engineer developed a proposed odor control improvements program for the primary sedimentation basins and aerated influent channel. Two (2) recommended odor control alternatives were presented in the "MFWQTC Primary Sedimentation Basin Rehabilitation BODR." The BODR was submitted along with drawings, list of specifications and preliminary cost opinions as part of the 30% design deliverable in September 2020.

3.1 Primary Sedimentation Basin Rehabilitation Odor Sampling Protocol

The design engineer submitted a document titled "MFWQTC Primary Sedimentation Basin Rehabilitation Odor Control Sampling Protocol" in August 2020. The purpose of this document was to identify field sampling locations, schedule, sampling procedures, equipment required to perform sampling, and laboratory analyses procedures to be followed for the existing Sedimentation Basins and Aerated Influent Channel. **Table 3-1** summarizes the field sampling locations identified in the August 2020 document.

Table 3-1 – Field Sampling Summary, 2020

Sample Location No.	Sampling Location	Time of Day		Sample Method
		AM	PM	
1	Aerated Influent Channel to Sedimentation Basins	Y	Y	Near water surface inside channel
2	Sedimentation Basin No. 1 Inlet	Y	Y	Flux chamber on water surface of basin
3	Sedimentation Basin No. 1 Outlet	Y	Y	Flux chamber on water surface of basin
4	Sedimentation Basin No. 1 Effluent Weir	Y	Y	Flux chamber on water surface of basin
5	Sedimentation Basin No. 4 Inlet	Y	Y	Flux chamber on water surface of basin
6	Sedimentation Basin No. 4 Outlet	Y	Y	Flux chamber on water surface of basin
7	Sedimentation Basin No. 4 Effluent Weir	Y	Y	Flux chamber on water surface of basin
8	Sedimentation Basin Effluent Channel	Y	Y	Flux chamber on water surface of basin

Recommended air sampling methods involved using flux chambers on the water surface, with the exception of Sample Location No. 1, which was taken near the water surface inside the aerated influent channel. It was also recommended that sampling was performed in August 2020 during hot dry days when odors are most prevalent. Tedlar bags were utilized for air sampling and properly conditioned prior to sample collection. Tedlar bag samples were shipped for testing of VOCs, sulfur compounds, and odor panel testing. This document outlined the protocol for various laboratory analyses using Drager tubes to approximate field concentrations of H_2S, methyl mercaptan, and dimethyl sulfide.

3.2 Odor Panel Test Results

Air samples from each of the (8) sampling locations were collected on September 30, 2020 and shipped to laboratories for further testing. Odor panel testing results were received and evaluated on October 1, 2020.

Across the 8 sampling locations, the AM sample at the Aerated Influent Channel to the Sedimentation basins showed the highest odor concentration, followed by the PM sample of the Sedimentation Basin No. 4 effluent weir. The lowest odor concentrations were observed at the Sedimentation Basin No. 4 outlet during the morning hours followed by the Sedimentation Basin No. 1 inlet during evening hours.

3.3 H_2S Monitoring Odor Panel Test Results

Hydrogen sulfide (H_2S) concentrations were continuously monitored from October 1, 2020 to October 8, 2020 at four (4) locations. Available documentation included graphs of H_2S concentrations (ppm), temperature (degrees F), and humidity (%) across the monitoring period. The graphs also included computation of average, minimum and maximum H_2S concentration during the monitoring period. The H_2S monitoring instrument was not indicated in available data.

H_2S concentrations were highly variable at the Aerated Influent Channel (Location No. 1) and reached high levels multiple times each day between October 1 to October 8, 2020. Average H_2S levels were also highest at the Aerated Influent Channel. Peak H_2S levels at the Sedimentation Basin Effluent Weirs (Nos. 2 and 3) occurred at approximately 1:00 AM on October 8. H_2S concentrations were lowest at the Effluent Channel (No. 4), with the peak H_2S concentration occurring mid-day on October 3, 2020. Generally, the H_2S concentrations followed the trends of temperature and humidity at each location.

3.4 Additional Laboratory Analysis

In addition to odor panel testing and H_2S monitoring, MSD contracted a laboratory to perform laboratory analysis of 2 of the samples collected on September 30, 2020. The samples were received and analyzed on October 1, 2020. A spreadsheet from the laboratory was provided containing the laboratory results at the Aerated Influent Channel.

As expected, the highest levels of H_2S and methyl mercaptan were observed at the Influent Channel. Sedimentation Basin No. 1 also showed relatively high levels of sulfur compounds. Generally, Sedimentation basin No. 1 showed higher concentrations of sulfur compounds compared to Basin No. 2.

3.5 MFWQTC Primary Sedimentation Basin Rehabilitation BODR

The “MFWQTC Primary Sedimentation Basin BODR” was submitted in September 2020 to document the scope of work and design criteria for the Replacement and Rehabilitation of Primary Sedimentation Basins and Related Equipment Project. This project is currently ongoing and involves the following components:

- Existing Aerated Influent Channel modifications
- Existing Primary Sedimentation Basins modifications
- Existing South and North Pump Stations modifications
- New Chemically Enhanced Primary Treatment (CEPT) System
- Addition of Odor Control at the Primary Sedimentation Basins and related equipment

The Basis of Design Report (BODR) was reviewed to assess the proposed installation of an odor collection and treatment system at the primary sedimentation basins and related equipment. Two (2) alternatives for treatment of primary sedimentation basin odorous air were presented in the report:

- **Alternative 1**: Repurpose the existing Bases of Control (BOC) System located adjacent to the Bioroughing Towers
- **Alternative 2**: Construct a new odor control system using new Biotrickling Scrubbers

Regardless of the selected alternative, the proposed odor control system will consist of the following:

- Coverings at the Aerated Influent Channel
- Coverings at the Sedimentation Basin Effluent Weirs
- Coverings at the Sedimentation Basin Effluent Channels
- Conveyance ductwork from capture locations to odor control system

Table 3-2 presents the preliminary basis of design for the proposed odor control systems included in Alternative 1 and Alternative 2 of the BODR.

Table 3-2 – Primary Sedimentation Basin Odor Control System Basis of Design Summary

Parameter	Alternative 1	Alternative 2
Process Conditions	Continuous	Continuous
Process Airflow	16,500 cfm	20,000 cfm
Inlet H_2S Concentration	30 ppmv (avg)/ 2000 ppmv (peak)	60 ppmv (avg)/ 150 ppmv (peak)

The report indicates that the biotrickling scrubbers (Alternative 1) was the recommended odor control strategy based on MSD's experience with the BOCs, anticipated odor compounds and concentrations and lower O&M requirements compared to other methods, and proven efficacy.

3.6 Primary Sedimentation Basin Rehabilitation 60% Design

The documentation, drawings and specifications, included in the 60% design submission is minimal for the odor control system. For this reason, comments were not able to be provided since the technical information concerning the odor treatment units, inlet and outlet air loading to the biotrickling units and other process design were not available.

3.7 Primary Sedimentation Basin Rehabilitation Project Review

The following conclusions were determined based on review of available documentation for the Preliminary Sedimentation Basin Rehabilitation project:

- Detailed air sampling program (odor concentrations and total reduced sulfur compounds) and H_2S monitoring were conducted at targeted areas within the Sedimentation Basins and the Aerated Influent Channel.
- The sampling program results are showing high odor values at most of the sampling locations.
- High H_2S concentrations have been measured at several locations.
- The 60% design approach for the odor control system is considering one stage treatment only using the biotrickling scrubber technology.
- Biotrickling scrubber technology has high removal efficiency for H_2S but lower removal (no more than 80%) for odor and TRS.

- The next design submission will most likely include the process calculations such as: air flow rates, pressure loss calculations, duct and fan sizing, etc. In addition, the drawings should identify the sampling port locations upstream and downstream of the odor treatment units.
- The odor control system and technology design is recommended to be evaluated using the following criteria: reliability; technology controlling most of the chemical compounds; effectiveness & removal efficiency; life cycle; size and footprint; equipment maintenance requirements.

4. Odor Control System in Ohio River Force Main (ORFM)

The ORFM (shown in **Figure 4-1**) consists of two (2) parallel force mains with diameter ranging from 16 to 24 inches and 6 cross connections. The ORFM is 8.5 miles long and is routed south of the Ohio River beginning at a pump station near US 42 West and SR 841 in northern Jefferson County and discharges to a manhole at the intersection of Hancock and Main Street in downtown Louisville on the Ohio River Interceptor (ORI).

The ORFM discharge flows by gravity from the discharge manhole through the ORI to the Morris Forman Water Quality Treatment Center. Sulfates present in wastewater convert to odorous sulfides under anaerobic conditions. Force Main air release valves (ARV), which are releasing air into the surrounding environment, result in odor complaints and the released air is also highly corrosive to metal and concrete components.

The following documentation was used for the review and evaluation of this process modification:

- Ohio River Force Main Odor Study –2018

In response to increased odor complaints in the vicinity of the ORFM, particularly at ARV locations, a design engineer was contracted to perform an evaluation of potential odor sources at the ORFM and its receiving interceptor, the ORI. The study assumed that H_2S was the dominant source of odors in the ORFM, therefore the proposed odor control system was selected to remove H_2S only and not other total reduced sulfur compounds. The study’s findings were presented in the document titled “Ohio River Force Main Odor Study,” dated March 2018.

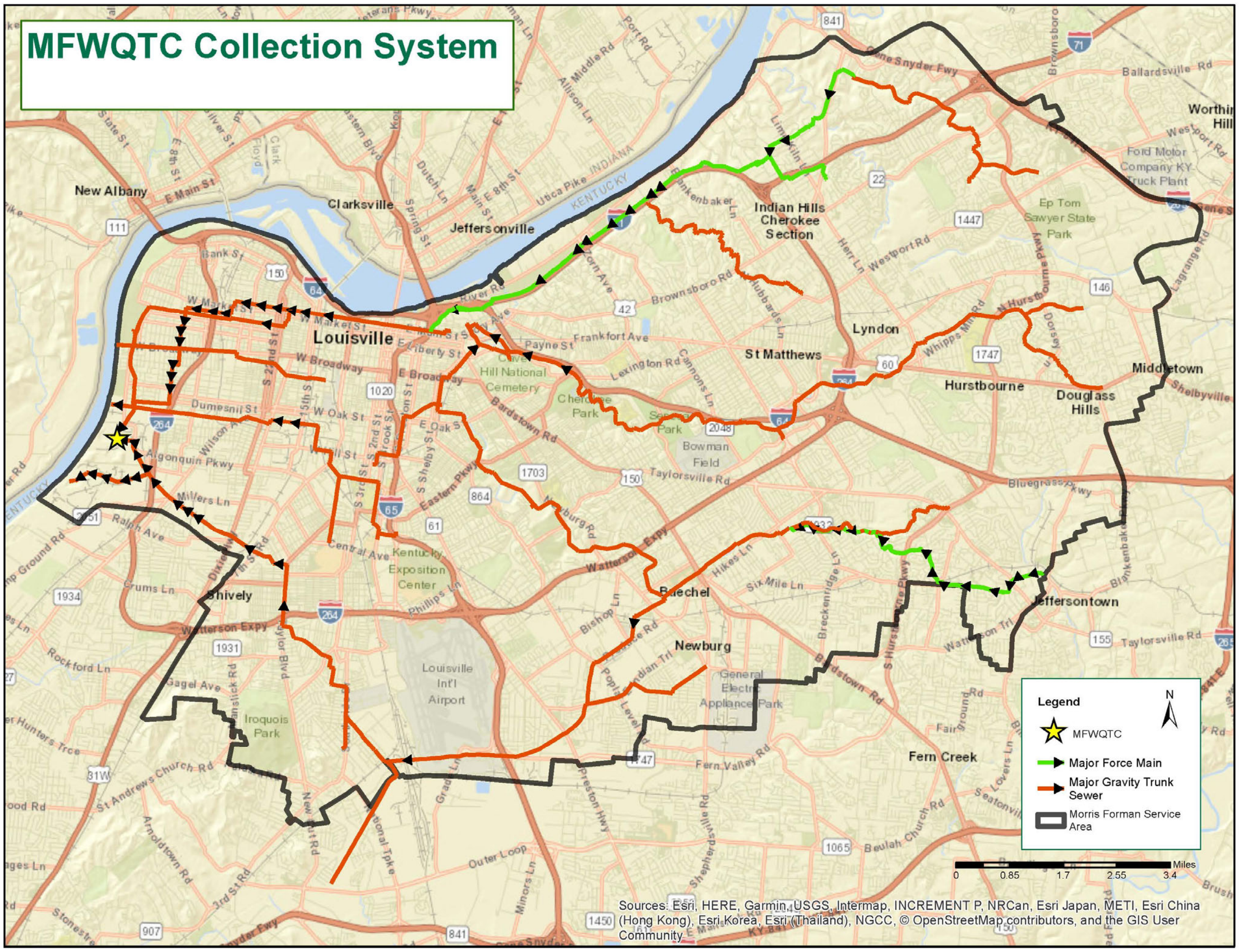

Figure 4-1 – MFWQTC Collection System Overview Map

4.1 ORFM / ORI Liquid Sampling

Liquid phase sampling was performed at (19) locations along the ORFM and the ORI. Two liquid grab samples were collected on two different days at each sampling location; the first round of sampling was conducted in late April 2017 and the second round was conducted in early June 2017. The following parameters were measured at each sampling location:

- COD
- Total Sulfide
- Dissolved Sulfide
- Alkalinity
- pH
- Temperature

COD was measured to assess the anaerobicity of the wastewater within the FM.

The highest average COD concentration was observed at the ORI South Sidestream. The highest total sulfide and dissolved sulfide concentrations were observed within the ORI North Sidestream. High COD levels and sulfide levels were also observed at multiple locations along the northern portion of the ORFM. Based on the sampling results the study concluded that the primary source of sulfides is the ORFM, and not tributary wastewater. The results showed a pH range across the sampling locations. The highest pH reading was observed at the ORI North Sidestream location and the lowest pH reading occurred at the ORFM discharge manhole. Both of these pH readings were observed during the first sampling round in late April 2017. Average temperature was 67.5 degrees F on the April 2017 sampling day and 66.0 degrees F on the June 2017 sampling day. The highest temperature reading of 79.5 degrees F was observed at the sampling location along the ORI, about 16,000 feet downstream of the ORFM discharge.

In addition to liquid phase sampling, H_2S monitoring results were used to evaluate the performance of a biofilter pilot test at the ARV. An Odalog tracking instrument was utilized in the field test installed at the ARV located at the Botanical Gardens along the ORFM.

4.2 ORFM / ORI H_2S Monitoring

H_2S and vapor phase trends were monitored at nine (9) locations equipped with OdaLogs. Four (4) of the locations were installed at ARVs and the remaining five (5) were located at critical manholes or connection points. The monitoring period was continuous from April 26, 2017 through May 9, 2017.

The Odalog data showed that vapor phase H_2S concentrations exceeded the maximum acceptable H_2S threshold at three (3) ARV locations, and the ORFM Discharge Manhole. It was also noted that the liquid sulfide concentration and odor and corrosion potential was likely reduced within the ORI downstream of the ORFM discharge location due to dilution caused by additional wastewater streams

H_2S monitoring results were used to evaluate the performance of a biofilter pilot-test installed at one ARV. The biofilter system consisted of two stages; the first stage involved a 4-ft by 8-ft precast tank with 3 feet of biofilter media, and the second stage included a 4-ft by 8-ft precast tank with 3 feet of activated carbon media. This field test was initiated to evaluate the H_2S reduction efficiency of the proposed ARV biofilter system and potential implementation across the ORFM. The biofilter system was monitored for inlet and outlet H_2S concentrations from August to October 2017.

On average the biofilter H_2S removal efficiency was considered acceptable with a minimum of 79.5% during acclimation phases and a maximum removal efficiency of 99.9% during the final monitoring phase. However, the biofilter performance was less efficient for peak inlet H_2S loadings, with peak H_2S removal efficiency ranging from 63.6% to 95.5%. Based on the average H_2S removal efficiency results, the design engineer concluded that the biofilter system was an effective tool in this application and therefore included the ARV biofilter systems as part of the future ORFM odor control alternatives However, it was noted that H_2S peak loadings should be kept below 100 ppm via oxygen injection for more effective biofiltration.

Based on the observed inlet and outlet loadings from the pilot-test, this particular biofilter technology may not be the appropriate technology for this application.

4.3 ORFM Odor Control Alternatives Evaluation

Based on dispersion modelling efforts, hydraulic modelling, preliminary cost comparisons, and ARV biofilter test findings, five (5) ORFM odor control scenarios were assessed to reduce odor emissions along the ORFM, specifically at the existing ARV locations:

Alternative 1: Close all the FM barrels, or a segment of one FM barrel to decrease detention time and sulfide formation.

Alternative 2: Treat the ARV discharges with biofilters equipped with dispersion stacks. Treat the ORFM discharge into the ORI with vapor phase controls (i.e. biofilter).

Alternative 3: Add chemical to the ORFM at high doses. Based on life cycle cost analysis, oxygen injection was recommended for implementation.

Alternative 3A: Alternative 3 plus additional odor control (biofilter, carbon adsorption or dispersion stack) at ARV discharges.

Alternative 4: Add chemicals to the ORFM at lower doses and install dispersion stacks on the ARV discharge.

Using WATS software, dispersion modelling was performed to further refine Alternative 1 and Alternative 2. Modelling scenarios involved various levels of H_2S loadings, dispersion stack sizing and FM barrel closure. The desired peak odor level criteria was a peak Dilutions to Threshold (D/T) value of 7 D/T. Alternative 1, which involved closing one of the two FM barrels, or a portion of one (1) barrel, showed an average predicted H_2S reduction ranging between 71% and 75%, based on existing average peak H_2S conditions at the ARV collected in August –October 2017. Alternative 2 was not considered a viable control option due to site accessibility constraints and aesthetic concerns. Oxygen was the recommended chemical option (in lieu of Bioxide or ferric chloride) included in Alternative 3 and 3A based on lifecycle cost comparison. Alternative 3A was the recommended future ORFM odor control alternative due to the following:

- Significantly reduces odors, corrosion and H_2S exposure limits within the ORFM through oxygen injection, including at the ARV locations and the ORFM discharge manhole
- Provides redundancy at the ARV in the instance that the oxygen system is inoperable and the existing biofilter should be utilized as the primary odor control method at this location. It was also noted that additional control measures should be further evaluated at this location, including the installation of a dispersion stack or carbon adsorption vessel.
- Offers the lowest lifecycle cost

The 20-year Present Worth Value for Alternative 3A was estimated at approximately $5.5M, which does not include biofilter or carbon adsorption system costs for the Botanical Gardens ARV. It is also important to note that the study assumed that H_2S was the dominant source of odors in the ORFM, therefore the proposed odor control system was designed to remove H_2S specifically, and no additional reduced sulfur compounds.

Based on the ORFM odor control recommendations, MSD has implemented Alternative 1 by closing one of the two FM barrels. In addition, MSD continues to operate the pilot biofilter system installed at the ARV location.

4.4 ORFM Oxygen System

The second part of the study involved the system and site layout planning for the proposed oxygen injection system recommended as Alternative 3A. The Super Oxygenation oxygen transfer device was utilized during system concept design which has a design oxygen transfer efficiency of 90% to 95%.

The report outlines potential oxygen supply and storage options, as well as the pros and cons of liquid oxygen versus oxygen generation systems. The design engineer recommends liquid oxygen over oxygen generation based on the following parameters:

- Lower Capital and Operation and Maintenance (O&M) costs
- Easier to operate and maintain
- Easier delivery access to site

Two (2) oxygen dosing stations were recommended to prevent sulfide formation throughout the length of the ORFM, with the intention that one station be located in the upstream portion of the ORFM, and one station in the downstream portion. Screening evaluation was performed and detailed for a total of six (6) MSD-owned locations. Site considerations included liquid oxygen delivery accessibility, system aesthetics for the adjacent community, easement acquisition limitations, permitting, floodplain proximity, potential utility crossings or relocation. MSD-owned facilities were also preferred. The method of liquid oxygen delivery was also considered and recommended for each potential oxygen station site.

Based on the screening evaluation findings, the upstream PS and downstream PS were selected as the two oxygen injection stations. **Table 4-1** summarizes the recommended ORFM oxygen system including selected oxygen stations (upstream and downstream) oxygen delivery method and preliminary cost estimates.

Table 4-1 – Preliminary ORFM Oxygen System Summary

Station Location	Oxygen Delivery Method	Estimated Capital Costs[1]	Estimated O&M Costs	20-Year Present Worth
Upstream PS[2]	Micro-bulk	$1,270,000	$79,000	$2,540,000
Downstream PS[3]	Micro-bulk	$1,560,000	$87,000	$2,960,000
Total		**$2,830,000**	**$166,000**	**$5,500,000**

[1]Includes Construction, Engineering and Administration Costs
[2]Oxygen dosing system at this PS is currently under construction.
[3]This site was evaluated as a potential option but may not be installed.

MSD is currently moving forward with the installation of the proposed oxygen system at the upstream PS. The second oxygen station at the downstream PS was recommended but only the upstream PS was selected for construction.

4.5 ORFM Odor Study Project Review

The following conclusions were determined based on review of available documentation for the ORFM Odor Study project:

- The air sampling program monitored H_2S only.
- The liquid sampling program captured the key elements to determine the sewage chemical composition.

- The odor control system design approach did not identify a clear solution to mitigate the odor emissions from the ORFM operation system.
- Other options besides oxygen injection should be evaluated for the chemical addition/injection.
- The next vapor sampling program is recommended to be expanded to include: odor, total reduced sulfur, ammonia, aldehydes, etc.
- High H_2S concentrations have been measured at several locations.
- The study should include the process calculations such as: air flow rates, pressure loss calculations, duct and fan sizing, etc.
- Evaluation of the odor control system and technology design is suggested using the following criteria: reliability; technology controlling most of the chemical compounds; effectiveness & removal efficiency; life cycle; size and footprint; equipment maintenance requirements.

5. Odor Control Splitter Structure One at MSD Pump Station

MSD built a wet weather facility at the property adjacent to the MSD Pump Station to capture combined sewer overflows. The facility has screen and grit capture, the capability of adding polymer and coagulant, and then chlorination and disinfection. Splitter Structure One (SP1) is located on the pump station property and during dry weather up to 100 MG is sent to MFWQTC for full treatment. As a rain event occurs and depending on the capacity at MFWQTC, up to 160 MGD can be sent to the wet weather station through SP1, or a combination of flow sent to MFWQTC and the wet weather facility. The wet weather station has a 25 mg equalization basin and two high rate treatment trains processing 25 MG each. A modulating gate on SP1 will divert all or a portion of the wet weather flow to the wet weather facility.

Splitter Structure 1 is open to the atmosphere. When the wet weather facility was initially put into service the amount of turbulence in the splitter structure along with weir drops significantly contributed to fugitive odors. Rubber matting material has been placed on the grating atop SP1 to inhibit the air flow from escaping the structure. This is not a long-term solution as containing these emissions will accelerate the deterioration of the structure as it was not lined with any corrosion resistant material during construction.

The following documentation was provided for the review and evaluation of this process modification:

- H_2S and Humidity Monitoring between 06/26/2020 and 7/17/2020
- H_2S and Humidity Monitoring between 06/26/2020 and 7/4/2020
- H_2S and Humidity Monitoring between 07/03/2020 and 7/11/2020
- H_2S and Humidity Monitoring between 07/10/2020 and 7/17/2020

MSD clarified that a preliminary design for odor control has been ongoing with a variety of different options. At the 30% design a carbon absorber was being recommended to treat this captured air from SP1. However, in a 60% design meeting a biotrickling filter has been incorporated into the design and the carbon absorber was removed.

Presently the odor control system design approach is being re-evaluated and a Technical Memorandum outlining the proposed new design is expected in the future.

5.1 Splitter Structure One Odor Control Project Review

The following conclusions were determined based on review of available documentation for the Splitter Structure One at SWPS project:

- The air sampling program monitored H_2S only and high concentrations have been recorded.
- Performing a new vapor sampling program is recommended to include: odor, total reduced sulfur, ammonia, aldehydes, etc. Liquid sampling will also be beneficial to identify the sewage chemical composition.
- The proposed odor control system and technology design is recommended to be evaluated using the following criteria: reliability; technology controlling most of the chemical compounds; effectiveness & removal efficiency; life cycle; size and footprint; equipment maintenance requirements.
- The design report for the proposed odor control system should include the process calculations such as: air flow rates, pressure loss calculations, inlet and outlet air loading information, duct and fan sizing, etc.

6. Conclusions and Recommendations

6.1 Conclusions

Available documents were reviewed and evaluated to understand existing and future odor control systems for planned process modifications and aid in identifying areas for further evaluation as part of the OCMP Update.

Each process modification analyzed in this Technical Memorandum includes a section with the findings and conclusions of the odor control system evaluation and the key notes are listed below.

- Most of the odor and dust control systems are at the design or early construction stage.
- Some of the available technical documentation does not provide enough information on the air odor, chemical composition, and particulate loading at the treatment units.
- For the existing odor control systems, the technical documentation did not provide any information on the condition and operation of these systems.
- The air flow and capture efficiency at the process areas should be measured or calculated to minimize the odor emissions in the surrounding environment.
- Most of the air sampling programs measured H_2S only and high concentrations were found at all planned process modification projects.
- The rationale behind the selection of the odor control technology chosen was not presented with enough information and details.

6.2 Recommendations

The OCMP Update will involve a multi-step approach to develop and implement odor control systems which will meet MSD targets. Detailed field sampling will be performed at target locations to assess the existing and future odor conditions and using sampling results, dispersion modelling will be performed to evaluate potential odor control scenarios.

The odor control systems currently at the design or construction stage should operate at performance parameters which will meet the OCMP Update and below are several recommendations for consideration.

- Future air sampling program(s) should be expanded to include: odor, total reduced sulfur, ammonia, aldehydes, etc.
- Future liquid sampling should be performed, as needed, to provide key elements to determine the sewage chemical composition in support of the odor control system approach.
- Proposed odor control system and technology designs should be evaluated using the following criteria: reliability; technology controlling most of the chemical compounds; effectiveness & removal efficiency; life cycle; size and footprint; equipment maintenance requirements.
- The project design report for the proposed odor control system should include the process calculations such as: air flow rates, pressure loss calculations, inlet and outlet air loading information, duct and fan sizing, etc.
- Ambient air sampling should be performed at the planned process modification project locations to establish the air quality prior to the implementation of the proposed odor control system.