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March 23, 2023

Ms. Katharine Buckner
South Carolina Department of Health and Environmental Control Bureau
of Air Quality - Air Permitting Division
2600 Bull Street
Columbia, South Carolina 29201

Re: **New-Indy Catawba LLC**
Consent Order to Correct Undesirable Levels of Air Contaminants
Construction Permit Application

Ms. Buckner,

New-Indy Catawba LLC (New-Indy Catawba) operates a pulp and paper mill located in Catawba, South Carolina (Mill) and currently operates under Title V Operating Permit No. TV-2440-0005 (Title V Operating Permit or TV-2440-0005).

New-Indy Catawba has prepared this construction permit application as required by the South Carolina Department of Health and Environmental Control (SCDHEC) Consent Order to Correct Undesirable Levels of Air Contaminants, signed November 23, 2022 (Consent Order).

The attached document represents the construction permit application for this Project (Application). Appendix A of the application contains the required completed SCDHEC construction permit application forms. Appendix B of the application provides Project-related emissions calculations and supporting information. The Project-related emissions information has been refined since the previous submittal of the draft calculations on March 15, 2023. Comments received from SCDHEC regarding the Project-related emissions submitted on March 15 will be addressed by March 31, 2023. Appendix C of the application includes a description of air dispersion modeling performed for SCDHEC toxic air pollutants. The supporting air dispersion modeling files will be made available to the SCDHEC Air Modeling Section in electronic format.

If you have any additional questions regarding the attached construction permit application, please contact Bob Tourville at (803) 981 – 8009 or by e-mail at bob.tourville@new-indycb.com.

Sincerely,

Charles Cleveland
Technical Manager

attachment

cc: Sheryl Watkins, P.E. - ALL4
Steven Moore - ALL4
Environmental File 200-air-205-air_permits

NEW CONDENSATE STRIPPER CONSTRUCTION PERMIT APPLICATION

NEW-INDY CATAWBA LLC – CATAWBA, SC MILL

MARCH 2023

Submitted by:

New-Indy Catawba LLC – Catawba, SC Mill
5300 Cureton Ferry Road
Catawba, SC 29704

Submitted to:

SC Department of Health and Environmental Control
Bureau of Air Quality – Division of Air Permitting
2600 Bull Street
Columbia, SC 29201

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1. INTRODUCTION AND APPLICATION OVERVIEW

New-Indy Catawba LLC (New-Indy Catawba) operates a pulp and paper mill located in Catawba, South Carolina (Mill or the Mill) and currently operates under Title V Operating Permit No. TV-2440-005 (TVOP or TV-2440-0005), effective on July 1, 2019.

New-Indy Catawba has prepared this construction permit application as required by the Consent Order to Correct Undesirable Levels of Air Contaminants ("Consent Order"), issued on November 23, 2022, by the South Carolina Department of Health and Environmental Control (SCDHEC)[1]. For compliance with the provisions of the Consent Order, New-Indy Catawba is proposing a modification to their current foul condensate treatment system (condensate treatment system) to install a new foul condensate stripper (new steam stripper) and demote the existing steam stripper [existing steam stripper (ID 9801)] strictly to backup operation during periods of downtime experienced by the new steam stripper (Project). The Project also includes the installation of a stripper feed tank, methanol storage tank, and hot water tank to serve the new steam stripper. The stripper feed tank and methanol storage tank will be controlled in the LVHC system. The hot water tank is not expected to be a source of emissions. The Project will also satisfy the requirements of Item I.a. of Appendix A of Consent Decree Civil No. 0:21-cv-02053-SAL, United States of America v. New-Indy Catawba, LLC, dated November 16, 2022 (EPA Consent Decree). This document represents the construction permit application for this Project (Application).

[1] The November 23, 2022, Consent Order amends and replaces the Order to Correct Undesirable Level of Air Contaminants issued by SCDHEC on May 7, 2021.

2. PROCESS AND PROJECT DESCRIPTION

New-Indy Catawba is comprised of seven distinct process areas that include the following: the woodyard area, the kraft pulp mill area, the paper mill area, the chemical recovery area, the utilities area, the waste treatment area, and a miscellaneous area. A simplified process flow diagram for these process areas is included as Figure 2-1. A description of the process areas is presented below, with more detail provided in the areas that are impacted by the Project.

Southern pine logs and chips are received at the woodyard. Logs are debarked, chipped, and the chips are screened prior to storage for use within the pulping process. Likewise, purchased wood chips received are screened, and processed as needed, prior to use within the pulping processes.

The kraft (sulfate) process area is used to produce pulp. Pulp from the kraft process is produced from "cooking" wood chips in the continuous digester in a caustic solution at an elevated temperature and pressure. The pulp slurry from the continuous digester is sent to the blow tank, then to one of two parallel pulping lines, each consisting of an enclosed deshive refiner and a three-stage drum displacement washer system and associated filtrate tanks. Weak black liquor from the washer filtrate tanks is stored before being recycled to chemical recovery. Rejects from the refiners are sent to the screw presses, with the filtrate being screened and stored before being recycled to chemical recovery. Washed pulp is stored and then sent to the paper mill area. With the exception of the pulp storage tanks after pulp washing, the kraft pulp mill sources are currently collected and routed to the high volume low concentration (HVLC) or low volume, high concentration (LVHC) systems, and emissions are controlled through combustion in the Nos. 1 or 2 Combination Boilers.

Linerboard (the outside layer of a corrugated container) is produced in the paper mill area on one state-of-the-art paper machine. Unbleached market pulp is produced on one pulp dryer. A second paper machine at the Mill is currently idled.

Weak black liquor is concentrated in the Nos. 1-3 Evaporator Sets and is then fired in the recovery furnaces (chemical recovery area) that burn the organics extracted from the chips and recover cooking chemicals. The causticizing area utilizes the chemicals recovered by the recovery furnaces, and after adding lime, provides the cooking chemicals for the kraft process.

Emissions from the Evaporator Sets and Turpentine Recovery System are collected in the LVHC gas collection system and combusted in the Nos. 1 or 2 Combination Boilers. Several weak black liquor tanks are collected in the HVLC system and combusted in the Nos. 1 or 2 Combination Boilers. Evaporator condensates are segregated, with the combined condensates being recycled to the Brownstock washer system or sewered. The foul condensates are treated in a dual control device configuration: foul condensates are preferentially treated in the existing

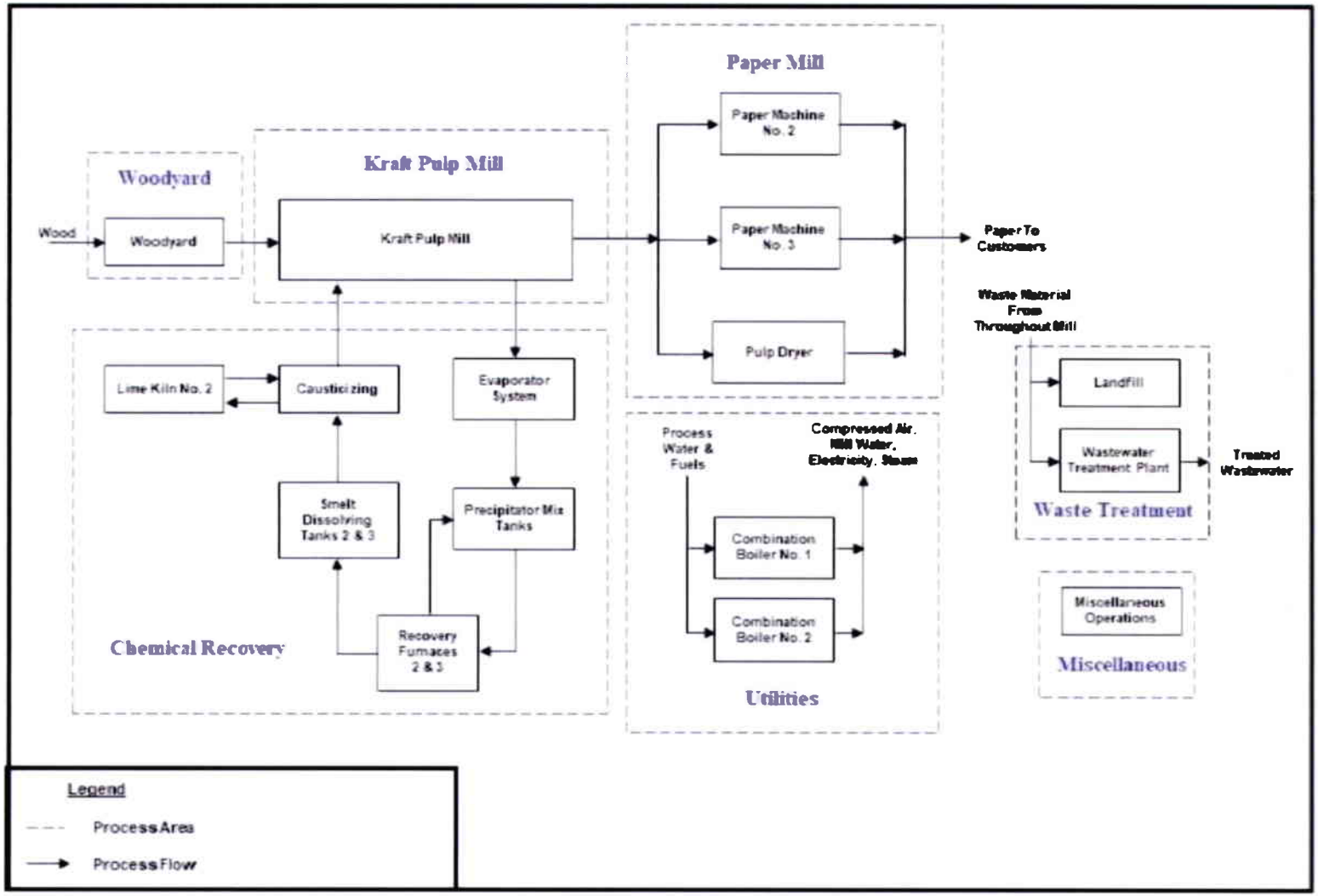
condensate steam stripper system, with the remaining flow being directed to the aerated stabilization basin (ASB) via the Hardpipe (ID 9802).

Steam and electricity are produced for facility-wide use by two combination boilers. The recovery furnaces also generate steam.

A waste treatment area receives wastewater and mill waste (solid waste) from the various previously mentioned areas of the facility. Wastewater undergoes biological treatment to remove the dissolved organic wastes prior to discharge into the receiving stream. Mill solid waste is deposited in an on-site landfill.

The miscellaneous areas include everything that is not captured in one of the aforementioned process operating areas, such as facility roads and the pulp storage tanks.

Figure 2-1 Simplified Mill Flow Diagram

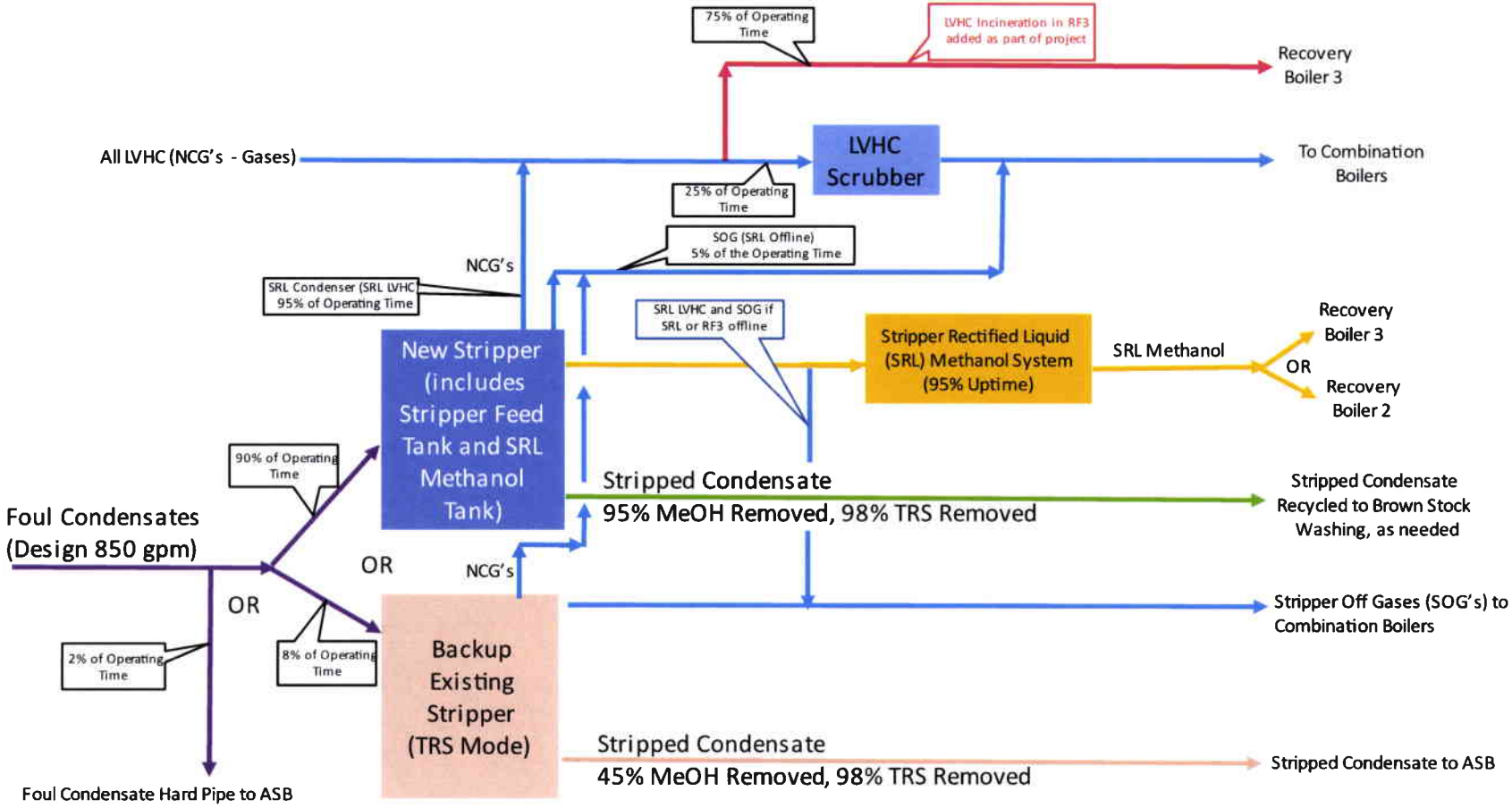


This document represents the construction permit application for this Project in accordance with the DHEC Consent Order. The Project consists of the following new equipment and proposed changes to the existing treatment scenarios:

1. Construct and operate a new low-pressure steam foul condensate stripper system that will process the pulping process condensates (foul condensate) for compliance with 40 CFR Part 63, Subpart S. The resultant stripped methanol will be condensed into a liquid [called stripper rectified liquid (SRL)] and combusted in the Nos. 2 and 3 Recovery Furnaces (ID Nos. 2505 and 5105). The methanol will be added to the black liquor at a maximum amount of 1% by volume. This methanol addition limit is required for safely operating the recovery furnaces. There are no anticipated changes in black liquor firing as a result of the project. The LVHC gases from the SRL condenser system, stripper feed tank, and SRL methanol tank will be combusted in the No. 3 Recovery Furnace. The LVHC system will include a 1.0 mmBtu/hr natural gas ignitor for combustion of the LVHC gases when black liquor firing is less than 50% of capacity. The existing Nos. 1 and 2 Combination Boilers (ID Nos. 2605 and 3705) will serve as back-up control for the new Stripper's LVHC gases when the SRL condenser system is not in operation. Stripped condensates will be recycled to the Brownstock washers (ID 5230), as needed;
2. Operate the existing steam stripper (ID 9801) as a backup to the new low-pressure steam stripper. The existing steam stripper will be operated to process the foul condensate and remove 98% of the total reduced sulfur (TRS) compounds; although with reduced methanol removal efficiency. Further methanol treatment through biological destruction will be accomplished by routing the stripped condensates to the existing Hardpipe system that discharges the foul condensates below the liquid surface of the existing ASB; and
3. Modify the No. 3 Recovery Furnace to combust gases collected in the LVHC system. The Nos. 1 and 2 Combination Boilers will serve as backup control for the LVHC gases following the Project. When these LVHC gases are combusted in the combination boilers, a caustic scrubber will be operated to provide 50% removal of the sulfur prior to combustion.

Figure 2-2 presents a simplified process flow with the possible operating scenarios for treatment of the foul condensates and the associated control scenarios for the new and existing steam stripper vent gases. Section 3.2.2.3 presents the prevention of significant deterioration (PSD) analysis that details the basis for the projected actual emissions (PAE) calculations for the proposed future operating scenarios.

Figure 2-2 Stripper Operating Scenarios



3. REGULATORY REVIEW

This section summarizes Federal and State air quality regulations that potentially apply to the Project. Discussions pertaining to applicable regulatory requirements are separated into three categories:

- Federal Air Quality Regulations
- South Carolina Air Quality Regulations
- Provisions of the SCDHEC Consent Order and EPA Consent Decree

3.1 FEDERAL AIR QUALITY REGULATIONS

For the purpose of this Application, potentially applicable Federal regulations consist of:

- Standards of Performance for New Stationary Sources (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- New Source Review (NSR) and PSD
- Compliance Assurance Monitoring (CAM)
- Requirements for Preparation, Adoption, and Submittal of Implementation Plans
- Title V Operating Permits

A discussion of each specific Federal air quality regulation is provided in the following subsections.

3.1.1 Standards of Performance for New Stationary Sources

U.S. EPA has promulgated NSPS at 40 CFR Part 60. NSPS requirements are promulgated under 40 CFR 60 pursuant to Section 111 of the Clean Air Act.

3.1.1.1 40 CFR Part 60, Subparts BB and BBa – Standards of Performance for Kraft Pulp Mills

40 CFR Part 60, Subpart BB – Standards of Performance for Kraft Pulp Mills applies to TRS emissions from digesters, brownstock washers, multiple-effect evaporators, recovery furnaces, smelt dissolving tanks, lime kilns, and condensate strippers that commenced construction, reconstruction, or modification after September 24, 1976, and on or before May 23, 2013. Subpart BBa applies to the same sources that commence construction, reconstruction, or modification after May 23, 2013.

The existing condensate stripper system and Nos. 1-3 Multi-effect Evaporator Sets with Concentrators are currently subject to 40 CFR 60, Subpart BB for TRS (Standards of Performance for Kraft Pulp Mills). Compliance with the TRS standard at 60.283a(a)(1) is currently demonstrated by combusting the stripper off-gases and evaporator vent gases in the Nos. 1 and 2 Combination Boilers per §60.283(a)(1)(iii) [combust the gases at a minimum temperature of 650 °C (1200 °F) for at least 0.5 seconds]. As there are no physical modifications to the existing condensate stripper and Nos. 1-3 Multi-effect Evaporator Sets with Concentrators, the Mill will continue to combust the existing stripper off-gases in the Nos. 1 and 2 Combination Boilers; however, following the Project, the vent gases from the Nos. 1-3 Multi-effect Evaporator Sets with Concentrators will be combusted in the No. 3 Recovery Furnace per §60.283(a)(1)(ii) [gases are combusted in a recovery furnace subject to §60.283(a)(2)] or in the Nos. 1 and 2 Combination Boilers per §60.283(a)(1)(iii).

Upon completion of the Project, the new condensate stripper system will be subject to 40 CFR Part 60, Subpart BBa for TRS (Standards of Performance for Kraft Pulp Mill Affected Sources for Which Construction, Reconstruction, or Modification Commenced After May 23, 2013). Compliance with the TRS standard at 60.283a(a)(1) will be demonstrated through collection of the stripper off-gases (SOG) in the existing SOG collection system and SRL gases in the existing low volume high concentration (LVHC) closed-vent collection system meeting the requirements of §63.450. The SOG will continue to be combusted in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). The LVHC collection system gases will be combusted in the No. 3 Recovery Furnace per §60.283a(a)(1)(ii) or in the Nos. 1 and 2 Combination Boilers per §60.283a(a)(1)(iii). Emissions from the stripper feed tank will also be collected in the LVHC collection system. The Mill will continuously monitor the incineration of SOG and LVHC gases in the No. 3 recovery furnace, each combination boiler, and venting of the SOG and LVHC closed-vent systems as required by §60.284a(d)(3)(iii) and currently utilized for monitoring compliance with Subpart BB.

New-Indy Catawba will maintain records of excess emissions and malfunctions for the new stripper as required by §60.287a(b)(7) and (c), respectively. The Mill will report periods of excess emissions and malfunctions as required by §60.288a(a) and (d), respectively. As defined in §60.284a(e)(1)(vi), periods of excess emissions from the LVHC closed-vent system (condensate stripper system) that are less than one percent (1%) of operating time during a semi-annual period are not a violation of §60.283a(a)(1)(iii).

The stripper feed tank, methanol tank, hot water tank, Hardpipe, and ASB are not included in the definition of condensate stripper system under §60.281 or §60.281a and are not affected sources under Subparts BB or BBa.

3.1.1.2 40 CFR Part 60, Subpart Kb - Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

The Project includes a new stripper feed tank, new methanol tank, and a new hot water tank. 40 CFR Part 60, Subpart Kb includes standards of performance for new storage tanks. However, per 60.111b, the definition of storage tank does not include process tanks (tanks that collect material from one part of a process before sending it to another part of the process). Therefore, the new tanks are not subject to Subpart Kb.

3.1.2 National Emission Standards for Hazardous Air Pollutants

NESHAP found in 40 CFR Part 61 apply to specific compounds emitted from certain listed processes. 40 CFR Part 61 subparts do not apply to the Mill, and there are no Part 61 subparts that apply to the proposed Project. Applicability of Part 63 NESHAP is discussed below.

3.1.2.1 40 CFR Part 63, Subpart S – National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry

New-Indy Catawba is subject to 40 CFR Part 63, Subpart S, also referred to as Maximum Achievable Control Technology (MACT) I for the pulp and paper industry. This standard regulates hazardous air pollutant (HAP) emissions from pulping and bleaching systems. The affected source under this standard is the total of all HAP emission points in the pulping and bleaching systems. The Mill does not produce bleached pulp and is therefore not subject to the requirements of §63.445.

The Nos. 1-3 Multi-effect Evaporator Sets with Concentrators and Turpentine Recovery System were constructed prior to 1993 and are existing affected sources, while the existing condensate stripper was constructed after 1993, making it a new source under 40 CFR Part 63, Subpart S. Compliance is currently demonstrated by collecting the gases in the existing LVHC closed-vent system meeting the requirements of §63.450 and combustion of the SOG and LVHC system gases in the Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i) (introduce the HAP emission stream with the primary fuel or into the flame zone). The Mill currently complies with the pulping condensates collection requirements in §63.446(c)(1) [collect all named pulping process condensate streams listed in 40 CFR § 63.446(b)(1-5)] and the treatment requirements in §63.446(e)(4) [treat a minimum of 6.6 lb HAP per ton oven dried ton of pulp (ODTP)]. The Mill has utilized concurrent use of the existing steam stripper and Hardpipe for compliance with §63.446(e)(4).

Subpart S requires collection of LVHC gases from steam stripper systems, defined to include the stripper column, associated feed tanks, condensers, and any methanol rectification process. The new condensate stripper, stripper feed tank, methanol condenser, and methanol tank will be subject to this rule upon startup.

Following the completion of the proposed Project, SOG from the existing condensate stripper and vent gases from the existing Nos. 1-3 Multi-effect Evaporator Sets with Concentrators and Turpentine system will continue to be collected in the existing LVHC closed-vent system meeting the requirements of §63.450 and §63.453(k)(1-6). The existing SOG will continue to be combusted in the Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i). However, the vent gases from the LVHC collection system will be combusted in the No. 3 Recovery Furnace or in the Nos. 1 and 2 Combination Boilers (as backup) per §63.443(d)(4)(i). The Mill will update the leak detection and repair (LDAR) site inspection plan as appropriate per §63.454(b).

The Mill plans to demonstrate compliance with the pulping condensates collection requirements in §63.446(c)(3) [collect the pulping process condensates from equipment systems listed in §63.446(b)(1) through (b)(5) that in total contain 7.2 lb HAP/ODTP] and the treatment requirements in §63.446(e)(4) [treat a minimum of 6.6 lb HAP/ODTP]. The Mill will utilize the new condensate stripper for compliance with §63.446(e)(4) and will operate a continuous monitoring system for the parameters in §63.453(g)(1-3). Vents from the new condensate stripper (including the stripper feed tank, SRL condenser, and SRL methanol tank) will be collected in the existing LVHC closed-vent system meeting the requirements of §63.450 and combusted in the No. 3 Recovery Furnace or Nos. 1 and 2 Combination Boilers per §63.443(d)(4)(i). The Mill will update the LDAR site inspection plan as appropriate per §63.454(b) and will perform the required inspection and monitoring requirements per §63.453(k)(1-6). The new stripper will be included in semi-annual excess emission reports under §63.455. Per §63.446(g), periods of excess emissions reported under §63.455 are not considered a violation of §63.446(e)(4) provided that the time of excess emissions divided by the total process operating time in a semi-annual reporting period does not exceed 10 percent.

At the request of SCDHEC, the Mill is providing additional information regarding plans to demonstrate continuous compliance with the pulping condensate collection and treatment in the new steam stripper. These are as follows:

- Pulping condensate collection emissions limit of 7.2 lb HAP/ODTP:
  - HAP will be measured "as methanol" per §63.457(f)(2);
  - Daily sampling of foul condensates for methanol concentration representative of the inlet to the new stripper;

  - Continuous measurement of new steam stripper inlet foul condensate feed flow (gpm);
  - Daily measurement of pulp production (ODTP); and
  - Daily calculation of a 15-day rolling average collection (lbs methanol/ODTP) [Note: The Mill may use historical and/or collect future foul condensate sampling data to support a longer averaging period].
- Pulping condensate treatment in the new steam stripper to remove 6.6 lb HAP/ODTP:
  - HAP will be measured "as methanol" per §63.457(f)(2); and
  - Daily sampling of stripped condensates for methanol concentration representative of the outlet of the new stripper.
  - Continuous measurement of:
    - New steam stripper inlet foul condensate feed flow (gpm);
    - New steam stripper steam feed flow (lbs/hr);
    - Foul condensate to new steam stripper feed temperature (°F); and
    - New steam stripper stripped condensate flow (gpm).
  - Daily measurement of pulp production (ODTP).
  - Daily calculation of the percent methanol removed in the steam stripper .
  - Daily calculation of the treatment in the new steam stripper [15-day (or other averaging period, as justified) rolling average methanol collected (lbs methanol/ODTP) multiplied by the calculated daily methanol percent removal in the new stripper].

Please note that the Mill may choose to establish a methanol concentration factor in lieu of daily methanol sampling at the inlet to the new steam stripper once sufficient data has been collected demonstrating consistency in the foul condensate methanol concentration. In addition, the Mill may choose to establish an effective steam to feed ratio (ESFR) curve for the new stripper system to be used to establish the methanol removal efficiency across the stripper in lieu of the method described above. The compliance approach will be delineated in the Notification of Compliance Status (NOCS) that will be submitted with the results of the initial compliance demonstration to be conducted within 180 days of startup of the new stripper system.

3.1.2.2 40 CFR Part 63, Subpart MM National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-Alone Semichemical Pulp Mills

New-Indy Catawba is subject to 40 CFR Part 63, Subpart MM, also referred to as MACT II for the pulp and paper industry. This standard regulates particulate matter (PM) emissions from existing recovery boilers, smelt tanks, and lime kilns when processing black liquor or calcium oxide. The Nos. 2 and 3 Recovery Furnaces are currently subject to the existing source requirements of this regulation. The proposed Project will modify the LVHC collection system

that delivers the LVHC gases to the No. 3 Recovery Furnace for combustion, but no changes in black liquor firing are expected for the recovery furnaces and PM emissions from black liquor combustion are not expected to increase. The Mill will continue to meet the existing PM emission limits under Subpart MM after completion of the Project.

3.1.2.3 40 CFR Part 63, Subpart EEEE – National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (non-Gasoline)

Subpart EEEE applies to organic liquids distribution (OLD) operations at major sources of HAP. The Project includes installation of a new methanol tank and a new hot water tank. However, these new tanks are not subject to this rule because they are part of the Mill's pulping system as defined under Subpart S. EPA confirmed that tanks in pulp and paper mills that are part of the pulping or bleaching systems are not subject to Subpart EEEE in a December 2004 determination (ADI Control Number M050008).

3.1.2.4 40 CFR Part 63, Subpart DDDDD – National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters.

New-Indy Catawba is subject to 40 CFR Part 63, Subpart DDDDD, also referred to as Boiler MACT. Boiler MACT sets forth emissions limits and work practice standards; testing and fuel analyses requirements; and monitoring, recordkeeping, notification, and reporting requirements that apply to boilers and process heaters located at major sources of HAP. The Nos. 1 and 2 Combination Boilers are subject to the requirements of 40 CFR Part 63, Subpart DDDDD. The Nos. 2 and 3 Recovery Furnaces are not subject to the rule per §63.7491(b). The Project will not affect the regulatory applicability of 40 CFR Part 63, Subpart DDDDD, for either combination boiler and will not affect compliance with the applicable emissions limits. The Mill will continue to comply with the currently applicable provisions of 40 CFR Part 63, Subpart DDDDD, in the same manner after completion of the Project.

3.1.3 New Source Review

The Mill is located in York County which is classified as in attainment of or unclassifiable for the National Ambient Air Quality Standards (NAAQS) for regulated NSR pollutants. Therefore, Nonattainment New Source Review (NNSR) regulations do not apply to this Project and the Project is analyzed for applicability as it relates to the PSD requirements. Implementation of the PSD regulations (i.e., 40 CFR §51.166) has been delegated in full to the State of South Carolina. Refer to Section 3.2.2.3 for a discussion of PSD applicability.

3.1.4 Compliance Assurance Monitoring

U.S. EPA developed the CAM rule at 40 CFR Part 64 as a means for providing reasonable assurance that continuous compliance with applicable requirements is achieved for certain emissions units located at major stationary sources subject to Title V permitting. CAM applies to pollutant-specific emissions units (PSEUs) that (1) are subject to an emissions limit or standard (2) use a control device to achieve compliance with that emissions limit or standard, and (3) have potential pre-control device emissions in the amount required to classify the unit as a major source under Part 70 of the Clean Air Act (CAA). Part 64 does not apply to emissions limitations or standards proposed after November 15, 1990 pursuant to Section 111 or 112 of the Clean Air Act (e.g., post-1990 NSPS or NESHAP). The proposed Project is not subject to CAM requirements because the new steam stripper is subject to 40 CFR Part 60, Subpart BBa and 40 CFR Part 63, Subpart S, which are standards proposed after November 15, 1990.

3.1.5 Requirements for Preparation, Adoption, and Submittal of Implementation Plans

U.S. EPA requires air agencies to develop and submit air quality data characterizing maximum 1-hour ambient concentrations of sulfur dioxide (SO_2) through ambient air quality monitoring or air quality modeling analysis at the air agency's election. These requirements are promulgated under 40 CFR Part 51.

3.1.5.1 40 CFR Part 51, Subpart BB—Data Requirements for Characterizing Air Quality for the Primary SO_2 NAAQS (SO_2 Data Requirements Rule or SO_2 DRR)

The Mill submitted facility-wide air dispersion modeling in November 2016 to comply with 40 CFR 51.1203(d). The Mill updated the facility-wide air dispersion modeling in October 2021. The actual SO_2 emissions following the Project are expected to remain below the SO_2 emission rates included in the modeling analysis submitted in 2016 and 2021. The Mill will continue to perform and annual review of the actual SO_2 emission rates against the 2016 and 2021 model emission rates to determine if an updated modeling demonstration is necessary.

3.1.6 Title V Operating Permits

New-Indy Catawba operates under TVOP TV-2440-0005 issued on May 7, 2019, with an effective date of July 1, 2019, and an expiration date of December 31, 2023. Through this Application, New-Indy Catawba is requesting a construction permit to perform the Project. Construction permit application forms required by SCDHEC are included in Appendix A. New-Indy Catawba will request a modification to the TVOP within 15 days of startup of the Project, which is required by the Consent Order to be no later than June 30, 2025.

3.2 SOUTH CAROLINA AIR QUALITY REGULATIONS

This section addresses the applicability of state air regulatory requirements to the Project.

3.2.1 Regulation 61-62.1: Section II, Permit Requirements

This regulation specifies the construction and operating permit requirements for new or modified sources. This permit application is intended to satisfy the construction permitting requirements of Regulation 62.1 Section II. Completed SCDHEC construction permit application forms are included in Appendix A.

3.2.2 Regulation 61-62.5: Air Pollution Control Standards

The list below identifies potentially applicable SC air pollution control regulations and standards associated with the Project.

- Standard No. 2 – Ambient Air Quality Standards
- Standard No. 3 – Waste Combustion and Reduction
- Standard No. 4 – Emissions from Process Industries
- Standard No. 7 – Prevention of Significant Deterioration
- Standard No. 8 – Toxic Air Pollutants

3.2.2.1 Standard No. 2 – Ambient Air Quality Standards

SCDHEC Standard No. 2 addresses the National Ambient Air Quality Standards (NAAQS). Except for an ambient air quality standard for gaseous fluorides, the SCHDEC ambient air quality standards are equivalent to the Federal NAAQS. New-Indy Catawba has previously submitted facility-wide air dispersion modeling evaluations to demonstrate compliance with Standard No. 2.

The Project may slightly increase the actual emissions of SO_2, nitrogen oxides (NO_X), and carbon monoxide (CO) from the No. 3 Recovery Furnace when burning LVHC gases. However, the maximum SO_2 and NO_X emissions from the No.3 Recovery Furnace when burning LVHC gases will be less than 10 percent of the emissions from burning the LVHC gases in the Nos. 1 and 2 Combination Boilers. The maximum SO_2 and NO_X emissions from LVHC combustion in the combination boilers are not expected to change as a result of the project. The CO emissions from burning LVHC gases will be unchanged when combusted in the recovery furnace or the combination boilers.

The emissions of SO_2, NO_X, CO, particulate matter (PM), PM less than 10 microns (PM_{10}), and PM less than 2.5 microns ($PM_{2.5}$) from the LVHC System natural gas ignitor in the No. 3 Recovery Furnace are well below the 1.14 pounds per hour modeling exemption threshold in the South Carolina Modeling Guidelines[2], Section 2.2.3. Therefore, the very small emissions increases from the LVHC natural gas ignitor have not been modeled for this permit application.

The additional steam potentially required from the combination boilers to operate the new condensate stripper will not exceed the current steaming capacity of each combination boiler, as reflected in the SO_2, NO_X, CO, PM, PM_{10}, $PM_{2.5}$ and CO emissions rates modeled previously. Therefore, no updates to the modeled emissions rates from the combination boilers are required for this permit application.

The SO_2 emissions from the Project will decrease by more than 100 tons per year. The reduction in SO_2 emissions meets the single factor emissions netting option 2 in the South Carolina Other Information Guidance[3]. The modeled SO_2 Emissions Rate from black liquor combustion in the 2016 and 2021 SO_2 DRR modeling is 18.70 lb/hr from the No. 3 Recovery Furnace. The maximum SO_2 emissions rate from burning black liquor in the 2018 Title V renewal application is 5.95 pounds per hour. The additional SO_2 emissions from LVHC gases and methanol combustion is 7.4 pounds per hour, making the new total SO_2 emissions 13.35 pounds per hour, more than 5 pounds per hour lower than the modeled SO_2 emissions rate from black liquor combustion. Therefore, no updates to the SO_2 modeling submitted previously in 2016 and 2021 have been prepared for this permit application.

The NO_X emissions will increase from the Project less than one-half the Prevention of Significant Deterioration (PSD) significance threshold, due primarily to increased steam usage by the new condensate stripper. The NO_X emissions due to the Project meet weight of evidence approach 1 in the South Carolina Other Information. The modeled NO_X Emissions Rate for Ambient Air Standards in the current Title V permit is 146.03 lb/hr from the No. 3 Recovery Furnace. The maximum NO_X emissions rate from burning black liquor in the 2018 Title V renewal application is 122.4 pounds per hour. The additional NO_X emissions from LVHC gases and methanol combustion is 2.3 pounds per hour, making the new total NO_X emissions 124.7 pounds per hour, more than 20 pounds per hour lower than the modeled NO_X emissions rate.

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[2] South Carolina Modeling Guidelines for Air Quality Permits (Revised April 15, 2019).

[3] Guidance Concerning Other Information Used for Permitting Requirements in Demonstrating Emissions Do Not Interfere With Attainment or Maintenance of any State of Federal Standard (Updated December 12, 2018).

Therefore, no updates to the NO_X modeling submitted previously have been prepared for this permit application.

The CO emissions will increase from the Project less than one-half the Prevention of Significant Deterioration (PSD) significance threshold, due primarily to increased steam usage by the new condensate stripper. The CO emissions due to the Project meet weight of evidence approach 1 in the South Carolina Other Information. The CO emissions from burning LVHC gases will be unchanged when combusted in the recovery furnace or the combination boilers. The modeled CO Emissions Rate for Ambient Air Standards in the current Title V permit is 330.96 lb/hr from the No. 3 Recovery Furnace. The maximum CO emissions rate from burning black liquor in the 2018 Title V renewal application is 102.9 pounds per hour. The additional CO emissions from LVHC gases and methanol combustion is 8.3 pounds per hour, making the new total CO emissions 111.1 pounds per hour, more than 200 pounds per hour lower than the modeled CO emissions rate. Therefore, no updates to the CO modeling submitted previously have been prepared for this permit application.

Therefore, no updates to the previous Standard No. 2 modeling demonstration are required.

3.2.2.1 Standard No. 3 – Waste Combustion and Reduction

Standard No. 3 applies to any source that burns any waste other than virgin fuels for any purpose. The standard contains various exemptions for the pulp and paper source category. Section I.J.1 specifies that recovery furnaces burning black liquor and TRS compounds are not subject to the standard. Section I.J.1 also specifies that gaseous process streams containing TRS compounds that are regulated in accordance with Section XI of Regulation 61-62.5, Standard No. 4, or NSPS are not subject to Standard No. 3. Because the SOG and LVHC collection system gases containing TRS that are regulated in accordance with Standard No. 4 or NSPS Subpart BB/BBa, combustion of those gases in combination boilers or recovery furnaces is not subject to Standard No. 3.

Standard No. 3 specifically states that any "facility with an emission unit and/or control device that complies with all the requirements of an applicable Maximum Achievable Control Technology (MACT) Standard under 40 CFR 63, including the testing and reporting requirements, may request an exemption from this standard." (61 -62.5, Section I.J.3.)

During development of the Pulp and Paper MACT regulations at 40 CFR 63, Subpart S, U.S. EPA reviewed the practice of combusting methanol condensed from stripper-off-gases. The U.S. EPA determined that the methanol condensate "does not appear to contain metal or chlorinated organic HAP's ..." (61 Fed. Reg. 9397) (emphasis added). The U.S. EPA also found that burning methanol condensate "will not increase the potential environmental risk over the burning of the

steam stripper vent gases prior to condensation." U.S. EPA reaffirmed this conclusion in 2011 during its Residual Risk and Technology Review (RTR) of the Pulp and Paper (Subpart S) MACT. In the final RTR rule, U.S. EPA stated: "We conclude based on the Residual Risk Assessment cited here that the risks from the subpart S pulp and papermaking source category are acceptable and that the current standard protects the public health with an ample margin of safety. Consequently, we are re-adopting the MACT standards for subpart S pursuant to our 112(f)(2) review." (77 Fed. Reg. 55705)

Therefore, the combustion of black liquor and condensed methanol from stripper-off-gases in the recovery furnaces mill qualifies for the exemption from Standard No. 3 provided in Section I.J.3.

3.2.2.2 Standard No. 4 – Emissions from Process Industries

SCDHEC Regulation 61-62.5, Standard No. 4 establishes standards for opacity and certain other pollutants for specific sources in specific industries and establishes PM and opacity standards for industrial processes not otherwise regulated. The new steam stripper and the new tanks do not cause visible emissions into the atmosphere; therefore, this standard does not apply.

Section XI regulates emissions of TRS from Kraft Pulp Mills where construction or modification commenced prior to September 24, 1976 from recovery furnaces, digester systems, multiple-effect evaporator systems, lime kilns, and condensate stripper systems. The No. 2 Recovery Furnace is currently subject to Standard 4 and will continue to comply with the TRS limits after completion of the Project. The TRS emissions from the No. 3 Recovery Furnace, Nos. 1-3 Evaporator Sets with Concentrators, and the existing steam stripper are subject to 40 CFR Part 60, Subpart BB. The TRS emissions from the new condensate stripper will be subject to 40 CFR Part 60, Subpart BBa.

3.2.2.3 Standard No. 7 – Prevention of Significant Deterioration – Permit Requirements

PSD requirements apply to major stationary sources of regulated NSR pollutants that are located in areas that are in attainment with the NAAQS or unclassifiable. Implementation of the PSD regulations has been delegated in full to the State of South Carolina. These air quality regulations are contained in SCDHEC Regulation 61-62.5, Standard No. 7. The PSD regulations apply to major modifications at major stationary sources, which are considered those sources belonging to any one of the 28 source categories listed in the regulations that have the potential to emit (PTE) 100 tons per year (tpy) or more of an NSR-regulated pollutant, or any other source that has the PTE 250 tpy or more of an NSR-regulated pollutant. The Mill is considered a major stationary source because it emits or has the PTE 100 tpy or more of a regulated NSR pollutant.

Because it includes physical changes to the Mill, the installation of the new steam stripper is a "project" as defined in Standard No. 7(b)(40).

New-Indy Catawba has assessed the applicability of PSD to this Project by performing the hybrid test as prescribed under U.S. EPA's PSD rules (as adopted by South Carolina) at 40 CFR 52.21(a)(2)(iv)(f), described as the hybrid test for projects that involve multiple types of emissions units. The future emissions from the backup steam stripper system, existing foul condensate Hardpipe, existing ASB, existing evaporator and turpentine recovery system LVHC gases, and steam required for the existing steam stripper system are calculated as PAE per SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41). The future emissions from the new steam stripper and the generation of steam to operate the new steam stripper are PTE per SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(37).

The PSD applicability analysis has been completed for the applicable NSR regulated air pollutants, including SO_2, NO_x, CO, volatile organic compounds (VOC), TRS, H_2S, PM, PM_{10}, PM $PM_{2.5}$, lead (Pb), sulfuric acid mist, and carbon dioxide as CO_2e (CO_2e). There are no increases in emissions of fluorides from the Project. Emissions calculations used for determining PSD applicability are included in Appendix B.

At this time, New-Indy Catawba has not excluded emissions the mill was capable of accommodating during the baseline period or excluded demand growth from the projected actual emissions as allowed under SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41)(b)(iii). New-Indy Catawba may decide to utilize these two exclusions from PAE during this or future permitting if desirable.

3.2.2.3.1 Baseline Actual Emissions

Baseline actual emissions (BAE) from an existing source are defined by Standard No. 7, paragraph (B)(4)(b) as:

> "*the average rate, in tpy, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding either the date the owner or operator begins actual construction of the project, or the date a complete permit application is received by the Department for a permit required under this section or under a plan approved by the Administrator, whichever is earlier, except that the 10-year period shall not include any period earlier than November 15, 1990.*"

BAE for all existing sources and pollutants are based on the 24-month period following conversion of the mill to manufacturing unbleached paper grades starting in March 2021 and extending through February 2023. For simplicity, baseline annual production rates are assumed

to occur over 8,760 operating hours. The BAE for the existing steam stripper (aka future backup stripper) off gases (and the required steam) are adjusted using the actual operating days to reflect that the stripper did not return to service until May 3, 2021.

Sulfur Dioxide

The baseline actual SO_2 emissions from burning the SOG from the existing steam stripper and LVHC collection system gases are based on the average emissions factors developed from the most recent (October 2021) source testing for SO_2. The emissions are further sub-divided between LVHC and HVLC streams using the post-Project Columbia SO_2 emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

Nitrogen Oxides and Carbon Monoxide

The baseline actual NO_X and CO emissions from burning the SOG from the existing steam stripper are based on the post-Project Columbia NO_X emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

Volatile Organic Compounds

The baseline actual VOC emissions from the existing condensate stripper system are based on the actual amount of methanol stripped from the foul condensate during the baseline period for which records are available. The non-methanol VOC emissions (including the TRS compounds that are also VOC as further described in the next section) from the ASB from treatment of Mill process wastewater and the foul condensate not treated in the existing steam stripper are calculated using the U.S. EPA WATER9 Model. To calculate methanol emissions from the ASB, New-Indy Catawba used a spreadsheet version of the WATER9 calculations from the National Council for Air and Stream Improvement (NCASI) to calculate the fractions biodegraded and emitted developed from Procedure 5 (Multiple Zone Concentration Measurements) in 40 CFR Part 63, Appendix C, Form XIII ("NCASI Form XIII calculation spreadsheet"). The WATER9 Model and Form XIII calculation utilize site-specific liquid concentration data, the site-specific configuration of the treatment unit [including the area or length of unit, liquid depth, wind speed, aeration type (i.e., mechanical aeration)], and the total amount of aeration to calculate the emissions rate in grams per second (g/s).

Baseline actual methanol emissions from the ASB are based on the NCASI Form XIII calculations for NESHAP Subpart S performance testing conducted during the baseline period. The baseline actual VOC emissions from the LVHC collection system are based on the post-Project Columbia

VOC emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

Hydrogen Sulfide and Total Reduced Sulfur Compounds

The baseline hydrogen sulfide (H_2S) and total reduced sulfur (TRS) emissions from burning the SOG from the existing steam stripper and the LVHC collection system gases are based on the average emissions factors developed from the June 2021 source testing for H_2S and TRS. The emissions are further sub-divided between LVHC and HVLC streams using the post-Project Columbia H_2S and TRS emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

The baseline actual H_2S emissions from the ASB from treatment of Mill process wastewater and the foul condensate not treated in the existing steam stripper are calculated using the NCASI Hydrogen Sulfide Emissions Simulator, or "H2SSIM" Model, which utilizes site-specific wastewater configuration, site-specific liquid test results for H_2S, and site-specific data inputs [e.g., temperature, dissolved oxygen (DO), pH]. H2SSIM inputs are based on May and July 2022 sampling data for H_2S in the foul condensate, as well as dissolved oxygen (DO) data for the ASB taken during NESHAP Subpart S performance testing during the baseline period. The baseline emissions for methyl mercaptan (MMC), dimethyl disulfide (DMDS), and dimethyl sulfide (DMS) are calculated using WATER9 based on May and July 2022 sampling of the foul condensate. During the May and July 2022 testing, foul condensate sample results were representative of the concentrations before chemical oxidant was added. The Mill has been chemically oxidizing the contents of the Hardpipe prior to entry into the ASB since June 2021. For calculating BAE of H_2S and TRS emissions from the ASB, the May and July 2022 foul condensate samples were adjusted as follows to account for the effects of the chemical oxidant:

- H_2S concentrations in the Hardpipe effluent were reduced by 99%.
- DMS concentrations in the Hardpipe effluent were reduced by 90%.
- MMC concentrations in the Hardpipe effluent were reduced by 99% and assumed to be converted to DMDS.
- DMDS concentrations are assumed to not be reduced by chemical oxidant. DMDS concentrations in the Hardpipe effluent were increased to account for the oxidation of MMC to DMDS.

These adjustments are based on NCASI Technical Bulletin No. 949, Section 5.3.1 for Hydrogen Peroxide and additional bench scale study results and curves provided by NCASI. Pertinent pages from NCASI Technical Bulletin No. 949 and the bench scale study are attached as supporting information in Appendix B.

Steam Baseline

The BAE of products of combustion (NO_X, CO, VOC, PM, PM_{10}, $PM_{2.5}$, Lead, and CO_2e) for the steam required by the existing steam stripper are based on the actual heat input from fossil fuels to both combination boilers during the baseline period. New-Indy Catawba operates the two recovery furnaces as base-loaded steam generators with the combination boilers handling most swings in steam load. New-Indy Catawba burns all the biomass available in the combination boilers because biomass is the most cost-effective fuel on an MMBtu basis. Additional steam is generated from burning natural gas and No. 6 fuel oil as needed. During the baseline period, natural gas accounted for 97.9% of the fossil fuel heat input to both combination boilers, with No. 6 fuel oil constituting the remaining 2.1% of the fossil fuel heat input.

3.2.2.3.2 Projected Actual Emissions and Potential to Emit

PAE is defined by the SCDHEC Regulation 61-62.5, Standard No. 7, paragraph (B)(41) as:

> *"the maximum annual rate, in tpy, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the five (5) years (12-month period) following the date the unit resumes regular operation after the project, or in any one of the ten (10) years following that date, if the project involves increasing the emissions unit's design capacity or its potential to emit that regulated NSR pollutant and full utilization of the unit would result in a significant emissions increase or a significant net emissions increase at the major stationary source."*

As described previously, PAE are calculated from the existing steam stripper, existing foul condensate Hardpipe, existing ASB, existing LVHC collection system gases, and steam required for the existing steam stripper.

PTE is defined by the SCDHEC Regulation 61-62.5, Standard No Standard No. 7, paragraph (B)(37) as:

> *"the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable."*

The future emissions from the new steam stripper system and the generation of steam to operate the new steam stripper system are PTE.

PAE and PTE were calculated for three different stripper operating scenarios as shown below in Table 3-1. The new stripper is expected to be online at least 90% of the annual operating time. The backup steam stripper is expected to be online 8% of the annual operating time. There will also be brief periods when the new stripper may need to go offline and the backup stripper brought into service. During these transition periods, untreated foul condensate will be discharged through the Hardpipe to the ASB. While in the Hardpipe prior to entering the ASB, the TRS compounds in the condensates will be chemically oxidized to reduce the potential for odors from the ASB when operating during these brief transition periods, which are expected to be equal to or less than 2% of the annual operating time.

The PAE and PTE for all scenarios are based on the design foul condensate sulfur loading [168 parts per million by weight (ppmw)] and maximum design foul condensate flow [850 gallons per minute (gpm)]. Emissions factors [on a pound per air-dried ton of pulp (lb/ADTP) basis] are calculated based on 2,444 ADTP/day, which is at the lower range of production for which the maximum design foul condensate flow is expected. The design foul condensate sulfur loading is based on liquid samples taken during the June 2021 site-specific testing. The sulfur concentration of 168 ppmw at the design foul condensate flow is equivalent to 0.70 pound of TRS as sulfur per ADTP. PAE are calculated for each of the three stripper operating scenarios based on 8,760 hours per year and a maximum pulp production of 2,700 ADTP/day.

The following sections provide further detail and different operating configurations within particular scenarios.

New Steam Stripper Online Scenario

While the new steam stripper is operating, the stripped condensate from the new steam stripper will be recycled to the brownstock washers, as needed.

The new stripper has two operating configurations, with and without the rectified methanol system operating. The rectified methanol system will separate methanol from the new stripper's offgases. The rectified methanol is referred to as SRL. As stated previously, the new steam stripper is expected to be online at least 90% of the annual operating time. The rectified methanol system is expected to be online 95% of the time that the new stripper is operating. A summary of the different operating control configurations for when the new stripper is operating is summarized in Table 3-2 below.

Table 3-1 Stripper Operating Scenarios

Stripper Operating Scenario	Stripper Scenario Operating Time	
	%	hrs
New Stripper Online	90%	7,884.0
Backup Stripper Online	8%	700.8
No Stripper Online (Foul Condensate to Hard Pipe)	2%	175.2

Table 3-2 New Stripper System Operating Scenarios

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time	
	%	hrs		%	hrs		%	hrs
New Stripper Online	90%	7,884.0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8
			SRL Online	95%	7,489.8	SRL LVHC to RF3	75.0%	5,617.4
			SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2	25.0%	1,872.5
			SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2

The SRL methanol is expected to contain approximately 40% of the TRS, with the remaining 60% in the LVHC off-gases from the rectified methanol system. The SRL methanol will be blended with black liquor and burned in both recovery furnaces at a maximum concentration of 1% for safe operation of each recovery furnace. The sodium fume inside the recovery furnace absorbs the sulfur from combustion of the black liquor and will also absorb the sulfur from combustion of the SRL methanol. We conservatively assumed 99% absorption within the salt fume based on information provided in NCASI Technical Bulletin No. 604. This is expected to occur 100% of the time the rectified methanol system is operating (SRL mode).

When operating in SRL mode, the LVHC off-gases from the rectified methanol system will be vented into the LVHC System. In addition, the LVHC gases from the evaporators and turpentine recovery system will be vented to the No. 3 Recovery Furnace as part of this project. The No. 3 Recovery Furnace is expected to be available for LVHC combustion at least 75% of the operating time. When the No. 3 Recovery Furnace cannot receive these gases, the LVHC will be combusted in the combination boilers the remaining 25% of the time. The LVHC gases will pass through the LVHC caustic scrubber prior to being combusted in the combination boilers. The LVHC scrubber removes approximately 50% of the sulfur from the gas stream. The LVHC gas scrubber is not necessary and will not be used when the LVHC gases are being combusted in the No. 3 Recovery Furnace because the salt fume in the recovery furnace provides the expected sulfur control.

Sulfur Dioxide, Hydrogen Sulfide, and Total Reduced Sulfur Compounds

As previously stated, the SRL methanol is expected to contain approximately 40% of the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP. The sodium fume inside the recovery furnace absorbs the sulfur produced from combusting black liquor and will also absorb the sulfur produced by combusting the foul condensate present in the methanol. It is conservatively assumed that 99% of the sulfur from combusting the SRL methanol is absorbed by the sodium fume (NCASI Technical Bulletin 604), and the remaining 1% is oxidized to SO_2. This is expected to occur 100% of the time in SRL mode.

To calculate TRS and H_2S emissions from burning the SRL methanol in the recovery furnaces, a sulfur capture of 99% is applied with a 99% conversion factor to SO_2, for a combined capture and conversion factor of 99.9%.

Similarly, the LVHC gases from the rectified methanol system are expected to contain approximately 60% of the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP and will be vented into the LVHC System. When the LVHC is combusted in the No. 3 Recovery Furnace, the sodium fume inside the recovery furnace is also expected to absorb 99% of the sulfur from the LVHC gases before it can be converted to SO_2. When the LVHC is combusted in the combination boilers, the LVHC scrubber will capture 50% of the sulfur before conversion to SO_2. H_2S and

TRS emissions from the rectified methanol system LVHC are calculated based on conservatively assuming 99.9% capture or conversion to SO_2 in the recovery furnace and 99% conversion to SO_2 in the combination boilers.

When the rectified methanol system is not operating, SOG from the new stripper will be vented to the combination boilers, and the TRS as sulfur foul condensate loading of 0.70 lb S/ADTP is assumed to be 100% converted to SO_2 to calculate SO_2 emissions. H_2S and TRS emissions from combusting SOGs in the combination boilers are based on conservatively assuming a 99% conversion to SO_2.

When the new stripper is operating, regardless of SRL status, there will be no foul or stripped condensate flow to the Hardpipe. Projected emissions of TRS compounds (excluding H_2S) from the ASB are calculated based on the WATER9 Model. Projected emissions of H_2S from the ASB are calculated based on the H2SSIM Model. Both WATER9 and H2SSIM emissions calculations are based on the average ASB influent concentrations from data collected during the 2021 and 2022 TRS testing efforts.

Nitrogen Oxides

When the rectified methanol system is operating, the methanol condenser is expected to condense more than 90% of the methanol in the SOG. The SOG also contains ammonia, which is also expected to be condensed with the methanol. The remaining ammonia will be vented with the SRL off-gases into the LVHC system. As a result, there will be an increase in ammonia when (1) SRL methanol is mixed with liquor and burned in the recovery furnaces and (2) the SRL LVHC off-gases are combusted in the No. 3 Recovery Furnace.

The ammonia in the methanol is expected to contribute less than 1% of the total nitrogen in the black liquor. The NO_X emissions from the recovery furnaces have been conservatively assumed to increase 1% when burning SRL methanol and the SRL LVHC.

The NO_X emissions from combustion of the SRL LVHC and SOG in the combination boilers are based on the post-Project Columbia NO_X emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

Carbon Monoxide

In SRL mode, the SRL methanol will be blended with the black liquor and burned in both recovery furnaces at a maximum concentration of 1% for safe operation of each recovery furnace. There is

no information to suggest the CO emissions will change when the SRL methanol is burned in the recovery furnaces.

The CO emissions from combustion of the SRL LVHC and SOG are based on the post-Project Columbia CO emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

Volatile Organic Compounds

The projected actual VOC emissions for the new steam stripper system are based on the theoretical maximum methanol collection (16 lb/ODTP) at the maximum pulp production (2,700 ADTP/day).

In SRL mode, the SRL methanol will be blended with the black liquor and burned in both recovery furnaces at a maximum concentration of 1% for safe operation of each recovery furnace. The SRL methanol will be combusted in the recovery furnace to an expected 99.9% VOC destruction in the liquid phase.

When the new stripper is operating, there will be no foul or stripped condensate flow to the Hardpipe. Non-methanol VOC emissions (acetaldehyde, methyl ethyl ketone, propionaldehyde, and TRS VOCs) from the ASB are calculated based on WATER9, using the average ASB influent concentrations from data collected during 2021 and 2022 TRS and NESHAP Subpart S testing efforts. Methanol emissions from the ASB are based on the NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests.

Backup Stripper Online Scenario

As stated previously, once the new stripper is installed, the existing stripper will be demoted to the backup steam stripper role. The backup steam stripper is expected to be online 8% of the annual operating time. The backup steam stripper will be operated in "TRS mode" to remove TRS from the foul condensate. In TRS mode, the backup stripper will also remove approximately 45% of the methanol from the foul condensate. The SOG from the backup steam stripper will be vented to the combination boilers. The stripped condensate from the backup steam stripper will be discharged to the Hardpipe where the remaining unstripped methanol will be biologically treated in the ASB.

Sulfur Dioxide

The backup steam stripper will be operated in "TRS mode" to remove TRS from the foul condensate. SO_2 emissions from combustion of the backup stripper SOG in the combination

boilers are conservatively calculated assuming all of the 0.70 lb S/ADTP of sulfur present in the foul condensate will be captured in the SOG and converted to SO_2 during combustion.

Nitrogen Oxides and Carbon Monoxide

The NO_X and CO emissions from combustion of SOG are based on the post-Project Columbia NO_X emissions factors presented in Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

Volatile Organic Compounds

The projected actual VOC emissions for the backup stripper are based on the maximum expected methanol collection (16 lb/ODTP) at the maximum pulp production (2,700 ADTP/day). To calculate VOC emissions from backup stripper SOG combustion, it is conservatively assumed that the methanol present in the foul condensate will be captured with the SOG and combusted with 98% control at the combination boilers.

Methanol emissions from the ASB are based on the NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests. The methanol concentration in the stripped condensate from the backup stripper is based on the theoretical maximum methanol collection (16 lb/ODTP) in the foul condensate and an expected 45% removal efficiency from the backup stripper operating in "TRS mode."

Acetaldehyde, methyl ethyl ketone, and propionaldehyde are assumed to be emitted at the same ratio to methanol as compared to the baseline. Emissions of TRS compounds that are also VOC are calculated using WATER9 with the design foul condensate loadings of TRS compounds being reduced by 98% in the backup stripper operating in "TRS mode" before entering the ASB.

Hydrogen Sulfide and Total Reduced Sulfur Compounds

To calculate TRS and H_2S emissions from backup stripper SOG combustion, it is conservatively assumed that the design foul condensate sulfur loading will be captured with the SOG and only 99% will be converted to SO_2 at the combination boilers.

Projected emissions of TRS compounds (excluding H_2S) from the ASB are based on WATER9. Projected emissions of H_2S from the ASB are calculated based on H2SSIM. Both WATER9 and H2SSIM emissions are based on the average ASB influent concentrations from data collected during 2021 and 2022 TRS testing and the design foul condensate sulfur loadings of TRS compounds being reduced by 98% in the backup stripper operating in "TRS mode."

No Stripper Online Scenario

The post-Project emissions also account for brief periods when the new stripper may need to go offline and the backup stripper brought into service. During these transition periods, untreated foul condensate will be discharged through the Hardpipe to the ASB. While in the Hardpipe prior to entering the ASB, the TRS compounds will be chemically oxidized to reduce the potential for odors from the ASB when operating during these brief transition periods, which are expected to be less than 2% of the annual operating time.

When there is no SOG being created by either stripper, there are no emissions of SO_2, NOx, or CO corresponding to the brief periods when all foul condensate is treated in the ASB.

Volatile Organic Compounds, Hydrogen Sulfide, and Total Reduced Sulfur Compounds

Methanol emissions from the ASB are based on NCASI Form XIII calculation spreadsheet using the average ASB influent and effluent methanol concentrations from all data collected during 2021 and 2022 and the average zone treatment profiles from 2021 and 2022 NESHAP Subpart S performance tests. The methanol concentration in the foul condensate is based on the maximum methanol collection (16 lb/ODTP).

Acetaldehyde, methyl ethyl ketone, and propionaldehyde are assumed to be emitted at the same ratio to methanol as compared to the baseline.

Emissions of TRS compounds are calculated using WATER9 and H2SSIM (H_2S) with the design foul condensate sulfur loadings of TRS compounds being adjusted based on NCASI Technical Bulletin No. 949 to account for the effects of the chemical oxidant, consistent with how baseline actual emissions are calculated.

- H_2S concentrations in the Hardpipe were reduced by 99%.
- DMS concentrations in the Hardpipe were reduced by 90%.
- MMC concentrations in the Hardpipe were reduced by 99% and assumed to be converted to DMDS.
- DMDS concentrations are assumed not reduced by chemical oxidant. DMDS concentrations of the Hardpipe were increased to account for the MMC oxidized into DMDS.

PAE and PTE Independent from Stripper Operating Scenario

LVHC Collection System

As stated previously, the No. 3 Recovery Furnace is expected to provide LVHC combustion at least 75% of the operating time. When the No. 3 Recovery Furnace cannot receive the LVHC gases, the LVHC gases will then be combusted in the combination boilers the remaining 25% of the time. The emissions from combusting LVHC gases are unaffected by the stripper operating scenario. PAE of SO_2, H_2S, and TRS are based on 2021 stack testing. The VOC PAE from the LVHC collection system are based on the post-project Columbia VOC emissions factors presented Appendix C – Tab A of the July 2019 and April 2020 permit applications approved by SCDHEC in Construction Permit DF.

No. 3 Recovery Furnace LVHC Ignitor

The No. 3 Recovery Furnace will also have a 1 MMBtu/hr natural gas-fired LVHC ignitor to be used when the black liquor load is less than 50%. The natural gas ignitor is expected to be required no more than 15% of the time the No. 3 Recovery Furnace is in operation. PAE of products of combustion from the ignitor are based on AP-42 emissions factors.

Steam for New Stripper and Backup Stripper

The steam requirements for the new stripper and the backup stripper were provided by the vendor and adjusted for the thermal efficiency of the combination boilers firing natural gas and No. 6 fuel oil. The projected fossil fuel usage reflects the highest No. 6 fuel oil usage occurring during the previous 10 years. The highest fuel oil usage was during calendar year 2014 and accounted for 18.4% of the fossil fuel heat input. The PAE and PTE of products of combustion are based on AP-42 emissions factors.

3.2.2.3.3 PSD Non-Applicability

The changes in emissions from the Mill as a result of the Project were compared to the significant emission rates in Standard No. 7, paragraph (B)(49). Based on the emissions calculations described above, presented in Appendix B, and summarized in Table 3-3, the Project is not subject to the PSD permitting requirements in paragraphs (J) through (R) of Standard No. 7.

Table 3-3 Summary of PSD Applicability for the Project (tpy)

Pollutant[A]	PM	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	H2SO4	TRS	VOC	Pb	H_2S	Total CO_2e
Baseline Actual Emissions	1.26	1.16	1.09	132	770	27.1	1.28	13.4	249	1.24E-04	3.77	13,904
Projected Actual Emissions	13.4	10.4	8.45	148	629	64.2	2.43	15.6	248	2.08E-03	5.69	48,629
Net Emissions Changes (PAE - BAE)	12.2	9.28	7.36	16.1	-141.35	37.1	1.15	2.18	-1.4	1.95E-03	1.92	34,725
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

3.2.2.4 Standard No. 7 – Prevention of Significant Deterioration – Air Dispersion Modeling Requirements

Standard No. 7 also includes PSD air quality increments that apply to all increases and decreases in PSD pollutant emissions following the PSD minor source baseline date. In York County the minor source baseline dates are December 1, 1981, for PM10 and March 3, 2017 for PM2.5. This Application does not trigger PSD review as discussed above; therefore, the project is unlikely to interfere with attainment or maintenance of State or Federal ambient air quality standards.

3.2.2.5 Standard No. 8 – Toxic Air Pollutants

SCDHEC Standard No. 8 regulates emissions of air toxics from new and existing sources. The Standard does not apply to fuel burning sources that burn only virgin fuel or specification used oil. Section I.D(1) of Standard No. 8 exempts sources subject to a Federal NESHAP. The Mill is subject to the Federal NESHAP for the pulp and paper source category (Subparts S and MM), industrial boilers (Subpart DDDDD), and reciprocating internal combustion engines (Subpart ZZZZ). Section I.D(2) of Standard No. 8 exempts non-NESHAP sources after a facility-wide residual risk analysis is completed. U.S. EPA published the results of facility-wide residual risk analyses for Subpart S sources on December 27, 2011, and for Subpart MM sources on December 30, 2017. The residual risk analyses completed by U.S. EPA concluded that there was no unacceptable risk from pulp and paper mills. Therefore, all emissions sources of HAP at New-Indy Catawba are exempt from Standard No. 8 under sections I.D(1) and/or I.D(2).

New-Indy Catawba emits two South Carolina toxic air pollutants (TAP) that are not listed HAP, H_2S and methyl mercaptan. Both compounds are generated by the Kraft pulping process and are components of TRS gases that are contained in LVHC and HVLC gases and in the pulping process condensates. Section I.D(3) allows sources to request an exemption for non-HAPs controlled by MACT controls to reduce HAP. This Project will improve emissions of H_2S and MMC from the Mill. However, because SCDHEC recently modeled emissions of H_2S and MMC and to demonstrate that emissions from these two TAPs following the Project remain below the maximum allowable ambient concentrations (MAAC) in Standard No. 8, the Mill has included an updated modeling demonstration in Appendix C.

The updated modeling analysis for TRS (as H_2S), H_2S and MMC in Appendix C focused on the changes to the emissions from the aerated stabilization basin. The TRS, H_2S and MMC emissions from the No. 3 Recovery furnace were not updated due to the insignificant maximum modeled concentrations from the No. 3 Recovery Furnace when compared to the overall maximum modeled concentrations for the Mill. The TRS (as H_2S) maximum modeled concentrations from the No. 3 Recovery Furnace were approximately 0.12% of the maximum modeled concentrations from the Mill. Similarly, the MMC concentrations were approximately 0.08% of the maximum

concentrations from the Mill, and the TRS (as H_2S) maximum concentrations from the No. 3 Recovery Furnace were approximately 0.04% of the maximum mill concentrations.

3.2.3 Regulation 61-62.60: South Carolina Designated Facility Plan and New Source Performance Standard

Regulation 61-62.60 incorporates the 40 CFR Part 60 Subparts by reference. Refer to Section 3.1.1 for a discussion of 40 CFR Part 60.

3.2.4 Regulation 61-62.61 and 61-62.62: National Emission Standards for Hazardous Air Pollutants

Regulation 61-62.61 incorporates the 40 CFR Part 61 Subparts by reference. Refer to Section 3.1.2 for a discussion of the non-applicability of 40 CFR Part 61. Regulation 61-62.63 incorporates the 40 CFR Part 63 Subparts by reference. Refer to Section 3.1.2 for a discussion of applicability of 40 CFR Part 63.

3.2.5 Regulation 61-62.70 – Title V Operating Permit Program

Refer to Section 3.1.6 for discussion of the TVOP Program.

3.3 PROVISIONS OF THE SCDHEC CONSENT ORDER AND EPA CONSENT DECREE

This section addresses the provisions of the November 23, 2022 SCDHEC Consent Order and Part I of Appendix A of the November 16, 2022 EPA Consent Decree.

3.3.1 November 23, 2022 SCDHEC Consent Order

Items 4 through 6 of the Consent Order require that New-Indy Catawba:

- Install, operate, and maintain a primary stripper that is adequately sized to collect and treat all foul condensate streams in accordance with applicable state and federal air quality regulations. *The proposed new stripper will be sized at 850 gpm, which is designed to process foul condensates generated from producing the maximum pulp production of 2,700 ADTP/d, and New-Indy Catawba will operate the unit in accordance with applicable state and federal air quality regulations.*
- The primary stripper shall use low-pressure steam and must be designed for both methanol and sulfur compound removal with the off gases being treated in the recovery boilers to absorb the sulfur compounds in the stripper off gas. The proposed new stripper will utilize 60 pounds per square inch gauge (psig) steam. *The new stripper off-gases and SRL methanol will be*

incinerated in the No. 2 or 3 Recovery Furnace, with the exception of when the SRL system is unavailable (5% of the operating time of the new stripper).

- Complete preliminary engineering and submit a construction permit application for the primary stripper within one hundred and twenty (120) days of the execution of this order. *Preliminary engineering is complete and this application is being submitted by March 23, 2023.*
- New-Indy must optimize, operate, and maintain the existing stripper at its current design capacity to allow it to be operated independently of the primary stripper. To optimize the existing stripper at its current design, it will be operated in "TRS mode" to remove 98% of the TRS and approximately 45% of the methanol from the foul condensate.
- The following required events will be completed in the future:
    - Order the primary stripper within 30 days of submitting the application for the air construction permit.
    - Within 30 days of receiving the air construction permit, New-Indy Catawba must start civil engineering preparation.
    - Within 30 days of receiving the primary stripper, New-Indy Catawba must start installation and testing.
    - New-Indy Catawba must complete startup operations and place the primary stripper into operation no later than June 30, 2025.
    - New-Indy shall operate its steam stripper system, comprised of the primary stripper and the existing stripper, in accordance with all applicable state and federal air quality regulations
    - In the event the stripping system is out of service and foul condensate must be discharged to the ASB, New-Indy Catawba must use automated control of addition of a chemical oxidant, hydrogen peroxide, to treat the unstripped foul condensate prior to discharging into the ASB to maintain a rolling 90-minute average ORP of the foul condensate above 0 millivolts.
    - New-Indy Catawba must notify SCDHEC at least 48 hours prior to any planned downtime and within 24 hours of unplanned downtime for which the primary stripper will not be operational (and for the existing stripper when it should be operating but will not be).
    - New-Indy Catawba must submit reports to the Department regarding the implementation of the Consent Order to NewIndyOrderReports@dhec.sc.gov. For twelve consecutive months after execution of this order, the reports shall be submitted monthly on the 1st business day of the month. Thereafter, reports shall only be submitted every three months on the 1st business day of the month until the order terminates.

3.3.2 November 16, 2022 EPA Consent Decree

Item I(a) of Appendix A

Item I(a) of Appendix A of the Consent Decree contains requirements related to the uptime and monitoring of the foul condensate steam stripper at the Mill.

- New-Indy Catawba will operate their foul condensate treatment system (inclusive of the new and existing steam strippers) during all times that unbleached kraft pulp is being produced and foul condensate is being generated at the Mill.
- During periods the new steam stripper is experiencing downtime the existing steam stripper will be used.
- Periods of downtime in which both strippers are down will not exceed 576 hours for the first year and 460 hours annually thereafter.
- Peroxide will be added to the non-stripped condensate during the transition to the existing steam stripper and will continue to be added throughout the period in which the existing steam stripper is in operation.
- The Mill will notify the necessary authorities forty-eight (48) hours prior to any scheduled downtime and within twenty-four (24) hours of any unscheduled downtime and will operate both steam strippers according to 40 CFR Part 63, Subpart S.

Item I(b) of Appendix A of the Consent Decree

Item I(b) of Appendix A of the Consent Decree covers the maintenance, operation, and calibration of the system used to treat the unstripped foul condensate by the Mill. The Mill's foul condensate treatment system (inclusive of the new equipment to be installed with this application) will be capable of continuously measuring the oxidation reduction potential (ORP) of the foul condensate, automatically controlling the dosage of hydrogen peroxide to maintain a rolling ninety-minute average of the ORP of the foul condensate above 0 millivolts (mV) before it is discharged to the ASB, and treating the maximum amount of foul condensate produced when both steam strippers are down and when untreated foul condensate is discharged to the Hardpipe.

Item I(c) of Appendix A of the Consent Decree

Item I(c) of Appendix A of the Consent Decree contains recordkeeping requirements for data obtained by the ORP monitoring system used by the Mill. The Mill will maintain continuous records of the ORP monitoring system used by the Mill and will provide data to U.S. EPA upon request.

Item I(d) of Appendix A of the Consent Decree

Item I(d) of Appendix A of the Consent Decree includes reporting requirements for the ORP monitoring system used by the Mill. When untreated foul condensate is discharged to the Hardpipe, New-Indy Catawba will include the date, time, and value of any instance of a rolling ninety-minute average of the ORP falling below 0 mV in the Mill's semi-annual report for the previous six months.

APPENDIX A -
PERMIT APPLICATION FORMS

RECEIVED
MAR 23 2023
BAQ PERMITTING

SECTION 1 - FACILITY IDENTIFICATION

SC Air Permit Number (8-digits only) *(Leave blank if one has never been assigned)* 2440 - 0005	Application Date March 2023
Facility Name/Legal Identity *(This should be the official legal name under which the facility is owned/operated and should be consistent with the name registered with the S.C. Secretary of State's office, as applicable.)* New-Indy Catawba LLC	
Facility Site Name (Optional) *(Please provide any alternative or additional identifier of the facility, such as a specific plant identifier (e.g., Columbia plant) or any applicable "doing business as" (DBA) identity. This name will be listed on the permit and used to identify the facility at the physical address listed below.)*	
Facility Federal Tax Identification Number *(Established by the U.S. Internal Revenue Service to identify a business entity)* 83-1904423	

REQUEST TYPE (Check all that apply)
Exemption Request: ☐ Complete Section 1 and attach documentation to support exemption request.
Construction Application: ☒ Minor New Source Review Project ☐ Synthetic Minor Project ☐ Prevention of Significant Deterioration Project ☐ 112(g) Project
Expedited Review Request: ☐ If checked, include Expedited Form D-2212 in the construction application package.
Construction Permit Modification: ☐ Provide the construction permit ID (e.g. CA, CB, etc.) for which modification is requested:
Application Revision: ☐

CONSTRUCTION PERMIT APPLICATION FORMS BEING REVISED
(Amended construction permit forms must be filled out completely and attached to this modification request.)

Form #	Date of Original Submittal	Brief Description of Revision
D-2566	N/A	N/A
D-2573	N/A	N/A

FACILITY PHYSICAL ADDRESS		
Physical Address: 5300 Cureton Ferry Road		County: York
City: Catawba	State: SC	Zip Code: 29704
Facility Coordinates *(Facility coordinates should be based at the front door or main entrance of the facility)* Latitude: 34°50'37"N	Longitude: 80°53'25"W	

FACILITY'S PRODUCTS / SERVICES	
Primary Products / Services *(List the primary product and/or service)* Linerboard / Pulp Manufacturing	
Primary SIC Code *(Standard Industrial Classification Codes)* 2631	Primary NAICS Code *(North American Industry Classification System)* 322130
Other Products / Services *(List other products and/or services)*	
Other SIC Code(s):	Other NAICS Code(s):

PROJECT DESCRIPTION
Project Description (What, why, how, etc.): Installation of a new steam stripper system to treat foul condensate prior to being recycled to the Brownstock washers. The new steam stripper will include a new stripper feed tank, new methanol tank, new hot water tank, and a new methanol rectification condenser. The rectified methanol will be burned in the recovery furnaces with the black liquor. The LVHC gases from the methanol condenser system, stripper feed tank, and methanol tank will be combusted in the No. 3 Recovery Furnace or back-up in the Nos. 1 or 2 Combination boilers. The hot water tank is not expected to be a source of air emissions. The existing steam stripper will serve as a backup to the new steam stripper. When both new and backup strippers are out of service, the condensate will be directed to the hard pipe with chemical oxidation prior to being treated in the aerated stabilization basin.

AIR PERMIT FACILITY CONTACT *(Person listed will be in our files as the point of contact for all air permitting related questions and will receive all air permitting notifications.)*			
Title/Position: Sr. Environ. Engineer	Salutation: Mr.	First Name: Bob	Last Name: Tourville
Mailing Address: P.O. Box 7			
City: Catawba		State: SC	Zip Code: 29704
E-mail Address: bob.tourville@newindycb.com		Primary Phone No.: (803) 981-8009	Alternate Phone No.:

The signed permit will be e-mailed to the designated Air Permit Contact. If additional individuals need copies of the permit, please provide their names and e-mail addresses.	
Name	**E-mail Address**
Steven Moore	smoore@all4inc.com

CONFIDENTIAL INFORMATION / DATA
Is confidential information or data being submitted under separate cover? ☒ No ☐ Yes*

If yes, submit **ONLY ONE COMPLETE CONFIDENTIAL APPLICATION, with original signature, along with the public version of the application.*

CO-LOCATION DETERMINATION
Are there other facilities in close proximity that could be considered collocated? ☒ No ☐ Yes*
If yes, list potential collocated facilities, including air permit numbers if applicable:

**If yes, please submit collocation applicability determination details in an attachment to this application.*

OWNER OR OPERATOR			
Title/Position: Technical Manager	Salutation: Mr.	First Name: Charles	Last Name: Cleveland
Mailing Address: P.O. Box 7			
City: Catawba		State: SC	Zip Code: 29704
E-mail Address: pete.cleveland@new-indycb.com		Primary Phone No.: 803-981-8000	Alternate Phone No.:

OWNER OR OPERATOR SIGNATURE

I certify, to the best of my knowledge and belief, that no applicable standards and/or regulations will be contravened or violated. I certify that any application form, supporting documentation, report, or compliance certification submitted in this permit application is true, accurate, and complete based on information and belief formed after reasonable inquiry. I understand that any statements and/or descriptions, which are found to be incorrect, may result in the immediate revocation of any permit issued for this application.

Signature of Owner or Operator — Date: 03/22/2023

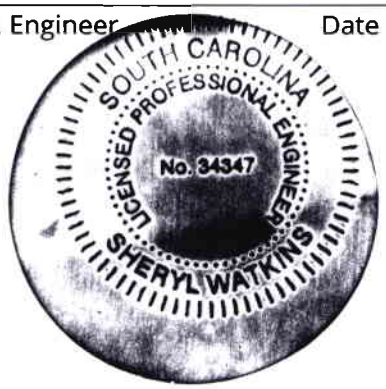
APPLICATION PREPARER (if other than Professional Engineer below)			
Title/Position: Senior Managing Consultant	Salutation: Mr.	First Name: Steven	Last Name: Moore
Mailing Address: 630 Davis Drive, Suite 203			
City: Durham		State: NC	Zip Code: 27560
E-mail Address: smoore@all4inc.com		Phone No.: (919) 234-5981	Cell No.: (864) 616-4711

PROFESSIONAL ENGINEER INFORMATION			
Consulting Firm Name: ALL4 LLC		SC Certificate of Authority License No.: 6409	
Title/Position: PE	Salutation: Ms.	First Name: Sheryl	Last Name: Watkins
Mailing Address: 300 Chastain Center Blvd, Suite 395			
City: Kennesaw		State: Georgia	Zip Code: 30144
E-mail Address: swatkins@all4inc.com		Phone No.: (678) 293-9428	Cell No.: (386) 503-0266
SC License/Registration No.: 34347			

PROFESSIONAL ENGINEER SIGNATURE

I have placed my signature and seal on the engineering documents submitted, signifying that I have reviewed this construction permit application as it pertains to the requirements of *South Carolina Regulation 61-62, Air Pollution Control Regulations and Standards*.

Sheryl Watkins 3-20-23
Signature of Professional Engineer — Date



This form is subject to Retention Schedule 16303.

EQUIPMENT / PROCESS INFORMATION					
Equipment ID/ Process ID	Action	Equipment / Process Description	Maximum Design Capacity (Units)	Control Device ID(s)	Emission Point ID(s)
9801	☐ Add ☐ Remove ☒ Modify ☐ Existing	Existing Steam Stripper	850 gallons/minute	9820, 2605, 3705, 2901	2610S2, 2610S1, Fugitive
9802	☐ Add ☐ Remove ☒ Modify ☐ Existing	Hardpipe	850 gallons/minute	2901	Fugitive
9803	☒ Add ☐ Remove ☐ Modify ☐ Existing	New Steam Stripper (Methanol Condenser)	6.5 gallons/minute	5260, 5260C, 2605, 3705, 5105	5105S, 2610S2, 2610S1
9803	☒ Add ☐ Remove ☐ Modify ☐ Existing	New Steam Stripper (Condensed Methanol)	6.5 gallons/minute	2505, 5105	2505S, 5105S
9803	☒ Add ☐ Remove ☐ Modify ☐ Existing	New Steam Stripper (Stripper Off Gases)	850 gallons/minute	9820, 2605, 3705	2610S2, 2610S1
9804	☒ Add ☐ Remove ☐ Modify ☐ Existing	New Steam Stripper Feed Tank	80,400 gallons	5260, 5260C, 5105, 2605, 3705	2610S2, 2610S1, 5105S
9805	☒ Add ☐ Remove ☐ Modify ☐ Existing	New Steam Stripper Rectified Liquid Methanol Tank	1,300 gallons	5260, 5260C, 5105, 2605, 3705	2610S2, 2610S1, 5105S

CONTROL DEVICE INFORMATION								
Control Device ID	Action	Control Device Description	Maximum Design Capacity (Units)	Inherent/ Required/ Voluntary	Pollutants Controlled (Include CAS #)	Capture Efficiency	Destruction/ Removal Efficiency	Emission Point ID(s)
2505	☐ Add ☐ Remove ☐ Modify ☒ Existing	No. 2 Recovery Furnace	412,140 tons BLS/year	Required	See Appendix B/Narrative			2505S
2605	☐ Add ☐ Remove ☐ Modify ☒ Existing	No. 1 Combination Boiler	405 MMBtu/hr	Required	See Appendix B/Narrative			2610S2
2901	☐ Add ☐ Remove ☐ Modify ☒ Existing	Aerated Biotreatment (Aerated Stabilization Basin)	N/A	Required	See Appendix B/Narrative			Fugitive
3705	☐ Add ☐ Remove ☐ Modify ☒ Existing	No. 2 Combination Boiler	720 MMBtu/hr	Required	See Appendix B/Narrative			2610S1
5105	☐ Add ☐ Remove ☐ Modify ☒ Existing	No. 3 Recovery Furnace	744,600 tons BLS/year	Required	See Appendix B/Narrative			5105S
9820	☐ Add ☐ Remove ☒ Modify ☐ Existing	Stripper Off Gases Collection System	2,700 ADTP/day	Required	See Appendix B/Narrative			2610S1, 2610S2
5260	☐ Add ☐ Remove ☒ Modify ☐ Existing	LVHC Collection System	2,700 ADTP/day	Required	See Appendix B/Narrative			2610S1, 2610S2, 5105S
5260C	☐ Add ☐ Remove ☐ Modify ☒ Existing	LVHC Collection System Caustic Scrubber	2,700 ADTP/day	Required	See Appendix B/Narrative			2610S1, 2610S2, 5105S

Check Box for information addressed	Required Information
	Source identification and emissions:
☒	• Name of each source, process, and control device.
☒	• Assign each source an Equipment ID. The IDs must match the IDs listed in Section 2 of this application.
☒	• Assign an Emission Point ID for each source.
☒	• Assign a Control Device ID for each control device.
☒	• List each pollutant the source will emit.
☒	• List the Uncontrolled, Controlled, and PTE emissions for each source or equipment in lb/hr and tons/year.
☒	• Emission rates for each pollutant should be totaled and listed in lb/hr and tons/year.
☒	• Provide the CAS# for each Hazardous Air Pollutant (HAP) and/or Toxic Air Pollutant (TAP).
	Information to support emission rates:
☒	• Sample calculations.
☒	• Emission factors. Include the source, revision date, specific table and/or chapters. Include source test data if factors were derived from source testing.
☒	• Explanation of assumptions, bottlenecks, etc.
☐	• Source test information: A copy of the source test results may be requested. If the test results are not included in the application, the application should cite whether this was a DHEC approved test, and if not, explain where the test was conducted and other identifying information.
☐	• Manufacturer's data.
☐	• Vendor guarantees that support control device efficiencies.
☒	• New Source Review (NSR) analysis.
☒	• Other (e.g. example particle size analysis)

Existing (Permitted) Facilities		
Check Box	**Required Information**	**Location in Application**
☒	Facility-wide emissions prior to construction/modification: • Include an explanation if these emissions do not match the facility-wide emissions submitted in the last application.	Appendix B
☒	Facility-wide emissions after construction/modification: • Include net change, if applicable.	Appendix B
	As applicable for the construction/ modification:	
☒	• Name of each source.	See Equipment/Process Information Above

Existing (Permitted) Facilities		
Check Box	**Required Information**	**Location in Application**
☒	• Assign each source an Equipment ID. The IDs must match the IDs listed in Section 2 of this application or on your current construction / operating permit.	See Equipment/Process Information Above
☒	• Assign a Control Device ID for each control device.	See Equipment/Process Information Above
☒	• Assign an Emission Point ID for each source.	See Equipment/Process Information Above
☒	• List each pollutant the source will emit.	Appendix B
☒	• List the Uncontrolled, Controlled, and PTE (if applicable) emissions for each source or equipment.	Appendix B
☒	• Emission rates for each pollutant should be totaled and listed in lb/hr and tons/year.	Appendix B
☒	• Provide the CAS# for each HAP and/or TAP.	Appendix B
Information to support facility-wide emission rates:		
☒	• Sample calculations.	Appendix B
☒	• Emission factors. Include the source, revision date, specific table and/or chapters. Include source test data if factors were derived from source testing.	Narrative, Appendix B
☒	• Explanation of assumptions, bottlenecks, etc.	Narrative
☒	• Source test information: A copy of source the test results may be requested. If the results are not included in the application, the application should cite whether this was a DHEC approved test and if not, explain where the test was conducted and other identifying information.	Appendix B
☐	• Manufacturer's data.	
☐	• Vendor guarantees that support control device efficiencies.	
☒	• NSR analysis.	Narrative
☒	• Other (please explain)	Appendix B

Check Box	State and Federal Air Pollution Control Regulations and Standards
☒	S.C. Regulation 61-62.1 Section II.E Synthetic Minor Construction Permits
☒	S.C. Regulation 61-62.5 Air Pollution Control Standards
☐	• Standard No. 1 Emissions from Fuel Combustion
☒	• Standard No. 2 Ambient Air Quality
☒	• Standard No. 3 Waste Combustion and Reduction (state only)
☒	• Standard No. 4 Emissions from Process Industries *(Note: If Section VIII of this Standard applies, include the process weight rate (PWR) in ton per hour for each applicable source or process.)*
☐	• Standard No. 5 Volatile Organic Compounds
☐	• Standard No. 5.2 Nitrogen Oxides Lowest Achievable Emission Rate
☒	• Standard No. 7 Prevention of Significant Deterioration (PSD)
☐	• Standard No. 7.1 Nonattainment New Source Review (NSR)
☒	• Standard No. 8 Toxic Air Pollutants (TAPs) (state only)
☐	S.C. Regulation 61-62.6 Control of Fugitive Particulate Matter
☒	S.C. Regulation 61-62.60 and 40 CFR Part 60 New Source Performance Standards (NSPS)
☒	S.C. Regulation 61-62.61 and 40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants (NESHAP)
☒	S.C. Regulation 61-62.63 and 40 CFR Part 63 National Emission Standards for Hazardous Air Pollutants (NESHAP) for Source Categories
☒	40 CFR Part 64 Compliance Assurance Monitoring (CAM)
☐	S.C. Regulation 61-62.68 and 40 CFR Part 68 Chemical Accident Prevention Provisions
☒	S.C. Regulation 61-62.70 and 40 CFR Part 70 Title V Operating Program
☐	Other S.C. Air Pollution Control Regulations, as applicable.
☐	Other Federal Air Pollution Control Regulations, as applicable.
☐	40 CFR 98 Green House Gas (GHG) emissions *(Note: Quantify GHG emissions, if S.C. Regulation 61-62.5, Standard No. 7 or S.C. Regulation 61-62.5, Standard No. 7.1 is triggered.)*

Check Box	Completeness Checklist:
	Applicability Determination:
☒	• Is this regulation *applicable, reasonably applicable, potentially applicable,* or *not applicable?*
☒	• Is the basis for the applicability determination explained?
	Affected Sources:
☒	• Is the name and identification of each emission source or process included?
	Compliance Demonstration:
☒	• How will compliance be demonstrated?
☒	• Are specific methods or activities to be utilized by the facility to demonstrate compliance with each specific limitation and/or requirement provided?
☒	• Are control devices and control device requirements included?
☒	• Are monitoring, recordkeeping, and reporting requirements necessary to demonstrate compliance included?
	Regulatory Citations:
☒	• Are the regulatory citations identified?

Bureau of Air Quality
Emission Point Information
Page 1 of 4

A. APPLICATION IDENTIFICATION	
1. Facility Name: New-Indy Catawba LLC	
2. SC Air Permit Number (if known; 8-digits only): 2440 - 0005	3. Application Date: March 2023
4. Project Description: New Condensate Stripper Permit Application	
5. Are other facilities collocated for air compliance? ☐ Yes ☒ No	6. If Yes, provide permit numbers of collocated facilities:

B. AIR CONTACT			
Consulting Firm Name (if applicable):			
Title/Position: Senior Environmental Engineer	Salutation: Mr.	First Name: Bob	Last Name: Tourville
Mailing Address: P.O. Box 7			
City: Catawba		State: SC	Zip Code: 29704
E-mail Address: bob.tourville@new-indycb.com		Phone No.: (803) 981-8009	Cell No.:

C. EMISSION POINT DISPERSION PARAMETERS

- Source data requirements are based on the appropriate source classification.
- Each emission point is classified as a point, flare, area, area circular, area polygon, volume, open pit, line, or buoyant line source.
- Contact the Bureau of Air Quality for clarification of data requirements.
- Include sources on a scaled site map. Also, a picture of area or volume sources would be helpful but is not required.
- A user generated document or spreadsheet may be substituted in lieu of this form provided all of the required emission point parameters are submitted in the same order, units, etc. as presented in these tables.

Abbreviations / Units of Measure:

- AGL = Above Ground Level
- BTU/hr = British Thermal Unit per hour
- ° = Degrees
- °F = Degrees Fahrenheit
- ft = feet
- ft/s = feet per second
- K = Kelvin
- m = meters
- UTM = Universal Transverse Mercator

Reminder: For all Emission Points, list the unique Emission Point ID for that source. Use the same emission point ID as shown in the current permit and provided in the last modeling submittal (as applicable). If the emission point ID has been changed from what was previously submitted, please list the current emission point ID with the old emission point ID in parenthesis

D. POINT SOURCE

Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height AGL (ft)	Exit Temp. (°F)	Exit Velocity (ft/s)	Inside Diameter (ft)	Discharge Orienta-tion	Rain Cap? (Y/N)	Distance To Nearest Property Boundary (ft)	Building		
		Easting (m)	Northing (m)								Height (ft)	Length (ft)	Width (ft)
2610S1	No. 2 Combination Boiler Stack	510039.32	3855689.18	228	364	47.2	10.0	Vert.	N	3,937	N/A	N/A	N/A
2610S2	No. 1 Combination Boiler Stack	510020.32	3855678.18	228	405	62.3	10.0	Vert.	N	3,937	N/A	N/A	N/A
2505S	No. 2 Recovery Furnace	510095.85	3855743.58	195	365	99.1	7.0	Vert.	N	3,953	N/A	N/A	N/A
5105S	No. 3 Recovery Furnace	510032.37	3855802.28	225	342	61.7	10.5	Vert.	N	4,134	N/A	N/A	N/A

E. FLARE SOURCE

Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height AGL (ft)	Heat Release Rate (BTU/hr)	Exit Velocity (ft/s)	Exit Temp. (°F)	Heat Loss Fraction	Distance To Nearest Property Boundary (ft)	Building		
		Easting (m)	Northing (m)							Height (ft)	Length (ft)	Width (ft)

F. AREA SOURCE

Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height AGL (ft)	Easterly Length (ft)	Northerly Length (ft)	Angle From North (°)	Initial Vertical Dimension σ_z (ft)	Distance To Nearest Property Boundary (ft)
		Easting (m)	Northing (m)						

Bureau of Air Quality
Emission Point Information

G. AREA CIRCULAR SOURCE

Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height AGL (ft)	Radius of Area (ft)	Number of Vertices	Initial Vertical Dimension σ_z (ft)	Distance To Nearest Property Boundary (ft)
		Easting (m)	Northing (m)					

H. AREA POLYGON SOURCE

Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height AGL (ft)	Initial Vertical Dimension (ft)	Number of Vertices	Area (ft^2)	Distance To Nearest Property Boundary (ft)
		Easting-1 (m)	Northing-1 (m)					
Fugitive	Aerated Stabilization Basin (Zone 1)	510803.40	3856319.69	20	0	15	547,769	1,969
Fugitive	Aerated Stabilization Basin (Zone 2)	510964.42	3856054.20	20	0	18	733,653	1,510
Fugitive	Aerated Stabilization Basin (Zone 3)	511052.13	3855887.21	20	0	10	783,500	1,180

I. VOLUME SOURCE

Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height AGL (ft)	Physical Horizontal Dimension (ft)	Initial Horizontal Dimension σ_y (ft)	Physical Vertical Dimension (ft)	Initial Vertical Dimension σ_z (ft)	Distance To Nearest Property Boundary (ft)
		Easting (m)	Northing (m)						

J. OPEN PIT SOURCE

Emission Point ID	Description/Name	UTM Coordinates (NAD83)		Release Height AGL (ft)	Easterly Length (ft)	Northerly Length (ft)	Pit Volume (ft^3)	Angle From North (°)
		Easting (m)	Northing (m)					

K. LINE SOURCE									
Emission Point ID	Description/Name	UTM Coordinates (NAD83)				Release Height AGL (ft)	Line Length (ft)	Line Width (ft)	Initial Vertical Dimension σ_z (ft)
		Start Easting (m)	Start Northing (m)	End Easting (m)	End Northing (m)				

L. BUOYANT LINE SOURCE (must complete Line Source and Buoyant Line Source tables)							
Emission Point ID	Description/Name	Average Building Length (ft)	Average Building Height (ft)	Average Building Width (ft)	Average Line Source Width (ft)	Average Building Separation (ft)	Average Buoyancy Parameter (m^4/s^3)

M. EMISSION RATES						
Emission Point ID	Pollutant Name	CAS #	Emission Rate (lb/hr)	Same as Permitted? (1)	Controlled or Uncontrolled	Averaging Period
2610S2, 2610S1	Refer to Appendix B					
2505S						
5105S						
Fugitive						

(1) Any difference between the rates used for permitting and the air compliance demonstration must be explained in the application report.

APPENDIX B -
EMISSIONS CALCULATIONS

NEW-INDY CATAWBA MILL STRIPPER PROJECT

Stripper Operating Scenario	Operating Time	
	%	hrs
New Stripper Online	90%	7,884.0
Backup Stripper Online	8%	700.8
No Stripper Online	2%	175.2

LVHC Control Operating Scenario	Operating Time	
	%	hrs
RF3 Available for LVHC	75%	6,570.0
LVHC to CB1/CB2	25%	2,190.0

Summary of PSD Applicability
(tons/year)

Pollutant[A]	PM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	H2SO4	TRS	VOC	Pb	H_2S	Total CO_2e
Baseline Actual Emissions	1.26	1.16	1.09	132	770	27.1	1.28	13.4	249	1.24E-04	3.77	13,904
Projected Actual Emissions	13.4	10.4	8.45	148	629	64.2	2.43	15.6	248	2.08E-03	5.69	48,629
Net Emissions Changes (PAE - BAE)	12.2	9.28	7.36	16.1	-141.35	37.1	1.15	2.18	-1.4	1.95E-03	1.92	34,725
PSD Significant Emissions Rates	25	15	10	40	40	100	7	10	40	0.6	10	75,000
PSD Significant?	No	No	No	No	No	No	No	No	No	No	No	No

A - HF is not emitted from new, modified, or affected emissions units.

SO2 EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		SO2 Emissions Factor		Sulfur Capture[C]	SO2 Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper SOG[A]	91.4%	8,004.0	NA	100%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	1.06	Stack Test	NA	63.1	252.5
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	1.97	Stack Test	NA	117.0	512.4
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B,E]	97.9%	7,835.7	NA	100.0%	7,835.7	29.5	mmBtu/hr	6.00E-04	AP-42	NA	0.02	0.1
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B,E]	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	2.20E+00	AP-42	NA	61.9	5.2
SO2 BASELINE ACTUAL EMISSIONS (BAE)															**770.2**
PROJECTED ACTUAL EMISSIONS															
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL Methanol to RF2/3[G]	100.0%	7,489.8	2,700	ADTP/day	0.56	Vendor	99%	0.6	2.4
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to RF3[G]	75.0%	5,617.4	2,700	ADTP/day	0.84	Vendor	99%	0.9	2.7
New Stripper Online	90.0%	7,884.0	SRL Online	95%	7,489.8	SRL LVHC to CB1/CB2[G]	25.0%	1,872.5	2,700	ADTP/day	0.84	Vendor	50%	47.2	44.2
New Stripper Online	90.0%	7,884.0	SRL Offline	5%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	1.40	Vendor	0%	157.4	31.0
Backup Stripper Online	8.0%	700.8	NA	100%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	1.40	Vendor	0%	157.4	55.1
No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	5.25	Stack Test	99%	5.9	19.4
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.25	Stack Test	50%	295.2	323.3
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas[I]	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	6.00E-04	AP-42	NA	0.00	0.0
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas[D,F]	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	6.00E-04	AP-42	NA	0.06	0.2
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil[D,F]	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	2.20E+00	AP-42	NA	202.9	147.2
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas[D,F]	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	6.00E-04	AP-42	NA	0.02	0.004
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil[D,F]	18.4%	128.9	NA	100.0%	128.9	24.1	mmBtu/hr	2.20E+00	AP-42	NA	53.1	3.4
SO2 PROJECTED ACTUAL EMISSIONS (PAE)															**628.84**
NET EMISSIONS CHANGE (PAE - BAE)															
NET EMISSIONS CHANGE (PAE - BAE)															**-141.35**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

				Foul UNCTRL lb/ADTP	Methanol[G] UNCTRL lb/ADTP	LVHC[G] UNCTRL lb/ADTP
TRS as S		MW	AHL	0.70	0.28	0.42
sulfur	S	32.065				
sulfur dioxide	SO_2	64.064		1.40	0.56	0.84

H2SO4 EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		H2SO4 Emissions Factor		Sulfur Capture	H2SO4 Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/ADTP	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.3	1.3
H2SO4 BASELINE ACTUAL EMISSIONS (BAE)															**1.3**
PROJECTED ACTUAL EMISSIONS															
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.55	1.82
LVHC Collection System	100%	8,760.0	NA	100%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	4.93E-03	NCASI Technical Bulletin 858, Table 10	NA	0.55	0.61
H2SO4 PROJECTED ACTUAL EMISSIONS (PAE)															**2.43**
NET EMISSIONS CHANGE (PAE - BAE)															
NET EMISSIONS CHANGE (PAE - BAE)															**1.15**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99, sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

NOX EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		NOX Emissions Factor		Ammonia Increase[C]	NOX Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper SOG[A]	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100%	8,004.0	1,426	ADTP/day	0.415	Columbia	NA	24.7	98.7
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B,E]	97.9%	7,835.7	NA	100%	7,835.7	29.5	mmBtu/hr	2.80E-01	AP-42	NA	8.3	32.4
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B,E]	2.1%	168.3	NA	100%	168.3	28.1	mmBtu/hr	3.13E-01	AP-42	NA	8.8	0.7
NOX BASELINE ACTUAL EMISSIONS															**131.8**
PROJECTED ACTUAL EMISSIONS															
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3[G]	100%	7,489.8	2,852	TBLS/day	1.500	Title V	1.0%	1.8	6.7
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3[G]	75%	5,617.4	316.9	TBLS/day	1.500	Title V	1.0%	0.2	0.6
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2[G]	25%	1,872.5	270.0	ADTP/day	0.415	Columbia	NA	4.7	4.4
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	0.415	Columbia	NA	46.7	9.2
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	0.415	Columbia	NA	46.7	16.4
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas[I]	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	2.80E-01	AP-42	NA	0.3	0.1
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas[D,F]	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	2.80E-01	AP-42	NA	27.1	87.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil[D,F]	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	3.13E-01	AP-42	NA	28.9	20.9
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas[D,F]	81.6%	571.9	NA	100%	571.9	25.3	mmBtu/hr	2.80E-01	AP-42	NA	7.1	2.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil[D,F]	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	3.13E-01	AP-42	NA	7.5	0.5
NOX PROJECTED ACTUAL EMISSIONS															**147.9**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**16.1**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Ammonia input to recovery furnace increases >1% (methanol input limited to 1% of black liquor input by BLRBAC).

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

CO EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		CO Emissions Factor		CO Control	CO Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper SOG[A]	91.4%	8,004.0	NA	100.0%	8,004.0	SOG to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	0.0728	Columbia	NA	4.3	17.3
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B]	97.9%	7,835.7	NA	100.0%	7,835.7	29.5	mmBtu/hr	8.40E-02	AP-42	NA	2.5	9.7
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B]	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	3.33E-02	AP-42	NA	0.9	0.1
CO BASELINE ACTUAL EMISSIONS															**27.1**
PROJECTED ACTUAL EMISSIONS															
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3	100.0%	7,489.8	NA	NA	NA	NA	NA	NA	NA
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3	75%	5,617.4	2,700	ADTP/day	0.0728	Columbia	NA	8.2	23.0
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2	25%	1,872.5	2,700	ADTP/day	0.0728	Columbia	NA	8.2	7.7
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.0728	Columbia	NA	8.2	1.6
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.0728	Columbia	NA	8.2	2.9
No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	NA	NA	NA	NA	NA	NA	NA
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas[I]	15.0%	985.5	NA	100.0%	985.5	1.0	mmBtu/hr	8.40E-02	AP-42	NA	0.1	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas[D]	81.6%	6,433.3	NA	100.0%	6,433.3	96.8	mmBtu/hr	8.40E-02	AP-42	NA	8.1	26.2
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil[D]	18.4%	1,450.7	NA	100.0%	1,450.7	92.2	mmBtu/hr	3.33E-02	AP-42	NA	3.1	2.2
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas[D]	81.6%	571.9	NA	100.0%	571.9	25.3	mmBtu/hr	8.40E-02	AP-42	NA	2.1	0.6
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil[D]	18.4%	128.9	NA	100.0%	128.9	24.1	mmBtu/hr	3.33E-02	AP-42	NA	0.8	0.1
CO PROJECTED ACTUAL EMISSIONS															**64.2**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**37.1**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

VOC EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		VOC Emissions Factor		Removal[C]	VOC Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper SOG[A]	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	4.37	Stripped	98.0%	5.19	20.78
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	NA	100.0%	8,760.0	1,426	ADTP/day	8.73E-01	WATER9	NA	51.88	227.21
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	3.10E-03	Columbia	NA	0.18	0.81
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B]	97.9%	7,835.7	NA	100.0%	7,835.7	29.5	mmBtu/hr	5.39E-03	AP-42	NA	0.2	0.6
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B]	2.1%	168.3	NA	100.0%	168.3	28.1	mmBtu/hr	1.87E-03	AP-42	NA	0.1	0.0
VOC BASELINE ACTUAL EMISSIONS															**249.43**
PROJECTED ACTUAL EMISSIONS															
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3[G]	100%	7,489.8	2,700	ADTP/day	14.40	Vendor	99.9%	1.62	6.07
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3[G]	75%	5,617.4	2,700	ADTP/day	1.60	Vendor	98%	3.60	10.11
New Stripper Online	90%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2[G]	25%	1,872.5	2,700	ADTP/day	1.60	Vendor	98%	3.60	3.37
New Stripper Online	90%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100%	394.2	2,700	ADTP/day	16.00	Vendor	98%	36.00	7.10
Backup Stripper Online	8%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100%	700.8	2,700	ADTP/day	16.00	Vendor	98%	36.00	12.61
ASB - New Stripper Online	90%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100%	7,884.0	2,700	ADTP/day	0.29	WATER9	NA	32.40	127.72
ASB - Backup Stripper Online	8%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100%	700.8	2,700	ADTP/day	1.42	WATER9	NA	159.98	56.06
ASB - No Stripper Online	2%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	NA	100%	175.2	2,700	ADTP/day	2.20	WATER9	NA	247.05	21.64
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75%	6,570.0	2,700	ADTP/day	3.10E-03	Columbia	NA	0.35	1.15
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25%	2,190.0	2,700	ADTP/day	3.10E-03	Columbia	NA	0.35	0.38
Recovery Furnace #3 LVHC Ignitor	75%	6,570.0	Natural Gas[I]	15.0%	985.5	NA	100%	985.5	1.0	mmBtu/hr	5.39E-03	AP-42	NA	0.0	0.0
New Stripper Steam - Natural Gas	90%	7,884.0	Natural Gas[D]	81.6%	6,433.3	NA	100%	6,433.3	96.8	mmBtu/hr	5.39E-03	AP-42	NA	0.5	1.7
New Stripper Steam - No. 6 Oil	90%	7,884.0	No. 6 Oil[D]	18.4%	1,450.7	NA	100%	1,450.7	92.2	mmBtu/hr	1.87E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - Natural Gas	8%	700.8	Natural Gas[D]	81.6%	571.9	NA	100%	571.9	25.3	mmBtu/hr	5.39E-03	AP-42	NA	0.1	0.0
Backup Stripper Steam - No. 6 Oil	8%	700.8	No. 6 Oil[D]	18.4%	128.9	NA	100%	128.9	24.1	mmBtu/hr	1.87E-03	AP-42	NA	0.0	0.0
VOC PROJECTED ACTUAL EMISSIONS															**248.05**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**-1.38**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - VOC destruction >98% in vapor phase, 99.9% in liquid phase.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - >90% of methanol condensed and burned in recovery furnace, < 10% of methanol vented into LVHC System.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

TRS EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		TRS Emissions Factor		Sulfur Capture[C]	TRS Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper SOG[A]	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	2.88E-03	Stack test	NA	0.17	0.68
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	NA	100.0%	8,760.0	NA	100.0%	8,760.0	1,426	ADTP/day	4.08E-02	H2SSIM/WATER9	NA	2.42	10.61
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	8.01E-03	Stack test	NA	0.48	2.09
TRS BASELINE ACTUAL EMISSIONS															**13.38**
PROJECTED ACTUAL EMISSIONS															
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3[G,H]	100.0%	7,489.8	2,700	ADTP/day	0.33	Vendor	99.9%	0.04	0.14
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3[G,H]	75.0%	5,617.4	2,700	ADTP/day	0.49	Vendor	99.9%	0.05	0.15
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2[G]	25.0%	1,872.5	2,700	ADTP/day	0.49	Vendor	99%	0.55	0.51
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.81	Vendor	99%	0.91	0.18
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.81	Vendor	99%	0.91	0.32
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	2.42E-02	H2SSIM/WATER9	NA	2.72	10.74
ASB - Backup Stripper Online	8.0%	700.8	TRS Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	2.72E-02	H2SSIM/WATER9	NA	3.06	1.07
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	7.28E-02	H2SSIM/WATER9	NA	8.19	0.72
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.75E+00	Stack test	99.9%	0.20	0.65
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	8.76E-03	Stack test	NA	0.99	1.08
TRS PROJECTED ACTUAL EMISSIONS															**15.56**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**2.18**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

					Foul UNCTRL lb/ADTP	Methanol[G] UNCTRL lb/ADTP	LVHC[G] UNCTRL lb/ADTP
TRS as S		MW		AHL	0.70	0.28	0.42
sulfur	S	32.065					
hydrogen sulfide	H_2S	34.081	82.3%		0.61	0.24	0.37
methyl mercaptan	CH_4S	48.107	6.4%		0.07	0.03	0.04
dimethyl sulfide	C_2H_6S	62.134	5.2%		0.07	0.03	0.04
dimethyl disulfide	$C_2H_6S_2$	94.199	6.1%		0.06	0.03	0.04
TRS as TRS	TRS				0.81	0.33	0.49

H2S EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		H2S Emissions Factor		Sulfur Capture[C]	H2S Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper SOG[A]	91.4%	8,004.0	NA	100.0%	8,004.0	LVHC to CB1/CB2	100.0%	8,004.0	1,426	ADTP/day	4.13E-04	Stack test	NA	0.02	0.10
Aerated Stabilization Basin (ASB)	100.0%	8,760.0	Foul Condensate to Hard Pipe	100.0%	8,760.0	Hydrogen Peroxide Addition	100.0%	8,760.0	1,426	ADTP/day	1.36E-02	H2SSIM	NA	0.81	3.54
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	100.0%	8,760.0	1,426	ADTP/day	5.03E-04	Stack test	NA	0.03	0.13
H2S BASELINE ACTUAL EMISSIONS															**3.77**
PROJECTED ACTUAL EMISSIONS															
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL Methanol to RF2/3[B,H]	100.0%	7,489.8	2,700	ADTP/day	0.24	Vendor	99.9%	0.03	0.10
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to RF3[B,H]	75.0%	5,617.4	2,700	ADTP/day	0.37	Vendor	99.9%	0.04	0.12
New Stripper Online	90.0%	7,884.0	SRL Online	95.0%	7,489.8	SRL LVHC to CB1/CB2[G]	25.0%	1,872.5	2,700	ADTP/day	0.37	Vendor	99%	0.41	0.39
New Stripper Online	90.0%	7,884.0	SRL Offline	5.0%	394.2	SOG to CB1/CB2	100.0%	394.2	2,700	ADTP/day	0.61	Vendor	99%	0.69	0.14
Backup Stripper Online	8.0%	700.8	NA	100.0%	700.8	SOG to CB1/CB2	100.0%	700.8	2,700	ADTP/day	0.61	Vendor	99%	0.69	0.24
ASB - New Stripper Online	90.0%	7,884.0	No Foul Condensate to Hard Pipe	100.0%	7,884.0	NA	100.0%	7,884.0	2,700	ADTP/day	9.27E-03	H2SSIM	NA	1.04	4.11
ASB - Backup Stripper Online	8.0%	700.8	H2S Stripped From Foul Condensate	100.0%	700.8	NA	100.0%	700.8	2,700	ADTP/day	9.81E-03	H2SSIM	NA	1.10	0.39
ASB - No Stripper Online	2.0%	175.2	Foul Condensate to Hard Pipe	100.0%	175.2	Hydrogen Peroxide Addition	100.0%	175.2	2,700	ADTP/day	9.54E-03	H2SSIM	NA	1.07	0.09
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to RF3	75.0%	6,570.0	2,700	ADTP/day	1.17E-01	Stack test	99.9%	0.01	0.04
LVHC Collection System	100.0%	8,760.0	NA	100.0%	8,760.0	LVHC to CB1/CB2	25.0%	2,190.0	2,700	ADTP/day	5.87E-04	Stack test	NA	0.07	0.07
H2S PROJECTED ACTUAL EMISSIONS															**5.69**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**1.92**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - Sulfur capture in recovery furnace >99.9% (see note H), sulfur capture in LVHC scrubber 50%, sulfur conversion in combination boilers 99%.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - 40% of TRS/H2S condensed into methanol and 60% of TRS/H2S vented into LVHC System.

H - Recovery Furnace captures 99% of sulfur and converts 99% of remaining uncaptured sulfur.

					Foul UNCTRL lb/ADTP	Methanol[G] UNCTRL lb/ADTP	LVHC[G] UNCTRL lb/ADTP
TRS as S		MW		AHL	0.70	0.28	0.42
sulfur	S	32.065					
hydrogen sulfide	H_2S	34.081	82.3%		0.61	0.24	0.37
methyl mercaptan	CH_4S	48.107	6.4%		0.07	0.03	0.04
dimethyl sulfide	C_2H_6S	62.134	5.2%		0.07	0.03	0.04
dimethyl disulfide	$C_2H_6S_2$	94.199	6.1%		0.06	0.03	0.04
TRS as TRS	TRS				0.81	0.33	0.49

PM EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time %	Stripper Scenario Operating Time hrs	Operating Configuration	Operating Configuration Time %	Operating Configuration Time hrs	Controls	Controls Operating Time %	Controls Operating Time hrs	Production Rate Value	Production Rate UOM	PM Emissions Factor lb/UOM	PM Emissions Factor Reference	PM Control %	PM Emissions lb/hr	PM Emissions tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B]	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.9
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B]	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	1.61E-01	AP-42	NA	4.5	0.4
PM BASELINE ACTUAL EMISSIONS															**1.3**
PROJECTED ACTUAL EMISSIONS															
Recovery Furnace #3 LVHC ignitor	75.0%	6,570.0	Natural Gas[I]	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas[D]	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil[D]	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.61E-01	AP-42	NA	14.8	10.8
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas[D]	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil[D]	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.61E-01	AP-42	NA	3.9	0.3
PM PROJECTED ACTUAL EMISSIONS															**13.4**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**12.2**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

PM10 EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		PM10 Emissions Factor		PM10 Control	PM10 Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B]	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.9
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B]	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	1.17E-01	AP-42	NA	3.3	0.3
PM10 BASELINE ACTUAL EMISSIONS															**1.2**
PROJECTED ACTUAL EMISSIONS															
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas[I]	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas[D]	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil[D]	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.17E-01	AP-42	NA	10.8	7.8
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas[C]	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil[D]	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.17E-01	AP-42	NA	2.8	0.2
PM10 PROJECTED ACTUAL EMISSIONS															**10.4**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**9.3**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

PM2.5 EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		PM2.5 Emissions Factor		PM2.5 Control	PM2.5 Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B]	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.9
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B]	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	8.80E-02	AP-42	NA	2.5	0.2
PM2.5 BASELINE ACTUAL EMISSIONS															**1.1**
PROJECTED ACTUAL EMISSIONS															
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas[I]	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	7.60E-03	AP-42	NA	7.60E-03	3.74E-03
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas[D]	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	7.60E-03	AP-42	NA	0.7	2.4
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil[D]	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	8.80E-02	AP-42	NA	8.1	5.9
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas[D]	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	7.60E-03	AP-42	NA	0.2	0.1
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil[D]	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	8.80E-02	AP-42	NA	2.1	0.1
PM2.5 PROJECTED ACTUAL EMISSIONS															**8.4**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**7.4**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

LEAD EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		Lead Emissions Factor		Lead Control	Lead Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B]	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	5.00E-07	AP-42	NA	1.48E-05	5.78E-05
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B]	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	2.80E-05	AP-42	NA	7.87E-04	6.63E-05
LEAD BASELINE ACTUAL EMISSIONS															**1.24E-04**
PROJECTED ACTUAL EMISSIONS															
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas[I]	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	5.00E-07	AP-42	NA	5.00E-07	2.46E-07
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas[D]	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	5.00E-07	AP-42	NA	4.84E-05	1.56E-04
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil[D]	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	2.80E-05	AP-42	NA	2.58E-03	1.87E-03
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas[D]	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	5.00E-07	AP-42	NA	1.27E-05	3.62E-06
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil[D]	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	2.80E-05	AP-42	NA	6.75E-04	4.35E-05
LEAD PROJECTED ACTUAL EMISSIONS															**2.08E-03**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**1.95E-03**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

CO2 EMISSIONS CALCULATIONS

Stripper Operating Scenario	Stripper Scenario Operating Time		Operating Configuration	Operating Configuration Time		Controls	Controls Operating Time		Production Rate		CO2 Emissions Factor		CO2 Control	CO2 Emissions	
	%	hrs		%	hrs		%	hrs	Value	UOM	lb/UOM	Reference	%	lb/hr	tpy
BASELINE ACTUAL EMISSIONS (March 2021 - February 2023)															
Backup Stripper Steam[A]	91.4%	8,004.0	Natural Gas[B]	97.9%	7,835.7		100.0%	7,835.7	29.5	mmBtu/hr	1.17E+02	AP-42	NA	3,448.9	13,512
Backup Stripper Steam[A]	91.4%	8,004.0	No. 6 Oil[B]	2.1%	168.3		100.0%	168.3	28.1	mmBtu/hr	1.66E+02	AP-42	NA	4,655.3	392
CO2 BASELINE ACTUAL EMISSIONS															**13,904**
PROJECTED ACTUAL EMISSIONS															
Recovery Furnace #3 LVHC Ignitor	75.0%	6,570.0	Natural Gas[I]	15.0%	985.5		100.0%	985.5	1.0	mmBtu/hr	1.17E+02	AP-42	NA	116.9	58
New Stripper Steam - Natural Gas	90.0%	7,884.0	Natural Gas[D]	81.6%	6,433.3		100.0%	6,433.3	96.8	mmBtu/hr	1.17E+02	AP-42	NA	11,313.5	36,392
New Stripper Steam - No. 6 Oil	90.0%	7,884.0	No. 6 Oil[D]	18.4%	1,450.7		100.0%	1,450.7	92.2	mmBtu/hr	1.66E+02	AP-42	NA	15,270.9	11,076
Backup Stripper Steam - Natural Gas	8.0%	700.8	Natural Gas[D]	81.6%	571.9		100.0%	571.9	25.3	mmBtu/hr	1.17E+02	AP-42	NA	2,958.3	846
Backup Stripper Steam - No. 6 Oil	8.0%	700.8	No. 6 Oil[D]	18.4%	128.9		100.0%	128.9	24.1	mmBtu/hr	1.66E+02	AP-42	NA	3,993.0	257
CO2 PROJECTED ACTUAL EMISSIONS															**48,629**
NET EMISSIONS CHANGE (PAE - BAE)															
PAE - BAE															**34,725**

A - Current (future backup) condensate steam stripper resumed operation on May 3, 2021.

B - Additional process steam to operate condensate stream stripper from fossil fuel combustion. Average fossil fuel distribution in Combination Boilers No. 1 and No. 2 during baseline.

C - reserved.

D - Historically high fuel oil percentage of fossil fuel heat input (2014).

E - Actual steam usage January 1 - December 16, 2022.

F - Projected steam usage at 850 gpm from vendor design.

G - reserved.

H - reserved.

I - Natural gas ignitor required when recovery furnace is less than 50% load on black liquor.

SUMMARY OF ASB EMISSIONS FACTORS

Scenario	ASB Emissions Factors (lb/ODTP)						
	H_2S	DMDS	DMS	MMC	Methanol	VOC[A]	TRS[B]
Baseline Actual Emissions	0.0151	0.0114	0.0185	3.28E-04	0.92	0.97	0.0453
New Stripper Scenario	0.0103	0.0028	0.0136	1.88E-04	0.30	0.32	0.0269
Backup Stripper Scenario	0.0109	0.0033	0.0147	1.30E-03	1.53	1.58	0.0302
No Stripper Scenario	0.0106	0.0504	0.0192	7.42E-04	2.31	2.44	0.0809

A - Includes VOC TRS compounds, methanol, acetaldehyde, methyl ethyl ketone, and propionaldehyde.

B - TRS as compounds

Stripper Inlet Foul Condensate - Table 2-17 (Weston report dated October 2, 2021, Work Order No. 15730.001.008)

		Concentration (ppm)				
Date	Sample Time	Hydrogen Sulfide	Methyl Mercaptan	Dimethyl Sulfide	Dimethyl Disulfide	Total TRS
6/24/2021	15:10	130	14	16	13	173
6/24/2021	15:10	140	14	16	17	187
6/24/2021	17:00	140	17	18	14	189
6/24/2021	18:45	150	19	18	16	203
6/25/2021	10:35	130	12	12	11	165
6/25/2021	12:05	120	10	12	9.6	151.6
6/25/2021	13:45	190	22	22	23	257
Average of all data		142.9	15.4	16.3	14.8	189.4
Max of 6/24 or 6/25		146.7	16.0	17.0	15.0	194.7

		MW	
H2S	Hydrogen Sulfide	34.08	g/mol
Ch4S	Methyl Mercaptan	48.11	g/mol
C2H6S	Dimethyl Sulfide	62.13	g/mol
C2H6S2	Dimethyl Disulfide	94.20	g/mol
S	Sulfur	32.07	g/mol

Convert compound to equivalent S (ppm)

Hydrogen Sulfide	Methyl Mercaptan	Dimethyl Sulfide	Dimethyl Disulfide
138.0	10.7	8.8	10.2
82.3%	6.4%	5.2%	6.1%

S (ppm)	168
Lb S/gallon FC	1.40E-03
Lb S/hr @850 gpm	71.3
Lb S/ADTP (@2200 ODTP)[a]	0.70

Maximum feed to stripper (AHL)

[a] Conservative Lb S/ADTP emissions factor using 2200 ODTP (2200 ODTP * ADTP/0.9 ODTP = 2444.4 ADTP) Emissions factor is representative of the lower end of the range of pulp production at the maximum steam stripper design of 850 gpm. Calculations are scaled to 2700 ADTP to represent worst case emissions.

Assumption
1. Assume no losses in feed tank
2. Assume 98% efficiency of S across stripper therefore 0.69 # S/ADTP in SOG

CONFIDENTIAL TAB M - New-Indy Catawba Monthly Production

Month	Kraft Mill ADTP	Combination Boiler No. 1 Natural Gas mmBtu	Combination Boiler No. 2 Natural Gas mmBtu	Total Natural Gas mmBtu	Combination Boiler No. 1 No. 6 Fuel Oil gallons	Combination Boiler No. 2 No. 6 Fuel Oil gallons	Total No. 6 Fuel Oil gallons	Total No. 6 Fuel Oil mmBtu		
Mar-21	42,474	61,175	99,507	160,683	0	2,057	2,057	309	1,370	
Apr-21	43,075	41,363	75,012	116,376	0	0	0	0	1,436	
May-21	46,962	38,834	63,467	102,301	0	0	0	0	1,515	
Jun-21	42,867	1,909	59,909	61,818	0	1,199	1,199	180	1,429	
Jul-21	49,371	67,565	55,824	123,389	3	97	100	15	1,593	
Aug-21	44,614	33,863	32,461	66,325	0	0	0	0	1,439	
Sep-21	40,177	40,779	41,811	82,590	86	0	86	13	1,339	
Oct-21	47,234	69,732	75,498	145,230	0	0	0	0	1,524	
Nov-21	39,185	60,664	80,397	141,061	0	0	0	0	1,306	
Dec-21	38,734	62,931	60,176	123,107	0	0	0	0	1,249	
Jan-22	43,690	84,088	82,251	166,339	69,200	66,720	135,920	20,388	1,409	
Feb-22	37,736	57,764	75,924	133,688	27,042	370	27,412	4,112	1,348	
Mar-22	43,944	62,423	82,083	144,506	335	0	335	50	1,418	
Apr-22	40,046	44,634	62,835	107,469	0	0	0	0	1,335	
May-22	38,896	39,982	73,918	113,900	0	0	0	0	1,255	
Jun-22	23,184	43,071	89,239	132,310	2,238	0	2,238	336	773	
Jul-22	39,890	64,532	86,134	150,666	0	0	0	0	1,287	
Aug-22	53,396	48,067	73,591	121,658	0	0	0	0	1,722	
Sep-22	45,044	60,782	65,899	126,681	24	0	24	4	1,501	
Oct-22	47,517	70,539	89,760	160,299	0	0	0	0	1,533	
Nov-22	40,133	82,534	114,164	196,698	0	0	0	0	1,338	
Dec-22	33,859	101,466	95,023	196,490	170,076	0	170,076	25,511	1,092	
Jan-23	35,464	95,982	92,733	188,715	102,558	0	102,558	15,384	1,144	1,041,075
Feb-23	39,276	78,431	96,813	175,244	21,626	53	21,679	3,252	1,403	520,537
Total	996,766			3,237,544				69,553		
Annual Average	498,383									
				97.9%				2.1%		

WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION
PEROXIDE ADDITION

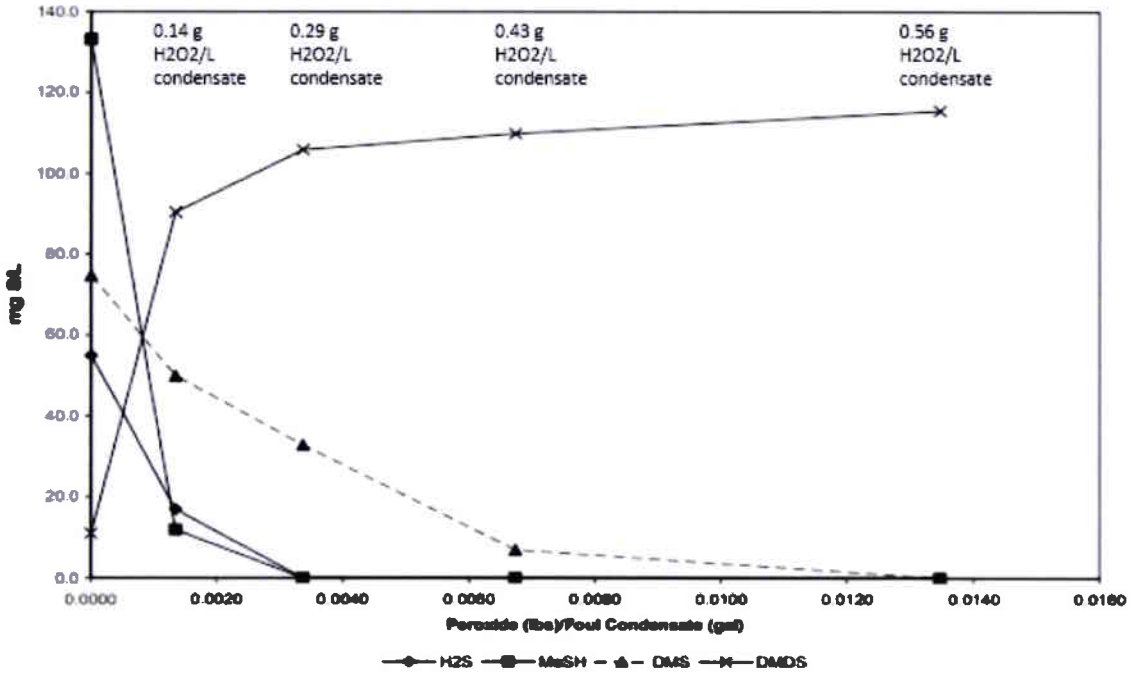
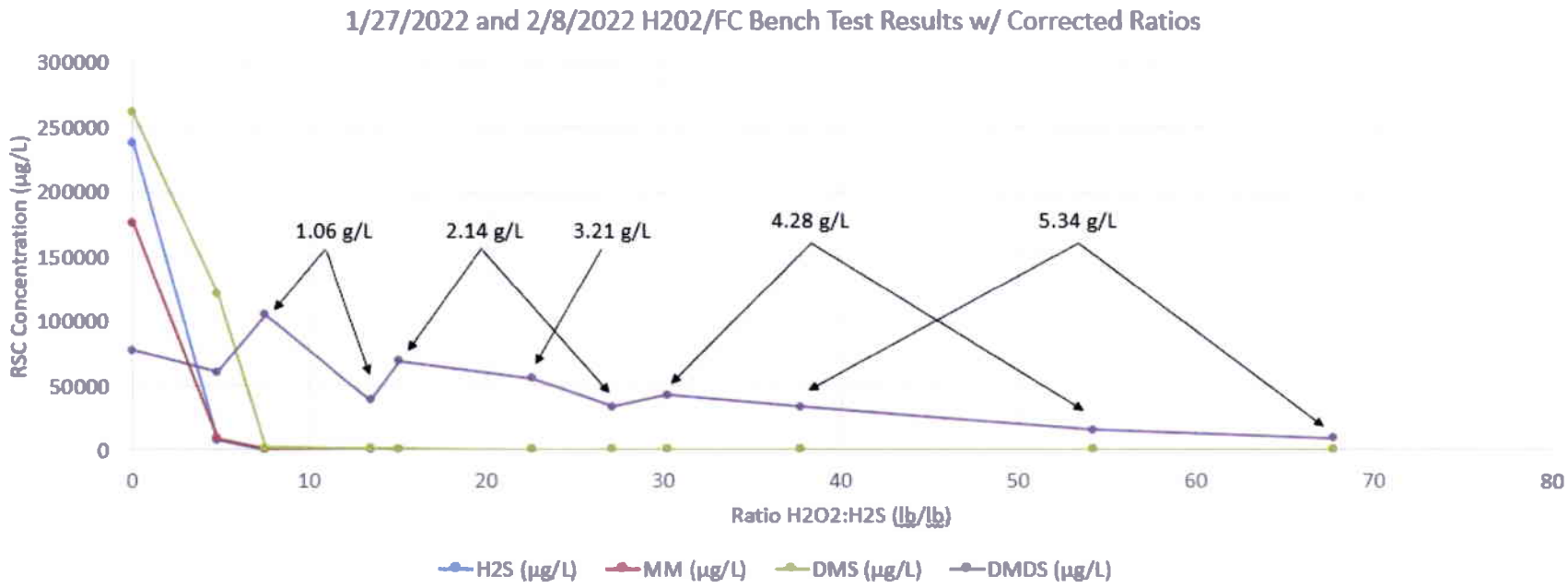


Figure 5.6 Hydrogen Peroxide Dose-Response Curve for Treatment of Foul Condensates

Source: TB949 H2O2 Mill Bench Scale Study


1/27/2022 and 2/8/2022 H202/FC Bench Test Results w/ Corrected Ratios
RSC Concentration (µg/L)
300000
250000
200000
150000
100000
50000
0
1.06 g/L
2.14 g/L
3.21 g/L
4.28 g/L
5.34 g/L
0
10
20
30
40
50
60
70
80
Ratio H2O2:H2S (lb/lb)
H2S (µg/L)
MM (µg/L)
DMS (µg/L)
DMDS (µg/L)

ncasi

NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT

SUMMARY OF INDUSTRY EXPERIENCE WITH ODOR MINIMIZATION AT WASTEWATER TREATMENT PLANTS

TECHNICAL BULLETIN NO. 949

MAY 2008

by
Diana Cook
NCASI West Coast Regional Center
Corvallis, Oregon

5.3 Oxidation

Several oxidizing agents have been used for destruction of odors resulting from H_2S. The approach is to oxidize the sulfide into nonvolatile forms such as elemental sulfur, thiosulfate, sulfite, and sulfate. Chemical oxidation reactions are generally slower than biochemical oxidation reactions (ASCE 1989). In the presence of large organic loads, as with industrial wastewaters, the economics of oxidizing agent use can be prohibitive due to competitive reactions with organic materials. Some of the commonly used oxidizing agents are chlorine, chlorine dioxide, hypochlorite, oxygen, and hydrogen peroxide. Industry experience with use of oxidizing agents is summarized herein.

5.3.1 *Hydrogen Peroxide*

Hydrogen peroxide (H_2O_2) can be used to chemically oxidize H_2S into either elemental sulfur or sulfate (the former at pH <8 to 9; the latter at pH >8 to 9), as shown in Equations 5.6 and 5.7. In the range of pH 7 to 9, both reactions may occur. Excess H_2O_2 can oxidize other wastewater components or decompose to release oxygen and water.

$$H_2O_2 + H_2S \rightarrow S + 2H_2O \quad \text{(Eq. 5.6)}$$

$$4H_2O_2 + S^{2-} \rightarrow SO_4^{2-} + 4H_2O \quad \text{(Eq. 5.7)}$$

H_2O_2 is a clear, colorless, nonflammable compound that is miscible with water in all proportions and is normally sold as a solution expressed as a percentage of the solution's weight (e.g., a 35% solution contains 35% H_2O_2 and 65% water by weight). Solutions of >8% are classified as oxidizers by the U.S. Department of Transportation. H_2O_2 can be obtained in small drums or tanks equipped with metering pumps and plumbed to the addition point. Storage containers must be properly vented because contamination or excess heat can accelerate decomposition to oxygen and water. Special safety handling is required, including eye protection and protective clothing.

Davies, Christy, and O'Connor (2000) reported on the effectiveness of using H_2O_2 to control odors resulting from release of H_2S at four locations around the WWTP at a pulp and paper mill in Canada. The specific objectives were to reduce H_2S concentration in an anaerobic spill basin effluent returned to the effluent clarification and treatment system; treat anaerobic sludge from the spill basin; minimize odors arising from sewering condensates; and treat all foul condensates from the mill during a scheduled shutdown of the steam stripper.

H_2O_2 was found to be effective for odor reduction at all the locations. It was added to the anaerobic spill basin effluent at a location that promoted good mixing prior to introduction into the clarifier. The residence time associated with transfer of effluent from the spill basin to the clarifier was sufficient to oxidize H_2S and minimize odor. Sludge dewatering equipment consisted of a screen, an agitation tank, a centrifuge, and a belt press. H_2O_2 was added to the agitation tank. In addition, an odor-controlling spray (Ecosorb) was applied to the air around the screens to capture any residual odors. H_2O_2 was also used to reduce odors during occasional sewering of condensates. Dosage levels were selected based on laboratory studies that indicated that ~200 mg H_2O_2/L of treated condensate was sufficient to remove odors. A solution containing 50% H_2O_2 was also used to reduce odors during steam stripper downtime events when foul condensates were piped directly into the aeration pond.

H_2O_2 and calcium peroxide (CaO_2) have been used in the presence of peroxidase, an enzyme found in horseradish, to remove odors in swine manure. Swine manure is known to contain large amounts of VFAs, phenolic compounds, and indolic compounds that have been implicated in odor. Peroxidase, in the presence of peroxides, has been found to polymerize phenolic odorants, thereby reducing associated odors (Govere et al. 2007).

H_2O_2 has also been used successfully as one element of a multi-pronged approach to control odor attributed to VFA generation in anaerobic environments (Davis and Smith 2001). H_2O_2 would be particularly beneficial for use in mills with high levels of water reuse (e.g., some recycle mills). Oxygen-limited environments in the process water transport system at those facilities can be ideal for anaerobic bacterial growth. Traditional oxidizers such as sodium hypochlorite, chlorine, and chlorine dioxide increase total chloride and conductivity in the reused effluent, which can disrupt process performance and cause corrosion. The multi-pronged approach used at a 100% recycled corrugating medium mill focused on good operating practices aimed at oxygenation, biocide application to control the amount of aerobic bacteria, and H_2O_2 use to prevent anaerobic environments in the secondary treatment system (Davis and Smith 2001).

NCASI assisted a bleached kraft mill that conducted a trial to investigate the effects of adding H_2O_2 to foul condensates. Foul condensates were piped directly to the first basin of a multi-stage ASB. Samples were collected at two locations (just prior to addition of peroxide and just following the addition point) over a five-day period to assess impacts on sulfide concentrations. Samples were analyzed using direct injection GC/PFPD (NCASI Method RSC-02.02; NCASI 2007). H_2O_2 was added as a 50% solution at a rate of 1.78 gallons per minute (GPM) to the foul condensate stream, which had a flow rate of 3 MGD, resulting in a concentration of approximately 0.51 g H_2O_2/L of foul condensate. The average reduction in sulfide concentration was over 79%, as illustrated in Figure 5.3.

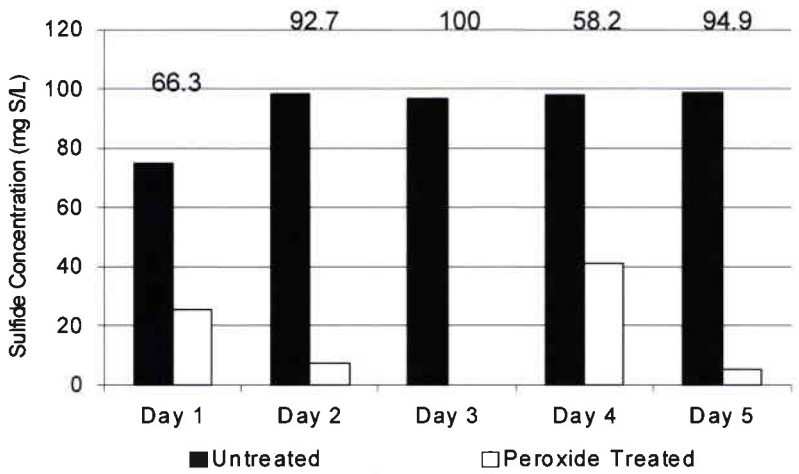


Figure 5.3 Sulfide Concentrations after Peroxide Addition (0.51 g/L) to a Foul Condensate [numbers above bars represent percent reductions in total sulfide observed each day]

Dosage and retention time trends were evaluated using a screening technique that involved collecting 25-mL samples in a 500-mL bottle that was closed and agitated for one minute. The cap was removed and a Jerome air monitor was used to measure volatile H_2S in the headspace. The effect of peroxide dose and retention time are illustrated in Figure 5.4. Reductions of >90% were observed after the first minute, and at some dosage rates they increased modestly with additional retention time. Figure 5.5 illustrates trends for doses of 0.5 and 1.0 GPM of a 50% H_2O_2 solution to the 3 MGD foul condensate at the four sampling locations (drop legs 1 through 4). Although some variability was observed, a significant reduction in sulfide was observed at the first drop leg under both addition rates investigated and increased gradually as the foul condensate progressed through the drop legs.

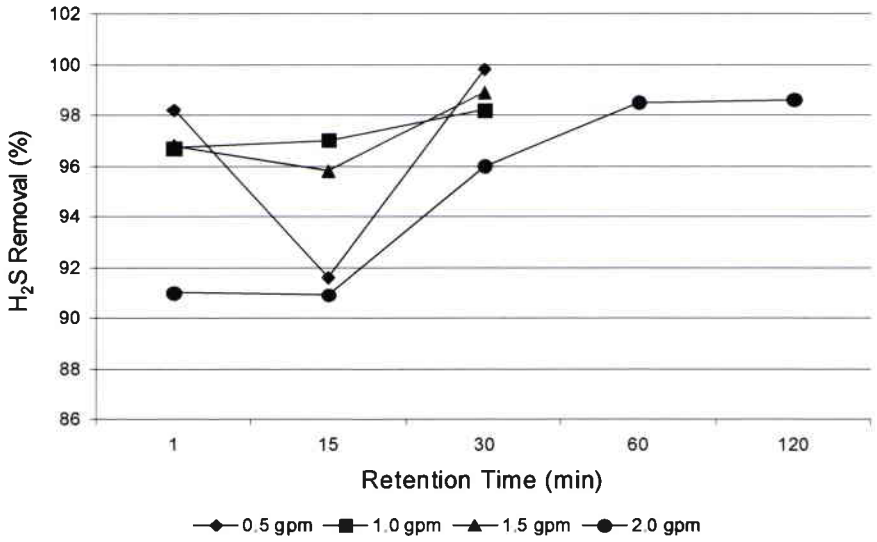


Figure 5.4 Effect of Hydrogen Peroxide Dose (0.14, 0.29, 0.43, and 0.56 g/L) and Retention Time on Sulfide Removal Efficiency [headspace measurements]

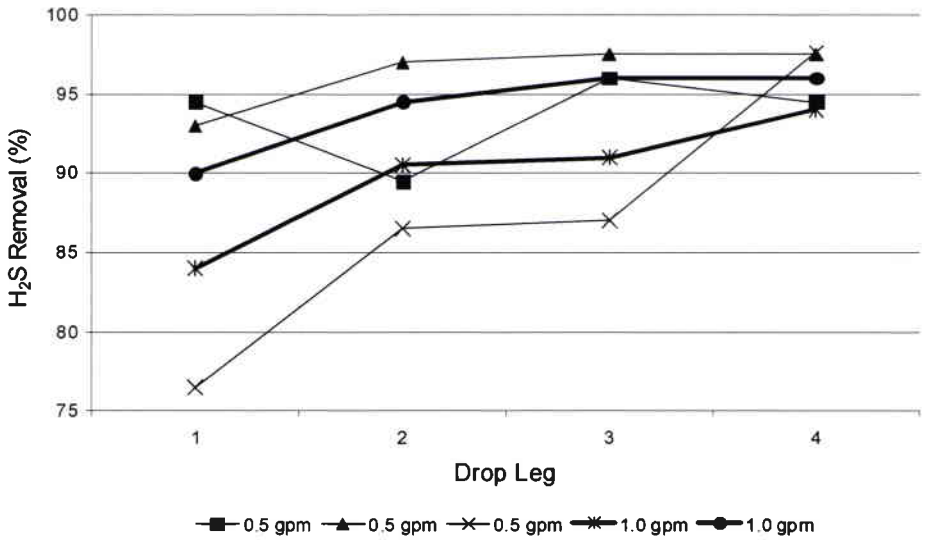


Figure 5.5 Effect of Hydrogen Peroxide Dose (0.14, 0.29, 0.43, and 0.56 g/L) and Sample Location on Sulfide Removal Efficiency [headspace measurements]

Another example of H_2O_2 use at a bleached kraft mill is illustrated in Figure 5.6. The mill conducted a bench study prior to an odor reduction trial to determine the dose-response curve for peroxide addition to foul condensates. Foul condensates were treated with the oxidant (50% H_2O_2; density 1.2 g/mL) volumes shown in the figure (equivalent to 0.14, 0.29, 0.43, and 0.56 g H_2O_2/L of foul condensate) at 50°C for 30 minutes in sealed vials. Samples were removed and analyzed by direct aqueous injection GC/sulfur chemiluminescence detectors (SCD) for sulfide, MeSH, DMS, and

DMDS. The data indicate that sulfide and MeSH were readily removed, but that DMS required significantly higher doses to achieve equivalent levels of removal. DMDS was not removed and in fact increased with peroxide dose, presumably due to oxidation of MeSH.

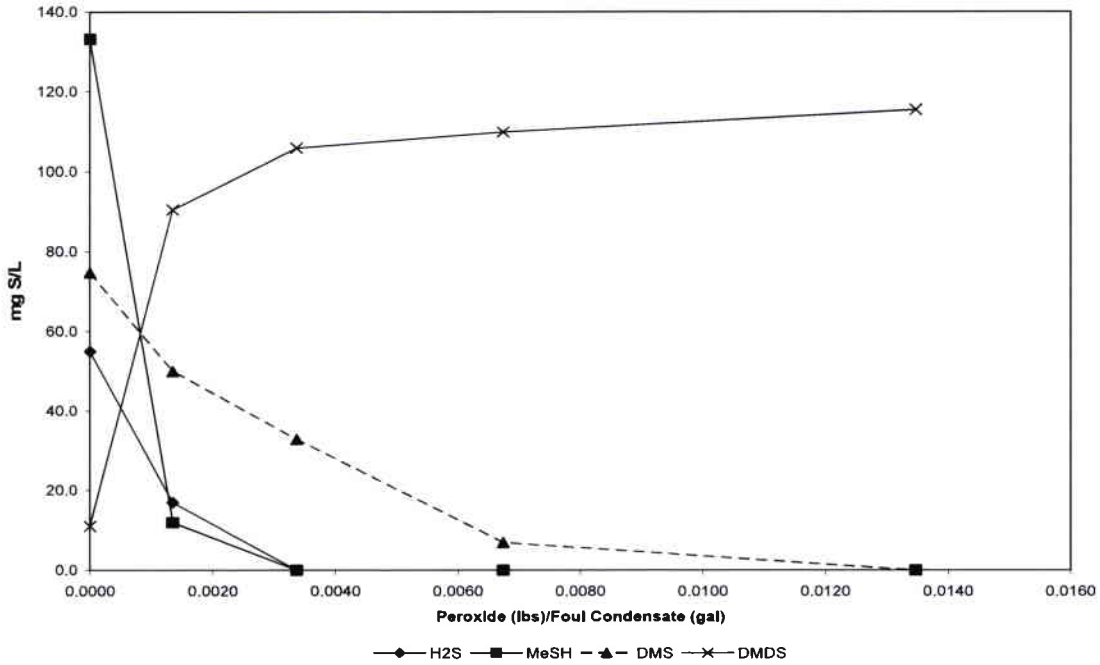


Figure 5.6 Hydrogen Peroxide Dose-Response Curve for Treatment of Foul Condensates

Following the bench studies, a mill trial was conducted over a five day period. H_2O_2 was added to the foul condensate tank (pH 9.0 to 9.3) at a rate of 1 gallon (100% H_2O_2) to every 500 gallons of condensate, which is equivalent to 2.8 g H_2O_2/L of foul condensate. This addition point provided a retention time of ~30 minutes prior to the WWTP. The trial resulted in overall average reductions in sulfide, MeSH, and DMS of 38.8, 64.6, and -3.9%, respectively (Table 5.1). The level of DMDS increased (probably due to oxidation of MeSH to DMDS) during the addition but reportedly did not affect overall odor from the WWTP (NCASI files). The mill continues to feed H_2O_2 to the foul condensate and has reported a reduction in odor at the WWTP.

Table 5.1 Percent Reduction in Hydrogen Sulfide, Methyl Mercaptan, and Dimethyl Sulfide during a Peroxide Addition Trial Conducted in a Foul Condensate

Day of Study	H_2S	MeSH	DMS
1	26.1	67.3	-20.8
2	68.3	74.7	16.5
3	38.1	57.0	1.9
4	36.4	60.0	2.6
5	25.3	63.8	-19.5
Average	38.8	64.6	-3.86

WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION
BASELINE ACTUAL EMISSIONS

May/July 2022 Baseline Emissions Calculations
H_2S, TRS Compounds, and VOC
New-Indy Catawba - Catawba, SC

		Method: GC/SCD Reduced Sulfur Analysis (Average)			
Sample Date	**Sample Location**	**ALS H2S, ppb**	**ALS DMDS, ppb**	**ALS DMS, ppb**	**ALS MMC, ppb**
2021/2022	Avg. ASB Influent (2021 and 2022)	252	86.78	199	2.60
5/17/2022	Foul Condensate (prior to H_2O_2)	105,667	6,633	14,667	8,267
	Predicted % Reduction from H_2O_2	0.99	MMC converted into DMDS	0.90	0.99
	Foul Condensate (after H_2O_2)	1,057	14,647	1,467	82.67
7/19/2022	Foul Condensate (prior to H_2O_2)	58,333	5,633	5,400	3,900
	Predicted % Reduction from H_2O_2	0.99	MMC converted into DMDS	0.90	0.99
	Foul Condensate (after H_2O_2)	583	9,414	540	39.00
7/20/2022	Foul Condensate (prior to H_2O_2)	76,200	6,932	7,140	7,393
	Predicted % Reduction from H_2O_2	0.99	MMC converted into DMDS	0.90	0.99
	Foul Condensate (after H_2O_2)	762	14,099	714	73.93
7/21/2022	Foul Condensate (prior to H_2O_2)	62,500	8,967	9,200	6,533
	Predicted % Reduction from H_2O_2	0.99	MMC converted into DMDS	0.90	0.99
	Foul Condensate (after H_2O_2)	625	15,300	920	65.33
		ALS H2S, ppm	**ALS DMDS, ppm**	**ALS DMS, ppm**	**ALS MMC, ppm**
Flow Weight Average Loading Calculation	Avg. Foul Condensate Concentration (after peroxide)	0.76	13.36	0.91	0.07
	Avg. ASB Inlet Concentration	0.25	0.09	0.20	2.60E-03
	Avg. Hardpipe Flow, MGD	0.34	[illegible]	[illegible]	[illegible]
	Avg. ASB Inlet Flow, MGD	23.96	[illegible]	[illegible]	[illegible]
	Total Flow	24.30	[illegible]	[illegible]	[illegible]
	Flow Weight. Avg. Loading (ppm)	**0.2593**	**0.2712**	**0.2088**	**0.0035**
Results and Emissions Factors Calculation	**H2SSIM/WATER9 Results**	**H2S, g/s**	**DMDS, g/s**	**DMS, g/s**	**MMC, g/s**
	ASB Zone 1	Multiple H2SSIM runs.	0.10	0.15	2.74E-03
	ASB Zone 2		1.43E-03	3.05E-03	4.63E-05
	ASB Zone 3		2.57E-05	1.01E-04	1.43E-06
	Total ASB		**0.10**	**0.16**	**2.78E-03**
	Baseline Emissions Factor 2200 ODTP/day	**H2S, lb/ODTP**	**DMDS, lb/ODTP**	**DMS, lb/ODTP**	**MMC, lb/ODTP**
	Baseline Emissions Factor	**1.51E-02**	**1.14E-02**	**1.85E-02**	**3.28E-04**

```
Type of unit is
1 Total water added at the unit (l/s)      50     0
2 Area of openings at unit (cm2)                  50
3 Radius of drop pipe (cm)                        5
4 Drop length to conduit (cm)                     61
5 Humidity of inlet air (%)                       40
6 Temperature of air (C)                          25
7 Drain air velocity (ft/min)                     84
8 manhole air velocity (ft/min)                   128
9 Conduit air velocity (ft/min)                   66
10 Wind speed (cm/s at 10 m)                      447
11 distance to next unit (cm)                     500
12 slope of underflow conduit                     .015
13 friction factor liquid                         .016
14 friction factor gas                            .006
15 radius of underflow conduit (cm)               12
16 Underflow T (C)                                25
17 oscillation cycle time (min)                   5
18 design collection velocities  (ft/s)           2
19 design branch line fraction full               .4

Type of unit is
8 HL partition flag=1, adjust for sorption        0
9 unit recycle convergence number                 200
10 oil molecular weight                           0
11 oil density  (g/cc)                            0
12 NaUT 1=municipal 2=industrial  3=turb.         0
13 NaUT 1=mass tr. 2=equil                        0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:17:08
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                      11    ASB Zone 1
2 Wastewater temperature   (C)                    34.08
3 length of aeration unit (m)                     295
4 width of aeration unit (m)                      295
5 depth of aeration unit (m)                      1.4
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           31
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.04

Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)
```

```
   hl= 0.001714 atm-m3/mol      vp= 45.945 mmHg (0.88868 psia)
       95.2 y/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.041e-05 cm2/s  dv= 0.088022 cm2/s
Compound flow rate from inlet water is 0.26179 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 31.792 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s.  Model: 2
kg is estimated as 0.005598 m/s.  Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.11564 m/s.
kl (agitated)is estimated as 0.017486 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1907.493 min. (31.792 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.11781
   KL aerated (m/s)                          0.017486
   KL OVERALL AERATED (m/s)                  0.005609
   KG quiescent (m/s)                        0.005703
   KL quiescent (m/s)                        5.971e-06
   KL OVERALL QUIESCENT (m/s)                5.883e-06
   KL OVERALL (m/s)                          2.753e-04
   air stripping time constant (min)         84.752
   FRACTION SURFACE VOLATILIZED              0.36432
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.36432
   FRACTION BIOLOGICALLY REMOVED             0.61949
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.095374
                    (Mg/year)                3.00772
   EMISSION FACTOR  (g/cm2-s)                1.096e-10
   UNIT EXIT CONCENTRATION (ppmw)            0.003981
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:17:08
COMPOUND: DIMETHYL DISULFIDE

Type of unit is system exit stream
1 Description of unit                      12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)                0.
```

```
                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                1.096e-10
   UNIT EXIT CONCENTRATION (ppmw)            6.079e-06
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:17:08
COMPOUND: DIMETHYL DISULFIDE

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1064.53 l/s.
   Weight fraction down is  2.712E-07
   Gas concentration in  0 mol fraction.
   Gas flow  1064.53 L/s
   Weight fraction out at base of drop is  2.45916666343852E-07
   fraction transferred in the drain drop from hub is .093228
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.093228
   fraction loss in unit                    0.
   fraction loss in line run                0.
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             3.134e-19
   mol fract. headspace vent base           6.978e-06
   headspace flow out vent (cc/s)           -1.065e+06
   headspace flow down line (cc/s)          1.065e+06
   KG surface (m/s)                         1860.422
   KL surface (m/s)                         6.37e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.2887
   total component into unit, g/s           0.26179
   TOTAL AIR EMISSIONS  (g/s)               0.026915
                    (Mg/year)               0.84879
   EMISSION FACTOR  (g/cm2-s)               1.096e-10
   UNIT EXIT CONCENTRATION (ppmw)           0.24592
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:17:08
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
```

```
2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
   hl= 0.00141 atm-m3/mol      vp= 37.814 mmHg (0.7314 psia)
       78.352 y/x
       0.056726 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.027e-05 cm2/s  dv= 0.085991 cm2/s
Compound flow rate from inlet water is 1.411e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.785 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 5.918e-06 m/s.
kg is estimated as 0.005575 m/s.  Model: 2
kg is estimated as 0.005575 m/s.  Model: 2
The Schmidt number is 1.74436.
The friction velocity is 37.398 m/s
kg is estimated as 0.012742 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.1143 m/s.
kl (agitated)is estimated as 0.015772 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 5.972e-05 m/s.
 The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1007.112 min. (16.785 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.11644
   KL aerated (m/s)                          0.015772
   KL OVERALL AERATED (m/s)                  0.004711
   KG quiescent (m/s)                        0.005679
   KL quiescent (m/s)                        5.918e-06
   KL OVERALL QUIESCENT (m/s)                5.813e-06
   KL OVERALL (m/s)                          5.972e-05
   air stripping time constant (min)         253.944
```

```
   FRACTION SURFACE VOLATILIZED              0.18189
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.18189
   FRACTION BIOLOGICALLY REMOVED             0.77225
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                2.567e-05
                        (Mg/year)            8.094e-04
   EMISSION FACTOR  (g/cm2-s)                3.631e-14
   UNIT EXIT CONCENTRATION (ppmw)            6.079e-06
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:17:08
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                       18    ASB Zone 2
2 Wastewater temperature   (C)                    32.08
3 length of aeration unit (m)                     368
4 width of aeration unit (m)                      184
5 depth of aeration unit (m)                      0.97
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           15
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.24

Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F)
   hl= 0.001558 atm-m3/mol      vp= 41.785 mmHg (0.80821 psia)
       86.579 y/x
       0.062258 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.034e-05 cm2/s  dv= 0.087022 cm2/s
Compound flow rate from inlet water is 0.004238 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 17.139 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 5.945e-06 m/s.
kg is estimated as 0.005633 m/s.  Model: 2
kg is estimated as 0.005633 m/s.  Model: 2
The Schmidt number is 1.72371.
The friction velocity is 37.398 m/s
kg is estimated as 0.012836 m/s.  Model: 3
_______Agitated surface_____________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

kg (agitated)is estimated as 0.11498 m/s.
kl (agitated)is estimated as 0.016622 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 1.598e-04 m/s.
The effective stripping time (surface + diffused air) is 101.198 minutes. (1.68663 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1028.32 min. (17.139 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.11714
KL aerated (m/s)	0.016622
KL OVERALL AERATED (m/s)	0.005152
KG quiescent (m/s)	0.005738
KL quiescent (m/s)	5.945e-06
KL OVERALL QUIESCENT (m/s)	5.85e-06
KL OVERALL (m/s)	1.598e-04
air stripping time constant (min)	101.198
FRACTION SURFACE VOLATILIZED	0.33837
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.33837
FRACTION BIOLOGICALLY REMOVED	0.62833
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.001434
(Mg/year)	0.045218
EMISSION FACTOR (g/cm2-s)	2.118e-12
UNIT EXIT CONCENTRATION (ppmw)	1.326e-04

Type of unit is
1 Total water added at the unit (l/s) 50 0
2 Area of openings at unit (cm2) 50
3 Radius of drop pipe (cm) 5
4 Drop length to conduit (cm) 61
5 Humidity of inlet air (%) 40
6 Temperature of air (C) 25
7 Drain air velocity (ft/min) 84
8 manhole air velocity (ft/min) 128
9 Conduit air velocity (ft/min) 66
10 Wind speed (cm/s at 10 m) 447
11 distance to next unit (cm) 500
12 slope of underflow conduit .015
13 friction factor liquid .016
14 friction factor gas .006
15 radius of underflow conduit (cm) 12
16 Underflow T (C) 25
17 oscillation cycle time (min) 5
18 design collection velocities (ft/s) 2
19 design branch line fraction full .4

Type of unit is
8 HL partition flag=1, adjust for sorption 0
9 unit recycle convergence number 200
10 oil molecular weight 0
11 oil density (g/cc) 0
12 NaUT 1=municipal 2=industrial 3=turb. 0
13 NaUT 1=mass tr. 2=equil 0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:13
COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment
1 Description of unit 11 ASB Zone 1
2 Wastewater temperature (C) 34.08
3 length of aeration unit (m) 295
4 width of aeration unit (m) 295
5 depth of aeration unit (m) 1.4
6 Area of agitation (each aerator,m2) 135
7 Total number of agitators in the unit 31
8 Power of agitation (each aerator,HP) 75
9 Impeller diameter (cm) 49.53
10 Impeller rotation (RPM) 1200
11 Agitator mechanical efficiency 0.83
12 aerator effectiveness, alpha 0.83
13 if there is plug flow, enter 1 0
14 Overall biorate (mg/g bio-hr) 19
15 Aeration air flow (m3/s) 0
16 active biomass, aeration (g/l) 0.3
17 If covered, then enter 1 0
18 special input 0
19 pH (enter 0 for no pH adjustment) 7.04

Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

```
   hl= 0.002924 atm-m3/mol      vp= 704.653 mmHg (13.629 psia)
       162.463 y/x
       0.11606 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.504e-05 cm2/s  dv= 0.14765 cm2/s
Compound flow rate from inlet water is 0.19189 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 31.792 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
________Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 7.634e-06 m/s.
kg is estimated as 0.007917 m/s.  Model: 2
kg is estimated as 0.007917 m/s.  Model: 2
The Schmidt number is 1.01591.
The friction velocity is 37.398 m/s
kg is estimated as 0.017873 m/s.  Model: 3
________Agitated surface___________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14978 m/s.
kl (agitated)is estimated as 0.021024 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 4.77e-04 m/s.
 The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1907.493 min. (31.792 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.15258
   KL aerated (m/s)                          0.021024
   KL OVERALL AERATED (m/s)                  0.009769
   KG quiescent (m/s)                        0.008066
   KL quiescent (m/s)                        7.634e-06
   KL OVERALL QUIESCENT (m/s)                7.574e-06
   KL OVERALL (m/s)                          4.77e-04
   air stripping time constant (min)         48.915
   FRACTION SURFACE VOLATILIZED              0.80226
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.80226
   FRACTION BIOLOGICALLY REMOVED             0.17717
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.15394
                    (Mg/year)                4.85471
   EMISSION FACTOR  (g/cm2-s)                1.769e-10
   UNIT EXIT CONCENTRATION (ppmw)            0.003708
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:18:13
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is system exit stream
1 Description of unit                    12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)              0.
```

```
                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                1.769e-10
   UNIT EXIT CONCENTRATION (ppmw)            1.362e-05
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:18:13
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1064.53 l/s.
   Weight fraction down is  2.088E-07
   Gas concentration in  0 mol fraction.
   Gas flow  1064.53 L/s
   Weight fraction out at base of drop is  1.80253671574623E-07
   fraction transferred in the drain drop from hub is .136716
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.13672
   fraction loss in unit                    0.
   fraction loss in line run                0.
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             4.509e-19
   mol fract. headspace vent base           1.195e-05
   headspace flow out vent (cc/s)           -1.065e+06
   headspace flow down line (cc/s)          1.065e+06
   KG surface (m/s)                         2626.947
   KL surface (m/s)                         8.245e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.22227
   total component into unit, g/s           0.19189
   TOTAL AIR EMISSIONS  (g/s)               0.030388
                    (Mg/year)               0.95833
   EMISSION FACTOR  (g/cm2-s)               1.769e-10
   UNIT EXIT CONCENTRATION (ppmw)           0.18025
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:18:13
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
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2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of DIMETHYL SULFIDE  (DMS) at 30. deg.C (86. deg.F)
   hl= 0.002519 atm-m3/mol      vp= 606.985 mmHg (11.74 psia)
       139.945 y/x
       0.10132 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.485e-05 cm2/s  dv= 0.14425 cm2/s
Compound flow rate from inlet water is 1.708e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.785 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 7.566e-06 m/s.
kg is estimated as 0.007884 m/s.  Model: 2
kg is estimated as 0.007884 m/s.  Model: 2
The Schmidt number is 1.03989.
The friction velocity is 37.398 m/s
kg is estimated as 0.017611 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14804 m/s.
kl (agitated)is estimated as 0.018962 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.053e-04 m/s.
 The effective stripping time (surface + diffused air) is 144.073 minutes.
 (2.40122 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1007.112 min. (16.785 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.15081
   KL aerated (m/s)                          0.018962
   KL OVERALL AERATED (m/s)                  0.00854
   KG quiescent (m/s)                        0.008032
   KL quiescent (m/s)                        7.566e-06
   KL OVERALL QUIESCENT (m/s)                7.497e-06
   KL OVERALL (m/s)                          1.053e-04
   air stripping time constant (min)         144.073
```

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   FRACTION SURFACE VOLATILIZED              0.59355
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.59355
   FRACTION BIOLOGICALLY REMOVED             0.32154
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                1.014e-04
                        (Mg/year)            0.003197
   EMISSION FACTOR  (g/cm2-s)                1.434e-13
   UNIT EXIT CONCENTRATION (ppmw)            1.362e-05
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:18:13
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                       18    ASB Zone 2
2 Wastewater temperature   (C)                    32.08
3 length of aeration unit (m)                     368
4 width of aeration unit (m)                      184
5 depth of aeration unit (m)                      0.97
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           15
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.24

Properties of DIMETHYL SULFIDE  (DMS) at 32.1 deg.C (89.7 deg.F)
   hl= 0.002719 atm-m3/mol      vp= 655.201 mmHg (12.673 psia)
       151.062 y/x
       0.10863 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.495e-05 cm2/s  dv= 0.14597 cm2/s
Compound flow rate from inlet water is 0.003948 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 17.139 hr.
___Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface__Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 7.6e-06 m/s.
kg is estimated as 0.007966 m/s.  Model: 2
kg is estimated as 0.007966 m/s.  Model: 2
The Schmidt number is 1.02758.
The friction velocity is 37.398 m/s
kg is estimated as 0.017744 m/s.  Model: 3
_______Agitated surface_____________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

kg (agitated)is estimated as 0.14892 m/s.
kl (agitated)is estimated as 0.019984 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 2.809e-04 m/s.
The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1028.32 min. (17.139 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.15171
KL aerated (m/s)	0.019984
KL OVERALL AERATED (m/s)	0.009148
KG quiescent (m/s)	0.008115
KL quiescent (m/s)	7.6e-06
KL OVERALL QUIESCENT (m/s)	7.537e-06
KL OVERALL (m/s)	2.809e-04
air stripping time constant (min)	57.552
FRACTION SURFACE VOLATILIZED	0.77311
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.77311
FRACTION BIOLOGICALLY REMOVED	0.18362
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.003052
(Mg/year)	0.096247
EMISSION FACTOR (g/cm2-s)	4.507e-12
UNIT EXIT CONCENTRATION (ppmw)	1.605e-04

Type of unit is
1 Total water added at the unit (l/s) 50 0
2 Area of openings at unit (cm2) 50
3 Radius of drop pipe (cm) 5
4 Drop length to conduit (cm) 61
5 Humidity of inlet air (%) 40
6 Temperature of air (C) 25
7 Drain air velocity (ft/min) 84
8 manhole air velocity (ft/min) 128
9 Conduit air velocity (ft/min) 66
10 Wind speed (cm/s at 10 m) 447
11 distance to next unit (cm) 500
12 slope of underflow conduit .015
13 friction factor liquid .016
14 friction factor gas .006
15 radius of underflow conduit (cm) 12
16 Underflow T (C) 25
17 oscillation cycle time (min) 5
18 design collection velocities (ft/s) 2
19 design branch line fraction full .4

Type of unit is
8 HL partition flag=1, adjust for sorption 0
9 unit recycle convergence number 200
10 oil molecular weight 0
11 oil density (g/cc) 0
12 NaUT 1=municipal 2=industrial 3=turb. 0
13 NaUT 1=mass tr. 2=equil 0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM 19:18:53
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit 11 ASB Zone 1
2 Wastewater temperature (C) 34.08
3 length of aeration unit (m) 295
4 width of aeration unit (m) 295
5 depth of aeration unit (m) 1.4
6 Area of agitation (each aerator,m2) 135
7 Total number of agitators in the unit 31
8 Power of agitation (each aerator,HP) 75
9 Impeller diameter (cm) 49.53
10 Impeller rotation (RPM) 1200
11 Agitator mechanical efficiency 0.83
12 aerator effectiveness, alpha 0.83
13 if there is plug flow, enter 1 0
14 Overall biorate (mg/g bio-hr) 19
15 Aeration air flow (m3/s) 0
16 active biomass, aeration (g/l) 0.3
17 If covered, then enter 1 0
18 special input 0
19 pH (enter 0 for no pH adjustment) 7.04

Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

```
   hl= 0.004158 atm-m3/mol      vp= 2272.142 mmHg (43.948 psia)
       230.99 y/x
       0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.525e-05 cm2/s  dv= 0.23702 cm2/s
Compound flow rate from inlet water is 0.003078 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 31.792 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
kg is estimated as 0.010871 m/s.  Model: 2
kg is estimated as 0.010871 m/s.  Model: 2
The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
kg is estimated as 0.024173 m/s.  Model: 3
_______Agitated surface_________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18977 m/s.
kl (agitated)is estimated as 0.021167 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 6.265e-04 m/s.
 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1907.493 min. (31.792 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.19332
   KL aerated (m/s)                          0.021167
   KL OVERALL AERATED (m/s)                  0.012876
   KG quiescent (m/s)                        0.011075
   KL quiescent (m/s)                        7.703e-06
   KL OVERALL QUIESCENT (m/s)                7.672e-06
   KL OVERALL (m/s)                          6.265e-04
   air stripping time constant (min)         37.242
   FRACTION SURFACE VOLATILIZED              0.88891
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.88891
   FRACTION BIOLOGICALLY REMOVED             0.093739
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.002736
                     (Mg/year)               0.086272
   EMISSION FACTOR  (g/cm2-s)                3.144e-12
   UNIT EXIT CONCENTRATION (ppmw)            5.017e-05
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:18:53
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is system exit stream
1 Description of unit                      12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)               0.
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                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                3.144e-12
   UNIT EXIT CONCENTRATION (ppmw)            1.458e-07
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:18:53
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1064.53 l/s.
   Weight fraction down is  3.5E-09
   Gas concentration in  0 mol fraction.
   Gas flow  1064.53 L/s
   Weight fraction out at base of drop is  2.89099406807993E-09
   fraction transferred in the drain drop from hub is .174002
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.174
   fraction loss in unit                    0.
   fraction loss in line run                0.
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             9.429e-21
   mol fract. headspace vent base           3.292e-07
   headspace flow out vent (cc/s)           -1.065e+06
   headspace flow down line (cc/s)          1.065e+06
   KG surface (m/s)                         3602.086
   KL surface (m/s)                         8.324e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.003726
   total component into unit, g/s           0.003078
   TOTAL AIR EMISSIONS  (g/s)               6.483e-04
                    (Mg/year)               0.020445
   EMISSION FACTOR  (g/cm2-s)               3.144e-12
   UNIT EXIT CONCENTRATION (ppmw)           0.002891
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:18:53
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
```

```
2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
   hl= 0.003687 atm-m3/mol      vp= 2014.774 mmHg (38.97 psia)
       204.826 y/x
       0.14829 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.505e-05 cm2/s  dv= 0.23155 cm2/s
Compound flow rate from inlet water is 1.957e-06 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.785 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
________Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 7.635e-06 m/s.
kg is estimated as 0.010826 m/s.  Model: 2
kg is estimated as 0.010826 m/s.  Model: 2
The Schmidt number is 0.64779.
The friction velocity is 37.398 m/s
kg is estimated as 0.023814 m/s.  Model: 3
________Agitated surface___________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18756 m/s.
kl (agitated)is estimated as 0.019092 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.391e-04 m/s.
 The effective stripping time (surface + diffused air) is 109.038 minutes.
 (1.81731 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1007.112 min. (16.785 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.19108
   KL aerated (m/s)                          0.019092
   KL OVERALL AERATED (m/s)                  0.011483
   KG quiescent (m/s)                        0.011029
   KL quiescent (m/s)                        7.635e-06
   KL OVERALL QUIESCENT (m/s)                7.6e-06
   KL OVERALL (m/s)                          1.391e-04
   air stripping time constant (min)         109.038
```

```
   FRACTION SURFACE VOLATILIZED              0.7324
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.7324
   FRACTION BIOLOGICALLY REMOVED             0.1883
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                1.433e-06
                        (Mg/year)            4.52e-05
   EMISSION FACTOR  (g/cm2-s)                2.028e-15
   UNIT EXIT CONCENTRATION (ppmw)            1.458e-07
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\BAE\TRS\WATER9\ASB V5 3/14/2023 2:17:21 PM  19:18:53
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                      18    ASB Zone 2
2 Wastewater temperature   (C)                   32.08
3 length of aeration unit (m)                    368
4 width of aeration unit (m)                     184
5 depth of aeration unit (m)                     0.97
6 Area of agitation (each aerator,m2)            135
7 Total number of agitators in the unit          15
8 Power of agitation (each aerator,HP)           75
9 Impeller diameter (cm)                         49.53
10 Impeller rotation (RPM)                       1200
11 Agitator mechanical efficiency                0.83
12 aerator effectiveness, alpha                  0.83
13 if there is plug flow, enter 1                0
14 Overall biorate (mg/g bio-hr)                 19
15 Aeration air flow (m3/s)                      0
16 active biomass, aeration (g/l)                0.3
17 If covered, then enter 1                      0
18 special input                                 0
19 pH  (enter 0 for no pH adjustment)            7.24

Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F)
   hl= 0.003921 atm-m3/mol      vp= 2142.771 mmHg (41.446 psia)
       217.838 y/x
       0.15664 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.515e-05 cm2/s  dv= 0.23433 cm2/s
Compound flow rate from inlet water is 5.341e-05 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 17.139 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 7.67e-06 m/s.
kg is estimated as 0.010938 m/s.  Model: 2
kg is estimated as 0.010938 m/s.  Model: 2
The Schmidt number is 0.64013.
The friction velocity is 37.398 m/s
kg is estimated as 0.023996 m/s.  Model: 3
_______Agitated surface_____________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

kg (agitated)is estimated as 0.18868 m/s.
kl (agitated)is estimated as 0.020121 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 3.715e-04 m/s.
The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 1028.32 min. (17.139 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.19222
KL aerated (m/s)	0.020121
KL OVERALL AERATED (m/s)	0.012174
KG quiescent (m/s)	0.011143
KL quiescent (m/s)	7.67e-06
KL OVERALL QUIESCENT (m/s)	7.637e-06
KL OVERALL (m/s)	3.715e-04
air stripping time constant (min)	43.518
FRACTION SURFACE VOLATILIZED	0.86584
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.86584
FRACTION BIOLOGICALLY REMOVED	0.097514
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	4.625e-05
(Mg/year)	0.001458
EMISSION FACTOR (g/cm2-s)	6.83e-14
UNIT EXIT CONCENTRATION (ppmw)	1.838e-06

BAE H2S Factor
Summary of H2SSIM Inputs and Outputs

H2SSIM Inputs

Windspeed: 3.55 mph

H2SSIM Outputs

5/17/2022

	Zone 1	Zone 2	Zone 3
DO	1.57	4.63	4.66
Temp	87.52	83.91	80.19
pH	6.77	7.19	7.44
Length	968	1208	1235
Width	968	604	617
Aerators	31	15	6
Total HP	2325	1125	450

	Main Inlet	Hardpipe	Units
Flow	25.11	0.35	MGD
Total Sulfide	0.060	1.06	mg/L
Sulfate	390	390	mg/L

H2S g/s

Zone 1	Zone 2	Zone 3	Total ASB
0.07	0.02	0.02	**0.111** g/s
			1723 ODTP
			0.012 lb/ODTP

7/19/2022

	Zone 1	Zone 2	Zone 3
DO	1.57	4.63	4.66
Temp	96.27	93.37	89.26
pH	7.17	7.37	7.48
Length	968	1208	1235
Width	968	604	617
Aerators	31	15	6

	Main Inlet	Hardpipe	Units
Flow	25.32	0.42	MGD
Total Sulfide	0.921	0.583	mg/L
Sulfate	390	390	mg/L

H2S g/s

Zone 1	Zone 2	Zone 3	Total ASB
0.09	0.03	0.02	**0.144** g/s
			1900 ODTP
			0.014 lb/ODTP

7/20/2022

	Zone 1	Zone 2	Zone 3
DO	1.57	4.63	4.66
Temp	94.80	91.27	87.57
pH	7.10	7.22	7.39
Length	968	1208	1235
Width	968	604	617
Aerators	31	15	6

	Main Inlet	Hardpipe	Units
Flow	25.48	0.39	MGD
Total Sulfide	0.053	0.762	mg/L
Sulfate	390	390	mg/L

H2S g/s

Zone 1	Zone 2	Zone 3	Total ASB
0.06	0.03	0.02	**0.111** g/s
			1900 ODTP
			0.011 lb/ODTP
			0.01

7/21/2022

	Zone 1	Zone 2	Zone 3
DO	1.57	4.63	4.66
Temp	94.76	90.42	87.08
pH	7.10	7.19	7.35
Length	968	1208	1235
Width	968	604	617
Aerators	31	15	6

	Main Inlet	Hardpipe	Units
Flow	19.93	0.19	MGD
Total Sulfide	0.094	0.625	mg/L
Sulfate	390	390	mg/L

H2S g/s

Zone 1	Zone 2	Zone 3	Total ASB
0.06	0.03	0.02	**0.111** g/s
			940 ODTP
			0.022 lb/ODTP

*DO are based on average of all DO readings from 2021 and 2022 Subpart S performance testing.

AVG: **0.015** lb/ODTP

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

5/17/2022

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

Data Type 2. Model Zone Information

Number of Zones	3
Zone Location of Hardpipe	1
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	25.11	0.35	MGD
Total Sulfide	0.06	1.057	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph
Ambient Temperature	79	F

Data Type 5. Zone Physical and Chemical Conditions

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units
Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/L
Temperature	87.52	83.91	80.19		F
pH	6.77	7.19	7.44		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	968	1208	1235		feet
Width	968	604	617		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

5/17/2022

Basin Emissions		Units
Total Emissions (H_2S)	0.111	gms/s
Total Emissions (H_2S)	7726.8	lbs/yr
Total Emissions (H_2S)	3.9	tons/yr
Total Emissions (H_2S)	3.5	tonnes/yr
Emission Flux (H_2S)	15.5	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.07	0.02	0.02		gms/s
Zone Emissions (H_2S)	4978.9	1486.3	1261.7		lbs/yr
Emission Flux (H_2S)	25.9	9.9	8.1		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	34.400	6.200	5.200		lbs/yr

Percent Inlet Sulfide Removed	-35.4%

Current Parameters	
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/19/2022

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

Data Type 2. Model Zone Information

Number of Zones	3
Zone Location of Hardpipe	1
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	25.32	0.42	MGD
Total Sulfide	0.921	0.583	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph
Ambient Temperature	79	F

Data Type 5. Zone Physical and Chemical Conditions

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units
Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/L
Temperature	96.27	93.37	89.26		F
pH	7.17	7.37	7.48		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	968	1208	1235		feet
Width	968	604	617		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

7/19/2022

Basin Emissions		Units
Total Emissions (H_2S)	0.145	gms/s
Total Emissions (H_2S)	10050.3	lbs/yr
Total Emissions (H_2S)	5.0	tons/yr
Total Emissions (H_2S)	4.6	tonnes/yr
Emission Flux (H_2S)	20.2	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.09	0.03	0.02		gms/s
Zone Emissions (H_2S)	6430.8	1936.5	1683.0		lbs/yr
Emission Flux (H_2S)	33.5	13.0	10.8		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.005	0.000	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	60.200	6.100	5.400		lbs/yr

Percent Inlet Sulfide Removed	86.0%

Current Parameters	
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/20/2022

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

Data Type 2. Model Zone Information

Number of Zones	3
Zone Location of Hardpipe	1
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	25.48	0.39	MGD
Total Sulfide	0.053	0.762	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph
Ambient Temperature	79	F

Data Type 5. Zone Physical and Chemical Conditions

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units
Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/L
Temperature	94.8	91.27	87.57		F
pH	7.1	7.22	7.39		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	968	1208	1235		feet
Width	968	604	617		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

7/20/2022

Basin Emissions		Units
Total Emissions (H_2S)	0.111	gms/s
Total Emissions (H_2S)	7721.2	lbs/yr
Total Emissions (H_2S)	3.9	tons/yr
Total Emissions (H_2S)	3.5	tonnes/yr
Emission Flux (H_2S)	15.5	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.06	0.03	0.02		gms/s
Zone Emissions (H_2S)	4266.3	1852.9	1602.0		lbs/yr
Emission Flux (H_2S)	22.2	12.4	10.3		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.002	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	26.800	6.300	5.600		lbs/yr

Percent Inlet Sulfide Removed	-54.1%

Current Parameters	
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/21/2022

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

Data Type 2. Model Zone Information

Number of Zones	3
Zone Location of Hardpipe	1
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	19.93	0.19	MGD
Total Sulfide	0.094	0.625	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph
Ambient Temperature	79	F

Data Type 5. Zone Physical and Chemical Conditions

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units
Dissolved Oxygen	1.571780303	4.6275	4.659734848		mg/L
Temperature	94.76	90.42	87.08		F
pH	7.1	7.19	7.35		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	968	1208	1235		feet
Width	968	604	617		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results 7/21/2022

Basin Emissions		Units
Total Emissions (H_2S)	0.111	gms/s
Total Emissions (H_2S)	7700.8	lbs/yr
Total Emissions (H_2S)	3.9	tons/yr
Total Emissions (H_2S)	3.5	tonnes/yr
Emission Flux (H_2S)	15.5	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.06	0.03	0.02		gms/s
Zone Emissions (H_2S)	4305.7	1814.2	1580.9		lbs/yr
Emission Flux (H_2S)	22.4	12.1	10.1		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.002	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	21.300	5.000	4.400		lbs/yr

Percent Inlet Sulfide Removed	-27.1%

Current Parameters	
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

Baseline Methanol Emissions Factor

Date of Subpart S Performance Testing	Air Stripping* g/s	Pulp Production	Methanol Emissions Factor lb/ODTP
7/9/2021	14.10	1694	1.59
7/10/2021	11.58	1609	1.37
7/11/2021	8.71	1356	1.22
10/26/2021	15.17	1523	1.90
10/27/2021	12.03	1463	1.57
10/28/2021	13.31	1675	1.51
10/29/2021	12.16	1749	1.32
2/14/2022	8.69	1612	1.03
2/15/2022	8.96	1441	1.18
2/16/2022	10.15	1424	1.36
5/4/2022	0.50	2090	0.05
5/5/2022	1.54	1954	0.15
5/6/2022	1.03	2121	0.09
8/9/2022	1.60	2104	0.15
8/10/2022	1.78	1987	0.17
8/11/2022	1.33	1631	0.15
9/27/2022	1.60	1602	0.19
9/28/2022	1.78	1816	0.19
9/29/2022	1.33	1944	0.13
10/18/2022	0.89	1609	0.11
10/19/2022	0.33	1610	0.04
10/20/2022	0.19	1738	0.02

1.50 lb/ODTP, 2021 average
0.33 lb/ODTP, 2022 average
0.92 lb/ODTP, BAE Factor

*Air Stripping (g/s) for each day of Subpart S performance testing in 2021 and 2022 are from the NCASI Form XIII calculations provided in the performance test reports.

WASTEWATER TREATMENT PLANT – SUPPORTING INFORMATION
PROJECTED ACTUAL EMISSIONS

New Stripper Scenario - Projected Actual Emissions

H_2S, TRS Compounds, and VOC

New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
No Hardpipe flow (foul or stripped)	N/A	N/A	N/A	N/A
ASB Influent (Wastewater)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.25	0.09	0.20	2.60E-03
WATER9 Results	**H2S, g/s**	**DMDS, g/s**	**DMS, g/s**	**MMC, g/s**
ASB Zone 1	0.07	0.03	0.15	2.13E-03
ASB Zone 2	0.03	5.03E-04	3.19E-03	3.77E-05
ASB Zone 3	0.02	9.42E-06	1.11E-04	1.22E-06
Total ASB	**0.12**	**0.03**	**0.16**	**2.17E-03**
PAE Emissions Factors	**H2S, lb/ODTP**	**DMDS, lb/ODTP**	**DMS, lb/ODTP**	**MMC, lb/ODTP**
Total ASB	**1.03E-02**	**2.81E-03**	**1.36E-02**	**1.88E-04**

Hardpipe Flow (Foul or Stripped Condensate)	0	MGD
Post-Project ASB Influent Flow:	25.48	MGD
Total ASB Flow:	25.48	MGD
Total ASB Flow:	1116.47	L/s
Pulp Production	2200	ODTP/day

	MW
H2S	34
DMDS	94
DMS	62
MMC	48

Type of unit is
1 Total water added at the unit (l/s) 50 0
2 Area of openings at unit (cm2) 50
3 Radius of drop pipe (cm) 5
4 Drop length to conduit (cm) 61
5 Humidity of inlet air (%) 40
6 Temperature of air (C) 25
7 Drain air velocity (ft/min) 84
8 manhole air velocity (ft/min) 128
9 Conduit air velocity (ft/min) 66
10 Wind speed (cm/s at 10 m) 447
11 distance to next unit (cm) 500
12 slope of underflow conduit .015
13 friction factor liquid .016
14 friction factor gas .006
15 radius of underflow conduit (cm) 12
16 Underflow T (C) 25
17 oscillation cycle time (min) 5
18 design collection velocities (ft/s) 2
19 design branch line fraction full .4

Type of unit is
8 HL partition flag=1, adjust for sorption 0
9 unit recycle convergence number 200
10 oil molecular weight 0
11 oil density (g/cc) 0
12 NaUT 1=municipal 2=industrial 3=turb. 0
13 NaUT 1=mass tr. 2=equil 0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:27:50
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit 11 ASB Zone 1
2 Wastewater temperature (C) 34.08
3 length of aeration unit (m) 295
4 width of aeration unit (m) 295
5 depth of aeration unit (m) 1.4
6 Area of agitation (each aerator,m2) 135
7 Total number of agitators in the unit 31
8 Power of agitation (each aerator,HP) 75
9 Impeller diameter (cm) 49.53
10 Impeller rotation (RPM) 1200
11 Agitator mechanical efficiency 0.83
12 aerator effectiveness, alpha 0.83
13 if there is plug flow, enter 1 0
14 Overall biorate (mg/g bio-hr) 19
15 Aeration air flow (m3/s) 0
16 active biomass, aeration (g/l) 0.3
17 If covered, then enter 1 0
18 special input 0
19 pH (enter 0 for no pH adjustment) 7.04

Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

```
   hl= 0.001714 atm-m3/mol      vp= 45.945 mmHg (0.88868 psia)
       95.2 y/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.041e-05 cm2/s  dv= 0.088022 cm2/s
Compound flow rate from inlet water is 0.087838 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 30.325 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s.  Model: 2
kg is estimated as 0.005598 m/s.  Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.11564 m/s.
kl (agitated)is estimated as 0.017486 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1819.519 min. (30.325 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.11781
   KL aerated (m/s)                          0.017486
   KL OVERALL AERATED (m/s)                  0.005609
   KG quiescent (m/s)                        0.005703
   KL quiescent (m/s)                        5.971e-06
   KL OVERALL QUIESCENT (m/s)                5.883e-06
   KL OVERALL (m/s)                          2.753e-04
   air stripping time constant (min)         84.752
   FRACTION SURFACE VOLATILIZED              0.36393
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.36393
   FRACTION BIOLOGICALLY REMOVED             0.61912
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.031967
                    (Mg/year)                1.00811
   EMISSION FACTOR  (g/cm2-s)                3.673e-11
   UNIT EXIT CONCENTRATION (ppmw)            0.001334
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:27:50
COMPOUND: DIMETHYL DISULFIDE

Type of unit is system exit stream
1 Description of unit                      12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)                0.
```

```
                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                3.673e-11
   UNIT EXIT CONCENTRATION (ppmw)            2.231e-06
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:27:50
COMPOUND: DIMETHYL DISULFIDE

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1116 l/s.
   Weight fraction down is  8.680001E-08
   Gas concentration in  0 mol fraction.
   Gas flow  1116 L/s
   Weight fraction out at base of drop is  7.87078550837274E-08
   fraction transferred in the drain drop from hub is .093228
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.093228
   fraction loss in unit                    0.
   fraction loss in line run                0.
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             9.876e-20
   mol fract. headspace vent base           2.233e-06
   headspace flow out vent (cc/s)           -1.116e+06
   headspace flow down line (cc/s)          1.116e+06
   KG surface (m/s)                         1932.406
   KL surface (m/s)                         6.575e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.096869
   total component into unit, g/s           0.087838
   TOTAL AIR EMISSIONS  (g/s)               0.009031
                    (Mg/year)               0.2848
   EMISSION FACTOR  (g/cm2-s)               3.673e-11
   UNIT EXIT CONCENTRATION (ppmw)           0.078708
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:27:50
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
```

```
2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
   hl= 0.00141 atm-m3/mol      vp= 37.814 mmHg (0.7314 psia)
       78.352 y/x
       0.056726 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.027e-05 cm2/s  dv= 0.085991 cm2/s
Compound flow rate from inlet water is 5.19e-05 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.011 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 5.918e-06 m/s.
kg is estimated as 0.005575 m/s.  Model: 2
kg is estimated as 0.005575 m/s.  Model: 2
The Schmidt number is 1.74436.
The friction velocity is 37.398 m/s
kg is estimated as 0.012742 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.1143 m/s.
kl (agitated)is estimated as 0.015772 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 5.972e-05 m/s.
 The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 960.664 min. (16.011 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.11644
   KL aerated (m/s)                          0.015772
   KL OVERALL AERATED (m/s)                  0.004711
   KG quiescent (m/s)                        0.005679
   KL quiescent (m/s)                        5.918e-06
   KL OVERALL QUIESCENT (m/s)                5.813e-06
   KL OVERALL (m/s)                          5.972e-05
   air stripping time constant (min)         253.944
```

```
   FRACTION SURFACE VOLATILIZED              0.18149
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.18149
   FRACTION BIOLOGICALLY REMOVED             0.77054
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                9.419e-06
                    (Mg/year)                2.97e-04
   EMISSION FACTOR  (g/cm2-s)                1.332e-14
   UNIT EXIT CONCENTRATION (ppmw)            2.231e-06
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:27:50
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                       18    ASB Zone 2
2 Wastewater temperature   (C)                    32.08
3 length of aeration unit (m)                     368
4 width of aeration unit (m)                      184
5 depth of aeration unit (m)                      0.97
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           15
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.24

Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F)
   hl= 0.001558 atm-m3/mol      vp= 41.785 mmHg (0.80821 psia)
       86.579 y/x
       0.062258 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.034e-05 cm2/s  dv= 0.087022 cm2/s
Compound flow rate from inlet water is 0.001489 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.348 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 5.945e-06 m/s.
kg is estimated as 0.005633 m/s.  Model: 2
kg is estimated as 0.005633 m/s.  Model: 2
The Schmidt number is 1.72371.
The friction velocity is 37.398 m/s
kg is estimated as 0.012836 m/s.  Model: 3
_______Agitated surface_____________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

```
319         kg (agitated)is estimated as 0.11498 m/s.
320         kl (agitated)is estimated as 0.016622 m/s.
321             The specified and growth biomass is 0.3 g/L.
322          The effective KL (surface + diffused air) is 1.598e-04 m/s.
323          The effective stripping time (surface + diffused air) is 101.198 minutes.
             (1.68663 hrs.)
324          The pump mixing time is 5 x the pumping recirculaion time, 0. min.
325          The ratio of the mixing to the striping (surface + diffused air) is 0.
326          The mean residence time is 980.894 min. (16.348 hr.)
327          The ratio of the pump mixing to the residence time is 0.
328            KG aerated (m/s)                          0.11714
329            KL aerated (m/s)                          0.016622
330            KL OVERALL AERATED (m/s)                  0.005152
331            KG quiescent (m/s)                        0.005738
332            KL quiescent (m/s)                        5.945e-06
333            KL OVERALL QUIESCENT (m/s)                5.85e-06
334            KL OVERALL (m/s)                          1.598e-04
335            air stripping time constant (min)         101.198
336            FRACTION SURFACE VOLATILIZED              0.33782
337            FRACTION SUBMERGED VOLATILIZED            0.
338            TOTAL FRACTION VOLATILIZED                0.33782
339            FRACTION BIOLOGICALLY REMOVED             0.62732
340            FRACTION ABSORBED                         0.
341            TOTAL AIR EMISSIONS  (g/s)                5.03e-04
342                              (Mg/year)               0.015863
343            EMISSION FACTOR  (g/cm2-s)                7.429e-13
344            UNIT EXIT CONCENTRATION (ppmw)            4.65e-05
345
```

Type of unit is
1 Total water added at the unit (l/s) 50 0
2 Area of openings at unit (cm2) 50
3 Radius of drop pipe (cm) 5
4 Drop length to conduit (cm) 61
5 Humidity of inlet air (%) 40
6 Temperature of air (C) 25
7 Drain air velocity (ft/min) 84
8 manhole air velocity (ft/min) 128
9 Conduit air velocity (ft/min) 66
10 Wind speed (cm/s at 10 m) 447
11 distance to next unit (cm) 500
12 slope of underflow conduit .015
13 friction factor liquid .016
14 friction factor gas .006
15 radius of underflow conduit (cm) 12
16 Underflow T (C) 25
17 oscillation cycle time (min) 5
18 design collection velocities (ft/s) 2
19 design branch line fraction full .4

Type of unit is
8 HL partition flag=1, adjust for sorption 0
9 unit recycle convergence number 200
10 oil molecular weight 0
11 oil density (g/cc) 0
12 NaUT 1=municipal 2=industrial 3=turb. 0
13 NaUT 1=mass tr. 2=equil 0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:26
COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment
1 Description of unit 11 ASB Zone 1
2 Wastewater temperature (C) 34.08
3 length of aeration unit (m) 295
4 width of aeration unit (m) 295
5 depth of aeration unit (m) 1.4
6 Area of agitation (each aerator,m2) 135
7 Total number of agitators in the unit 31
8 Power of agitation (each aerator,HP) 75
9 Impeller diameter (cm) 49.53
10 Impeller rotation (RPM) 1200
11 Agitator mechanical efficiency 0.83
12 aerator effectiveness, alpha 0.83
13 if there is plug flow, enter 1 0
14 Overall biorate (mg/g bio-hr) 19
15 Aeration air flow (m3/s) 0
16 active biomass, aeration (g/l) 0.3
17 If covered, then enter 1 0
18 special input 0
19 pH (enter 0 for no pH adjustment) 7.04

Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

```
   hl= 0.002924 atm-m3/mol      vp= 704.653 mmHg (13.629 psia)
       162.463 y/x
       0.11606 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.504e-05 cm2/s  dv= 0.14765 cm2/s
Compound flow rate from inlet water is 0.19163 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 30.325 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 7.634e-06 m/s.
kg is estimated as 0.007917 m/s.  Model: 2
kg is estimated as 0.007917 m/s.  Model: 2
The Schmidt number is 1.01591.
The friction velocity is 37.398 m/s
kg is estimated as 0.017873 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14978 m/s.
kl (agitated)is estimated as 0.021024 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 4.77e-04 m/s.
 The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1819.519 min. (30.325 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.15258
   KL aerated (m/s)                          0.021024
   KL OVERALL AERATED (m/s)                  0.009769
   KG quiescent (m/s)                        0.008066
   KL quiescent (m/s)                        7.634e-06
   KL OVERALL QUIESCENT (m/s)                7.574e-06
   KL OVERALL (m/s)                          4.77e-04
   air stripping time constant (min)         48.915
   FRACTION SURFACE VOLATILIZED              0.80146
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.80146
   FRACTION BIOLOGICALLY REMOVED             0.17699
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.15358
                    (Mg/year)                4.84331
   EMISSION FACTOR  (g/cm2-s)                1.765e-10
   UNIT EXIT CONCENTRATION (ppmw)            0.0037
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:28:26
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is system exit stream
1 Description of unit                    12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)              0.
```

```
                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                1.765e-10
   UNIT EXIT CONCENTRATION (ppmw)            1.485e-05
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:28:26
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1116 l/s.
   Weight fraction down is  1.989E-07
   Gas concentration in  0 mol fraction.
   Gas flow  1116 L/s
   Weight fraction out at base of drop is  1.71707119336225E-07
   fraction transferred in the drain drop from hub is .136716
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.13672
   fraction loss in unit                    0.
   fraction loss in line run                0.
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             4.229e-19
   mol fract. headspace vent base           1.138e-05
   headspace flow out vent (cc/s)           -1.116e+06
   headspace flow down line (cc/s)          1.116e+06
   KG surface (m/s)                         2728.591
   KL surface (m/s)                         8.51e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.22197
   total component into unit, g/s           0.19163
   TOTAL AIR EMISSIONS  (g/s)               0.030347
                    (Mg/year)               0.95703
   EMISSION FACTOR  (g/cm2-s)               1.765e-10
   UNIT EXIT CONCENTRATION (ppmw)           0.17171
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:28:26
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
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```
2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of DIMETHYL SULFIDE  (DMS) at 30. deg.C (86. deg.F)
   hl= 0.002519 atm-m3/mol      vp= 606.985 mmHg (11.74 psia)
       139.945 y/x
       0.10132 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.485e-05 cm2/s  dv= 0.14425 cm2/s
Compound flow rate from inlet water is 1.869e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.011 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 7.566e-06 m/s.
kg is estimated as 0.007884 m/s.  Model: 2
kg is estimated as 0.007884 m/s.  Model: 2
The Schmidt number is 1.03989.
The friction velocity is 37.398 m/s
kg is estimated as 0.017611 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14804 m/s.
kl (agitated)is estimated as 0.018962 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.053e-04 m/s.
 The effective stripping time (surface + diffused air) is 144.073 minutes.
 (2.40122 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 960.664 min. (16.011 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.15081
   KL aerated (m/s)                          0.018962
   KL OVERALL AERATED (m/s)                  0.00854
   KG quiescent (m/s)                        0.008032
   KL quiescent (m/s)                        7.566e-06
   KL OVERALL QUIESCENT (m/s)                7.497e-06
   KL OVERALL (m/s)                          1.053e-04
   air stripping time constant (min)         144.073
```

```
   FRACTION SURFACE VOLATILIZED              0.59112
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.59112
   FRACTION BIOLOGICALLY REMOVED             0.32022
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                1.105e-04
                        (Mg/year)            0.003484
   EMISSION FACTOR  (g/cm2-s)                1.563e-13
   UNIT EXIT CONCENTRATION (ppmw)            1.485e-05
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:28:26
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                        18    ASB Zone 2
2 Wastewater temperature   (C)                     32.08
3 length of aeration unit (m)                      368
4 width of aeration unit (m)                       184
5 depth of aeration unit (m)                       0.97
6 Area of agitation (each aerator,m2)              135
7 Total number of agitators in the unit            15
8 Power of agitation (each aerator,HP)             75
9 Impeller diameter (cm)                           49.53
10 Impeller rotation (RPM)                         1200
11 Agitator mechanical efficiency                  0.83
12 aerator effectiveness, alpha                    0.83
13 if there is plug flow, enter 1                  0
14 Overall biorate (mg/g bio-hr)                   19
15 Aeration air flow (m3/s)                        0
16 active biomass, aeration (g/l)                  0.3
17 If covered, then enter 1                        0
18 special input                                   0
19 pH  (enter 0 for no pH adjustment)              7.24

Properties of DIMETHYL SULFIDE  (DMS) at 32.1 deg.C (89.7 deg.F)
   hl= 0.002719 atm-m3/mol      vp= 655.201 mmHg (12.673 psia)
       151.062 y/x
       0.10863 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.495e-05 cm2/s  dv= 0.14597 cm2/s
Compound flow rate from inlet water is 0.004129 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.348 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 7.6e-06 m/s.
kg is estimated as 0.007966 m/s.  Model: 2
kg is estimated as 0.007966 m/s.  Model: 2
The Schmidt number is 1.02758.
The friction velocity is 37.398 m/s
kg is estimated as 0.017744 m/s.  Model: 3
_______Agitated surface_____________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

kg (agitated)is estimated as 0.14892 m/s.
kl (agitated)is estimated as 0.019984 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 2.809e-04 m/s.
The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 980.894 min. (16.348 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.15171
KL aerated (m/s)	0.019984
KL OVERALL AERATED (m/s)	0.009148
KG quiescent (m/s)	0.008115
KL quiescent (m/s)	7.6e-06
KL OVERALL QUIESCENT (m/s)	7.537e-06
KL OVERALL (m/s)	2.809e-04
air stripping time constant (min)	57.552
FRACTION SURFACE VOLATILIZED	0.7715
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.7715
FRACTION BIOLOGICALLY REMOVED	0.18324
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.003185
(Mg/year)	0.10045
EMISSION FACTOR (g/cm2-s)	4.704e-12
UNIT EXIT CONCENTRATION (ppmw)	1.675e-04

Type of unit is
1 Total water added at the unit (l/s) 50 0
2 Area of openings at unit (cm2) 50
3 Radius of drop pipe (cm) 5
4 Drop length to conduit (cm) 61
5 Humidity of inlet air (%) 40
6 Temperature of air (C) 25
7 Drain air velocity (ft/min) 84
8 manhole air velocity (ft/min) 128
9 Conduit air velocity (ft/min) 66
10 Wind speed (cm/s at 10 m) 447
11 distance to next unit (cm) 500
12 slope of underflow conduit .015
13 friction factor liquid .016
14 friction factor gas .006
15 radius of underflow conduit (cm) 12
16 Underflow T (C) 25
17 oscillation cycle time (min) 5
18 design collection velocities (ft/s) 2
19 design branch line fraction full .4

Type of unit is
8 HL partition flag=1, adjust for sorption 0
9 unit recycle convergence number 200
10 oil molecular weight 0
11 oil density (g/cc) 0
12 NaUT 1=municipal 2=industrial 3=turb. 0
13 NaUT 1=mass tr. 2=equil 0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM 19:28:58
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit 11 ASB Zone 1
2 Wastewater temperature (C) 34.08
3 length of aeration unit (m) 295
4 width of aeration unit (m) 295
5 depth of aeration unit (m) 1.4
6 Area of agitation (each aerator,m2) 135
7 Total number of agitators in the unit 31
8 Power of agitation (each aerator,HP) 75
9 Impeller diameter (cm) 49.53
10 Impeller rotation (RPM) 1200
11 Agitator mechanical efficiency 0.83
12 aerator effectiveness, alpha 0.83
13 if there is plug flow, enter 1 0
14 Overall biorate (mg/g bio-hr) 19
15 Aeration air flow (m3/s) 0
16 active biomass, aeration (g/l) 0.3
17 If covered, then enter 1 0
18 special input 0
19 pH (enter 0 for no pH adjustment) 7.04

Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

```
   hl= 0.004158 atm-m3/mol      vp= 2272.142 mmHg (43.948 psia)
       230.99 y/x
       0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.525e-05 cm2/s  dv= 0.23702 cm2/s
Compound flow rate from inlet water is 0.002397 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 30.325 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
kg is estimated as 0.010871 m/s.  Model: 2
kg is estimated as 0.010871 m/s.  Model: 2
The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
kg is estimated as 0.024173 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18977 m/s.
kl (agitated)is estimated as 0.021167 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 6.265e-04 m/s.
 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1819.519 min. (30.325 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.19332
   KL aerated (m/s)                          0.021167
   KL OVERALL AERATED (m/s)                  0.012876
   KG quiescent (m/s)                        0.011075
   KL quiescent (m/s)                        7.703e-06
   KL OVERALL QUIESCENT (m/s)                7.672e-06
   KL OVERALL (m/s)                          6.265e-04
   air stripping time constant (min)         37.242
   FRACTION SURFACE VOLATILIZED              0.88816
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.88816
   FRACTION BIOLOGICALLY REMOVED             0.09366
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.002129
                    (Mg/year)                0.06713
   EMISSION FACTOR  (g/cm2-s)                2.446e-12
   UNIT EXIT CONCENTRATION (ppmw)            3.904e-05
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:28:58
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is system exit stream
1 Description of unit                      12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)                0.
```

```
                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                2.446e-12
   UNIT EXIT CONCENTRATION (ppmw)            1.24e-07
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:28:58
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1116 l/s.
   Weight fraction down is  2.6E-09
   Gas concentration in  0 mol fraction.
   Gas flow  1116 L/s
   Weight fraction out at base of drop is  2.14759568570224E-09
   fraction transferred in the drain drop from hub is .174002
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.174
   fraction loss in unit                    0.
   fraction loss in line run                0.
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             6.896e-21
   mol fract. headspace vent base           2.445e-07
   headspace flow out vent (cc/s)           -1.116e+06
   headspace flow down line (cc/s)          1.116e+06
   KG surface (m/s)                         3741.46
   KL surface (m/s)                         8.591e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.002902
   total component into unit, g/s           0.002397
   TOTAL AIR EMISSIONS  (g/s)               5.049e-04
                    (Mg/year)               0.015922
   EMISSION FACTOR  (g/cm2-s)               2.446e-12
   UNIT EXIT CONCENTRATION (ppmw)           0.002148
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:28:58
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
```

```
2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
   hl= 0.003687 atm-m3/mol      vp= 2014.774 mmHg (38.97 psia)
       204.826 y/x
       0.14829 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.505e-05 cm2/s  dv= 0.23155 cm2/s
Compound flow rate from inlet water is 1.671e-06 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.011 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 7.635e-06 m/s.
kg is estimated as 0.010826 m/s.  Model: 2
kg is estimated as 0.010826 m/s.  Model: 2
The Schmidt number is 0.64779.
The friction velocity is 37.398 m/s
kg is estimated as 0.023814 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18756 m/s.
kl (agitated)is estimated as 0.019092 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.391e-04 m/s.
 The effective stripping time (surface + diffused air) is 109.038 minutes.
 (1.81731 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 960.664 min. (16.011 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.19108
   KL aerated (m/s)                          0.019092
   KL OVERALL AERATED (m/s)                  0.011483
   KG quiescent (m/s)                        0.011029
   KL quiescent (m/s)                        7.635e-06
   KL OVERALL QUIESCENT (m/s)                7.6e-06
   KL OVERALL (m/s)                          1.391e-04
   air stripping time constant (min)         109.038
```

```
   FRACTION SURFACE VOLATILIZED              0.7296
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.7296
   FRACTION BIOLOGICALLY REMOVED             0.18759
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                1.219e-06
                        (Mg/year)            3.844e-05
   EMISSION FACTOR  (g/cm2-s)                1.724e-15
   UNIT EXIT CONCENTRATION (ppmw)            1.24e-07
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\New
  Stripper Scenario\ASB New Stripper V5 3/14/2023 1:52:24 PM  19:28:58
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                        18    ASB Zone 2
2 Wastewater temperature   (C)                     32.08
3 length of aeration unit (m)                      368
4 width of aeration unit (m)                       184
5 depth of aeration unit (m)                       0.97
6 Area of agitation (each aerator,m2)              135
7 Total number of agitators in the unit            15
8 Power of agitation (each aerator,HP)             75
9 Impeller diameter (cm)                           49.53
10 Impeller rotation (RPM)                         1200
11 Agitator mechanical efficiency                  0.83
12 aerator effectiveness, alpha                    0.83
13 if there is plug flow, enter 1                  0
14 Overall biorate (mg/g bio-hr)                   19
15 Aeration air flow (m3/s)                        0
16 active biomass, aeration (g/l)                  0.3
17 If covered, then enter 1                        0
18 special input                                   0
19 pH  (enter 0 for no pH adjustment)              7.24

Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F)
   hl= 0.003921 atm-m3/mol      vp= 2142.771 mmHg (41.446 psia)
       217.838 y/x
       0.15664 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.515e-05 cm2/s  dv= 0.23433 cm2/s
Compound flow rate from inlet water is 4.357e-05 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 16.348 hr.
___Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 7.67e-06 m/s.
kg is estimated as 0.010938 m/s.  Model: 2
kg is estimated as 0.010938 m/s.  Model: 2
The Schmidt number is 0.64013.
The friction velocity is 37.398 m/s
kg is estimated as 0.023996 m/s.  Model: 3
_______Agitated surface_____________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

kg (agitated)is estimated as 0.18868 m/s.
kl (agitated)is estimated as 0.020121 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 3.715e-04 m/s.
The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 980.894 min. (16.348 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.19222
KL aerated (m/s)	0.020121
KL OVERALL AERATED (m/s)	0.012174
KG quiescent (m/s)	0.011143
KL quiescent (m/s)	7.67e-06
KL OVERALL QUIESCENT (m/s)	7.637e-06
KL OVERALL (m/s)	3.715e-04
air stripping time constant (min)	43.518
FRACTION SURFACE VOLATILIZED	0.86431
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.86431
FRACTION BIOLOGICALLY REMOVED	0.097342
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	3.766e-05
(Mg/year)	0.001188
EMISSION FACTOR (g/cm2-s)	5.562e-14
UNIT EXIT CONCENTRATION (ppmw)	1.497e-06

Backup Stripper Scenario - Projected Actual Emissions
H_2S, TRS Compounds, and VOC
New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings to Backup Stripper	147	15.00	17.00	16.00
Backup Stripper TRS Removal Efficiency	0.98	0.98	0.98	0.98
Stripped Condensate to Hardpipe	2.93	0.30	0.34	0.32
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.38	0.10	0.21	0.02
WATER9 Results	**H2S, g/s**	**DMDS, g/s**	**DMS, g/s**	**MMC, g/s**
ASB Zone 1	0.08	0.04	0.17	0.01
ASB Zone 2	0.03	6.14E-04	3.60E-03	2.73E-04
ASB Zone 3	0.02	1.20E-05	1.31E-04	9.23E-06
Total ASB	**0.13**	**0.04**	**0.17**	**0.02**
PAE Emissions Factors	**H2S, lb/ODTP**	**DMDS, lb/ODTP**	**DMS, lb/ODTP**	**MMC, lb/ODTP**
Total ASB	**1.09E-02**	**3.28E-03**	**1.47E-02**	**1.30E-03**

Post-Project Stripped Condensate Flow:	850	gpm
Post-Project Stripped Condensate Flow:	1.22	MGD
Post-Project ASB Influent Flow:	25.48	MGD
Total ASB Flow:	26.71	MGD
Total ASB Flow:	1170	L/s
Pulp Production	2200	ODTP/day

	MW
H2S	34
DMDS	94
DMS	62
MMC	48

Type of unit is
1 Total water added at the unit (l/s) 50 0
2 Area of openings at unit (cm2) 50
3 Radius of drop pipe (cm) 5
4 Drop length to conduit (cm) 61
5 Humidity of inlet air (%) 40
6 Temperature of air (C) 25
7 Drain air velocity (ft/min) 84
8 manhole air velocity (ft/min) 128
9 Conduit air velocity (ft/min) 66
10 Wind speed (cm/s at 10 m) 447
11 distance to next unit (cm) 500
12 slope of underflow conduit .015
13 friction factor liquid .016
14 friction factor gas .006
15 radius of underflow conduit (cm) 12
16 Underflow T (C) 25
17 oscillation cycle time (min) 5
18 design collection velocities (ft/s) 2
19 design branch line fraction full .4

Type of unit is
8 HL partition flag=1, adjust for sorption 0
9 unit recycle convergence number 200
10 oil molecular weight 0
11 oil density (g/cc) 0
12 NaUT 1=municipal 2=industrial 3=turb. 0
13 NaUT 1=mass tr. 2=equil 0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 11:39:37
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit 11 ASB Zone 1
2 Wastewater temperature (C) 34.08
3 length of aeration unit (m) 295
4 width of aeration unit (m) 295
5 depth of aeration unit (m) 1.4
6 Area of agitation (each aerator,m2) 135
7 Total number of agitators in the unit 31
8 Power of agitation (each aerator,HP) 75
9 Impeller diameter (cm) 49.53
10 Impeller rotation (RPM) 1200
11 Agitator mechanical efficiency 0.83
12 aerator effectiveness, alpha 0.83
13 if there is plug flow, enter 1 0
14 Overall biorate (mg/g bio-hr) 19
15 Aeration air flow (m3/s) 0
16 active biomass, aeration (g/l) 0.3
17 If covered, then enter 1 0
18 special input 0
19 pH (enter 0 for no pH adjustment) 7.04

Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)

```
   hl= 0.001714 atm-m3/mol      vp= 45.945 mmHg (0.88868 psia)
       95.2 y/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.041e-05 cm2/s  dv= 0.088022 cm2/s
Compound flow rate from inlet water is 0.10249 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s.  Model: 2
kg is estimated as 0.005598 m/s.  Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.11564 m/s.
kl (agitated)is estimated as 0.017486 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.11781
   KL aerated (m/s)                          0.017486
   KL OVERALL AERATED (m/s)                  0.005609
   KG quiescent (m/s)                        0.005703
   KL quiescent (m/s)                        5.971e-06
   KL OVERALL QUIESCENT (m/s)                5.883e-06
   KL OVERALL (m/s)                          2.753e-04
   air stripping time constant (min)         84.752
   FRACTION SURFACE VOLATILIZED              0.36364
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.36364
   FRACTION BIOLOGICALLY REMOVED             0.6186
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.037268
                    (Mg/year)                1.17529
   EMISSION FACTOR  (g/cm2-s)                4.282e-11
   UNIT EXIT CONCENTRATION (ppmw)            0.001555
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  11:39:37
COMPOUND: DIMETHYL DISULFIDE

Type of unit is system exit stream
1 Description of unit                    12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)              0.
```

```
                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                4.282e-11
   UNIT EXIT CONCENTRATION (ppmw)            2.847e-06
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  11:39:37
COMPOUND: DIMETHYL DISULFIDE

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1170 l/s.
   Weight fraction down is  9.66E-08
   Gas concentration in  0 mol fraction.
   Gas flow  1170 L/s
   Weight fraction out at base of drop is  8.7594214355091E-08
   fraction transferred in the drain drop from hub is .093228
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.093228
   fraction loss in unit                    0.
   fraction loss in line run                -7.27e-08
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             1.082e-19
   mol fract. headspace vent base           2.486e-06
   headspace flow out vent (cc/s)           -1.17e+06
   headspace flow down line (cc/s)          1.17e+06
   KG surface (m/s)                         2007.233
   KL surface (m/s)                         6.787e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.11302
   total component into unit, g/s           0.10249
   TOTAL AIR EMISSIONS  (g/s)               0.010537
                    (Mg/year)               0.33229
   EMISSION FACTOR  (g/cm2-s)               4.282e-11
   UNIT EXIT CONCENTRATION (ppmw)           0.087594
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  11:39:37
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
```

```
2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
   hl= 0.00141 atm-m3/mol      vp= 37.814 mmHg (0.7314 psia)
       78.352 y/x
       0.056726 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.027e-05 cm2/s  dv= 0.085991 cm2/s
Compound flow rate from inlet water is 6.639e-05 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 5.918e-06 m/s.
kg is estimated as 0.005575 m/s.  Model: 2
kg is estimated as 0.005575 m/s.  Model: 2
The Schmidt number is 1.74436.
The friction velocity is 37.398 m/s
kg is estimated as 0.012742 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.1143 m/s.
kl (agitated)is estimated as 0.015772 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 5.972e-05 m/s.
 The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 916.326 min. (15.272 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.11644
   KL aerated (m/s)                          0.015772
   KL OVERALL AERATED (m/s)                  0.004711
   KG quiescent (m/s)                        0.005679
   KL quiescent (m/s)                        5.918e-06
   KL OVERALL QUIESCENT (m/s)                5.813e-06
   KL OVERALL (m/s)                          5.972e-05
   air stripping time constant (min)         253.944
```

```
   FRACTION SURFACE VOLATILIZED              0.18107
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.18107
   FRACTION BIOLOGICALLY REMOVED             0.76875
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                1.202e-05
                        (Mg/year)            3.791e-04
   EMISSION FACTOR  (g/cm2-s)                1.7e-14
   UNIT EXIT CONCENTRATION (ppmw)            2.847e-06
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  11:39:37
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                       18    ASB Zone 2
2 Wastewater temperature   (C)                    32.08
3 length of aeration unit (m)                     368
4 width of aeration unit (m)                      184
5 depth of aeration unit (m)                      0.97
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           15
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.24

Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F)
   hl= 0.001558 atm-m3/mol      vp= 41.785 mmHg (0.80821 psia)
       86.579 y/x
       0.062258 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   k1= 0. L/g-hr          dl= 1.034e-05 cm2/s  dv= 0.087022 cm2/s
Compound flow rate from inlet water is 0.00182 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.594 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 5.945e-06 m/s.
kg is estimated as 0.005633 m/s.  Model: 2
kg is estimated as 0.005633 m/s.  Model: 2
The Schmidt number is 1.72371.
The friction velocity is 37.398 m/s
kg is estimated as 0.012836 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

kg (agitated)is estimated as 0.11498 m/s.
kl (agitated)is estimated as 0.016622 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 1.598e-04 m/s.
The effective stripping time (surface + diffused air) is 101.198 minutes. (1.68663 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.11714
KL aerated (m/s)	0.016622
KL OVERALL AERATED (m/s)	0.005152
KG quiescent (m/s)	0.005738
KL quiescent (m/s)	5.945e-06
KL OVERALL QUIESCENT (m/s)	5.85e-06
KL OVERALL (m/s)	1.598e-04
air stripping time constant (min)	101.198
FRACTION SURFACE VOLATILIZED	0.33725
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.33725
FRACTION BIOLOGICALLY REMOVED	0.62627
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	6.138e-04
(Mg/year)	0.019356
EMISSION FACTOR (g/cm2-s)	9.065e-13
UNIT EXIT CONCENTRATION (ppmw)	5.674e-05

Type of unit is
1 Total water added at the unit (l/s) 50 0
2 Area of openings at unit (cm2) 50
3 Radius of drop pipe (cm) 5
4 Drop length to conduit (cm) 61
5 Humidity of inlet air (%) 40
6 Temperature of air (C) 25
7 Drain air velocity (ft/min) 84
8 manhole air velocity (ft/min) 128
9 Conduit air velocity (ft/min) 66
10 Wind speed (cm/s at 10 m) 447
11 distance to next unit (cm) 500
12 slope of underflow conduit .015
13 friction factor liquid .016
14 friction factor gas .006
15 radius of underflow conduit (cm) 12
16 Underflow T (C) 25
17 oscillation cycle time (min) 5
18 design collection velocities (ft/s) 2
19 design branch line fraction full .4

Type of unit is
8 HL partition flag=1, adjust for sorption 0
9 unit recycle convergence number 200
10 oil molecular weight 0
11 oil density (g/cc) 0
12 NaUT 1=municipal 2=industrial 3=turb. 0
13 NaUT 1=mass tr. 2=equil 0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:24:18
COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment
1 Description of unit 11 ASB Zone 1
2 Wastewater temperature (C) 34.08
3 length of aeration unit (m) 295
4 width of aeration unit (m) 295
5 depth of aeration unit (m) 1.4
6 Area of agitation (each aerator,m2) 135
7 Total number of agitators in the unit 31
8 Power of agitation (each aerator,HP) 75
9 Impeller diameter (cm) 49.53
10 Impeller rotation (RPM) 1200
11 Agitator mechanical efficiency 0.83
12 aerator effectiveness, alpha 0.83
13 if there is plug flow, enter 1 0
14 Overall biorate (mg/g bio-hr) 19
15 Aeration air flow (m3/s) 0
16 active biomass, aeration (g/l) 0.3
17 If covered, then enter 1 0
18 special input 0
19 pH (enter 0 for no pH adjustment) 7.04

Properties of DIMETHYL SULFIDE (DMS) at 34.1 deg.C (93.3 deg.F)

```
   hl= 0.002924 atm-m3/mol      vp= 704.653 mmHg (13.629 psia)
       162.463 y/x
       0.11606 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.504e-05 cm2/s  dv= 0.14765 cm2/s
Compound flow rate from inlet water is 0.20746 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 7.634e-06 m/s.
kg is estimated as 0.007917 m/s.  Model: 2
kg is estimated as 0.007917 m/s.  Model: 2
The Schmidt number is 1.01591.
The friction velocity is 37.398 m/s
kg is estimated as 0.017873 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14978 m/s.
kl (agitated)is estimated as 0.021024 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 4.77e-04 m/s.
 The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.15258
   KL aerated (m/s)                          0.021024
   KL OVERALL AERATED (m/s)                  0.009769
   KG quiescent (m/s)                        0.008066
   KL quiescent (m/s)                        7.634e-06
   KL OVERALL QUIESCENT (m/s)                7.574e-06
   KL OVERALL (m/s)                          4.77e-04
   air stripping time constant (min)         48.915
   FRACTION SURFACE VOLATILIZED              0.80063
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.80063
   FRACTION BIOLOGICALLY REMOVED             0.17681
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.1661
                    (Mg/year)                5.23815
   EMISSION FACTOR  (g/cm2-s)                1.909e-10
   UNIT EXIT CONCENTRATION (ppmw)            0.004001
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  19:24:18
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is system exit stream
1 Description of unit                      12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)                0.
```

```
                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                1.909e-10
   UNIT EXIT CONCENTRATION (ppmw)            1.753e-05
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  19:24:18
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1170 l/s.
   Weight fraction down is  2.054E-07
   Gas concentration in  0 mol fraction.
   Gas flow  1170 L/s
   Weight fraction out at base of drop is  1.77318497496617E-07
   fraction transferred in the drain drop from hub is .136716
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.13672
   fraction loss in unit                    0.
   fraction loss in line run                0.
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             4.299e-19
   mol fract. headspace vent base           1.175e-05
   headspace flow out vent (cc/s)           -1.17e+06
   headspace flow down line (cc/s)          1.17e+06
   KG surface (m/s)                         2834.248
   KL surface (m/s)                         8.784e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.24032
   total component into unit, g/s           0.20746
   TOTAL AIR EMISSIONS  (g/s)               0.032855
                    (Mg/year)               1.03613
   EMISSION FACTOR  (g/cm2-s)               1.909e-10
   UNIT EXIT CONCENTRATION (ppmw)           0.17732
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  19:24:18
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
```

```
2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of DIMETHYL SULFIDE  (DMS) at 30. deg.C (86. deg.F)
   hl= 0.002519 atm-m3/mol      vp= 606.985 mmHg (11.74 psia)
       139.945 y/x
       0.10132 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.485e-05 cm2/s  dv= 0.14425 cm2/s
Compound flow rate from inlet water is 2.217e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 7.566e-06 m/s.
kg is estimated as 0.007884 m/s.  Model: 2
kg is estimated as 0.007884 m/s.  Model: 2
The Schmidt number is 1.03989.
The friction velocity is 37.398 m/s
kg is estimated as 0.017611 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14804 m/s.
kl (agitated)is estimated as 0.018962 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.053e-04 m/s.
 The effective stripping time (surface + diffused air) is 144.073 minutes.
 (2.40122 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 916.326 min. (15.272 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.15081
   KL aerated (m/s)                          0.018962
   KL OVERALL AERATED (m/s)                  0.00854
   KG quiescent (m/s)                        0.008032
   KL quiescent (m/s)                        7.566e-06
   KL OVERALL QUIESCENT (m/s)                7.497e-06
   KL OVERALL (m/s)                          1.053e-04
   air stripping time constant (min)         144.073
```

```
   FRACTION SURFACE VOLATILIZED              0.5886
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.5886
   FRACTION BIOLOGICALLY REMOVED             0.31886
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                1.305e-04
                        (Mg/year)            0.004115
   EMISSION FACTOR  (g/cm2-s)                1.846e-13
   UNIT EXIT CONCENTRATION (ppmw)            1.753e-05
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  19:24:18
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                       18    ASB Zone 2
2 Wastewater temperature   (C)                    32.08
3 length of aeration unit (m)                     368
4 width of aeration unit (m)                      184
5 depth of aeration unit (m)                      0.97
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           15
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.24

Properties of DIMETHYL SULFIDE  (DMS) at 32.1 deg.C (89.7 deg.F)
   hl= 0.002719 atm-m3/mol      vp= 655.201 mmHg (12.673 psia)
       151.062 y/x
       0.10863 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.495e-05 cm2/s  dv= 0.14597 cm2/s
Compound flow rate from inlet water is 0.004681 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.594 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 7.6e-06 m/s.
kg is estimated as 0.007966 m/s.  Model: 2
kg is estimated as 0.007966 m/s.  Model: 2
The Schmidt number is 1.02758.
The friction velocity is 37.398 m/s
kg is estimated as 0.017744 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

kg (agitated)is estimated as 0.14892 m/s.
kl (agitated)is estimated as 0.019984 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 2.809e-04 m/s.
The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.15171
KL aerated (m/s)	0.019984
KL OVERALL AERATED (m/s)	0.009148
KG quiescent (m/s)	0.008115
KL quiescent (m/s)	7.6e-06
KL OVERALL QUIESCENT (m/s)	7.537e-06
KL OVERALL (m/s)	2.809e-04
air stripping time constant (min)	57.552
FRACTION SURFACE VOLATILIZED	0.76981
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.76981
FRACTION BIOLOGICALLY REMOVED	0.18284
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.003604
(Mg/year)	0.11365
EMISSION FACTOR (g/cm2-s)	5.322e-12
UNIT EXIT CONCENTRATION (ppmw)	1.895e-04

Type of unit is

1 Total water added at the unit (l/s)	50	0
2 Area of openings at unit (cm2)		50
3 Radius of drop pipe (cm)		5
4 Drop length to conduit (cm)		61
5 Humidity of inlet air (%)		40
6 Temperature of air (C)		25
7 Drain air velocity (ft/min)		84
8 manhole air velocity (ft/min)		128
9 Conduit air velocity (ft/min)		66
10 Wind speed (cm/s at 10 m)		447
11 distance to next unit (cm)		500
12 slope of underflow conduit		.015
13 friction factor liquid		.016
14 friction factor gas		.006
15 radius of underflow conduit (cm)		12
16 Underflow T (C)		25
17 oscillation cycle time (min)		5
18 design collection velocities (ft/s)		2
19 design branch line fraction full		.4

Type of unit is

8 HL partition flag=1, adjust for sorption	0
9 unit recycle convergence number	200
10 oil molecular weight	0
11 oil density (g/cc)	0
12 NaUT 1=municipal 2=industrial 3=turb.	0
13 NaUT 1=mass tr. 2=equil	0
14 parts biomass per 1000 parts COD	
15 oil water partition method 0=owpc	
16 use UNIFAC aqueous data base =1	
17 specify mass transfer for unit, =1	
18 Use biomass for unit option, =1	
19 biogrowth Monod half concentration ppm	

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM 19:25:00
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment

1 Description of unit	11	ASB Zone 1
2 Wastewater temperature (C)		34.08
3 length of aeration unit (m)		295
4 width of aeration unit (m)		295
5 depth of aeration unit (m)		1.4
6 Area of agitation (each aerator,m2)		135
7 Total number of agitators in the unit		31
8 Power of agitation (each aerator,HP)		75
9 Impeller diameter (cm)		49.53
10 Impeller rotation (RPM)		1200
11 Agitator mechanical efficiency		0.83
12 aerator effectiveness, alpha		0.83
13 if there is plug flow, enter 1		0
14 Overall biorate (mg/g bio-hr)		19
15 Aeration air flow (m3/s)		0
16 active biomass, aeration (g/l)		0.3
17 If covered, then enter 1		0
18 special input		0
19 pH (enter 0 for no pH adjustment)		7.04

Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)

```
   hl= 0.004158 atm-m3/mol      vp= 2272.142 mmHg (43.948 psia)
       230.99 y/x
       0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.525e-05 cm2/s  dv= 0.23702 cm2/s
Compound flow rate from inlet water is 0.016622 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
___Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
kg is estimated as 0.010871 m/s.  Model: 2
kg is estimated as 0.010871 m/s.  Model: 2
The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
kg is estimated as 0.024173 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18977 m/s.
kl (agitated)is estimated as 0.021167 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 6.265e-04 m/s.
 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.19332
   KL aerated (m/s)                          0.021167
   KL OVERALL AERATED (m/s)                  0.012876
   KG quiescent (m/s)                        0.011075
   KL quiescent (m/s)                        7.703e-06
   KL OVERALL QUIESCENT (m/s)                7.672e-06
   KL OVERALL (m/s)                          6.265e-04
   air stripping time constant (min)         37.242
   FRACTION SURFACE VOLATILIZED              0.88738
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.88738
   FRACTION BIOLOGICALLY REMOVED             0.093577
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.01475
                    (Mg/year)                0.46517
   EMISSION FACTOR  (g/cm2-s)                1.695e-11
   UNIT EXIT CONCENTRATION (ppmw)            2.705e-04
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  19:25:00
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is system exit stream
1 Description of unit                    12    def.system exit st

   TOTAL AIR EMISSIONS  (g/s)                0.
```

```
                    (Mg/year)                0.
   EMISSION FACTOR  (g/cm2-s)                1.695e-11
   UNIT EXIT CONCENTRATION (ppmw)            9.387e-07
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  19:25:00
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is open hub drain
1 Description of unit                      13    default open hub d
2 Underflow T (C)                                43.89
3 Total water added at the unit (l/s)            0
4 Area of openings at unit (cm2)                 50
5 Radius of drop pipe (cm)                       5
6 Drop length to conduit (cm)                    61
7 Open surface=1                                 1
8 Subsurface entrance=1                          0
9 subsurface exit =1                             0
10 radius of underflow conduit (cm)              12
11 distance to next unit (cm)                    500
12 slope of underflow conduit                    0.015
16 velocity air at drain opening (ft/min)        84
17 municipal waste in conduit =1                 0
18 Assume equilibrium in unit, =1                0
19 pH  (enter 0 for no pH adjustment)            8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1170 l/s.
   Weight fraction down is  1.72E-08
   Gas concentration in  0 mol fraction.
   Gas flow  1170 L/s
   Weight fraction out at base of drop is  1.42071711698917E-08
   fraction transferred in the drain drop from hub is .174002
   fraction loss in waste1 drop to hub      0.
   fraction loss in waste2 drop to hub      0.
   fraction loss in waste3 drop to hub      0.
   fraction loss in collection hub drop     0.174
   fraction loss in unit                    0.
   fraction loss in line run                0.
   component upstream of unit, g/s          0.
   mol fract. headspace upstream (y)        0.
   headspace at conduit discharge, y        0.
   headspace end of conduit (y)             4.491e-20
   mol fract. headspace vent base           1.618e-06
   headspace flow out vent (cc/s)           -1.17e+06
   headspace flow down line (cc/s)          1.17e+06
   KG surface (m/s)                         3886.338
   KL surface (m/s)                         8.868e-09
   flow of waste down hub (l/s)             0.
   component flow in waste into unit (g/s)  0.020124
   total component into unit, g/s           0.016622
   TOTAL AIR EMISSIONS  (g/s)               0.003502
                    (Mg/year)               0.11043
   EMISSION FACTOR  (g/cm2-s)               1.695e-11
   UNIT EXIT CONCENTRATION (ppmw)           0.014207
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  19:25:00
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                      17    ASB Zone 3
```

```
2 Wastewater temperature   (C)                    30.01
3 length of aeration unit (m)                     376
4 width of aeration unit (m)                      188
5 depth of aeration unit (m)                      0.91
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           6
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.42

Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
   hl= 0.003687 atm-m3/mol      vp= 2014.774 mmHg (38.97 psia)
       204.826 y/x
       0.14829 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   k1= 0. L/g-hr          dl= 1.505e-05 cm2/s  dv= 0.23155 cm2/s
Compound flow rate from inlet water is 1.27e-05 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
________Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 7.635e-06 m/s.
kg is estimated as 0.010826 m/s.  Model: 2
kg is estimated as 0.010826 m/s.  Model: 2
The Schmidt number is 0.64779.
The friction velocity is 37.398 m/s
kg is estimated as 0.023814 m/s.  Model: 3
________Agitated surface___________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18756 m/s.
kl (agitated)is estimated as 0.019092 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.391e-04 m/s.
 The effective stripping time (surface + diffused air) is 109.038 minutes.
 (1.81731 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 916.326 min. (15.272 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.19108
   KL aerated (m/s)                          0.019092
   KL OVERALL AERATED (m/s)                  0.011483
   KG quiescent (m/s)                        0.011029
   KL quiescent (m/s)                        7.635e-06
   KL OVERALL QUIESCENT (m/s)                7.6e-06
   KL OVERALL (m/s)                          1.391e-04
   air stripping time constant (min)         109.038
```

```
   FRACTION SURFACE VOLATILIZED              0.72669
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.72669
   FRACTION BIOLOGICALLY REMOVED             0.18684
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                9.23e-06
                        (Mg/year)            2.911e-04
   EMISSION FACTOR  (g/cm2-s)                1.306e-14
   UNIT EXIT CONCENTRATION (ppmw)            9.387e-07
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Old
  Stripper Scenario\ASB Old Stripper V7 3/16/2023 1:51:43 PM  19:25:00
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                      18    ASB Zone 2
2 Wastewater temperature   (C)                   32.08
3 length of aeration unit (m)                    368
4 width of aeration unit (m)                     184
5 depth of aeration unit (m)                     0.97
6 Area of agitation (each aerator,m2)            135
7 Total number of agitators in the unit          15
8 Power of agitation (each aerator,HP)           75
9 Impeller diameter (cm)                         49.53
10 Impeller rotation (RPM)                       1200
11 Agitator mechanical efficiency                0.83
12 aerator effectiveness, alpha                  0.83
13 if there is plug flow, enter 1                0
14 Overall biorate (mg/g bio-hr)                 19
15 Aeration air flow (m3/s)                      0
16 active biomass, aeration (g/l)                0.3
17 If covered, then enter 1                      0
18 special input                                 0
19 pH  (enter 0 for no pH adjustment)            7.24

Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F)
   hl= 0.003921 atm-m3/mol      vp= 2142.771 mmHg (41.446 psia)
       217.838 y/x
       0.15664 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.515e-05 cm2/s  dv= 0.23433 cm2/s
Compound flow rate from inlet water is 3.165e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.594 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 7.67e-06 m/s.
kg is estimated as 0.010938 m/s.  Model: 2
kg is estimated as 0.010938 m/s.  Model: 2
The Schmidt number is 0.64013.
The friction velocity is 37.398 m/s
kg is estimated as 0.023996 m/s.  Model: 3
_______Agitated surface_____________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
```

kg (agitated)is estimated as 0.18868 m/s.
kl (agitated)is estimated as 0.020121 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 3.715e-04 m/s.
The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.19222
KL aerated (m/s)	0.020121
KL OVERALL AERATED (m/s)	0.012174
KG quiescent (m/s)	0.011143
KL quiescent (m/s)	7.67e-06
KL OVERALL QUIESCENT (m/s)	7.637e-06
KL OVERALL (m/s)	3.715e-04
air stripping time constant (min)	43.518
FRACTION SURFACE VOLATILIZED	0.86271
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.86271
FRACTION BIOLOGICALLY REMOVED	0.097161
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	2.731e-04
(Mg/year)	0.008611
EMISSION FACTOR (g/cm2-s)	4.033e-13
UNIT EXIT CONCENTRATION (ppmw)	1.086e-05

No Stripper Scenario - Projected Actual Emissions
H_2S, TRS Compounds, and VOC
New-Indy Catawba - Catawba, SC

Concentration Loadings	H2S, ppm	DMDS, ppm	DMS, ppm	MMC, ppm
Design Foul Condensate Loadings (prior to H2O2)	147	15.00	17.00	16.00
Predicted % Reduction from H_2O_2	0.99	MMC converted into DMDS	0.90	0.99
Foul Condensate (after H_2O_2)	1.47	30.51	1.70	0.16
Avg. ASB Inlet (2021 and 2022)	0.25	0.09	0.20	0.0026
Flow Weighted Loading:	0.31	1.48	0.27	9.82E-03
H2SSIM/WATER9 Results	**H2S, g/s**	**DMDS, g/s**	**DMS, g/s**	**MMC, g/s**
ASB Zone 1	0.08	0.57	0.22	8.40E-03
ASB Zone 2	0.03	9.43E-03	4.70E-03	1.56E-04
ASB Zone 3	0.02	1.85E-04	1.70E-04	5.26E-06
Total ASB	**0.12**	**0.58**	**0.22**	**8.56E-03**
PAE Emissions Factors	**H2S, lb/ODTP**	**DMDS, lb/ODTP**	**DMS, lb/ODTP**	**MMC, lb/ODTP**
Total ASB	**1.06E-02**	**5.04E-02**	**1.92E-02**	**7.42E-04**

Post-Project Foul Condensate Flow:	850	gpm
Post-Project Foul Condensate Flow:	1.22	MGD
Post-Project ASB Influent Flow:	25.48	MGD
Total ASB Flow:	26.71	MGD
Total ASB Flow:	1170	L/s
Pulp Production	2200	ODTP/day

	MW
H2S	34
DMDS	94
DMS	62
MMC	48

Type of unit is

1 Total water added at the unit (l/s)	50	0
2 Area of openings at unit (cm2)		50
3 Radius of drop pipe (cm)		5
4 Drop length to conduit (cm)		61
5 Humidity of inlet air (%)		40
6 Temperature of air (C)		25
7 Drain air velocity (ft/min)		84
8 manhole air velocity (ft/min)		128
9 Conduit air velocity (ft/min)		66
10 Wind speed (cm/s at 10 m)		447
11 distance to next unit (cm)		500
12 slope of underflow conduit		.015
13 friction factor liquid		.016
14 friction factor gas		.006
15 radius of underflow conduit (cm)		12
16 Underflow T (C)		25
17 oscillation cycle time (min)		5
18 design collection velocities (ft/s)		2
19 design branch line fraction full		.4

Type of unit is

8 HL partition flag=1, adjust for sorption	0
9 unit recycle convergence number	200
10 oil molecular weight	0
11 oil density (g/cc)	0
12 NaUT 1=municipal 2=industrial 3=turb.	0
13 NaUT 1=mass tr. 2=equil	0
14 parts biomass per 1000 parts COD	
15 oil water partition method 0=owpc	
16 use UNIFAC aqueous data base =1	
17 specify mass transfer for unit, =1	
18 Use biomass for unit option, =1	
19 biogrowth Monod half concentration ppm	

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker Poe Privileged and Confidential\New Stripper Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7 3/16/2023 1:47:24 PM 19:20:20
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment

1 Description of unit	11	ASB Zone 1
2 Wastewater temperature (C)		34.08
3 length of aeration unit (m)		295
4 width of aeration unit (m)		295
5 depth of aeration unit (m)		1.4
6 Area of agitation (each aerator,m2)		135
7 Total number of agitators in the unit		31
8 Power of agitation (each aerator,HP)		75
9 Impeller diameter (cm)		49.53
10 Impeller rotation (RPM)		1200
11 Agitator mechanical efficiency		0.83
12 aerator effectiveness, alpha		0.83
13 if there is plug flow, enter 1		0
14 Overall biorate (mg/g bio-hr)		19
15 Aeration air flow (m3/s)		0
16 active biomass, aeration (g/l)		0.3
17 If covered, then enter 1		0
18 special input		0
19 pH (enter 0 for no pH adjustment)		7.04

```
Properties of DIMETHYL DISULFIDE at 34.1 deg.C (93.3 deg.F)
   hl= 0.001714 atm-m3/mol      vp= 45.945 mmHg (0.88868 psia)
       95.2 y/x
       0.068011 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.041e-05 cm2/s  dv= 0.088022 cm2/s
Compound flow rate from inlet water is 1.57133 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 5.971e-06 m/s.
kg is estimated as 0.005598 m/s.  Model: 2
kg is estimated as 0.005598 m/s.  Model: 2
The Schmidt number is 1.70412.
The friction velocity is 37.398 m/s
kg is estimated as 0.012927 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.11564 m/s.
kl (agitated)is estimated as 0.017486 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 2.753e-04 m/s.
 The effective stripping time (surface + diffused air) is 84.752 minutes. (1.41254
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.11781
   KL aerated (m/s)                          0.017486
   KL OVERALL AERATED (m/s)                  0.005609
   KG quiescent (m/s)                        0.005703
   KL quiescent (m/s)                        5.971e-06
   KL OVERALL QUIESCENT (m/s)                5.883e-06
   KL OVERALL (m/s)                          2.753e-04
   air stripping time constant (min)         84.752
   FRACTION SURFACE VOLATILIZED              0.36452
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.36452
   FRACTION BIOLOGICALLY REMOVED             0.61768
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.57278
                        (Mg/year)            18.063
   EMISSION FACTOR  (g/cm2-s)                6.582e-10
   UNIT EXIT CONCENTRATION (ppmw)            0.023907
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
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COMPOUND: DIMETHYL DISULFIDE

Type of unit is system exit stream
1 Description of unit                    12    def.system exit st
```

```
   TOTAL AIR EMISSIONS  (g/s)              0.
                        (Mg/year)          0.
   EMISSION FACTOR  (g/cm2-s)             6.582e-10
   UNIT EXIT CONCENTRATION (ppmw)         4.376e-05
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:20:20
COMPOUND: DIMETHYL DISULFIDE

Type of unit is open hub drain
1 Description of unit                    13    default open hub d
2 Underflow T (C)                              43.89
3 Total water added at the unit (l/s)          0
4 Area of openings at unit (cm2)               50
5 Radius of drop pipe (cm)                     5
6 Drop length to conduit (cm)                  61
7 Open surface=1                               1
8 Subsurface entrance=1                        0
9 subsurface exit =1                           0
10 radius of underflow conduit (cm)            12
11 distance to next unit (cm)                  500
12 slope of underflow conduit                  0.015
16 velocity air at drain opening (ft/min)      84
17 municipal waste in conduit =1               0
18 Assume equilibrium in unit, =1              0
19 pH  (enter 0 for no pH adjustment)          8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1170 l/s.
   Weight fraction down is  1.4811E-06
   Gas concentration in  0 mol fraction.
   Gas flow  1170 L/s
   Weight fraction out at base of drop is  1.3430203399053E-06
   fraction transferred in the drain drop from hub is .093228
   fraction loss in waste1 drop to hub     0.
   fraction loss in waste2 drop to hub     0.
   fraction loss in waste3 drop to hub     0.
   fraction loss in collection hub drop    0.093228
   fraction loss in unit                   0.
   fraction loss in line run               0.
   component upstream of unit, g/s         0.
   mol fract. headspace upstream (y)       0.
   headspace at conduit discharge, y       0.
   headspace end of conduit (y)            1.659e-18
   mol fract. headspace vent base          3.811e-05
   headspace flow out vent (cc/s)          -1.17e+06
   headspace flow down line (cc/s)         1.17e+06
   KG surface (m/s)                        2007.233
   KL surface (m/s)                        6.787e-09
   flow of waste down hub (l/s)            0.
   component flow in waste into unit (g/s) 1.73289
   total component into unit, g/s          1.57133
   TOTAL AIR EMISSIONS  (g/s)              0.16155
                        (Mg/year)          5.09474
   EMISSION FACTOR  (g/cm2-s)              6.582e-10
   UNIT EXIT CONCENTRATION (ppmw)          1.34302
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
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```

COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment

1	Description of unit	17	ASB Zone 3
2	Wastewater temperature (C)		30.01
3	length of aeration unit (m)		376
4	width of aeration unit (m)		188
5	depth of aeration unit (m)		0.91
6	Area of agitation (each aerator,m2)		135
7	Total number of agitators in the unit		6
8	Power of agitation (each aerator,HP)		75
9	Impeller diameter (cm)		49.53
10	Impeller rotation (RPM)		1200
11	Agitator mechanical efficiency		0.83
12	aerator effectiveness, alpha		0.83
13	if there is plug flow, enter 1		0
14	Overall biorate (mg/g bio-hr)		19
15	Aeration air flow (m3/s)		0
16	active biomass, aeration (g/l)		0.3
17	If covered, then enter 1		0
18	special input		0
19	pH (enter 0 for no pH adjustment)		7.42

Properties of DIMETHYL DISULFIDE at 30. deg.C (86. deg.F)
hl= 0.00141 atm-m3/mol vp= 37.814 mmHg (0.7314 psia)
78.352 y/x
0.056726 g/L gas per g/L liquid
Temperature adjustment factor = 1.046 ^(T-25), deg. C
k1= 0. L/g-hr dl= 1.027e-05 cm2/s dv= 0.085991 cm2/s
Compound flow rate from inlet water is 0.00102 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
____Biomass production_____
The biomass production rate is 0.mg/hr. (0. mg/L)
The fraction dissolved solids converted is 0. .
The estimated biomass exit concentration is 0. mg/L.
_____Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 5.918e-06 m/s.
kg is estimated as 0.005575 m/s. Model: 2
kg is estimated as 0.005575 m/s. Model: 2
The Schmidt number is 1.74436.
The friction velocity is 37.398 m/s
kg is estimated as 0.012742 m/s. Model: 3
_____Agitated surface_____
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.1143 m/s.
kl (agitated)is estimated as 0.015772 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 5.972e-05 m/s.
The effective stripping time (surface + diffused air) is 253.944 minutes. (4.2324 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 916.326 min. (15.272 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.11644
KL aerated (m/s)	0.015772
KL OVERALL AERATED (m/s)	0.004711
KG quiescent (m/s)	0.005679

```
   KL quiescent (m/s)                          5.918e-06
   KL OVERALL QUIESCENT (m/s)                  5.813e-06
   KL OVERALL (m/s)                            5.972e-05
   air stripping time constant (min)           253.944
   FRACTION SURFACE VOLATILIZED                0.18107
   FRACTION SUBMERGED VOLATILIZED              0.
   TOTAL FRACTION VOLATILIZED                  0.18107
   FRACTION BIOLOGICALLY REMOVED               0.76875
   FRACTION ABSORBED                           0.
   TOTAL AIR EMISSIONS  (g/s)                  1.848e-04
                        (Mg/year)              0.005827
   EMISSION FACTOR  (g/cm2-s)                  2.614e-13
   UNIT EXIT CONCENTRATION (ppmw)              4.376e-05
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
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COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                      18    ASB Zone 2
2 Wastewater temperature   (C)                   32.08
3 length of aeration unit (m)                    368
4 width of aeration unit (m)                     184
5 depth of aeration unit (m)                     0.97
6 Area of agitation (each aerator,m2)            135
7 Total number of agitators in the unit          15
8 Power of agitation (each aerator,HP)           75
9 Impeller diameter (cm)                         49.53
10 Impeller rotation (RPM)                       1200
11 Agitator mechanical efficiency                0.83
12 aerator effectiveness, alpha                  0.83
13 if there is plug flow, enter 1                0
14 Overall biorate (mg/g bio-hr)                 19
15 Aeration air flow (m3/s)                      0
16 active biomass, aeration (g/l)                0.3
17 If covered, then enter 1                      0
18 special input                                 0
19 pH  (enter 0 for no pH adjustment)            7.24

Properties of DIMETHYL DISULFIDE at 32.1 deg.C (89.7 deg.F)
   hl= 0.001558 atm-m3/mol      vp= 41.785 mmHg (0.80821 psia)
       86.579 y/x
       0.062258 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.034e-05 cm2/s  dv= 0.087022 cm2/s
Compound flow rate from inlet water is 0.027971 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.594 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 5.945e-06 m/s.
kg is estimated as 0.005633 m/s.  Model: 2
kg is estimated as 0.005633 m/s.  Model: 2
The Schmidt number is 1.72371.
The friction velocity is 37.398 m/s
kg is estimated as 0.012836 m/s.  Model: 3
```

Agitated surface

The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.11498 m/s.
kl (agitated)is estimated as 0.016622 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 1.598e-04 m/s.
The effective stripping time (surface + diffused air) is 101.198 minutes. (1.68663 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.11714
KL aerated (m/s)	0.016622
KL OVERALL AERATED (m/s)	0.005152
KG quiescent (m/s)	0.005738
KL quiescent (m/s)	5.945e-06
KL OVERALL QUIESCENT (m/s)	5.85e-06
KL OVERALL (m/s)	1.598e-04
air stripping time constant (min)	101.198
FRACTION SURFACE VOLATILIZED	0.33728
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.33728
FRACTION BIOLOGICALLY REMOVED	0.62623
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.009434
(Mg/year)	0.29751
EMISSION FACTOR (g/cm2-s)	1.393e-11
UNIT EXIT CONCENTRATION (ppmw)	8.721e-04

```
Type of unit is
1 Total water added at the unit (l/s)      50      0
2 Area of openings at unit (cm2)                   50
3 Radius of drop pipe (cm)                         5
4 Drop length to conduit (cm)                      61
5 Humidity of inlet air (%)                        40
6 Temperature of air (C)                           25
7 Drain air velocity (ft/min)                      84
8 manhole air velocity (ft/min)                    128
9 Conduit air velocity (ft/min)                    66
10 Wind speed (cm/s at 10 m)                       447
11 distance to next unit (cm)                      500
12 slope of underflow conduit                      .015
13 friction factor liquid                          .016
14 friction factor gas                             .006
15 radius of underflow conduit (cm)                12
16 Underflow T (C)                                 25
17 oscillation cycle time (min)                    5
18 design collection velocities  (ft/s)            2
19 design branch line fraction full                .4

Type of unit is
8 HL partition flag=1, adjust for sorption         0
9 unit recycle convergence number                  200
10 oil molecular weight                            0
11 oil density  (g/cc)                             0
12 NaUT 1=municipal 2=industrial  3=turb.          0
13 NaUT 1=mass tr. 2=equil                         0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:21:06
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                      11    ASB Zone 1
2 Wastewater temperature   (C)                     34.08
3 length of aeration unit (m)                      295
4 width of aeration unit (m)                       295
5 depth of aeration unit (m)                       1.4
6 Area of agitation (each aerator,m2)              135
7 Total number of agitators in the unit            31
8 Power of agitation (each aerator,HP)             75
9 Impeller diameter (cm)                           49.53
10 Impeller rotation (RPM)                         1200
11 Agitator mechanical efficiency                  0.83
12 aerator effectiveness, alpha                    0.83
13 if there is plug flow, enter 1                  0
14 Overall biorate (mg/g bio-hr)                   19
15 Aeration air flow (m3/s)                        0
16 active biomass, aeration (g/l)                  0.3
17 If covered, then enter 1                        0
18 special input                                   0
19 pH  (enter 0 for no pH adjustment)              7.04
```

```
Properties of DIMETHYL SULFIDE  (DMS) at 34.1 deg.C (93.3 deg.F)
   hl= 0.002924 atm-m3/mol      vp= 704.653 mmHg (13.629 psia)
       162.463 y/x
       0.11606 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.504e-05 cm2/s  dv= 0.14765 cm2/s
Compound flow rate from inlet water is 0.27039 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
________Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 7.634e-06 m/s.
kg is estimated as 0.007917 m/s.  Model: 2
kg is estimated as 0.007917 m/s.  Model: 2
The Schmidt number is 1.01591.
The friction velocity is 37.398 m/s
kg is estimated as 0.017873 m/s.  Model: 3
________Agitated surface___________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14978 m/s.
kl (agitated)is estimated as 0.021024 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 4.77e-04 m/s.
 The effective stripping time (surface + diffused air) is 48.915 minutes. (0.81526
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.15258
   KL aerated (m/s)                          0.021024
   KL OVERALL AERATED (m/s)                  0.009769
   KG quiescent (m/s)                        0.008066
   KL quiescent (m/s)                        7.634e-06
   KL OVERALL QUIESCENT (m/s)                7.574e-06
   KL OVERALL (m/s)                          4.77e-04
   air stripping time constant (min)         48.915
   FRACTION SURFACE VOLATILIZED              0.80064
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.80064
   FRACTION BIOLOGICALLY REMOVED             0.1768
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.21648
                        (Mg/year)            6.82699
   EMISSION FACTOR  (g/cm2-s)                2.488e-10
   UNIT EXIT CONCENTRATION (ppmw)            0.005215
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
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COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is system exit stream
1 Description of unit                    12    def.system exit st
```

```
   TOTAL AIR EMISSIONS  (g/s)                0.
                        (Mg/year)            0.
   EMISSION FACTOR  (g/cm2-s)                2.488e-10
   UNIT EXIT CONCENTRATION (ppmw)            2.285e-05
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:21:06
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is open hub drain
1 Description of unit                       13    default open hub d
2 Underflow T (C)                                 43.89
3 Total water added at the unit (l/s)             0
4 Area of openings at unit (cm2)                  50
5 Radius of drop pipe (cm)                        5
6 Drop length to conduit (cm)                     61
7 Open surface=1                                  1
8 Subsurface entrance=1                           0
9 subsurface exit =1                              0
10 radius of underflow conduit (cm)               12
11 distance to next unit (cm)                     500
12 slope of underflow conduit                     0.015
16 velocity air at drain opening (ft/min)         84
17 municipal waste in conduit =1                  0
18 Assume equilibrium in unit, =1                 0
19 pH  (enter 0 for no pH adjustment)             8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1170 l/s.
   Weight fraction down is  2.677E-07
   Gas concentration in  0 mol fraction.
   Gas flow  1170 L/s
   Weight fraction out at base of drop is  2.31101058606837E-07
   fraction transferred in the drain drop from hub is .136716
   fraction loss in waste1 drop to hub       0.
   fraction loss in waste2 drop to hub       0.
   fraction loss in waste3 drop to hub       0.
   fraction loss in collection hub drop      0.13672
   fraction loss in unit                     0.
   fraction loss in line run                 0.
   component upstream of unit, g/s           0.
   mol fract. headspace upstream (y)         0.
   headspace at conduit discharge, y         0.
   headspace end of conduit (y)              5.603e-19
   mol fract. headspace vent base            1.532e-05
   headspace flow out vent (cc/s)            -1.17e+06
   headspace flow down line (cc/s)           1.17e+06
   KG surface (m/s)                          2834.248
   KL surface (m/s)                          8.784e-09
   flow of waste down hub (l/s)              0.
   component flow in waste into unit (g/s)   0.31321
   total component into unit, g/s            0.27039
   TOTAL AIR EMISSIONS  (g/s)                0.042821
                        (Mg/year)            1.3504
   EMISSION FACTOR  (g/cm2-s)                2.488e-10
   UNIT EXIT CONCENTRATION (ppmw)            0.2311
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:21:06
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COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                          17    ASB Zone 3
2 Wastewater temperature   (C)                       30.01
3 length of aeration unit (m)                        376
4 width of aeration unit (m)                         188
5 depth of aeration unit (m)                         0.91
6 Area of agitation (each aerator,m2)                135
7 Total number of agitators in the unit              6
8 Power of agitation (each aerator,HP)               75
9 Impeller diameter (cm)                             49.53
10 Impeller rotation (RPM)                           1200
11 Agitator mechanical efficiency                    0.83
12 aerator effectiveness, alpha                      0.83
13 if there is plug flow, enter 1                    0
14 Overall biorate (mg/g bio-hr)                     19
15 Aeration air flow (m3/s)                          0
16 active biomass, aeration (g/l)                    0.3
17 If covered, then enter 1                          0
18 special input                                     0
19 pH  (enter 0 for no pH adjustment)                7.42

Properties of DIMETHYL SULFIDE  (DMS) at 30. deg.C (86. deg.F)
   hl= 0.002519 atm-m3/mol      vp= 606.985 mmHg (11.74 psia)
       139.945 y/x
       0.10132 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.485e-05 cm2/s  dv= 0.14425 cm2/s
Compound flow rate from inlet water is 2.889e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 7.566e-06 m/s.
kg is estimated as 0.007884 m/s.  Model: 2
kg is estimated as 0.007884 m/s.  Model: 2
The Schmidt number is 1.03989.
The friction velocity is 37.398 m/s
kg is estimated as 0.017611 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14804 m/s.
kl (agitated)is estimated as 0.018962 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.053e-04 m/s.
 The effective stripping time (surface + diffused air) is 144.073 minutes.
 (2.40122 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 916.326 min. (15.272 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.15081
   KL aerated (m/s)                          0.018962
   KL OVERALL AERATED (m/s)                  0.00854
   KG quiescent (m/s)                        0.008032
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   KL quiescent (m/s)                          7.566e-06
   KL OVERALL QUIESCENT (m/s)                  7.497e-06
   KL OVERALL (m/s)                            1.053e-04
   air stripping time constant (min)           144.073
   FRACTION SURFACE VOLATILIZED                0.5886
   FRACTION SUBMERGED VOLATILIZED              0.
   TOTAL FRACTION VOLATILIZED                  0.5886
   FRACTION BIOLOGICALLY REMOVED               0.31886
   FRACTION ABSORBED                           0.
   TOTAL AIR EMISSIONS  (g/s)                  1.701e-04
                        (Mg/year)              0.005363
   EMISSION FACTOR  (g/cm2-s)                  2.406e-13
   UNIT EXIT CONCENTRATION (ppmw)              2.285e-05
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:21:06
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                        18    ASB Zone 2
2 Wastewater temperature   (C)                     32.08
3 length of aeration unit (m)                      368
4 width of aeration unit (m)                       184
5 depth of aeration unit (m)                       0.97
6 Area of agitation (each aerator,m2)              135
7 Total number of agitators in the unit            15
8 Power of agitation (each aerator,HP)             75
9 Impeller diameter (cm)                           49.53
10 Impeller rotation (RPM)                         1200
11 Agitator mechanical efficiency                  0.83
12 aerator effectiveness, alpha                    0.83
13 if there is plug flow, enter 1                  0
14 Overall biorate (mg/g bio-hr)                   19
15 Aeration air flow (m3/s)                        0
16 active biomass, aeration (g/l)                  0.3
17 If covered, then enter 1                        0
18 special input                                   0
19 pH  (enter 0 for no pH adjustment)              7.24

Properties of DIMETHYL SULFIDE  (DMS) at 32.1 deg.C (89.7 deg.F)
   hl= 0.002719 atm-m3/mol      vp= 655.201 mmHg (12.673 psia)
       151.062 y/x
       0.10863 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   k1= 0. L/g-hr          dl= 1.495e-05 cm2/s  dv= 0.14597 cm2/s
Compound flow rate from inlet water is 0.006101 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.594 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 7.6e-06 m/s.
kg is estimated as 0.007966 m/s.  Model: 2
kg is estimated as 0.007966 m/s.  Model: 2
The Schmidt number is 1.02758.
The friction velocity is 37.398 m/s
kg is estimated as 0.017744 m/s.  Model: 3
```

Agitated surface

The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.14892 m/s.
kl (agitated)is estimated as 0.019984 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 2.809e-04 m/s.
The effective stripping time (surface + diffused air) is 57.552 minutes. (0.9592 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.15171
KL aerated (m/s)	0.019984
KL OVERALL AERATED (m/s)	0.009148
KG quiescent (m/s)	0.008115
KL quiescent (m/s)	7.6e-06
KL OVERALL QUIESCENT (m/s)	7.537e-06
KL OVERALL (m/s)	2.809e-04
air stripping time constant (min)	57.552
FRACTION SURFACE VOLATILIZED	0.76981
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.76981
FRACTION BIOLOGICALLY REMOVED	0.18284
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.004697
(Mg/year)	0.14812
EMISSION FACTOR (g/cm2-s)	6.937e-12
UNIT EXIT CONCENTRATION (ppmw)	2.469e-04

```
Type of unit is
1 Total water added at the unit (l/s)      50      0
2 Area of openings at unit (cm2)                   50
3 Radius of drop pipe (cm)                         5
4 Drop length to conduit (cm)                      61
5 Humidity of inlet air (%)                        40
6 Temperature of air (C)                           25
7 Drain air velocity (ft/min)                      84
8 manhole air velocity (ft/min)                    128
9 Conduit air velocity (ft/min)                    66
10 Wind speed (cm/s at 10 m)                       447
11 distance to next unit (cm)                      500
12 slope of underflow conduit                      .015
13 friction factor liquid                          .016
14 friction factor gas                             .006
15 radius of underflow conduit (cm)                12
16 Underflow T (C)                                 25
17 oscillation cycle time (min)                    5
18 design collection velocities  (ft/s)            2
19 design branch line fraction full                .4

Type of unit is
8 HL partition flag=1, adjust for sorption         0
9 unit recycle convergence number                  200
10 oil molecular weight                            0
11 oil density  (g/cc)                             0
12 NaUT 1=municipal 2=industrial  3=turb.          0
13 NaUT 1=mass tr. 2=equil                         0
14 parts biomass per 1000 parts COD
15 oil water partition method 0=owpc
16 use UNIFAC aqueous data base =1
17 specify mass transfer for unit, =1
18 Use biomass for unit option, =1
19 biogrowth Monod half concentration ppm

DETAILED CALCULATIONS at Unit 11 ASB Zone 1
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:21:41
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                      11    ASB Zone 1
2 Wastewater temperature   (C)                    34.08
3 length of aeration unit (m)                     295
4 width of aeration unit (m)                      295
5 depth of aeration unit (m)                      1.4
6 Area of agitation (each aerator,m2)             135
7 Total number of agitators in the unit           31
8 Power of agitation (each aerator,HP)            75
9 Impeller diameter (cm)                          49.53
10 Impeller rotation (RPM)                        1200
11 Agitator mechanical efficiency                 0.83
12 aerator effectiveness, alpha                   0.83
13 if there is plug flow, enter 1                 0
14 Overall biorate (mg/g bio-hr)                  19
15 Aeration air flow (m3/s)                       0
16 active biomass, aeration (g/l)                 0.3
17 If covered, then enter 1                       0
18 special input                                  0
19 pH  (enter 0 for no pH adjustment)             7.04
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```
Properties of METHANETHIOL(methyl mercaptan) at 34.1 deg.C (93.3 deg.F)
   hl= 0.004158 atm-m3/mol      vp= 2272.142 mmHg (43.948 psia)
       230.99 y/x
       0.16502 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.525e-05 cm2/s  dv= 0.23702 cm2/s
Compound flow rate from inlet water is 0.009471 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 28.926 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 237.766.
kl is estimated as 7.703e-06 m/s.
kg is estimated as 0.010871 m/s.  Model: 2
kg is estimated as 0.010871 m/s.  Model: 2
The Schmidt number is 0.63285.
The friction velocity is 37.398 m/s
kg is estimated as 0.024173 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18977 m/s.
kl (agitated)is estimated as 0.021167 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 6.265e-04 m/s.
 The effective stripping time (surface + diffused air) is 37.242 minutes. (0.62071
 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 1735.541 min. (28.926 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.19332
   KL aerated (m/s)                          0.021167
   KL OVERALL AERATED (m/s)                  0.012876
   KG quiescent (m/s)                        0.011075
   KL quiescent (m/s)                        7.703e-06
   KL OVERALL QUIESCENT (m/s)                7.672e-06
   KL OVERALL (m/s)                          6.265e-04
   air stripping time constant (min)         37.242
   FRACTION SURFACE VOLATILIZED              0.88738
   FRACTION SUBMERGED VOLATILIZED            0.
   TOTAL FRACTION VOLATILIZED                0.88738
   FRACTION BIOLOGICALLY REMOVED             0.093578
   FRACTION ABSORBED                         0.
   TOTAL AIR EMISSIONS  (g/s)                0.008404
                        (Mg/year)            0.26504
   EMISSION FACTOR  (g/cm2-s)                9.657e-12
   UNIT EXIT CONCENTRATION (ppmw)            1.541e-04
DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
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COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is system exit stream
1 Description of unit                       12    def.system exit st
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   TOTAL AIR EMISSIONS  (g/s)              0.
                        (Mg/year)          0.
   EMISSION FACTOR  (g/cm2-s)             9.657e-12
   UNIT EXIT CONCENTRATION (ppmw)         5.348e-07
DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:21:41
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is open hub drain
1 Description of unit                    13    default open hub d
2 Underflow T (C)                              43.89
3 Total water added at the unit (l/s)          0
4 Area of openings at unit (cm2)               50
5 Radius of drop pipe (cm)                     5
6 Drop length to conduit (cm)                  61
7 Open surface=1                               1
8 Subsurface entrance=1                        0
9 subsurface exit =1                           0
10 radius of underflow conduit (cm)            12
11 distance to next unit (cm)                  500
12 slope of underflow conduit                  0.015
16 velocity air at drain opening (ft/min)      84
17 municipal waste in conduit =1               0
18 Assume equilibrium in unit, =1              0
19 pH  (enter 0 for no pH adjustment)          8.9

 Equilibrium partitioning in drain drop hub is assumed.
   Total drain flow is  1170 l/s.
   Weight fraction down is  9.8E-09
   Gas concentration in  0 mol fraction.
   Gas flow  1170 L/s
   Weight fraction out at base of drop is  8.09478308097639E-09
   fraction transferred in the drain drop from hub is .174002
   fraction loss in waste1 drop to hub     0.
   fraction loss in waste2 drop to hub     0.
   fraction loss in waste3 drop to hub     0.
   fraction loss in collection hub drop    0.174
   fraction loss in unit                   0.
   fraction loss in line run               0.
   component upstream of unit, g/s         0.
   mol fract. headspace upstream (y)       0.
   headspace at conduit discharge, y       0.
   headspace end of conduit (y)            2.559e-20
   mol fract. headspace vent base          9.217e-07
   headspace flow out vent (cc/s)          -1.17e+06
   headspace flow down line (cc/s)         1.17e+06
   KG surface (m/s)                        3886.338
   KL surface (m/s)                        8.868e-09
   flow of waste down hub (l/s)            0.
   component flow in waste into unit (g/s) 0.011466
   total component into unit, g/s          0.009471
   TOTAL AIR EMISSIONS  (g/s)              0.001995
                        (Mg/year)          0.062918
   EMISSION FACTOR  (g/cm2-s)              9.657e-12
   UNIT EXIT CONCENTRATION (ppmw)          0.008095
DETAILED CALCULATIONS at Unit 17 ASB Zone 3
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:21:41
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COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                          17    ASB Zone 3
2 Wastewater temperature   (C)                       30.01
3 length of aeration unit (m)                        376
4 width of aeration unit (m)                         188
5 depth of aeration unit (m)                         0.91
6 Area of agitation (each aerator,m2)                135
7 Total number of agitators in the unit              6
8 Power of agitation (each aerator,HP)               75
9 Impeller diameter (cm)                             49.53
10 Impeller rotation (RPM)                           1200
11 Agitator mechanical efficiency                    0.83
12 aerator effectiveness, alpha                      0.83
13 if there is plug flow, enter 1                    0
14 Overall biorate (mg/g bio-hr)                     19
15 Aeration air flow (m3/s)                          0
16 active biomass, aeration (g/l)                    0.3
17 If covered, then enter 1                          0
18 special input                                     0
19 pH  (enter 0 for no pH adjustment)                7.42

Properties of METHANETHIOL(methyl mercaptan) at 30. deg.C (86. deg.F)
   hl= 0.003687 atm-m3/mol      vp= 2014.774 mmHg (38.97 psia)
       204.826 y/x
       0.14829 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.505e-05 cm2/s  dv= 0.23155 cm2/s
Compound flow rate from inlet water is 7.237e-06 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.272 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 329.675.
kl is estimated as 7.635e-06 m/s.
kg is estimated as 0.010826 m/s.  Model: 2
kg is estimated as 0.010826 m/s.  Model: 2
The Schmidt number is 0.64779.
The friction velocity is 37.398 m/s
kg is estimated as 0.023814 m/s.  Model: 3
_______Agitated surface_____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18756 m/s.
kl (agitated)is estimated as 0.019092 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 1.391e-04 m/s.
 The effective stripping time (surface + diffused air) is 109.038 minutes.
 (1.81731 hrs.)
 The pump mixing time is 5 x the pumping recirculaion time, 0. min.
 The ratio of the mixing to the striping (surface + diffused air) is 0.
 The mean residence time is 916.326 min. (15.272 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.19108
   KL aerated (m/s)                          0.019092
   KL OVERALL AERATED (m/s)                  0.011483
   KG quiescent (m/s)                        0.011029
```

```
   KL quiescent (m/s)                          7.635e-06
   KL OVERALL QUIESCENT (m/s)                  7.6e-06
   KL OVERALL (m/s)                            1.391e-04
   air stripping time constant (min)           109.038
   FRACTION SURFACE VOLATILIZED                0.72669
   FRACTION SUBMERGED VOLATILIZED              0.
   TOTAL FRACTION VOLATILIZED                  0.72669
   FRACTION BIOLOGICALLY REMOVED               0.18684
   FRACTION ABSORBED                           0.
   TOTAL AIR EMISSIONS  (g/s)                  5.259e-06
                        (Mg/year)              1.658e-04
   EMISSION FACTOR  (g/cm2-s)                  7.439e-15
   UNIT EXIT CONCENTRATION (ppmw)              5.348e-07
DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
  Project C:\BoxDrive\Box\ALL4 Client Files\New-Indy Catawba\CONFIDENTIAL\Parker
  Poe Privileged and Confidential\New Stripper
  Permitting\Emissions\WWTP\PAE\Hardpipe Scenario\ASB Hardpipe Scenario V7
  3/16/2023 1:47:24 PM  19:21:41
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                      18    ASB Zone 2
2 Wastewater temperature   (C)                   32.08
3 length of aeration unit (m)                    368
4 width of aeration unit (m)                     184
5 depth of aeration unit (m)                     0.97
6 Area of agitation (each aerator,m2)            135
7 Total number of agitators in the unit          15
8 Power of agitation (each aerator,HP)           75
9 Impeller diameter (cm)                         49.53
10 Impeller rotation (RPM)                       1200
11 Agitator mechanical efficiency                0.83
12 aerator effectiveness, alpha                  0.83
13 if there is plug flow, enter 1                0
14 Overall biorate (mg/g bio-hr)                 19
15 Aeration air flow (m3/s)                      0
16 active biomass, aeration (g/l)                0.3
17 If covered, then enter 1                      0
18 special input                                 0
19 pH  (enter 0 for no pH adjustment)            7.24

Properties of METHANETHIOL(methyl mercaptan) at 32.1 deg.C (89.7 deg.F)
   hl= 0.003921 atm-m3/mol      vp= 2142.771 mmHg (41.446 psia)
       217.838 y/x
       0.15664 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.515e-05 cm2/s  dv= 0.23433 cm2/s
Compound flow rate from inlet water is 1.803e-04 g/s.
Compound flow rate from inlet vent is 0. g/s.
Compound flow rate from inlet duct is 0. g/s.
Submerged aeration rate from inlet vent is 0. m3/s.
Total submerged aeration is 0. m3/s.
The residence time in the unit is 15.594 hr.
____Biomass production_____________
    The biomass production rate is 0.mg/hr. (0. mg/L)
    The fraction dissolved solids converted is 0. .
    The estimated biomass exit concentration is 0. mg/L.
_______Quiescent wind shear surface___Springer_
The fetch to depth ratio is 302.703.
kl is estimated as 7.67e-06 m/s.
kg is estimated as 0.010938 m/s.  Model: 2
kg is estimated as 0.010938 m/s.  Model: 2
The Schmidt number is 0.64013.
The friction velocity is 37.398 m/s
kg is estimated as 0.023996 m/s.  Model: 3
```

Agitated surface

The rotation speed is 125.654 radians per second.
The rotation factor NRW is 2.052e+06.
The power number NPR is 7.881e-04.
The rotation factor NFR is 797.027.
kg (agitated)is estimated as 0.18868 m/s.
kl (agitated)is estimated as 0.020121 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 3.715e-04 m/s.
The effective stripping time (surface + diffused air) is 43.518 minutes. (0.72529 hrs.)
The pump mixing time is 5 x the pumping recirculaion time, 0. min.
The ratio of the mixing to the striping (surface + diffused air) is 0.
The mean residence time is 935.622 min. (15.594 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.19222
KL aerated (m/s)	0.020121
KL OVERALL AERATED (m/s)	0.012174
KG quiescent (m/s)	0.011143
KL quiescent (m/s)	7.67e-06
KL OVERALL QUIESCENT (m/s)	7.637e-06
KL OVERALL (m/s)	3.715e-04
air stripping time constant (min)	43.518
FRACTION SURFACE VOLATILIZED	0.86271
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.86271
FRACTION BIOLOGICALLY REMOVED	0.097161
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	1.556e-04
(Mg/year)	0.004907
EMISSION FACTOR (g/cm2-s)	2.298e-13
UNIT EXIT CONCENTRATION (ppmw)	6.185e-06

PAE H2S Factor
Summary of H2SSIM Inputs and Outputs

PAE - No Stripper Scenario	Zone 1	Zone 2	Zone 3
DO	1.57	4.63	4.66
Temp	93.34	89.74	86.02
pH	7.04	7.24	7.42
Length	968	1208	1235
Width	968	604	617
Aerators	31	15	6

	Main Inlet	Hardpipe	Units
Flow	25.48	1.22	MGD
Total Sulfide	0.252	1.47	mg/L
Sulfate	390	390	mg/L

H2S g/s	Zone 1	Zone 2	Zone 3	Total ASB	
	0.08	0.03	0.02	**0.122**	g/s
				2200	ODTP/day
				1.06E-02	lb/ODTP

PAE - Backup Stripper	Zone 1	Zone 2	Zone 3
DO	1.57	4.63	4.66
Temp	93.34	89.74	86.02
pH	7.04	7.24	7.42
Length	968	1208	1235
Width	968	604	617
Aerators	31	15	6

	Main Inlet	Hardpipe	Units
Flow	25.48	1.22	MGD
Total Sulfide	0.252	2.93	mg/L
Sulfate	390	390	mg/L

H2S g/s	Zone 1	Zone 2	Zone 3	Total ASB	
	0.08	0.03	0.02	**0.126**	g/s
				2200	ODTP/day
				1.09E-02	lb/ODTP

PAE - New Stripper	Zone 1	Zone 2	Zone 3
DO	1.57	4.63	4.66
Temp	93.34	89.74	86.02
pH	7.04	7.24	7.42
Length	968	1208	1235
Width	968	604	617
Aerators	31	15	6

	Main Inlet	Hardpipe	Units
Flow	25.48	0.00	MGD
Total Sulfide	0.252	0.00	mg/L
Sulfate	390	390	mg/L

H2S g/s	Zone 1	Zone 2	Zone 3	Total ASB	
	0.07	0.03	0.02	**0.119**	
				2200	ODTP/day
				1.03E-02	lb/ODTP

*DO are based on average of all DO readings from 2021 and 2022 Subpart S performance testing.

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)
Version 1.3

New Stripper Scenario

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

Data Type 2. Model Zone Information

Number of Zones	3
Zone Location of Hardpipe	1
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	25.48		MGD
Total Sulfide	0.252		mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph
Ambient Temperature	79	F

Data Type 5. Zone Physical and Chemical Conditions

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units
Dissolved Oxygen	1.57	4.63	4.66		mg/L
Temperature	93.34	89.74	86.02		F
pH	7.04	7.24	7.42		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	968	1208	1235		feet
Width	968	604	617		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

New Stripper Scenario

Basin Emissions		Units
Total Emissions (H_2S)	0.119	gms/s
Total Emissions (H_2S)	8271.8	lbs/yr
Total Emissions (H_2S)	4.1	tons/yr
Total Emissions (H_2S)	3.8	tonnes/yr
Emission Flux (H_2S)	16.6	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.07	0.03	0.02		gms/s
Zone Emissions (H_2S)	4987.3	1762.5	1522.0		lbs/yr
Emission Flux (H_2S)	26.0	11.8	9.8		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	36.300	6.200	5.400		lbs/yr

Percent Inlet Sulfide Removed	57.7%

Current Parameters	
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)
Version 1.3

Backup Stripper Scenario

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

Data Type 2. Model Zone Information

Number of Zones	3
Zone Location of Hardpipe	1
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	25.48	1.22	MGD
Total Sulfide	0.252	2.93	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph
Ambient Temperature	79	F

Data Type 5. Zone Physical and Chemical Conditions

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units
Dissolved Oxygen	1.57	4.63	4.66		mg/L
Temperature	93.34	89.74	86.02		F
pH	7.04	7.24	7.42		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	968	1208	1235		feet
Width	968	604	617		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Backup Stripper
Scenario

Basin Emissions		Units
Total Emissions (H_2S)	0.126	gms/s
Total Emissions (H_2S)	8765.3	lbs/yr
Total Emissions (H_2S)	4.4	tons/yr
Total Emissions (H_2S)	4.0	tonnes/yr
Emission Flux (H_2S)	17.6	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.08	0.03	0.02		gms/s
Zone Emissions (H_2S)	5479.5	1763.8	1521.9		lbs/yr
Emission Flux (H_2S)	28.6	11.8	9.8		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.004	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	45.000	6.500	5.700		lbs/yr

Percent Inlet Sulfide Removed	71.2%

Current Parameters	
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)
Version 1.3

No Stripper Scenario

Data Type 1. Site Identification

Company Name	New-Indy
Facility Name	Catawba SC
Basin Name	ASB

Data Type 2. Model Zone Information

Number of Zones	3
Zone Location of Hardpipe	1
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	25.48	1.22	MGD
Total Sulfide	0.252	1.47	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.55	mph
Ambient Temperature	79	F

Data Type 5. Zone Physical and Chemical Conditions

Zone Condition	Zone 1	Zone 2	Zone 3	Zone 4	Units
Dissolved Oxygen	1.57	4.63	4.66		mg/L
Temperature	93.34	89.74	86.02		F
pH	7.04	7.24	7.42		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	968	1208	1235		feet
Width	968	604	617		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

No Stripper Scenario

Basin Emissions		Units
Total Emissions (H_2S)	0.123	gms/s
Total Emissions (H_2S)	8518.1	lbs/yr
Total Emissions (H_2S)	4.3	tons/yr
Total Emissions (H_2S)	3.9	tonnes/yr
Emission Flux (H_2S)	17.1	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.08	0.03	0.02		gms/s
Zone Emissions (H_2S)	5232.9	1763.2	1521.9		lbs/yr
Emission Flux (H_2S)	27.3	11.8	9.8		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.000		mg/L
Liquid Sulfide Load (lbs/yr)	41.500	6.500	5.700		lbs/yr

Percent Inlet Sulfide Removed	65.9%

Current Parameters	
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	272.2
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

Methanol PAE Emissions Factors

Methanol PAE Scenarios	Hardpipe ppm	Hardpipe Flow, MGD	Air Stripping g/s	Pulp Production	Methanol Emissions Factor lb/ODTP
New Stripper	N/A	N/A	3.47	2200	0.30
Backup Stripper	2095	1.22	17.63	2200	1.53
No Stripper	3809	1.22	26.69	2200	2.31

Design MeOH:	**1620**	lb/hr
	16	lb/ODT

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: PAE - New Stripper Scenario

Instructions: Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	35.4	33.5	31.3
Length	ft	968	1,208	1,235
Width	ft	968	604	617
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L	
Inlet Stream **	25.48	60.0	AVG ASB Inlet, 2021 and 2022
Condensate Stream	0.0	0	
Outlet	25.5	5.1	AVG ASB Effluent, 2021 and 2022

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		25.5	60.0
Effluent Concentration			5.10
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	60.0	7.4	5.4	3.2	0.5
Temp.	F		95.7	92.3	88.3	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	86.3
Fraction air emissions	5.2
Fraction remaining in unit effluent	8.5

12%	9%	5%

Expected zone concentration reductions similar to 2022 data.
No Hardpipe Stream

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED
PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: PAE - New Stripper Scenario

	Diff in Water cm2/s	Diff in Air cm2/s	Henry's Law atm-m3/mol	Equil. Ratio (Hc) or (Keq) m3 liq to m3 gas	MW g/mol	ScG	Antoine Eqtn b	Antoine Eqtn c
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27

General

	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

TURBULENT
KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	45012	21780	8712
Total TurbArea (m2)	4181.6	2023.4	809.3
Frac. Agitated (by surface aerators)	0.048	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	937472	729750	762343
SurfArea (m2)	87208.33	67885.00	70916.98
F/D Ratio	243	301	328
These Parameters are used when F/D < **14 AND** U > 3.25 m/s: ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA
DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: **PAE - New Stripper Scenario**

Surface Aeration												
		Turbulent Area			Quiescent Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
Zone 2												
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
Zone 3												
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06

FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

Data Date: PAE - New Stripper Scenario

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	250372.98
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	1.116
FLOW RATE of condensate to the unit (m3/s)	5	0.000
Total wastewater flowrate - (including condensates) (m3/s)	5-A	1.116
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	60
Concentration in the condensates (mg/L)	8	0
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	60
Concentration in the effluent (mg/L)	9	5.0982378

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	1.116	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	224279	2.60 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	230157	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	7.38608521	87091.1501	3.54365E-06	2.2795	0.308621
2	5.393164807	67793.7816	2.39719E-06	0.8765	0.162515
3	3.166816433	70821.6825	1.37942E-06	0.309	0.097693
4					
5					
6					
TOTALS - sum for each zone.	15	225706.614	16	3.47	

Removal by air stripping (g/s). Line 16.	17	3.47
Loading in effluent (g/s). Line 9 times line 10.	18	5.69
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	67.0
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	57.8
Fraction biodegraded: Divide line 20 by line 19.	21	0.863
Fraction air emissions: Divide line 17 by line 19.	22	0.052
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.085

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: PAE - Old Stripper Scenario

Instructions: Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	35.4	33.5	31.3
Length	ft	968	1,208	1,235
Width	ft	968	604	617
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	25.48	59.5
Condensate Stream	1.2	2,095
Outlet	26.7	5.1

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		26.7	152.8
Effluent Concentration			5.10
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	152.8	41.9	24.2	7.6	0.5
Temp.	F		95.7	92.3	88.3	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	86.8
Fraction air emissions	9.9
Fraction remaining in unit effluent	3.3

27%	16%	5%

Avg. 2021/2022 Zone Reductions

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED
PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: PAE - Old Stripper Scenario

	Diff in Water cm2/s	Diff in Air cm2/s	Henry's Law atm-m3/mol	Equil. Ratio (Hc) or (Keq) m3 liq to m3 gas	MW g/mol	ScG	Antoine Eqtn b	Antoine Eqtn c
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27

General

	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

TURBULENT
KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	45012	21780	8712
Total TurbArea (m2)	4181.6	2023.4	809.3
Frac. Agitated (by surface aerators)	0.048	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	937472	729750	762343
SurfArea (m2)	87208.33	67885.00	70916.98
F/D Ratio	243	301	328
These Parameters are used when F/D < 14 **AND** U > 3.25 m/s — ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA
DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: **PAE - Old Stripper Scenario**

Surface Aeration												
		Turbulent Area			Quiescient Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
Zone 2												
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
Zone 3												
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06

FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

Data Date: PAE - Old Stripper Scenario

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	250372.98
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	1.116
FLOW RATE of condensate to the unit (m3/s)	5	0.054
Total wastewater flowrate - (including condensates) (m3/s)	5-A	1.170
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	59.511413
Concentration in the condensates (mg/L)	8	2094.7948
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	152.79058
Concentration in the effluent (mg/L)	9	5.0982378

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	1.170	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	214000	2.48 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	230157	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	41.94854003	87091.1501	3.54365E-06	12.9462	0.308621
2	24.242506	67793.7816	2.39719E-06	3.9398	0.162515
3	7.579459633	70821.6825	1.37942E-06	0.740	0.097693
4					
5					
6					
TOTALS - sum for each zone.	15	225706.614	16	17.63	

Removal by air stripping (g/s). Line 16.	17	17.63
Loading in effluent (g/s). Line 9 times line 10.	18	5.96
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	178.8
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	155.2
Fraction biodegraded: Divide line 20 by line 19.	21	0.868
Fraction air emissions: Divide line 17 by line 19.	22	0.099
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.033

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: PAE - No Stripper

Instructions: Enter data in green shaded sections of this page of this spreadsheet only.

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	35.4	33.5	31.3
Length	ft	968	1,208	1,235
Width	ft	968	604	617
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	25.48	59.5
Condensate Stream	1.2	3,809
Outlet	26.7	5.1

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		26.7	231.3
Effluent Concentration			5.09824
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	231.3	63.5	36.7	11.5	0.5
Temp.	F		95.7	92.3	88.3	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	( )
Fraction air emissions	9.9
Fraction remaining in unit effluent	2.2

27%	16%	5%

Avg. 2021/2022 Zone Reductions

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED
PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: PAE - No Stripper

	Diff in Water cm2/s	Diff in Air cm2/s	Henry's Law atm-m3/mol	Equil. Ratio (Hc) or (Keq) m3 liq to m3 gas	MW g/mol	ScG	Antoine Eqtn b	c
Methanol	1.64E-05	0.150	5.19E-06	2.12E-04	32.0	1.006	1474	229.13
Acetaldehyde	1.41E-05	0.124	8.77E-05	3.58E-03	45.1	1.216	1600	291.8
MEK	9.80E-06	0.081	1.30E-04	5.31E-03	72.1	1.867	1305	229.27

General

	Units	Value	Name
viscosity of air	g/cm-s	0.000181	va
viscosity of water	g/cm-s	0.002	vw
density of air	g/cm3	0.0012	da
density of water	g/cm3	1	dw
MW of air	g/mol	29	Mwa
MW of water	g/mol	18	MWw
Diff of O2 in H2O	cm2/s	2.40E-05	DO2w
grav const.	lb-ft/s2/lb	32.17	g
R	atm-m3/mol K	8.21E-05	R_
Aerator Motor Eff	fraction	0.85	AerEff
O2 Trans Correct		0.83	Beta
Wind Speed	m/s	1.69	U
Diff of Ether	m/s	8.50E-06	Dether
O2 Trans	lb O2/HP-h	3	J

TURBULENT
KL Params

		Zone 1	Zone 2	Zone 3
w		126.3	126.3	126.3
Re		2.07E+06	2.07E+06	2.07E+06
PI		35063	35063	35063
Power Number, p		7.92E-04	7.92E-04	7.92E-04
Fr		8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)		45012	21780	8712
Total TurbArea (m2)		4181.6	2023.4	809.3
Frac. Agitated (by surface aerators)		0.048	0.030	0.011
QUIESCENT				
Depth		1.37	0.98	0.92
SurfArea (ft2)		937472	729750	762343
SurfArea (m2)		87208.33	67885.00	70916.98
F/D Ratio		243	301	328
These Parameters are used when F/D < 14 **AND** U > 3.25 m/s	ScL - Methanol	NA	NA	NA
	ScL - Acetaldehyde	NA	NA	NA
	ScL - MEK	NA	NA	NA
	U* (Friction Velocity)	NA	NA	NA
DIFFUSED				
Air flow, cfm		0	0	0
Air flow, m3/s		0.000	0.000	0.000

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: **PAE - No Stripper**

Surface Aeration												
		Turbulent Area			Quiescent Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	8.77E-06	1.55E-01	2.27E-02	5.37E-05	3.82E-03	4.31E-06	NA	3.38E-06	1.16E-06	4.31E-06	1.01E-06	3.54E-06
Zone 2												
Methanol	7.99E-06	1.55E-01	2.17E-02	4.92E-05	3.88E-03	4.31E-06	NA	4.06E-06	1.16E-06	4.31E-06	9.57E-07	2.40E-06
Zone 3												
Methanol	7.16E-06	1.55E-01	2.06E-02	4.44E-05	3.87E-03	4.31E-06	NA	4.37E-06	1.16E-06	4.31E-06	8.82E-07	1.38E-06

FORM XIII. DATA FORM FOR THE ESTIMATION OF MULTIPLE ZONE BIODEGRADATION FROM UNIT CONCENTRATIONS

Data Date: PAE - No Stripper

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	250372.98
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	1.116
FLOW RATE of condensate to the unit (m3/s)	5	0.054
Total wastewater flowrate - (including condensates) (m3/s)	5-A	1.170
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	59.511413
Concentration in the condensates (mg/L)	8	3808.7177
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	231.34146
Concentration in the effluent (mg/L)	9	5.0982378

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	1.170	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	214000	2.48 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	230157	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	63.5146271	87091.1501	3.54365E-06	19.6019	0.308621
2	36.70577636	67793.7816	2.39719E-06	5.9652	0.162515
3	11.47612174	70821.6825	1.37942E-06	1.121	0.097693
4					
5					
6					
TOTALS - sum for each zone.	15	225706.614	16	26.69	

Removal by air stripping (g/s). Line 16.	17	26.69
Loading in effluent (g/s). Line 9 times line 10.	18	5.96
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	270.7
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	238.0
Fraction biodegraded: Divide line 20 by line 19.	21	0.879
Fraction air emissions: Divide line 17 by line 19.	22	0.099
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.022

APPENDIX C -
AIR DISPERSION MODELING DOCUMENTATION

Appendix C – Supporting Modeling Information

New-Indy Catawba LLC (New-Indy Catawba) is submitting our updated ambient air dispersion modeling analysis for the proposed modification to the current foul condensate treatment system at the Mill, in support of the New Condensate Stripper Construction Permit Application (Application). The modification will install a new foul condensate stripper (new steam stripper) and demote the existing steam stripper (existing steam stripper) strictly to backup operation during periods of downtime experienced by the new steam stripper. In support of the Application, New-Indy Catawba has conducted an ambient air dispersion modeling analysis of hydrogen sulfide (H_2S), methyl mercaptan (MMC), and total reduced sulfur (TRS) and is providing additional information regarding the analysis below. The modeling files will be submitted to the South Carolina Department of Health and Environmental Control (SCDHEC) electronically.

Background

On May 7, 2021, SCDHEC issued *an Order to Correct Undesirable Level of Contaminants* (Order) to New-Indy Catawba. Paragraph 5 of the Order required New-Indy to conduct a facility-wide air dispersion modeling analysis for sulfur dioxide (SO_2), H_2S, and TRS. New-Indy submitted an analysis for these pollutants in August 2021. In response to comments from SCDHEC and the United States Environmental Protection Agency (U.S. EPA), an updated analysis was submitted in October 2021. SCDHEC made an additional request for the emissions of each TRS constituent for each emission point that had been previously modeled as part of the Order. SCHDEC used this information, which was provided to SCDHEC on June 30, 2022, to conduct a modeling analysis for MMC to address community concerns and to update H_2S and TRS modeling.

On September 26, 2022, SCDHEC concluded its modeling analysis. During the course of updating the modeling, SCDHEC identified a small number of anomalously high modeled concentrations at a few, isolated receptors. SCDHEC and U.S. EPA reviewed the source of the anomalously high concentrations and concluded they were a result of a bug in the AERMOD (American Meteorological Society/EPA Regulatory Model) code triggered by rare combinations of meteorological and topographic conditions. For the New-Indy Catawba modeling, SCDHEC concluded that only the 1-hour averaging period results from the DITCH2 modeled source were affected. SCDHEC implemented an alternate characterization methodology for the DITCH2 source by reorganizing the order of vertices of the source in the modeling, which eliminated the trigger for the model code bug. U.S. EPA Region 4 concurred that the alternate characterization was appropriate for the analysis.

As mandated by Item V of Appendix A of the November 16, 2022, Consent Decree Civil No. 0:21-cv-02053-SAL, United States of America v. New Indy Catawba, LLC (EPA Consent Decree), New-Indy Catawba must install, maintain, and operate a containment system to prevent any uncontrolled black liquor overflows or releases from reaching the Mill's Aeration Stabilization Basin (ASB). To meet this requirement, New-Indy Catawba submitted a construction permit application (Application) to add the Black Liquor Storage Tank Secondary Containment (Equipment ID 2490) system to the Mill.

On February 13, 2023, New-Indy Catawba received the following email from SCDHEC:

> *As was touched-upon in the recent pre-application meeting for the stripper project, we request that a modeling analysis be submitted to account for facility-wide increases of hydrogen sulfide, methyl mercaptan and total reduced sulfur (TRS - modeled as H2S) as a result of the addition of a secondary containment tank for black liquor storage at the facility.*
>
> *The modeled emissions and stack parameters should reflect those used in the 9/26/2022 modeling conducted by DHEC as part of the Order to Correct Undesirable Level of Air*

Contaminants (dated 5/7/2021). Both 24 hour and 1 hour averaging periods should be used, consistent with the previous modeling.

On February 15, 2023, SCDHEC provided the AERMOD files used in their September 26, 2022 modeling to ALL4 LLC (ALL4), who is conducting air dispersion modeling on behalf of New-Indy Catawba. As directed by SCDHEC, ALL4 used the SCDHEC-provided modeling, including the reorganized DITCH2 characterization only for the 1-hour analysis of H_2S, as the basis for modeling the addition of a secondary containment tank for black liquor storage.

Facility-wide modeling of H2S, MMC, and TRS was conducted using the emissions rates, source parameters, meteorology, and receptor network provided by SCDHEC, with the exception of the additional secondary containment tank (Source ID NEWSPLTK) and associated structure (Structure ID NEWSPLTK). New-Indy Catawba has not reviewed the emissions rates provided in any of the SCDHEC modeling files and makes no claims, promises, or guarantees about their accuracy, completeness, or adequacy. Results of the air dispersion modeling analysis, which demonstrate that ambient concentrations are below the relevant standards for H_2S, MMC, and TRS for each averaging period, were provided to SCDHEC on March 8, 2023.

Air Dispersion Modeling for the New Condensate Stripper

To comply with Part I of Appendix A of the EPA Consent Decree, New-Indy Catawba will install a new steam stripper to treat all foul condensate. During periods when the new steam stripper is offline, foul condensate will be routed to the existing steam stripper where TRS compounds will be stripped. Peroxide addition to the stripped foul condensate in the Hardpipe will take place prior to discharging the treated pulping condensates to the ASB.

Facility-wide modeling of H_2S, MMC, and TRS was conducted using the source parameters, meteorology, and receptor network provided by SCDHEC, with the exception of the additional secondary containment tank (Source ID NEWSPLTK) and associated structure (Structure ID NEWSPLTK) that were included in the March 8, 2023 modeling submitted to SCDHEC. New-Indy Catawba used the maximum actual emissions rates as submitted in the October 2021 analysis (for H_2S and TRS) and corresponding MMC emissions rates, with the exception of the additional secondary containment tank and the ASB. Emissions rates from the March 8, 2023 analysis were used for the secondary containment tank and refined emissions reflecting the new steam stripper operation and foul condensate flow for the ASB. Results of the air dispersion modeling analysis demonstrate that ambient concentrations are below the relevant standards for H_2S, MMC, and TRS for each averaging period.

2023 New Steam Stripper Application

Pollutant	Standard[a]	Averaging Period[b]	Modeled Concentration ($\mu g/m^3$)	UTM Easting (m)	UTM Northing (m)	Rank[a]	Standard[a][c][d] ($\mu g/m^3$)
H_2S	MAAC	24-hour	14.83	511,348.28	3,856,641.25	1st High	140
	EPA Action Level	30-minute	67.00	511,298.99	3,856,643.04	1-hour 1st High	837
MMM	MAAC	24-hour	9.40	510,115.55	3,856,041.31	1st High	10
	EPA Action Level	30-minute	47.99	510,209.41	3,856,039.95	1-hour 1st High	57,000
TRS	MAAC	24-hour	70.67	511,249.70	3,856,644.83	1st High	140
	EPA Action Level	30-minute	385.32	510,143.86	3,855,999.18	1-hour 1st High	837

(a) https://scdhec.gov/sites/default/files/media/document/BAQ_SC%20Modeling%20Guidelines_10.15.18_revised%204.15.19.pdf.

(b) 30-minute averaging period to be compared against maximum 1-hour modeled concentration, per DHEC October 6, 2021 request.

(c) TRS does not have a SC Standard - compare to H_2S.

(d) Methyl Mercaptan does not have an established AEGL-1 value due to insufficient data. Comparison of modeled concentrations are to the 30-minute AEGL-2 value for MMC only.