ATTACHMENT A
QUESTION 32 RESPONSE AND ATTACHMENT IPT 11

32. *Section 3.4 states in several locations that the results for the model were unexpected, and the summary of results in Table 3-3 appear to be inconsistent and unrepeatable. Provide a detailed explanation as to why the results were unexpected, and provide a detailed explanation to what the company expected the results to be. Also provide a discussion of the actions the company has taken to correct these issues, and timeline for the corrective measures to be completed.*

Response 32: In Question No. 1 of the June 2, 2021 Information Request issued by EPA pursuant to Section 114(a)(1) of the Clean Air Act (CAA) (U.S. EPA Information Request), EPA directed New-Indy Catawba to update the IPT Plan to: (1) take samples and analyze for hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide; and (2) utilize 40 CFR Part 63 Appendix C Procedure 5 to calculate the Fbio for hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide. New-Indy Catawba's response submitted on June 15, 2021, recommended the use of the Hydrogen Sulfide Emissions Simulator, or "H2SSIM" model, developed by the NCASI for estimating hydrogen sulfide emissions and fraction hydrogen sulfide destroyed, rather than the Appendix C calculations. The H2SSIM model was utilized for calculating the hydrogen sulfide emissions and the fraction removed in the ASB, and these results were reasonable and expected because the H2SSIM Model is calibrated to measured data in the field. Regarding the remaining TRS compounds, New-Indy Catawba provided the following response to address use of Appendix C calculations:

Similar to hydrogen sulfide, the situation is also more complicated for methyl mercaptan and dimethyl disulfide, as methyl mercaptan is easily oxidized to dimethyl disulfide. Liquid material balance data in conjunction with emissions data from the field study results published in NCASI Technical Bulletin No. 956 indicate that a significant fraction of the methyl mercaptan entering the ASB with the influent is oxidized to dimethyl disulfide. Therefore, methyl mercaptan and dimethyl disulfide results from the Appendix C calculations will be adjusted based on the field study results published in NCASI Technical Bulletin No. 956. Calculating Fbio for any individual TRS compound may be difficult or impossible in the event of non-detect results from the liquid sampling. Air emissions (E), in grams per second (g/s), are calculated as follows for the ASB/ASB zones in the Appendix C/Form XIII worksheet and the EPA WATER9 emissions model:

E (g/s) = CL * KL * A

Where:

CL (mg/l) = Liquid concentration of the compound in the effluent of each ASB/ASB zone

KL (m/s) = Overall mass transfer coefficient of each ASB/ASB zone; and

A (m^2) = Liquid Surface Area of the ASB/ASB zone

The Appendix C/Form XIII calculation workbook and EPA's WATER9 model utilize the same emission model equations and site-specific data to calculate KL and A; however, the Appendix C, Form XIII worksheet utilizes the measured liquid concentration in the respective zones for CL, while the WATER9 model calculates CL from site-specific data and defaults provided in WATER9 for the maximum biorate, limiting first-order biorate constant, and the biomass concentration.

The Appendix C/Form XIII worksheet calculated air emissions for methyl mercaptan, dimethyl sulfide, and dimethyl disulfide are greater than the inlet loading to the ASB; therefore, the calculated fraction emitted to the air (Fair) is greater than 1.0, and thus, the calculated Fbio is a negative value. This was an unexpected outcome as the fraction emitted to the air should be less than 1.0, and the Fbio should be a value between

zero and 1.0. The same air emissions results cannot be repeated utilizing the WATER9 model with the same zone data inputs and using the flow-weighted inlet concentration into the ASB for each compound (*i.e.*, calculated liquid concentration in the inlet to the ASB from the measured ASB inlet flow and liquid concentrations and the measured foul condensate flow and liquid concentrations). The WATER9 model calculates an outlet concentration for each zone based on the emission model equations instead of using the measured liquid concentrations in each zone.

New-Indy Catawba has performed revised calculations for E, Fair, and Fbio for methyl mercaptan, dimethyl sulfide, and dimethyl disulfide utilizing the WATER9 model with the same zone data inputs and flow-weighted inlet concentrations into the ASB. As the Zone 1 liquid concentration results for methyl mercaptan were in some cases higher in Zone 1 than the inlet concentration and results for dimethyl disulfide were lower in some cases in Zone 1 than the inlet concentration, we have not adjusted the WATER 9 output results for methyl mercaptan and dimethyl disulfide to incorporate the field study results published in NCASI Technical Bulletin No. 956. However, New-Indy Catawba may choose to revise this approach for future performance tests. All individual TRS calculations have been revised to reflect the use of the WATER9 emission model. The revised results and supporting tables and documentation are provided in Attachment IPT11.

IPT COMMENT 11
REVISED IPT TABLES

Attachment IPT11

Table 2-9

Condensate Collection and Treatment IPT Results

New-Indy Catawba - Catawba, SC

Date	Total MeOH Collected 15-day average (lb/ODTP)	Required MeOH Collected (lb/ODTP)	Effective Steam to Feed Ratio (ESFR)	Steam Stripper MeOH Removal Efficiency (%)	HAP Treated in Steam Stripper (lb/ODTP)	F_{bio}	Number of Aerators	HAP Treated in ASB (lb/ODTP)	Total HAP Treated (lb/ODTP)	Required HAP Treated (lb/ODTP)
7/9/2021	10.9	7.2	18.3	78%	6.5	86.5	37	3.3	9.9	6.6
7/10/2021	11.2	7.2	18.2	77%	6.4	90.1	37	3.7	10.1	6.6
7/11/2021	11.3	7.2	17.9	76%	6.6	90.9	37	3.8	10.5	6.6
Average	--	--	18.1	77%	--	89.17	--	--	--	--

Attachment IPT11

Table 2-10

Aeration Stabilization Basin Data

New-Indy Catawba - Catawba, SC

Date	ASB Effluent BOD_5 Data (ppm)	ASB Zone 1 MLVSS (ppm)	ASB Zone 2 MLVSS (ppm)	ASB Zone 3 MLVSS (ppm)	Aerator Horsepower (hp)	ASB Inlet Liquid Flow (MGD)
7/9/2021	15	243	191	154	2,775	21.66
7/10/2021	16	350	250	98	2,775	21.58
7/11/2021	24	397	273	147	2,775	20.82

Notes:
MLVSS: Mixed Liquor Volatile Suspended Solids
BOD_5: Total Biochemical Oxygen Demand, 5-day

Attachment IPT11

Table 3-1

Laboratory Sulfides Data - Method RSK-175

New-Indy Catawba - Catawba, SC

Date	Sample	RSK H2S, ppb	RSK DMDS, ppb	RSK DMS, ppb	RSK MMC, ppb
7/9/2021	Foul Condensate - Average	114,205	7,954	5,619	6,731
	Stripped Condensate - Average	32,226	2,537	1,195	572
	ASB Influent (Wastewater) - Average	25.4	14.0	27.7	0.23
	ASB Zone 1 Center - Average	22,458	4.4	52.6	188
	ASB Zone 2 Center - Average	2,500	1.6	6.5	32.8
	ASB Zone 3 Center - Average	74.1	1.0	1.5	3.0
	ASB Effluent - Average	3.3	1.2	7.9	0.73
	Post-Aeration Basin Inlet	2.5	7.4	2.8	1.3
	Post-Aeration Basin Surface	62.9	59.3	21.4	9.0
	Post-Aeration Basin Outlet	212	21.1	9.4	3.8
7/10/2021	Foul Condensate - Average	96,940	9,978	6,343	4,827
	Stripped Condensate - Average	2,292	2,957	939	59.9
	ASB Influent (Wastewater) - Average	12.5	29.3	64.5	0.38
	ASB Zone 1 Center - Average	11,471	131	137	155
	ASB Zone 2 Center - Average	1,757	19.8	14.0	40.4
	ASB Zone 3 Center - Average	2.1	1.0	0.38	0.19
	ASB Effluent - Average	2.9	1.3	3.9	0.95
	Post-Aeration Basin Inlet	0.83	1.0	1.3	0.11
	Post-Aeration Basin Surface	0.63	1.0	0.34	0.11
	Post-Aeration Basin Outlet	1.1	1.0	1.2	0.11
7/11/2021	Foul Condensate - Average	46,857	4,827	2,729	1,052
	Stripped Condensate - Average	6,031	864	381	34.8
	ASB Influent (Wastewater) - Average	14.0	14.7	60.2	0.54
	ASB Zone 1 Center - Average	10,837	858	346	49.8
	ASB Zone 2 Center - Average	466	4.2	2.0	27.7
	ASB Zone 3 Center - Average	6.7	34.3	7.8	1.1
	ASB Effluent - Average	18.2	3.3	3.0	1.3
	Post-Aeration Basin Inlet	1.8	3.6	0.68	0.11
	Post-Aeration Basin Surface	0.25	1.0	0.34	0.11
	Post-Aeration Basin Outlet	0.04	1.0	0.43	0.11

Attachment IPT11

Table 3-3

F_{air} and F_{bio}

New-Indy Catawba - Catawba, SC

Date	Source	ASB F_{air} [(a)]	Post-Aeration Tank F_{air} [(a)]	ASB F_{bio} [(a)]	Post-Aeration Tank F_{bio} [(a)]
7/9/2021	Hydrogen Sulfide	4%	125%	96%	-25%
7/10/2021	Hydrogen Sulfide	10%	171%	90%	-71%
7/11/2021	Hydrogen Sulfide	19%	27%	81%	73%
Average During IPT (7/9-11/2021)[(b)]	Hydrogen Sulfide	11%	108%	89%	-8%
	Methyl Mercaptan	91%	77%	9%	5%
	Dimethyl Sulfide	83%	63%	17%	11%
	Dimethyl Disulfide	41%	31%	59%	47%

[(a)] For hydrogen sulfide, F_{bio} is the percent of inlet sulfide concentration removed. F_{air} is equal to $(1-F_{bio})$

[(b)] F_{air} and F_{bio} for methyl mercaptan, dimethyl sulfide, and dimethyl disulfide were calculated using WATER9 using the average data during the IPT. Hydrogen sulfide results are from H2SSIM for each day of the IPT.

Attachment IPT11

Table E-1

Comparison of Original and Duplicate Data - Methanol and HAP[a]

New-Indy Catawba - Catawba, SC

Sample Location	Date	Time	Acetaldehyde			2-Butanone (MEK)			Propionaldehyde			Methanol		
			Original Result (ppm)	Duplicate Result (ppm)	Percent Difference	Original Result (ppm)	Duplicate Result (ppm)	Percent Difference	Original Result (ppm)	Duplicate Result (ppm)	Percent Difference	Original Result (ppm)	Duplicate Result (ppm)	Percent Difference
Foul Condensate Composite	6/30/2021	8:00 AM	19	20	5%	10	10	0%	*1.0*	*1.0*	0%	2,000	2,100	5%
Foul Condensate Sample 3	7/9/2021	5:00 PM	24	24	0%	7.6	7.5	-1%	*1.0*	1.0	0%	2,500	2,400	-4%
Stripped Condensate Sample 3	7/9/2021	5:05 PM	3.8	3.6	-5%	1.7	1.5	-12%	*1.0*	*1.0*	0%	440	430	-2%
ASB Influent Sample 3	7/9/2021	5:40 PM	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	82	78	-5%
ASB Effluent Sample 3	7/9/2021	5:45 PM	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	*0.5*	*0.5*	0%
ASB Zone 1 Sample 1	7/10/2021	9:39 AM	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	59	57	-3%
ASB Zone 2 Sample 1	7/10/2021	8:31 AM	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	8.4	10	19%
ASB Zone 3 Sample 1	7/10/2021	8:14 AM	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	*1.0*	*1.0*	0%	*0.5*	0.86	72%

[a] Results in *italic* font were below the method reporting limit (MRL). The results have been reported at the MRL.

ED_006445A_00001490-00009

Attachment IPT11

Table G-3

Detailed R Factor Calculations

New-Indy Catawba - Catawba, SC

Date	Acetaldehyde (ppm)	MEK (ppm)	Propionaldehyde (ppm)	Concentration of non-MeOH HAP (ppm)	Pulp Production (ODTP)	Total Foul Condensate Flow (MGD)	F(nonmethanol) (lb/ODTP)	R-Factor
7/9/2021	24.33	7.65	1.07	33.05	1,694	1.04	0.17	0.014
7/10/2021	25.33	5.73	4.00	35.07	1,609	1.06	0.19	0.015
7/11/2021	25.00	6.50	7.00	38.50	1,356	1.04	0.25	0.019
Average:	--	--	--	--	--	--	--	0.016

Attachment IPT11

Table G-4

Detailed Condensate Treatment Calculations - ASB

New-Indy Catawba - Catawba, SC

Date[a]	Foul Condensate Methanol (ppm)	Foul Condensate Flow to ASB (MGD)	MeOH to ASB (lbs/day)	MeOH to ASB, 15-day Total (lbs/day)	Pulp Production (ODTP)	MeOH to ASB, 15-day Total (lbs/ODTP)	Number of Aerators	F_{bio}	R-Factor	MeOH Treated in ASB (lbs/ODTP)
6/23/2021	1,700	0.16	2,267	--	1,539	--	--	--	--	--
6/24/2021	2,400	0.29	5,723	--	2,102	--	--	--	--	--
6/25/2021	2,600	0.28	6,069	--	2,040	--	--	--	--	--
6/26/2021	2,400	0.32	6,377	--	1,884	--	--	--	--	--
6/27/2021	2,500	0.21	4,457	--	1,808	--	--	--	--	--
6/28/2021	2,500	0.11	2,340	--	1,697	--	--	--	--	--
6/29/2021	2,400	0.36	7,115	--	1,804	--	--	--	--	--
6/30/2021	2,050	0.47	8,042	--	1,874	--	--	--	--	--
7/1/2021	1,900	0.40	6,356	--	1,360	--	--	--	--	--
7/2/2021	1,600	0.37	4,883	--	1,166	--	--	--	--	--
7/3/2021	2,000	0.40	6,653	--	1,749	--	--	--	--	--
7/4/2021	2,200	0.53	9,702	--	1,663	--	--	--	--	--
7/6/2021	1,600	0.81	10,784	--	1,806	--	--	--	--	--
7/7/2021	2,200	0.41	7,530	--	1,947	--	--	--	--	--
7/8/2021	2,300	0.39	7,537	--	1,449	--	--	--	--	--
7/9/2021	2,383	0.33	6,506	100,074	1,694	3.8	37	86.5	0.014	3.3
7/10/2021	2,267	0.35	6,710	101,061	1,609	4.0	37	90.1	0.015	3.7
7/11/2021	2,000	0.33	5,573	100,566	1,356	4.0	37	90.9	0.019	3.8

[a] July 5, 2021 was excluded due to low pulp production unrepresentative of typical operation.

Attachment IPT11

Table I-1

Comparison of Original and Duplicate Data - Total Reduced Sulfur - Method RSK-175[a]

New-Indy Catawba - Catawba, SC

Sample Location	Date	Time	Hydrogen Sulfide			Dimethyl Disulfide			Dimethyl Sulfide			Methyl Mercaptan			Notes
			Original Result (ppb)	Duplicate Result (ppb)	Percent Difference	Original Result (ppb)	Duplicate Result (ppb)	Percent Difference	Original Result (ppb)	Duplicate Result (ppb)	Percent Difference	Original Result (ppb)	Duplicate Result (ppb)	Percent Difference	
5A-ASB Zone 1	7/9/2021	8:45 AM	N/A	13,038	--	*1.0*	*1,006*	99874%	1.9	*339*	18239%	104	*113*	9%	Duplicate for DMDS and DMS are not included in the average because the method reporting limit is greater than the measured value.
	7/10/2021	9:39 AM	26,832	5,100	-81%	1.8	4.6	150%	25.9	20.4	-21%	157	98.1	-38%	
5B-ASB Zone 2	7/9/2021	9:25 AM	N/A	863	--	1.6	*1,006*	61226%	8.2	*339*	4037%	29.0	*113*	291%	Duplicate for DMDS, DMS, and MMC are not included in the average because the method reporting limit is greater than the measured value.
	7/10/2021	8:31 AM	4,201	3,509	-16%	1.2	1.6	30%	2.4	3.2	34%	37.6	50.1	33%	
5C-ASB Zone 3	7/9/2021	9:53 AM	10.6	**37.4**	253%	*1.0*	*1.0*	0%	*0.34*	*0.34*	0%	0.13	0.40	198%	
	7/10/2021	8:14 AM	3.9	0.64	-84%	*1.0*	*1.0*	0%	*0.34*	*0.34*	1%	*0.11*	*0.11*	1%	
4A-Post-Aeration Tank Inlet	7/10/2021	10:11 AM	0.26	1.4	445%	*1.0*	*1.0*	0%	*0.34*	2.3	573%	*0.11*	*0.11*	0%	
4B-Post-Aeration Tank Surface	7/10/2021	10:21 AM	0.84	0.41	-51%	*1.0*	*1.0*	0%	*0.34*	*0.34*	0%	*0.11*	*0.11*	0%	
4C-Post-Aeration Tank Outelt	7/10/2021	10:23 AM	0.74	1.5	97%	*1.0*	*1.0*	0%	*0.34*	2.1	514%	*0.11*	*0.11*	1%	
1A ASB Influent	7/9/2021	8:00 AM	0.10	19.9	19603%	*1.0*	*1.0*	0%	24.7	8.8	-64%	*0.11*	0.43	281%	
	7/9/2021	5:40 PM	1,479	2.3	-100%	8,637	28.8	-100%	**1,669**	39.3	-98%	936	0.20	-100%	The original results were above the calibration range and are not included in the average.
1B ASB Effluent	7/9/2021	8:00 AM	6.1	0.36	-94%	2.3	1.1	-51%	27.0	8.0	-70%	*0.11*	0.32	185%	
	7/9/2021	5:45 PM	7.6	4.4	-42%	*1.0*	*1.0*	0%	2.8	3.0	9%	0.80	0.97	21%	
2A Foul Condensate	7/9/2021	8:00 AM	N/A	**130,032**	--	N/A	6,427	--	N/A	5,687	--	N/A	5,232	--	
	7/9/2021	5:00 PM	156,776	14.2	-100%	9,527	*1.0*	-100%	5,737	*0.34*	-100%	12,242	0.26	-100%	Duplicate not averaged because so low in comparison with other samples.
2B Stripped Condensate	7/9/2021	8:05 AM	N/A	12,100	--	**1,968**	*10,057*	411%	**1,268**	*3,392*	168%	**204**	*1,133*	456%	Duplicate is not averaged because the method reporting limit is greater than the measured value.
	7/9/2021	5:05 PM	99,291	9,138	-91%	4,252	2,551	-40%	**796**	**1,571**	97%	1,144	**135**	-88%	

[a] Results in **bold** font were outside of the calibration range, and the laboratory report indicated that results should be considered estimated. Results in italic font were below the method reporting limit (MRL). The results have been reported at the MRL. "N/A" is reported where results "peaked out." Results in grey shading were not averaged.

IPT COMMENT 11
REVISED TRS COMPOUND FBIO CALCULATIONS
ASB H2SSIM RUNS

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/9/2021

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	21.66	0.33	MGD
Total Sulfide	0.0254	114.2	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.79	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	0.69	0.29	2		mg/L
Temperature	95.8	89.2	87.2		F
pH	8.75	8.57	8.74		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	739	1196	1248		feet
Width	739	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	16	15	6		
Total Horsepower	1200	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 7/9/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.071	gms/s
Total Emissions (H_2S)	4954.0	lbs/yr
Total Emissions (H_2S)	2.5	tons/yr
Total Emissions (H_2S)	2.2	tonnes/yr
Emission Flux (H_2S)	11.9	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.02	0.03	0.02		gms/s
Zone Emissions (H_2S)	1640.4	1735.9	1577.6		lbs/yr
Emission Flux (H_2S)	14.7	11.9	9.9		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.010	0.008	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	105.700	87.000	9.900		lbs/yr

Percent Inlet Sulfide Removed	95.7%

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	196.11
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/10/2021

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	21.58	0.35	MGD
Total Sulfide	0.0125	96.94	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.79	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	0.06	0.05	1.5		mg/L
Temperature	97.16	89.6	87.8		F
pH	8.08	8.39	8.38		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	739	1196	1248		feet
Width	739	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderati	Moderat	Moderat		
Number of Aerators	16	15	6		
Total Horsepower	1200	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 7/10/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.144	gms/s
Total Emissions (H_2S)	9998.9	lbs/yr
Total Emissions (H_2S)	5.0	tons/yr
Total Emissions (H_2S)	4.5	tonnes/yr
Emission Flux (H_2S)	23.9	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.08	0.04	0.02		gms/s
Zone Emissions (H_2S)	5359.9	3014.2	1624.9		lbs/yr
Emission Flux (H_2S)	47.9	20.6	10.2		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.047	0.041	0.002		mg/L
Liquid Sulfide Load (lbs/yr)	493.300	429.100	16.400		lbs/yr

Percent Inlet Sulfide Removed	90.4%

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	232.67
O_2 Transfer Coeff.	2
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/11/2021

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	20.82	0.33	MGD
Total Sulfide	0.014	46.86	mg/L
Sulfate	390	390	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.79	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	0.11	0.11	1		mg/L
Temperature	93.32	92	89.54		F
pH	8.02	8.01	7.99		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	739	1196	1248		feet
Width	739	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	16	15	6		
Total Horsepower	1200	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 7/11/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.133	gms/s
Total Emissions (H_2S)	9276.1	lbs/yr
Total Emissions (H_2S)	4.6	tons/yr
Total Emissions (H_2S)	4.2	tonnes/yr
Emission Flux (H_2S)	22.2	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.05	0.05	0.03		gms/s
Zone Emissions (H_2S)	3851.1	3647.0	1778.0		lbs/yr
Emission Flux (H_2S)	34.4	24.9	11.1		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.028	0.024	0.002		mg/L
Liquid Sulfide Load (lbs/yr)	287.900	239.000	24.800		lbs/yr

Percent Inlet Sulfide Removed	80.6%

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

IPT COMMENT 11
REVISED TRS COMPOUND FBIO CALCULATIONS
POST-ASB H2SSIM RUNS

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/9/2021

Data Type 1. Site Identification

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

Data Type 2. Model Zone Information

Number of Zones	1
Zone Location of Hardpipe	None
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	25.1	0	MGD
Total Sulfide	0.0025	0	mg/L
Sulfate	390	0	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.79	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	0.25				mg/L
Temperature	85.2				F
pH	7.67				s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	60				feet
Width	40				feet
Depth	15				feet
Mixing	High	Moderat	Moderat		
Number of Aerators	3				
Total Horsepower	234				HP
Impellor Size	1.625				feet
Impellor RPM	1200				RPM
Diffused Air Flow	0				cms
Weir Height	0				meters

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results 7/9/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.002	gms/s
Total Emissions (H_2S)	152.1	lbs/yr
Total Emissions (H_2S)	0.1	tons/yr
Total Emissions (H_2S)	0.1	tonnes/yr
Emission Flux (H_2S)	309.3	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.00				gms/s
Zone Emissions (H_2S)	152.1				lbs/yr
Emission Flux (H_2S)	309.3				gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.007				mg/L
Liquid Sulfide Load (lbs/yr)	87.100				lbs/yr

Percent Inlet Sulfide Removed	-25.2%

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	2500
O_2 Transfer Coeff.	1.24
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/10/2021

Data Type 1. Site Identification

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

Data Type 2. Model Zone Information

Number of Zones	1
Zone Location of Hardpipe	None
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	24.7	0	MGD
Total Sulfide	0.00083	0	mg/L
Sulfate	390	0	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.79	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	0.53				mg/L
Temperature	84.5				F
pH	7.69				s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	60				feet
Width	40				feet
Depth	15				feet
Mixing	High	Moderat	Moderat		
Number of Aerators	3				
Total Horsepower	234				HP
Impellor Size	1.625				feet
Impellor RPM	1200				RPM
Diffused Air Flow	0				cms
Weir Height	0				meters

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results 7/10/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.001	gms/s
Total Emissions (H_2S)	68.0	lbs/yr
Total Emissions (H_2S)	0.0	tons/yr
Total Emissions (H_2S)	0.0	tonnes/yr
Emission Flux (H_2S)	138.3	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.00				gms/s
Zone Emissions (H_2S)	68.0				lbs/yr
Emission Flux (H_2S)	138.3				gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.003				mg/L
Liquid Sulfide Load (lbs/yr)	38.700				lbs/yr

Percent Inlet Sulfide Removed	-70.9%

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	2500
O_2 Transfer Coeff.	1.24
alpha 1	0.83
alpha 2	0.6

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

7/11/2021

Data Type 1. Site Identification

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

Data Type 2. Model Zone Information

Number of Zones	1
Zone Location of Hardpipe	None
Type of Basin	ASB

Data Type 3. Load Characteristics

Loading Characteristics	Main Influent	Hardpipe	Units
Flow	19.3	0	MGD
Total Sulfide	0.0018	0	mg/L
Sulfate	390	0	mg/L

Data Type 4. Atmospheric Conditions

Windspeed	3.79	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	3.68				mg/L
Temperature	84.5				F
pH	7.6				s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	60				feet
Width	40				feet
Depth	15				feet
Mixing	High	Moderat	Moderat		
Number of Aerators	3				
Total Horsepower	234				HP
Impellor Size	1.625				feet
Impellor RPM	1200				RPM
Diffused Air Flow	0				cms
Weir Height	0				meters

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results 7/11/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.000	gms/s
Total Emissions (H_2S)	21.9	lbs/yr
Total Emissions (H_2S)	0.0	tons/yr
Total Emissions (H_2S)	0.0	tonnes/yr
Emission Flux (H_2S)	44.7	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.00				gms/s
Zone Emissions (H_2S)	21.9				lbs/yr
Emission Flux (H_2S)	44.7				gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.001				mg/L
Liquid Sulfide Load (lbs/yr)	7.100				lbs/yr

Percent Inlet Sulfide Removed	72.6%

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	2500
O_2 Transfer Coeff.	1.24
alpha 1	0.83
alpha 2	0.6

IPT COMMENT 11
REVISED TRS COMPOUND FBIO CALCULATIONS
ASB WATER9 INPUT AND OUTPUT

Table A-37
Water9 Inputs - ASB
New-Indy Catawba - Catawba, SC

Sources	Variable	Value	Unit	Source
ASB Zone 1	Wastewater Temperature	35.2	C	Average Temperature during IPT (7/9-11/2021)
	Length of aeration unit	225	m	Estimated based on Google Earth and drone footage (when available)
	Width of aeration unit	225	m	Estimated based on Google Earth and drone footage (when available)
	depth of aeration unit	1.4	m	Estimated based on site-specific data
	area of agitation (per aerator)	135	m^2	Aerator Design
	total number of agitators in the unit	16		Figure 2-1
	power of agitation, each aerator	75	HP	Aerator Design
	impeller diameter	49.53	cm	Aerator Design
	impeller rotation	1200	RPM	Aerator Design
	agitator mechanical efficiency	0.83		Water9 Default
	aerator effectiveness, alpha	0.83		Water9 Default
	overall biorate	19	mg/g bio-hr	Water9 Default
	aeration air flow		m^3/s	Water9 Default
	active biomass, aeration	0.3	g/l	Water9 Default
	pH	8.28		Average pH during IPT (7/9-11/2021)

Table A-37
Water9 Inputs - ASB
New-Indy Catawba - Catawba, SC

Sources	Variable	Value	Unit	Source
ASB Zone 2	Wastewater Temperature	32.4	C	Average Temperature during IPT (7/9-11/2021)
	Length of aeration unit	365	m	Estimated based on Google Earth and drone footage (when available)
	Width of aeration unit	182.3	m	Estimated based on Google Earth and drone footage (when available)
	depth of aeration unit	0.97	m	Estimated based on site-specific data
	area of agitation (per aerator)	135	m^2	Aerator Design
	total number of agitators in the unit	15		Figure 2-1
	power of agitation	75	HP	Aerator Design
	impeller diameter	49.53	cm	Aerator Design
	impeller rotation	1200	RPM	Aerator Design
	agitator mechanical efficiency	0.83		Water9 Default
	aerator effectiveness, alpha	0.83		Water9 Default
	overall biorate	19	mg/g bio-hr	Water9 Default
	aeration air flow		m^3/s	Water9 Default
	active biomass, aeration	0.3	g/l	Water9 Default
	pH	8.33		Average pH during IPT (7/9-11/2021)

Table A-37
Water9 Inputs - ASB
New-Indy Catawba - Catawba, SC

Sources	Variable	Value	Unit	Source
ASB Zone 3	Wastewater Temperature	31.211	C	Average Temperature during IPT (7/9-11/2021)
	Length of aeration unit	380.4	m	Estimated based on Google Earth and drone footage (when available)
	Width of aeration unit	190.2	m	Estimated based on Google Earth and drone footage (when available)
	depth of aeration unit	0.91	m	Estimated based on site-specific data
	area of agitation (per aerator)	135	m^2	Aerator Design
	total number of agitators in the unit	6		Figure 2-1
	power of agitation	75	HP	Aerator Design
	impeller diameter	49.53	cm	Aerator Design
	impeller rotation	1200	RPM	Aerator Design
	agitator mechanical efficiency	0.83		Water9 Default
	aerator effectiveness, alpha	0.83		Water9 Default
	overall biorate	19	mg/g bio-hr	Water9 Default
	aeration air flow		m^3/s	Water9 Default
	active biomass, aeration	0.3	g/l	Water9 Default
	pH	8.37		Average pH during IPT (7/9-11/2021)

```
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:\Users\akelley\Desktop\Water9\October 5
Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM
22:20:43
COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment
1 Description of unit                      11    ASB Zone 1
2 Wastewater temperature   (C)                   35.2
3 length of aeration unit (m)                   225
4 width of aeration unit (m)                    225
5 depth of aeration unit (m)                    1.4
6 Area of agitation (each aerator,m2)           135
7 Total number of agitators in the unit         16
```

```
      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)           8.28

      Properties of DIMETHYL DISULFIDE at 35.2 deg.C (95.4 deg.F)
         hl= 0.001806 atm-m3/mol      vp= 48.422 mmHg (0.93658
psia)
             100.332 y/x
             0.071416 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.045e-05 cm2/s  dv= 0.088584
cm2/s
      Compound flow rate from inlet water is 0.11846 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 20.713 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 181.347.
      kl is estimated as 5.985e-06 m/s.
      kg is estimated as 0.005792 m/s.  Model: 2
      kg is estimated as 0.005792 m/s.  Model: 2
      The Schmidt number is 1.69331.
      The friction velocity is 37.398 m/s
      kg is estimated as 0.012978 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 0.11601 m/s.
      kl (agitated)is estimated as 0.017989 m/s.
          The specified and growth biomass is 0.3 g/L.
       The effective KL (surface + diffused air) is 2.564e-04
m/s.
       The effective stripping time (surface + diffused air) is
90.994 minutes. (1.51657 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 1242.781 min. (20.713 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.11819
KL aerated (m/s)	0.017989
KL OVERALL AERATED (m/s)	0.005878
KG quiescent (m/s)	0.005901
KL quiescent (m/s)	5.985e-06
KL OVERALL QUIESCENT (m/s)	5.904e-06
KL OVERALL (m/s)	2.564e-04
air stripping time constant (min)	90.994
FRACTION SURFACE VOLATILIZED	0.33406
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.33406
FRACTION BIOLOGICALLY REMOVED	0.64148
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.039572
(Mg/year)	1.24795
EMISSION FACTOR (g/cm2-s)	7.817e-11
UNIT EXIT CONCENTRATION (ppmw)	0.003048

DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:20:43
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)	7.817e-11
UNIT EXIT CONCENTRATION (ppmw)	3.484e-06

DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:20:43
COMPOUND: DIMETHYL DISULFIDE

Type of unit is open hub drain
1 Description of unit 13 default open hub d
2 Underflow T (C) 44.4
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  950.489 l/s.
         Weight fraction down is  1.37709E-07
         Gas concentration in  0 mol fraction.
         Gas flow  950.489 L/s
         Weight fraction out at base of drop is
1.24628900916417E-07
         fraction transferred in the drain drop from hub
is .094984
         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     0.094984
         fraction loss in unit                    0.
         fraction loss in line run                6.29e-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)             1.653e-19
         mol fract. headspace vent base           3.616e-06
         headspace flow out vent (cc/s)           -9.505e+05
         headspace flow down line (cc/s)          9.505e+05
         KG surface (m/s)                         1701.612
         KL surface (m/s)                         5.911e-09
         flow of waste down hub (l/s)             0.
         component flow in waste into unit (g/s)  0.13089
         total component into unit, g/s           0.11846
         TOTAL AIR EMISSIONS  (g/s)               0.012433
                          (Mg/year)               0.39207
         EMISSION FACTOR  (g/cm2-s)               7.817e-11
         UNIT EXIT CONCENTRATION (ppmw)           0.12463
      DETAILED CALCULATIONS at Unit 17 ASB Zone 3
      Type: aerated biotreatment
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM
22:20:43
      COMPOUND: DIMETHYL DISULFIDE

      Type of unit is aerated biotreatment
      1 Description of unit                      17    ASB Zone 3
      2 Wastewater temperature   (C)                   31.211
```

```
3 length of aeration unit (m)                    380.4
4 width of aeration unit (m)                     190.2
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)            8.37

Properties of DIMETHYL DISULFIDE at 31.2 deg.C (88.2 deg.F)
   hl= 0.001495 atm-m3/mol      vp= 40.078 mmHg (0.77518
psia)
       83.042 y/x
       0.059884 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.031e-05 cm2/s  dv= 0.086588
cm2/s
Compound flow rate from inlet water is 8.625e-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 19.242 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 333.533.
kl is estimated as 5.934e-06 m/s.
kg is estimated as 0.005594 m/s.  Model: 2
kg is estimated as 0.005594 m/s.  Model: 2
The Schmidt number is 1.73233.
The friction velocity is 37.398 m/s
kg is estimated as 0.012797 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 0.1147 m/s.
kl (agitated)is estimated as 0.016259 m/s.
    The specified and growth biomass is 0.3 g/L.
```

The effective KL (surface + diffused air) is 6.133e-05 m/s.

The effective stripping time (surface + diffused air) is 247.292 minutes. (4.12153 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 1154.5 min. (19.242 hr.)

The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.11685
KL aerated (m/s)	0.016259
KL OVERALL AERATED (m/s)	0.004963
KG quiescent (m/s)	0.005698
KL quiescent (m/s)	5.934e-06
KL OVERALL QUIESCENT (m/s)	5.834e-06
KL OVERALL (m/s)	6.133e-05
air stripping time constant (min)	247.292
FRACTION SURFACE VOLATILIZED	0.17927
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.17927
FRACTION BIOLOGICALLY REMOVED	0.78233
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	1.546e-05
(Mg/year)	4.876e-04
EMISSION FACTOR (g/cm2-s)	2.137e-14
UNIT EXIT CONCENTRATION (ppmw)	3.484e-06

DETAILED CALCULATIONS at Unit 18 ASB Zone 2

Type: aerated biotreatment

Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:20:43

COMPOUND: DIMETHYL DISULFIDE

Type of unit is aerated biotreatment

1 Description of unit	18	ASB Zone 2
2 Wastewater temperature (C)		32.4
3 length of aeration unit (m)		365
4 width of aeration unit (m)		182.3
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)               8.33

      Properties of DIMETHYL DISULFIDE at 32.4 deg.C (90.3 deg.F)
         hl= 0.001582 atm-m3/mol      vp= 42.429 mmHg (0.82066
psia)
             87.913 y/x
             0.06315 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.035e-05 cm2/s  dv= 0.087181
cm2/s
      Compound flow rate from inlet water is 0.002897 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 18.863 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 300.07.
      kl is estimated as 5.949e-06 m/s.
      kg is estimated as 0.005645 m/s.  Model: 2
      kg is estimated as 0.005645 m/s.  Model: 2
      The Schmidt number is 1.72055.
      The friction velocity is 37.398 m/s
      kg is estimated as 0.012851 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 0.11509 m/s.
      kl (agitated)is estimated as 0.016757 m/s.
          The specified and growth biomass is 0.3 g/L.
       The effective KL (surface + diffused air) is 1.646e-04
m/s.
       The effective stripping time (surface + diffused air) is
98.199 minutes. (1.63664 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 1131.756 min. (18.863 hr.)
       The ratio of the pump mixing to the residence time is 0.
         KG aerated (m/s)                          0.11725
         KL aerated (m/s)                          0.016757
         KL OVERALL AERATED (m/s)                  0.005223
         KG quiescent (m/s)                        0.005751
         KL quiescent (m/s)                        5.949e-06
```

KL OVERALL QUIESCENT (m/s)	5.855e-06
KL OVERALL (m/s)	1.646e-04
air stripping time constant (min)	98.199
FRACTION SURFACE VOLATILIZED	0.34308
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.34308
FRACTION BIOLOGICALLY REMOVED	0.62716
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	9.94e-04
(Mg/year)	0.031348
EMISSION FACTOR (g/cm2-s)	1.494e-12
UNIT EXIT CONCENTRATION (ppmw)	9.074e-05

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```
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:\Users\akelley\Desktop\Water9\October 5
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22:21:04
COMPOUND: DIMETHYL SULFIDE  (DMS)

Type of unit is aerated biotreatment
1 Description of unit                      11    ASB Zone 1
2 Wastewater temperature   (C)                   35.2
3 length of aeration unit (m)                    225
4 width of aeration unit (m)                     225
5 depth of aeration unit (m)                     1.4
6 Area of agitation (each aerator,m2)            135
7 Total number of agitators in the unit          16
```

```
      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)           8.28

      Properties of DIMETHYL SULFIDE  (DMS) at 35.2 deg.C (95.4
deg.F)
         hl= 0.003045 atm-m3/mol      vp= 733.622 mmHg (14.19
psia)
             169.142 y/x
             0.1204 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.51e-05 cm2/s  dv= 0.14859
cm2/s
      Compound flow rate from inlet water is 0.10355 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 20.713 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 181.347.
      kl is estimated as 7.652e-06 m/s.
      kg is estimated as 0.008191 m/s.  Model: 2
      kg is estimated as 0.008191 m/s.  Model: 2
      The Schmidt number is 1.00946.
      The friction velocity is 37.398 m/s
      kg is estimated as 0.017945 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 0.15025 m/s.
      kl (agitated)is estimated as 0.021629 m/s.
          The specified and growth biomass is 0.3 g/L.
       The effective KL (surface + diffused air) is 4.396e-04
m/s.
       The effective stripping time (surface + diffused air) is
53.083 minutes. (0.88472 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 1242.781 min. (20.713 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.15307
KL aerated (m/s)	0.021629
KL OVERALL AERATED (m/s)	0.010132
KG quiescent (m/s)	0.008345
KL quiescent (m/s)	7.652e-06
KL OVERALL QUIESCENT (m/s)	7.596e-06
KL OVERALL (m/s)	4.396e-04
air stripping time constant (min)	53.083
FRACTION SURFACE VOLATILIZED	0.77235
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.77235
FRACTION BIOLOGICALLY REMOVED	0.19466
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.07998
(Mg/year)	2.52225
EMISSION FACTOR (g/cm2-s)	1.58e-10
UNIT EXIT CONCENTRATION (ppmw)	0.003594

DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:21:04
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)	1.58e-10
UNIT EXIT CONCENTRATION (ppmw)	1.009e-05

DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:21:04
COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is open hub drain
1 Description of unit 13 default open hub d
2 Underflow T (C) 44.4
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  950.489 l/s.
         Weight fraction down is  1.26472E-07
         Gas concentration in  0 mol fraction.
         Gas flow  950.489 L/s
         Weight fraction out at base of drop is
1.08947962902627E-07
         fraction transferred in the drain drop from hub
is .138561
         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     0.13856
         fraction loss in unit                    0.
         fraction loss in line run                -7.195e-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)             2.837e-19
         mol fract. headspace vent base           7.346e-06
         headspace flow out vent (cc/s)           -9.505e+05
         headspace flow down line (cc/s)          9.505e+05
         KG surface (m/s)                         2402.706
         KL surface (m/s)                         7.651e-09
         flow of waste down hub (l/s)             0.
         component flow in waste into unit (g/s)  0.12021
         total component into unit, g/s           0.10355
         TOTAL AIR EMISSIONS  (g/s)               0.016656
                            (Mg/year)             0.52528
         EMISSION FACTOR  (g/cm2-s)               1.58e-10
         UNIT EXIT CONCENTRATION (ppmw)           0.10895
      DETAILED CALCULATIONS at Unit 17 ASB Zone 3
      Type: aerated biotreatment
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM
22:21:04
      COMPOUND: DIMETHYL SULFIDE  (DMS)

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

```
2 Wastewater temperature   (C)                    31.211
3 length of aeration unit (m)                     380.4
4 width of aeration unit (m)                      190.2
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)             8.37

Properties of DIMETHYL SULFIDE  (DMS) at 31.2 deg.C (88.2
deg.F)
   hl= 0.002634 atm-m3/mol      vp= 634.599 mmHg (12.274
psia)
       146.312 y/x
       0.10551 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.49e-05 cm2/s  dv= 0.14525
cm2/s
Compound flow rate from inlet water is 1.317e-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 19.242 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 333.533.
kl is estimated as 7.586e-06 m/s.
kg is estimated as 0.00791 m/s.  Model: 2
kg is estimated as 0.00791 m/s.  Model: 2
The Schmidt number is 1.03272.
The friction velocity is 37.398 m/s
kg is estimated as 0.017688 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 0.14855 m/s.
```

kl (agitated)is estimated as 0.019549 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 1.069e-04 m/s.
The effective stripping time (surface + diffused air) is 141.812 minutes. (2.36353 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 1154.5 min. (19.242 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.15134
KL aerated (m/s)	0.019549
KL OVERALL AERATED (m/s)	0.008889
KG quiescent (m/s)	0.008059
KL quiescent (m/s)	7.586e-06
KL OVERALL QUIESCENT (m/s)	7.52e-06
KL OVERALL (m/s)	1.069e-04
air stripping time constant (min)	141.812
FRACTION SURFACE VOLATILIZED	0.59325
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.59325
FRACTION BIOLOGICALLY REMOVED	0.33388
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	7.81e-05
(Mg/year)	0.002463
EMISSION FACTOR (g/cm2-s)	1.08e-13
UNIT EXIT CONCENTRATION (ppmw)	1.009e-05

DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:21:04
COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is aerated biotreatment

1 Description of unit	18	ASB Zone 2
2 Wastewater temperature (C)		32.4
3 length of aeration unit (m)		365
4 width of aeration unit (m)		182.3
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)            8.33

      Properties of DIMETHYL SULFIDE  (DMS) at 32.4 deg.C (90.3
deg.F)
         hl= 0.002751 atm-m3/mol      vp= 662.92 mmHg (12.822
psia)
             152.841 y/x
             0.10979 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.496e-05 cm2/s  dv= 0.14624
cm2/s
      Compound flow rate from inlet water is 0.003416 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 18.863 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 300.07.
      kl is estimated as 7.606e-06 m/s.
      kg is estimated as 0.007983 m/s.  Model: 2
      kg is estimated as 0.007983 m/s.  Model: 2
      The Schmidt number is 1.0257.
      The friction velocity is 37.398 m/s
      kg is estimated as 0.017764 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 0.14906 m/s.
      kl (agitated)is estimated as 0.020147 m/s.
          The specified and growth biomass is 0.3 g/L.
       The effective KL (surface + diffused air) is 2.887e-04
m/s.
       The effective stripping time (surface + diffused air) is
56.001 minutes. (0.93335 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 1131.756 min. (18.863 hr.)
       The ratio of the pump mixing to the residence time is 0.
         KG aerated (m/s)                        0.15185
         KL aerated (m/s)                        0.020147
```

KL OVERALL AERATED (m/s)	0.009246
KG quiescent (m/s)	0.008133
KL quiescent (m/s)	7.606e-06
KL OVERALL QUIESCENT (m/s)	7.543e-06
KL OVERALL (m/s)	2.887e-04
air stripping time constant (min)	56.001
FRACTION SURFACE VOLATILIZED	0.77885
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.77885
FRACTION BIOLOGICALLY REMOVED	0.18261
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.002661
(Mg/year)	0.083908
EMISSION FACTOR (g/cm2-s)	3.999e-12
UNIT EXIT CONCENTRATION (ppmw)	1.385e-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:\Users\akelley\Desktop\Water9\October 5
Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM
22:21:39
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment
1 Description of unit                      11    ASB Zone 1
2 Wastewater temperature   (C)                   35.2
3 length of aeration unit (m)                    225
4 width of aeration unit (m)                     225
5 depth of aeration unit (m)                     1.4
6 Area of agitation (each aerator,m2)            135
7 Total number of agitators in the unit          16
```

```
      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)           8.28

      Properties of METHANETHIOL(methyl mercaptan) at 35.2 deg.C
(95.4 deg.F)
         hl= 0.004295 atm-m3/mol      vp= 2347.095 mmHg (45.398
psia)
             238.61 y/x
             0.16984 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.531e-05 cm2/s  dv= 0.23854
cm2/s
      Compound flow rate from inlet water is 0.051199 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 20.713 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 181.347.
      kl is estimated as 7.722e-06 m/s.
      kg is estimated as 0.011248 m/s.  Model: 2
      kg is estimated as 0.011248 m/s.  Model: 2
      The Schmidt number is 0.62883.
      The friction velocity is 37.398 m/s
      kg is estimated as 0.024272 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 0.19037 m/s.
      kl (agitated)is estimated as 0.021776 m/s.
          The specified and growth biomass is 0.3 g/L.
       The effective KL (surface + diffused air) is 5.742e-04
m/s.
       The effective stripping time (surface + diffused air) is
40.638 minutes. (0.67729 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 1242.781 min. (20.713 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.19394
KL aerated (m/s)	0.021776
KL OVERALL AERATED (m/s)	0.013285
KG quiescent (m/s)	0.011459
KL quiescent (m/s)	7.722e-06
KL OVERALL QUIESCENT (m/s)	7.692e-06
KL OVERALL (m/s)	5.742e-04
air stripping time constant (min)	40.638
FRACTION SURFACE VOLATILIZED	0.86677
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.86677
FRACTION BIOLOGICALLY REMOVED	0.10489
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.044378
(Mg/year)	1.39951
EMISSION FACTOR (g/cm2-s)	8.766e-11
UNIT EXIT CONCENTRATION (ppmw)	0.001527

DETAILED CALCULATIONS at Unit 12 def.system exit st
Type: system exit stream
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:21:39
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)	8.766e-11
UNIT EXIT CONCENTRATION (ppmw)	3.417e-06

DETAILED CALCULATIONS at Unit 13 default open hub d
Type: open hub drain
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:21:39
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is open hub drain
1 Description of unit 13 default open hub d
2 Underflow T (C) 44.4
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  950.489 l/s.
         Weight fraction down is  6.535299E-08
         Gas concentration in  0 mol fraction.
         Gas flow  950.489 L/s
         Weight fraction out at base of drop is
5.38664415102028E-08
         fraction transferred in the drain drop from hub
is .175762
         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     0.17576
         fraction loss in unit                    0.
         fraction loss in line run                7.276e-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)             1.829e-19
         mol fract. headspace vent base           6.219e-06
         headspace flow out vent (cc/s)           -9.505e+05
         headspace flow down line (cc/s)          9.505e+05
         KG surface (m/s)                         3294.605
         KL surface (m/s)                         7.724e-09
         flow of waste down hub (l/s)             0.
         component flow in waste into unit (g/s)  0.062117
         total component into unit, g/s           0.051199
         TOTAL AIR EMISSIONS  (g/s)               0.010918
                            (Mg/year)             0.34431
         EMISSION FACTOR  (g/cm2-s)               8.766e-11
         UNIT EXIT CONCENTRATION (ppmw)           0.053866
      DETAILED CALCULATIONS at Unit 17 ASB Zone 3
      Type: aerated biotreatment
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM
22:21:39
      COMPOUND: METHANETHIOL(methyl mercaptan)

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

```
2 Wastewater temperature   (C)                    31.211
3 length of aeration unit (m)                     380.4
4 width of aeration unit (m)                      190.2
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)             8.37

Properties of METHANETHIOL(methyl mercaptan) at 31.2 deg.C
(88.2 deg.F)
   hl= 0.003821 atm-m3/mol      vp= 2088.317 mmHg (40.392
psia)
       212.302 y/x
       0.1531 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.511e-05 cm2/s  dv= 0.23316
cm2/s
Compound flow rate from inlet water is 4.733e-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 19.242 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 333.533.
kl is estimated as 7.655e-06 m/s.
kg is estimated as 0.010862 m/s.  Model: 2
kg is estimated as 0.010862 m/s.  Model: 2
The Schmidt number is 0.64333.
The friction velocity is 37.398 m/s
kg is estimated as 0.02392 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 0.18821 m/s.
```

kl (agitated)is estimated as 0.019682 m/s.
The specified and growth biomass is 0.3 g/L.
The effective KL (surface + diffused air) is 1.405e-04 m/s.
The effective stripping time (surface + diffused air) is 107.921 minutes. (1.79869 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 1154.5 min. (19.242 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.19174
KL aerated (m/s)	0.019682
KL OVERALL AERATED (m/s)	0.01188
KG quiescent (m/s)	0.011066
KL quiescent (m/s)	7.655e-06
KL OVERALL QUIESCENT (m/s)	7.621e-06
KL OVERALL (m/s)	1.405e-04
air stripping time constant (min)	107.921
FRACTION SURFACE VOLATILIZED	0.73417
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.73417
FRACTION BIOLOGICALLY REMOVED	0.1972
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	3.475e-05
(Mg/year)	0.001096
EMISSION FACTOR (g/cm2-s)	4.802e-14
UNIT EXIT CONCENTRATION (ppmw)	3.417e-06

DETAILED CALCULATIONS at Unit 18 ASB Zone 2
Type: aerated biotreatment
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\ASB\ASB Oct 5 Response v2 10/4/2021 7:59:10 PM 22:21:39
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is aerated biotreatment

1 Description of unit	18	ASB Zone 2
2 Wastewater temperature (C)		32.4
3 length of aeration unit (m)		365
4 width of aeration unit (m)		182.3
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)            8.33

      Properties of METHANETHIOL(methyl mercaptan) at 32.4 deg.C
(90.3 deg.F)
         hl= 0.003958 atm-m3/mol      vp= 2163.09 mmHg (41.839
psia)
             219.904 y/x
             0.15796 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.517e-05 cm2/s  dv= 0.23476
cm2/s
      Compound flow rate from inlet water is 0.001451 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 18.863 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 300.07.
      kl is estimated as 7.675e-06 m/s.
      kg is estimated as 0.010962 m/s.  Model: 2
      kg is estimated as 0.010962 m/s.  Model: 2
      The Schmidt number is 0.63895.
      The friction velocity is 37.398 m/s
      kg is estimated as 0.024025 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 0.18886 m/s.
      kl (agitated)is estimated as 0.020285 m/s.
          The specified and growth biomass is 0.3 g/L.
       The effective KL (surface + diffused air) is 3.813e-04
m/s.
       The effective stripping time (surface + diffused air) is
42.403 minutes. (0.70671 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 1131.756 min. (18.863 hr.)
       The ratio of the pump mixing to the residence time is 0.
         KG aerated (m/s)                        0.1924
         KL aerated (m/s)                        0.020285
```

KL OVERALL AERATED (m/s)	0.012284
KG quiescent (m/s)	0.011168
KL quiescent (m/s)	7.675e-06
KL OVERALL QUIESCENT (m/s)	7.643e-06
KL OVERALL (m/s)	3.813e-04
air stripping time constant (min)	42.403
FRACTION SURFACE VOLATILIZED	0.87048
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.87048
FRACTION BIOLOGICALLY REMOVED	0.096909
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	0.001263
(Mg/year)	0.039835
EMISSION FACTOR (g/cm2-s)	1.898e-12
UNIT EXIT CONCENTRATION (ppmw)	4.979e-05

IPT COMMENT 11
REVISED TRS COMPOUND FBIO CALCULATIONS
POST-ASB WATER9 INPUT AND OUTPUT

Table A-39
Water9 Inputs - Post-ASB
New-Indy Catawba - Catawba, SC

Sources	Variable	Value	Unit	Source
Post-ASB	Wastewater Temperature	28.9	C	Average Post-ASB Influent Temperature during IPT (7/9-11/2021)
	Length of Aeration Basin	18.3	m	Estimated based on Google Earth and drone footage (when available)
	Width of Aeration Basin	12.2	m	Estimated based on Google Earth and drone footage (when available)
	Depth of Aeration Basin	4.6	m	Estimated based on site-specific data
	Area of Agitation	47	m^2	Water9 Default
	Total number of Agitators	1		
	Power of Agitation	75	HP	Aerator Design
	Impeller Diameter	49.53	cm	Aerator Design
	Impeller Rotation	1200	rpm	Water9 Default
	Agitator Mechanical Efficiency	0.83		Water9 Default
	Aerator Effectiveness, alpha	0.83		Water9 Default
	Overall Biorate	19	mg/g bio-hr	Water9 Default
	Aeration Flow rate		m^3/s	
	Active Biomass, aeration	0.3	g/l	Water9 Default
	pH	7.86		Average Post-ASB Influent pH during IPT (7/9-11/2021)

Table A-39
Water9 Inputs - Post-ASB
New-Indy Catawba - Catawba, SC

Sources	Variable	Value	Unit	Source
Diffused Air	Wastewater Temperature	28.9	C	Average Post-ASB Influent Temperature during IPT (7/9-11/2021)
	Length of Aeration Basin	17.9	m	Calculated by subtracting area of agitation from aerator from area of Post-ASB
	Width of Aeration Basin	9.9	m	Calculated by subtracting area of agitation from aerator from area of Post-ASB
	Depth of Aeration Basin	4.6	m	Estimated based on site-specific data
	Fraction of surface agitated by air	1		100% agitation based on aerial
	Fraction of surface quiescent	0		100% agitation based on aerial
	Overall Biorate	19	mg/g bio-hr	Water9 Default
	Aeration air flow		m^3/s	
	Activated sludge biomass	2	g/l	Water9 Default
	pH	7.86		Average Post-ASB Influent pH during IPT (7/9-11/2021)

```
      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 def.aerated biotre
      Type: aerated biotreatment
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021
8:20:08 PM  22:31:17
      COMPOUND: DIMETHYL DISULFIDE

      Type of unit is aerated biotreatment
      1 Description of unit                      11
def.aerated biotre
      2 Wastewater temperature   (C)                   28.9
      3 length of aeration unit (m)                   18.3
      4 width of aeration unit (m)                    12.2
      5 depth of aeration unit (m)                    4.6
      6 Area of agitation (each aerator,m2)           47
```

```
7 Total number of agitators in the unit          1
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)            7.86

Properties of DIMETHYL DISULFIDE at 28.9 deg.C (84. deg.F)
   hl= 0.001336 atm-m3/mol      vp= 35.818 mmHg (0.6928
psia)
       74.216 y/x
       0.053929 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.023e-05 cm2/s  dv= 0.085441
cm2/s
Compound flow rate from inlet water is 0.003822 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 0.28269 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_
Springer correlation does not apply, use Mackay and Yeun
(1983).
The friction velocity is 13.347cm/s.
The Schmidt number is 977.316.
kl is estimated as 6.485e-06 m/s.
kg is estimated as 0.007619 m/s.  Model: 2
kg is estimated as 0.007619 m/s.  Model: 2
The Schmidt number is 1.75559.
The friction velocity is 31.28 m/s
kg is estimated as 0.010777 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 0.11393 m/s.
kl (agitated)is estimated as 0.044043 m/s.
    The specified and growth biomass is 0.3 g/L.
 The effective KL (surface + diffused air) is 0.001172 m/s.
```

The effective stripping time (surface + diffused air) is 65.412 minutes. (1.09019 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 16.961 min. (0.28269 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.11607
KL aerated (m/s)	0.044043
KL OVERALL AERATED (m/s)	0.005544
KG quiescent (m/s)	0.007762
KL quiescent (m/s)	6.485e-06
KL OVERALL QUIESCENT (m/s)	6.388e-06
KL OVERALL (m/s)	0.001172
air stripping time constant (min)	65.412
FRACTION SURFACE VOLATILIZED	0.16959
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.16959
FRACTION BIOLOGICALLY REMOVED	0.17636
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	6.481e-04
(Mg/year)	0.020439
EMISSION FACTOR (g/cm2-s)	2.903e-10
UNIT EXIT CONCENTRATION (ppmw)	0.002477

DETAILED CALCULATIONS at Unit 14 default open hub d
Type: open hub drain
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021 8:20:08 PM 22:31:17
COMPOUND: DIMETHYL DISULFIDE

Type of unit is open hub drain

1 Description of unit	14	default open hub d
2 Underflow T (C)		29.3
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		0
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)		7.65

Equilibrium partitioning in drain drop hub is assumed.

```
         Total drain flow is  1009.151 l/s.
         Weight fraction down is  3.994999E-09
         Gas concentration in  0 mol fraction.
         Gas flow  1009.151 L/s
         Weight fraction out at base of drop is
3.78699280644153E-09
         fraction transferred in the drain drop from hub
is .052067
         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     0.052067
         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        5.477e-08
         headspace end of conduit (y)             5.477e-08
         mol fract. headspace vent base           5.477e-08
         headspace flow out vent (cc/s)           -1.009e+06
         headspace flow down line (cc/s)          1.009e+06
         KG surface (m/s)                         1686.846
         KL surface (m/s)                         5.947e-09
         flow of waste down hub (l/s)             0.
         component flow in waste into unit (g/s)  0.004032
         total component into unit, g/s           0.003822
         TOTAL AIR EMISSIONS  (g/s)               2.099e-04
                            (Mg/year)             0.00662
         EMISSION FACTOR  (g/cm2-s)               2.903e-10
         UNIT EXIT CONCENTRATION (ppmw)           0.003787
      DETAILED CALCULATIONS at Unit 15 def.diffused air b
      Type: diffused air biotreatment
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021
8:20:08 PM  22:31:17
      COMPOUND: DIMETHYL DISULFIDE

      Type of unit is diffused air biotreatment
      1 Description of unit                      15
def.diffused air b
      2 Wastewater temperature   (C)                    28.9
      3 length of aeration unit (m)                     17.9
      4 width of aeration unit (m)                      9.9
      5 depth of aeration unit (m)                      4.6
      6 fraction of surface agitated by air             1
      7 fraction of surface quiescent                   0
      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 activated sludge biomass(g/l)                  2
      17 If covered, then enter 1                       0
      18 special input                                  0
```

```
19 pH  (enter 0 for no pH adjustment)            7.86

Properties of DIMETHYL DISULFIDE at 28.9 deg.C (84. deg.F)
   hl= 0.001336 atm-m3/mol      vp= 35.818 mmHg (0.6928
psia)
       74.216 y/x
       0.053929 g/L gas per g/L liquid
   Temperature adjustment factor = 1.046 ^(T-25), deg. C
   kl= 0. L/g-hr          dl= 1.023e-05 cm2/s  dv= 0.085441
cm2/s
Compound flow rate from inlet water is 0.0025 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 0.22438 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_
Springer correlation does not apply, use Mackay and Yeun
(1983).
The friction velocity is 13.347cm/s.
The Schmidt number is 977.316.
kl is estimated as 6.485e-06 m/s.
kg is estimated as 0.007716 m/s.  Model: 2
kg is estimated as 0.007716 m/s.  Model: 2
The Schmidt number is 1.75559.
The friction velocity is 28.484 m/s
kg is estimated as 0.009902 m/s.  Model: 3
________Agitated surface____________________
The rotation speed is 125.654 radians per second.
The rotation factor NRW is 3.011e+06.
The power number NPR is 6.188e-05.
The rotation factor NFR is 965.508.
kg (agitated)is estimated as 0.056285 m/s.
kl (agitated)is estimated as 0.016945 m/s.
    The specified and growth biomass is 2. g/L.
 The effective KL (surface + diffused air) is 0.002644 m/s.
 The effective stripping time (surface + diffused air) is
28.996 minutes. (0.48326 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 13.463 min. (0.22438 hr.)
 The ratio of the pump mixing to the residence time is 0.
   KG aerated (m/s)                          0.05734
   KL aerated (m/s)                          0.016945
   KL OVERALL AERATED (m/s)                  0.002644
   KG quiescent (m/s)                        0.007861
```

```
         KL quiescent (m/s)                        6.485e-06
         KL OVERALL QUIESCENT (m/s)                6.389e-06
         KL OVERALL (m/s)                          0.002644
         air stripping time constant (min)         28.996
         FRACTION SURFACE VOLATILIZED              0.16057
         FRACTION SUBMERGED VOLATILIZED            0.
         TOTAL FRACTION VOLATILIZED                0.16057
         FRACTION BIOLOGICALLY REMOVED             0.4936
         FRACTION ABSORBED                         0.
         TOTAL AIR EMISSIONS  (g/s)                4.014e-04
                          (Mg/year)                0.012657
         EMISSION FACTOR  (g/cm2-s)                2.265e-10
         UNIT EXIT CONCENTRATION (ppmw)            8.566e-04
      DETAILED CALCULATIONS at Unit 17 def.system exit st
      Type: system exit stream
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021
8:20:08 PM  22:31:17
      COMPOUND: DIMETHYL DISULFIDE

      Type of unit is system exit stream
      1 Description of unit                       17    def.system
exit st

         TOTAL AIR EMISSIONS  (g/s)                0.
                          (Mg/year)                0.
         EMISSION FACTOR  (g/cm2-s)                2.265e-10
         UNIT EXIT CONCENTRATION (ppmw)            8.566e-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 def.aerated biotre
      Type: aerated biotreatment
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021
8:20:08 PM  22:31:38
      COMPOUND: DIMETHYL SULFIDE  (DMS)

      Type of unit is aerated biotreatment
      1 Description of unit                      11
def.aerated biotre
      2 Wastewater temperature   (C)                    28.9
      3 length of aeration unit (m)                     18.3
      4 width of aeration unit (m)                      12.2
      5 depth of aeration unit (m)                      4.6
      6 Area of agitation (each aerator,m2)             47
```


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```
      7 Total number of agitators in the unit          1
      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)            7.86

      Properties of DIMETHYL SULFIDE  (DMS) at 28.9 deg.C (84.
deg.F)
         hl= 0.002417 atm-m3/mol      vp= 582.329 mmHg (11.263
psia)
             134.26 y/x
             0.097561 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.479e-05 cm2/s  dv= 0.14332
cm2/s
      Compound flow rate from inlet water is 0.001475 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 0.28269 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_
      Springer correlation does not apply, use Mackay and Yeun
(1983).
      The friction velocity is 13.347cm/s.
      The Schmidt number is 676.088.
      kl is estimated as 7.595e-06 m/s.
      kg is estimated as 0.010775 m/s.  Model: 2
      kg is estimated as 0.010775 m/s.  Model: 2
      The Schmidt number is 1.04659.
      The friction velocity is 31.28 m/s
      kg is estimated as 0.014832 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 0.14756 m/s.
      kl (agitated)is estimated as 0.052954 m/s.
          The specified and growth biomass is 0.3 g/L.
```

The effective KL (surface + diffused air) is 0.002449 m/s.
The effective stripping time (surface + diffused air) is 31.31 minutes. (0.52184 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 16.961 min. (0.28269 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.15033
KL aerated (m/s)	0.052954
KL OVERALL AERATED (m/s)	0.011603
KG quiescent (m/s)	0.010977
KL quiescent (m/s)	7.595e-06
KL OVERALL QUIESCENT (m/s)	7.542e-06
KL OVERALL (m/s)	0.002449
air stripping time constant (min)	31.31
FRACTION SURFACE VOLATILIZED	0.33807
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.33807
FRACTION BIOLOGICALLY REMOVED	0.037861
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	4.986e-04
(Mg/year)	0.015724
EMISSION FACTOR (g/cm2-s)	2.233e-10
UNIT EXIT CONCENTRATION (ppmw)	9.12e-04

DETAILED CALCULATIONS at Unit 14 default open hub d
Type: open hub drain
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021 8:20:08 PM 22:31:38
COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is open hub drain

1 Description of unit	14	default open hub d
2 Underflow T (C)		29.3
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		0
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)		7.65

Equilibrium partitioning in drain drop hub is assumed.
Total drain flow is 1009.151 l/s.
Weight fraction down is 1.606E-09
Gas concentration in 0 mol fraction.
Gas flow 1009.151 L/s
Weight fraction out at base of drop is
1.46145163148041E-09
fraction transferred in the drain drop from hub
is .090005

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	0.090005
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	5.772e-08
headspace end of conduit (y)	5.772e-08
mol fract. headspace vent base	5.771e-08
headspace flow out vent (cc/s)	-1.009e+06
headspace flow down line (cc/s)	1.009e+06
KG surface (m/s)	2381.856
KL surface (m/s)	7.697e-09
flow of waste down hub (l/s)	0.
component flow in waste into unit (g/s)	0.001621
total component into unit, g/s	0.001475
TOTAL AIR EMISSIONS (g/s)	1.459e-04
(Mg/year)	0.0046
EMISSION FACTOR (g/cm2-s)	2.233e-10
UNIT EXIT CONCENTRATION (ppmw)	0.001461

DETAILED CALCULATIONS at Unit 15 def.diffused air b
Type: diffused air biotreatment
Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021
8:20:08 PM 22:31:38
COMPOUND: DIMETHYL SULFIDE (DMS)

Type of unit is diffused air biotreatment

1 Description of unit	15 def.diffused air b
2 Wastewater temperature (C)	28.9
3 length of aeration unit (m)	17.9
4 width of aeration unit (m)	9.9
5 depth of aeration unit (m)	4.6
6 fraction of surface agitated by air	1
7 fraction of surface quiescent	0
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 activated sludge biomass(g/l)	2
17 If covered, then enter 1	0

```
      18 special input                                    0
      19 pH  (enter 0 for no pH adjustment)               7.86

      Properties of DIMETHYL SULFIDE  (DMS) at 28.9 deg.C (84.
deg.F)
         hl= 0.002417 atm-m3/mol      vp= 582.329 mmHg (11.263
psia)
             134.26 y/x
             0.097561 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.479e-05 cm2/s  dv= 0.14332
cm2/s
      Compound flow rate from inlet water is 9.204e-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 0.22438 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_
      Springer correlation does not apply, use Mackay and Yeun
(1983).
      The friction velocity is 13.347cm/s.
      The Schmidt number is 676.088.
      kl is estimated as 7.595e-06 m/s.
      kg is estimated as 0.010912 m/s.  Model: 2
      kg is estimated as 0.010912 m/s.  Model: 2
      The Schmidt number is 1.04659.
      The friction velocity is 28.484 m/s
      kg is estimated as 0.013594 m/s.  Model: 3
      _______Agitated surface___________________
      The rotation speed is 125.654 radians per second.
      The rotation factor NRW is 3.011e+06.
      The power number NPR is 6.188e-05.
      The rotation factor NFR is 965.508.
      kg (agitated)is estimated as 0.072898 m/s.
      kl (agitated)is estimated as 0.020373 m/s.
          The specified and growth biomass is 2. g/L.
       The effective KL (surface + diffused air) is 0.005396 m/s.
       The effective stripping time (surface + diffused air) is
14.208 minutes. (0.23679 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 13.463 min. (0.22438 hr.)
       The ratio of the pump mixing to the residence time is 0.
         KG aerated (m/s)                        0.074264
         KL aerated (m/s)                        0.020373
```

```
         KL OVERALL AERATED (m/s)                  0.005396
         KG quiescent (m/s)                        0.011117
         KL quiescent (m/s)                        7.595e-06
         KL OVERALL QUIESCENT (m/s)                7.543e-06
         KL OVERALL (m/s)                          0.005396
         air stripping time constant (min)         14.208
         FRACTION SURFACE VOLATILIZED              0.41769
         FRACTION SUBMERGED VOLATILIZED            0.
         TOTAL FRACTION VOLATILIZED                0.41769
         FRACTION BIOLOGICALLY REMOVED             0.14151
         FRACTION ABSORBED                         0.
         TOTAL AIR EMISSIONS  (g/s)                3.844e-04
                         (Mg/year)                 0.012124
         EMISSION FACTOR  (g/cm2-s)                2.169e-10
         UNIT EXIT CONCENTRATION (ppmw)            4.02e-04
      DETAILED CALCULATIONS at Unit 17 def.system exit st
      Type: system exit stream
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021
8:20:08 PM  22:31:38
      COMPOUND: DIMETHYL SULFIDE  (DMS)

      Type of unit is system exit stream
      1 Description of unit                      17    def.system
exit st

         TOTAL AIR EMISSIONS  (g/s)                0.
                         (Mg/year)                 0.
         EMISSION FACTOR  (g/cm2-s)                2.169e-10
         UNIT EXIT CONCENTRATION (ppmw)            4.02e-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 def.aerated biotre
      Type: aerated biotreatment
        Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021
8:20:08 PM  22:32:11
      COMPOUND: METHANETHIOL(methyl mercaptan)

      Type of unit is aerated biotreatment
      1 Description of unit                      11
def.aerated biotre
      2 Wastewater temperature   (C)                   28.9
      3 length of aeration unit (m)                   18.3
      4 width of aeration unit (m)                    12.2
      5 depth of aeration unit (m)                    4.6
      6 Area of agitation (each aerator,m2)           47
```


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```
      7 Total number of agitators in the unit          1
      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)            7.86

      Properties of METHANETHIOL(methyl mercaptan) at 28.9 deg.C
(84. deg.F)
         hl= 0.003566 atm-m3/mol      vp= 1948.555 mmHg (37.689
psia)
             198.094 y/x
             0.14395 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.499e-05 cm2/s  dv= 0.23007
cm2/s
      Compound flow rate from inlet water is 4.422e-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 0.28269 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_
      Springer correlation does not apply, use Mackay and Yeun
(1983).
      The friction velocity is 13.347cm/s.
      The Schmidt number is 666.952.
      kl is estimated as 7.64e-06 m/s.
      kg is estimated as 0.014795 m/s.  Model: 2
      kg is estimated as 0.014795 m/s.  Model: 2
      The Schmidt number is 0.65197.
      The friction velocity is 31.28 m/s
      kg is estimated as 0.019997 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 0.18696 m/s.
      kl (agitated)is estimated as 0.053315 m/s.
          The specified and growth biomass is 0.3 g/L.
```

The effective KL (surface + diffused air) is 0.003851 m/s.
The effective stripping time (surface + diffused air) is 19.911 minutes. (0.33184 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 16.961 min. (0.28269 hr.)
The ratio of the pump mixing to the residence time is 0.

KG aerated (m/s)	0.19047
KL aerated (m/s)	0.053315
KL OVERALL AERATED (m/s)	0.018262
KG quiescent (m/s)	0.015073
KL quiescent (m/s)	7.64e-06
KL OVERALL QUIESCENT (m/s)	7.614e-06
KL OVERALL (m/s)	0.003851
air stripping time constant (min)	19.911
FRACTION SURFACE VOLATILIZED	0.45075
FRACTION SUBMERGED VOLATILIZED	0.
TOTAL FRACTION VOLATILIZED	0.45075
FRACTION BIOLOGICALLY REMOVED	0.020131
FRACTION ABSORBED	0.
TOTAL AIR EMISSIONS (g/s)	1.993e-04
(Mg/year)	0.006286
EMISSION FACTOR (g/cm2-s)	8.929e-11
UNIT EXIT CONCENTRATION (ppmw)	2.319e-04

DETAILED CALCULATIONS at Unit 14 default open hub d
Type: open hub drain
Project C:\Users\akelley\Desktop\Water9\October 5 Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021 8:20:08 PM 22:32:11
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is open hub drain

1 Description of unit	14	default open hub d
2 Underflow T (C)		29.3
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		0
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)		7.65

Equilibrium partitioning in drain drop hub is assumed.
Total drain flow is 1009.151 l/s.
Weight fraction down is 5.02E-10
Gas concentration in 0 mol fraction.
Gas flow 1009.151 L/s
Weight fraction out at base of drop is
4.38233328871256E-10
fraction transferred in the drain drop from hub
is .127025

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	0.12703
fraction loss in unit	0.
fraction loss in line run	6.581e-08
component upstream of unit, g/s	0.
mol fract. headspace upstream (y)	0.
headspace at conduit discharge, y	3.288e-08
headspace end of conduit (y)	3.288e-08
mol fract. headspace vent base	3.288e-08
headspace flow out vent (cc/s)	-1.009e+06
headspace flow down line (cc/s)	1.009e+06
KG surface (m/s)	3266.015
KL surface (m/s)	7.771e-09
flow of waste down hub (l/s)	0.
component flow in waste into unit (g/s)	5.066e-04
total component into unit, g/s	4.422e-04
TOTAL AIR EMISSIONS (g/s)	6.435e-05
(Mg/year)	0.002029
EMISSION FACTOR (g/cm2-s)	8.929e-11
UNIT EXIT CONCENTRATION (ppmw)	4.382e-04

DETAILED CALCULATIONS at Unit 15 def.diffused air b
Type: diffused air biotreatment
Project C:\Users\akelley\Desktop\Water9\October 5
Comments Run\Post-ASB\Post ASB Oct 5 Response v2 10/4/2021
8:20:08 PM 22:32:11
COMPOUND: METHANETHIOL(methyl mercaptan)

Type of unit is diffused air biotreatment

1 Description of unit	15 def.diffused air b
2 Wastewater temperature (C)	28.9
3 length of aeration unit (m)	17.9
4 width of aeration unit (m)	9.9
5 depth of aeration unit (m)	4.6
6 fraction of surface agitated by air	1
7 fraction of surface quiescent	0
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 activated sludge biomass(g/l)	2
17 If covered, then enter 1	0

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      18 special input                                    0
      19 pH  (enter 0 for no pH adjustment)               7.86

      Properties of METHANETHIOL(methyl mercaptan) at 28.9 deg.C
(84. deg.F)
         hl= 0.003566 atm-m3/mol      vp= 1948.555 mmHg (37.689
psia)
             198.094 y/x
             0.14395 g/L gas per g/L liquid
         Temperature adjustment factor = 1.046 ^(T-25), deg. C
         kl= 0. L/g-hr          dl= 1.499e-05 cm2/s  dv= 0.23007
cm2/s
      Compound flow rate from inlet water is 2.34e-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 0.22438 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_
      Springer correlation does not apply, use Mackay and Yeun
(1983).
      The friction velocity is 13.347cm/s.
      The Schmidt number is 666.952.
      kl is estimated as 7.64e-06 m/s.
      kg is estimated as 0.014984 m/s.  Model: 2
      kg is estimated as 0.014984 m/s.  Model: 2
      The Schmidt number is 0.65197.
      The friction velocity is 28.484 m/s
      kg is estimated as 0.018298 m/s.  Model: 3
      _______Agitated surface___________________
      The rotation speed is 125.654 radians per second.
      The rotation factor NRW is 3.011e+06.
      The power number NPR is 6.188e-05.
      The rotation factor NFR is 965.508.
      kg (agitated)is estimated as 0.092361 m/s.
      kl (agitated)is estimated as 0.020512 m/s.
          The specified and growth biomass is 2. g/L.
       The effective KL (surface + diffused air) is 0.008222 m/s.
       The effective stripping time (surface + diffused air) is
9.325 minutes. (0.15541 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 13.463 min. (0.22438 hr.)
       The ratio of the pump mixing to the residence time is 0.
         KG aerated (m/s)                        0.094092
         KL aerated (m/s)                        0.020512
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         KL OVERALL AERATED (m/s)                  0.008222
         KG quiescent (m/s)                        0.015265
         KL quiescent (m/s)                        7.64e-06
         KL OVERALL QUIESCENT (m/s)                7.614e-06
         KL OVERALL (m/s)                          0.008222
         air stripping time constant (min)         9.325
         FRACTION SURFACE VOLATILIZED              0.54583
         FRACTION SUBMERGED VOLATILIZED            0.
         TOTAL FRACTION VOLATILIZED                0.54583
         FRACTION BIOLOGICALLY REMOVED             0.076112
         FRACTION ABSORBED                         0.
         TOTAL AIR EMISSIONS  (g/s)                1.277e-04
                         (Mg/year)                 0.004028
         EMISSION FACTOR  (g/cm2-s)                7.208e-11
         UNIT EXIT CONCENTRATION (ppmw)            8.766e-05
      DETAILED CALCULATIONS at Unit 17 def.system exit st
      Type: system exit stream
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      COMPOUND: METHANETHIOL(methyl mercaptan)

      Type of unit is system exit stream
      1 Description of unit                      17    def.system
exit st

         TOTAL AIR EMISSIONS  (g/s)                0.
                         (Mg/year)                 0.
         EMISSION FACTOR  (g/cm2-s)                7.208e-11
         UNIT EXIT CONCENTRATION (ppmw)            8.766e-05
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