MEMORANDUM

To:	New-Indy Catawba LLC (New-Indy)	**Date:**	September 16, 2021
From:	ALL4 LLC (ALL4)		
Subject:	Update to ASB Model Results for H_2S and Methanol		

As requested by New-Indy, ALL4 completed updated model runs for the aerated stabilization basin (ASB) for methanol (utilizing Appendix C/Form XIII calculations) and hydrogen sulfide (utilizing the NCASI H2SSIM model). The updated runs are meant to predict the impact of treating all foul condensates in the ASB at the current/revised aerator configuration (i.e. total of 52 aerators) and with hydrogen peroxide addition at the ASB inlet and foul condensate streams.

ALL4 utilized the data collected during the July 9-11, 2021 testing effort for the remaining inputs, with the exception of the following for the H2SSIM runs: (1) hydrogen sulfide inlet concentration/loading is assumed to be reduced by a minimum of 90% to account for the reaction of hydrogen peroxide and conversion to sulfur and/or sulfate compounds. New-Indy plans to add approximately 1.5 times the stochiometric amount for conversion; however, the 90% reduction value is a conservative assumption to account for potential reactions with other compounds and incomplete mixing; and (2) More recent dissolved oxygen (DO) values are considered for consistency with the increase in the number of aerators and additional removal of sludge. ALL4 also considered updated temperature and pH values that accompany the recent DO values. The H2SSIMS results for the various scenarios considered are included in Attachment A, Table A-1.

ALL4 completed the updated Appendix C/Form XIII methanol calculations for the total foul condensate flow to the ASB at the current aerator configuration. ALL4 utilized the data collected during the July 9-11, 2021 testing effort for the remaining inputs for Scenario A. In particular, the Zone 1 methanol concentration from the IPT was used. Since the higher foul condensate flow results in a higher combined inlet concentration to the ASB, this scenario indicates improved biodegradation to achieve the same Zone 1 concentration from the IPT. For Scenario B, ALL4 increased the Zone 1 methanol concentration by the ratio of the new flow weighted methanol concentration divided by the original IPT flow weighted methanol concentration to estimate the same biodegradation rate as the IPT.

The results of the Appendix C/Form XIII calculations for these scenarios are included in Attachment A, Table A-2. The H2SSIM output files and Appendix C/Form XIII calculations are included in Attachment B.

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Attachment A – Updated ASB Model Results
Attachment B – H2SSIM and Appendix C/Form XIII output files

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ATTACHMENT A – UPDATED ASB MODEL RESULTS

Table A-1
H2SSIM Model Scenarios
New-Indy Catawba - Catawba, SC

Scenario	IPT Data Date Range	Fraction Removed in the ASB	Zone 1 Emissions (lbs/yr)	Zone 2 Emissions (lbs/yr)	Zone 3 Emissions (lbs/yr)	Total Emissions (lbs/yr)	Total Emissions rate (lb/hr)
Scenario 0: IPT[a]	7/9/2021	96%	1,608.20	1,736.00	1,577.60	4,921.80	0.56
	7/10/2021	90%	5,266.90	3,013.90	1,624.90	9,905.70	1.13
	7/11/2021	79%	4,603.70	3,647.10	1,778.00	10,028.70	1.14
	Average	88%	3,826.27	2,799.00	1,660.17	8,285.40	0.95
Scenario 1[b]	7/9/2021	86%	1,610.60	1,734.90	1,577.60	4,923.10	0.56
	7/10/2021	61%	7,695.40	3,009.80	1,624.90	12,330.10	1.41
	7/11/2021	26%	5,555.80	3,642.60	1,778.00	10,976.40	1.25
	Average	58%	4,953.93	2,795.77	1,660.17	9,409.87	1.07
Scenario 2[c]	7/9/2021	87%	1,516.60	1,562.30	1,577.40	4,656.20	0.53
	7/10/2021	84%	1,895.60	1,594.30	1,616.00	5,106.00	0.58
	7/11/2021	66%	1,635.60	1,772.40	1,730.10	5,138.10	0.59
	Average	79%	1,682.60	1,643.00	1,641.17	4,966.77	0.57
Scenario 3[d]	7/9/2021	84%	2,475.20	1,702.10	1,669.80	5,847.10	0.67
	7/10/2021	81%	2,425.90	1,722.90	1,701.70	5,850.60	0.67
	7/11/2021	62%	1,958.50	1,855.40	1,797.80	5,611.70	0.64
	Average	76%	2,286.53	1,760.13	1,723.10	5,769.80	0.66
Scenario 4[e]	7/9/2021	87%	2,013.80	1,326.10	1,352.10	4,692.00	0.54
	7/10/2021	85%	1,897.20	1,325.60	1,352.10	4,574.90	0.52
	7/11/2021	72%	1,512.50	1,324.00	1,352.10	4,188.70	0.48
	Average	81%	1,807.83	1,325.23	1,352.10	4,485.20	0.51

[a] Scenario 0 includes actual foul condensate flow from the IPT.

[b] Scenario 1 uses the data from the IPT and assumes a 90% reduction in TRS loading due to peroxide treatment, full foul condensate flow to the ASB, dissolved oxygen (DO) concentration during the IPT, and 52 active aerators.

[c] Scenario 2 uses the data from Scenario 1 and the DO average of the ASB zones from September 8 and 13, 2021.

[d] Scenario 3 uses the data from Scenario 2 and the average pH of the ASB zones from September 8 and 13, 2021.

[e] Scenario 4 uses the data from Scenario 3 and the average temperature of the ASB zones from September 8 and 13, 2021.

Table A-2
Updated Form XII Calculation Results
New-Indy Catawba - Catawba, SC

Parameter	Original IPT	Scenario A[a]	Scenario B[b]
Average FC Flow (MGD)	0.34	1.05	1.05
Number of Aerators	37-42	52	52
Average F_{bio}	88.6%	89.9%	84.5%

[a] This scenario assumes that the methanol concentration in Zone 1 is the same as the sampling performed during the IPT. Since the higher foul condensate flow results in a higher combined inlet concentration to Zone 1, this implies more biodegradation to achieve the same Zone 1 concentration from the IPT.

[b] This scenario scales up the methanol concentration in Zone 1 by the proportional concentration reduction during the IPT to estimate the same biodegradation rate as the IPT.

ATTACHMENT B – H2SSIM AND APPENDIX C/FORM XIII OUTPUT FILES

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

Scenario 0: 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	0.025	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	730	1196	1248		feet
Width	730	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

Scenario 0: 7/9/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.071	gms/s
Total Emissions (H_2S)	4921.8	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)	1608.2	1736.0	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)	107.500	87.000	9.900		lbs/yr

Percent Inlet Sulfide Removed	95.8%

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

Scenario 0: 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	0.32	MGD
Total Sulfide	0.012	96.9	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	730	1196	1248		feet
Width	730	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

Scenario 0: 7/10/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.142	gms/s
Total Emissions (H_2S)	9905.7	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)	5266.9	3013.9	1624.9		lbs/yr
Emission Flux (H_2S)	48.3	20.6	10.2		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.046	0.041	0.002		mg/L
Liquid Sulfide Load (lbs/yr)	485.400	428.400	16.400		lbs/yr

Percent Inlet Sulfide Removed	89.6%

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	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

Scenario 0: 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	46.9	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	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	21	15	6		
Total Horsepower	1575	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

Scenario 0: 7/11/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.144	gms/s
Total Emissions (H_2S)	10028.7	lbs/yr
Total Emissions (H_2S)	5.0	tons/yr
Total Emissions (H_2S)	4.5	tonnes/yr
Emission Flux (H_2S)	24.2	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.07	0.05	0.03		gms/s
Zone Emissions (H_2S)	4603.7	3647.1	1778.0		lbs/yr
Emission Flux (H_2S)	42.2	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)	288.200	239.000	24.800		lbs/yr

Percent Inlet Sulfide Removed	79.1%

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

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

Scenario 1: 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	1.04	MGD
Total Sulfide	0.0025	11.42	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	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderati	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 1: 7/9/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.071	gms/s
Total Emissions (H_2S)	4923.1	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)	1610.6	1734.9	1577.6		lbs/yr
Emission Flux (H_2S)	14.8	11.8	9.9		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.005	0.008	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	58.100	89.300	10.300		lbs/yr

Percent Inlet Sulfide Removed	86.4%

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	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

Scenario 1: 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	1.06	MGD
Total Sulfide	0.0012	9.69	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	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderati	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 1: 7/10/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.177	gms/s
Total Emissions (H_2S)	12330.1	lbs/yr
Total Emissions (H_2S)	6.2	tons/yr
Total Emissions (H_2S)	5.6	tonnes/yr
Emission Flux (H_2S)	29.7	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.11	0.04	0.02		gms/s
Zone Emissions (H_2S)	7695.4	3009.8	1624.9		lbs/yr
Emission Flux (H_2S)	70.5	20.5	10.2		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.039	0.041	0.002		mg/L
Liquid Sulfide Load (lbs/yr)	425.800	441.700	17.000		lbs/yr

Percent Inlet Sulfide Removed	60.6%

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	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

Scenario 1: 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	1.04	MGD
Total Sulfide	0.0014	4.69	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	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 1: 7/11/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.158	gms/s
Total Emissions (H_2S)	10976.4	lbs/yr
Total Emissions (H_2S)	5.5	tons/yr
Total Emissions (H_2S)	5.0	tonnes/yr
Emission Flux (H_2S)	26.4	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.08	0.05	0.03		gms/s
Zone Emissions (H_2S)	5555.8	3642.6	1778.0		lbs/yr
Emission Flux (H_2S)	50.9	24.9	11.1		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.025	0.023	0.002		mg/L
Liquid Sulfide Load (lbs/yr)	260.300	246.500	25.600		lbs/yr

Percent Inlet Sulfide Removed	26.3%

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

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

Scenario 2: 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	1.04	MGD
Total Sulfide	0.0025	11.42	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	2	2	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	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderati	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 2: 7/9/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.067	gms/s
Total Emissions (H_2S)	4656.2	lbs/yr
Total Emissions (H_2S)	2.3	tons/yr
Total Emissions (H_2S)	2.1	tonnes/yr
Emission Flux (H_2S)	11.2	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.02	0.02	0.02		gms/s
Zone Emissions (H_2S)	1516.6	1562.3	1577.4		lbs/yr
Emission Flux (H_2S)	13.9	10.7	9.9		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	29.300	10.200	9.800		lbs/yr

Percent Inlet Sulfide Removed	87.2%

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	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

Scenario 2: 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	1.06	MGD
Total Sulfide	0.0012	9.69	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	2	2	2		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	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 2: 7/10/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.073	gms/s
Total Emissions (H_2S)	5106.0	lbs/yr
Total Emissions (H_2S)	2.6	tons/yr
Total Emissions (H_2S)	2.3	tonnes/yr
Emission Flux (H_2S)	12.3	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.03	0.02	0.02		gms/s
Zone Emissions (H_2S)	1895.6	1594.3	1616.0		lbs/yr
Emission Flux (H_2S)	17.4	10.9	10.1		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	28.200	10.500	10.300		lbs/yr

Percent Inlet Sulfide Removed	83.7%

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	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

Scenario 2: 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	1.04	MGD
Total Sulfide	0.0014	4.69	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	2	2	2		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	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 2: 7/11/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.074	gms/s
Total Emissions (H_2S)	5138.1	lbs/yr
Total Emissions (H_2S)	2.6	tons/yr
Total Emissions (H_2S)	2.3	tonnes/yr
Emission Flux (H_2S)	12.4	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.02	0.03	0.03		gms/s
Zone Emissions (H_2S)	1635.6	1772.4	1730.1		lbs/yr
Emission Flux (H_2S)	15.0	12.1	10.8		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.002	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	19.900	10.900	10.800		lbs/yr

Percent Inlet Sulfide Removed	65.5%

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

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

Scenario 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	1.04	MGD
Total Sulfide	0.0025	11.42	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	2	2	2		mg/L
Temperature	95.8	89.2	87.2		F
pH	7.71	7.71	7.5		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 3: 7/9/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.084	gms/s
Total Emissions (H_2S)	5847.1	lbs/yr
Total Emissions (H_2S)	2.9	tons/yr
Total Emissions (H_2S)	2.7	tonnes/yr
Emission Flux (H_2S)	14.1	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.04	0.02	0.02		gms/s
Zone Emissions (H_2S)	2475.2	1702.1	1669.8		lbs/yr
Emission Flux (H_2S)	22.7	11.6	10.5		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	35.000	12.100	12.800		lbs/yr

Percent Inlet Sulfide Removed	83.9%

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	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

Scenario 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	1.06	MGD
Total Sulfide	0.0012	9.69	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	2	2	2		mg/L
Temperature	97.16	89.6	87.8		F
pH	7.71	7.71	7.5		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 3: 7/10/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.084	gms/s
Total Emissions (H_2S)	5850.6	lbs/yr
Total Emissions (H_2S)	2.9	tons/yr
Total Emissions (H_2S)	2.7	tonnes/yr
Emission Flux (H_2S)	14.1	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.04	0.03	0.02		gms/s
Zone Emissions (H_2S)	2425.9	1722.9	1701.7		lbs/yr
Emission Flux (H_2S)	22.2	11.8	10.7		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.003	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	30.600	12.000	12.800		lbs/yr

Percent Inlet Sulfide Removed	81.3%

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

Scenario 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	1.04	MGD
Total Sulfide	0.0014	4.69	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	2	2	2		mg/L
Temperature	93.32	92	89.54		F
pH	7.71	7.71	7.5		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 3: 7/11/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.081	gms/s
Total Emissions (H_2S)	5611.7	lbs/yr
Total Emissions (H_2S)	2.8	tons/yr
Total Emissions (H_2S)	2.5	tonnes/yr
Emission Flux (H_2S)	13.5	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.03	0.03	0.03		gms/s
Zone Emissions (H_2S)	1958.5	1855.4	1797.8		lbs/yr
Emission Flux (H_2S)	17.9	12.7	11.3		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.002	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	21.400	11.700	12.400		lbs/yr

Percent Inlet Sulfide Removed	62.3%

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

NCASI WASTEWATER HYDROGEN SULFIDE EMISSIONS SIMULATOR (H2SSIM)

Version 1.3

Scenario 4: 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	1.04	MGD
Total Sulfide	0.0025	11.42	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	2	2	2		mg/L
Temperature	81.1	81.1	80.5		F
pH	7.71	7.71	7.5		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 4: 7/9/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.067	gms/s
Total Emissions (H_2S)	4692.0	lbs/yr
Total Emissions (H_2S)	2.3	tons/yr
Total Emissions (H_2S)	2.1	tonnes/yr
Emission Flux (H_2S)	11.3	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.03	0.02	0.02		gms/s
Zone Emissions (H_2S)	2013.8	1326.1	1352.1		lbs/yr
Emission Flux (H_2S)	18.5	9.1	8.5		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.004	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	45.400	11.700	12.300		lbs/yr

Percent Inlet Sulfide Removed	87.0%

Current Parameters	
kgen	0.25
ThetaGen	1.06
KDO	0.05
KSO4	10
kanox	0.006
ThetaOx	1.05
m	1
n	0.2
MLVSS	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

Scenario 4: 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	1.06	MGD
Total Sulfide	0.0012	9.69	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	2	2	2		mg/L
Temperature	81.1	81.1	80.5		F
pH	7.71	7.71	7.5		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 4: 7/10/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.066	gms/s
Total Emissions (H_2S)	4574.9	lbs/yr
Total Emissions (H_2S)	2.3	tons/yr
Total Emissions (H_2S)	2.1	tonnes/yr
Emission Flux (H_2S)	11.0	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.03	0.02	0.02		gms/s
Zone Emissions (H_2S)	1897.2	1325.6	1352.1		lbs/yr
Emission Flux (H_2S)	17.4	9.0	8.5		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.004	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	40.600	11.600	12.300		lbs/yr

Percent Inlet Sulfide Removed	85.4%

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

Scenario 4: 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	1.04	MGD
Total Sulfide	0.0014	4.69	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	2	2	2		mg/L
Temperature	81.1	81.1	80.5		F
pH	7.71	7.71	7.5		s.u.
Redox Condition	Aerobic	Aerobic	Aerobic	Aerobic	
Length	730	1196	1248		feet
Width	730	598	624		feet
Depth	4.5	3.2	3		feet
Mixing	Moderat	Moderat	Moderat		
Number of Aerators	31	15	6		
Total Horsepower	2325	1125	450		HP
Impellor Size	1.625	1.625	1.625		feet
Impellor RPM	1200	1200	1200		RPM
Diffused Air Flow	0	0	0		cms
Weir Height	0	0	0		feet

Model Controls

Run H2SSIM

View Parameters

Clear Input Sheet

H2SSIM Results

Scenario 4: 7/11/2021

Basin Emissions		Units
Total Emissions (H_2S)	0.060	gms/s
Total Emissions (H_2S)	4188.7	lbs/yr
Total Emissions (H_2S)	2.1	tons/yr
Total Emissions (H_2S)	1.9	tonnes/yr
Emission Flux (H_2S)	10.1	gms/m^2 yr

Zone Emissions	Zone 1	Zone 2	Zone 3	Zone 4	Units
Zone Emissions (H_2S)	0.02	0.02	0.02		gms/s
Zone Emissions (H_2S)	1512.5	1324.0	1352.1		lbs/yr
Emission Flux (H_2S)	13.9	9.0	8.5		gms/m^2 yr
Liquid Conc. (Total Sulfide)	0.002	0.001	0.001		mg/L
Liquid Sulfide Load (lbs/yr)	24.300	11.100	11.800		lbs/yr

Percent Inlet Sulfide Removed	71.9%

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

Original IPT

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/9/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	16	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	1200	1125	450
Temperature	C	35.4	31.8	30.7
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	21.7	77.7
Condensate Stream	0.3	2,383
Outlet	22.0	0.3

*** except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		22.0	112.0
Effluent Concentration			0.25
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	112.0	80.0	4.9	0.3	0.5
Temp.	F		95.8	89.2	87.2	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	86.8
Fraction air emissions	13.0
Fraction remaining in unit effluent	0.2

Original IPT

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

Data Date: 7/9

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

General

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

TURBULENT
KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	23232	21780	8712
Total TurbArea (m2)	2158.3	2023.4	809.3
Frac. Agitated (by surface aerators)	0.044	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA

These Parameters are used when F/D < 14 **AND** U > 3.25 m/s

DIFFUSED

Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Original IPT

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/9

Surface Aeration													
		Turbulent Area			Quiescient Area								
						kL, m/s							
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall
	H	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14<F/D<51.2	F/D>51.2	m/s	m/s	m/s
Zone1												
Methanol	8.79E-06	1.55E-01	2.27E-02	5.38E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	1.04E-06	3.34E-06
Zone 2												
Methanol	7.33E-06	1.55E-01	2.08E-02	4.54E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.00E-07	2.26E-06
Zone 3												
Methanol	6.94E-06	1.55E-01	2.03E-02	4.32E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	8.61E-07	1.33E-06

Original IPT

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

Data Date: **7/9**

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.949
FLOW RATE of condensate to the unit (m3/s)	5	0.014
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.963
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	77.666667
Concentration in the condensates (mg/L)	8	2383.3333
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	111.99344
Concentration in the effluent (mg/L)	9	0.25

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.963	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	206503	2.39 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	80	49506.41	3.33919E-06	13.2249	0.165311
2	4.866666667	66442.8232	2.25654E-06	0.7297	0.149931
3	0.25	72346.0608	1.33445E-06	0.024	0.096542
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	13.98	

Removal by air stripping (g/s). Line 16.	17	13.98
Loading in effluent (g/s). Line 9 times line 10.	18	0.24
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	107.9
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	93.6
Fraction biodegraded: Divide line 20 by line 19.	21	0.868
Fraction air emissions: Divide line 17 by line 19.	22	0.130
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.002

Original IPT

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/10/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	16	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	1200	1125	450
Temperature	C	36.2	32.0	31.0
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	21.6	91.7
Condensate Stream	0.3	2,267
Outlet	21.9	0.3

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		21.9	123.4
Effluent Concentration			0.25
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	123.4	58.7	9.5	0.4	0.5
Temp.	F		97.2	89.6	87.8	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	90.1
Fraction air emissions	9.7
Fraction remaining in unit effluent	0.2

Original IPT

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

Data Date: 7/10

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

General

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

TURBULENT
KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	23232	21780	8712
Total TurbArea (m2)	2158.3	2023.4	809.3
Frac. Agitated (by surface aerators)	0.044	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA

These Parameters are used when F/D < 14 **AND** U > 3.25 m/s

DIFFUSED

Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Original IPT

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/10

Surface Aeration													
		Turbulent Area			Quiescient Area								
						kL, m/s							
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall
	H	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14<F/D<51.2	F/D>51.2	m/s	m/s	m/s
Zone1												
Methanol	9.11E-06	1.55E-01	2.31E-02	5.57E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	1.07E-06	3.45E-06
Zone 2												
Methanol	7.42E-06	1.55E-01	2.09E-02	4.60E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.08E-07	2.28E-06
Zone 3												
Methanol	7.06E-06	1.55E-01	2.04E-02	4.39E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	8.72E-07	1.35E-06

Original IPT

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

Data Date: **7/10**

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.946
FLOW RATE of condensate to the unit (m3/s)	5	0.014
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.960
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	91.666667
Concentration in the condensates (mg/L)	8	2266.6667
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	123.38898
Concentration in the effluent (mg/L)	9	0.25

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.960	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	207270	2.40 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	58.66666667	49506.41	3.44621E-06	10.0091	0.17061
2	9.533333333	66442.8232	2.27985E-06	1.4441	0.15148
3	0.351666667	72346.0608	1.35275E-06	0.034	0.097866
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	11.49	

Removal by air stripping (g/s). Line 16.	17	11.49
Loading in effluent (g/s). Line 9 times line 10.	18	0.24
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	118.4
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	106.7
Fraction biodegraded: Divide line 20 by line 19.	21	0.901
Fraction air emissions: Divide line 17 by line 19.	22	0.097
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.002

Original IPT

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/11/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	21	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	1575	1125	450
Temperature	C	34.1	33.3	32.0
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	20.8	82.7
Condensate Stream	0.3	2,000
Outlet	21.2	0.8

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		21.2	112.9
Effluent Concentration			0.85
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	112.9	43.7	11.1	0.6	0.5
Temp.	F		93.3	92.0	89.5	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	89.6
Fraction air emissions	9.7
Fraction remaining in unit effluent	0.7

Original IPT

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

Data Date: 7/11

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

General

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

TURBULENT
KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	30492	21780	8712
Total TurbArea (m2)	2832.7	2023.4	809.3
Frac. Agitated (by surface aerators)	0.057	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA

These Parameters are used when F/D < 14 **AND** U > 3.25 m/s

DIFFUSED

Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Original IPT

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/11

Surface Aeration													
		Turbulent Area			Quiescient Area								
						kL, m/s							
	Temp Adj	kG	kL	KL turb	kG			U10 > 3.25		kL	KL quisc	KL overall
	H	m/s	m/s	m/s	m/s	U10 < 3.25	F/D<14	14<F/D<51.2	F/D>51.2	m/s	m/s	m/s
Zone1												
Methanol	8.22E-06	1.55E-01	2.20E-02	5.05E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	9.90E-07	3.83E-06
Zone 2												
Methanol	7.93E-06	1.55E-01	2.16E-02	4.89E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.53E-07	2.41E-06
Zone 3												
Methanol	7.41E-06	1.55E-01	2.09E-02	4.59E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	9.04E-07	1.41E-06

Original IPT

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

Data Date: **7/11**

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.912
FLOW RATE of condensate to the unit (m3/s)	5	0.015
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.927
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	82.666667
Concentration in the condensates (mg/L)	8	2000
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	112.94631
Concentration in the effluent (mg/L)	9	0.8466667

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.927	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	214578	2.48 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	43.66666667	49506.41	3.82563E-06	8.2702	0.189393
2	11.1	66442.8232	2.41222E-06	1.7790	0.160275
3	0.616666667	72346.0608	1.40676E-06	0.063	0.101774
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	10.11	

Removal by air stripping (g/s). Line 16.	17	10.11
Loading in effluent (g/s). Line 9 times line 10.	18	0.78
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	104.7
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	93.8
Fraction biodegraded: Divide line 20 by line 19.	21	0.896
Fraction air emissions: Divide line 17 by line 19.	22	0.097
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.007

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/9/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	35.4	31.8	30.7
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	21.7	77.7
Condensate Stream	1.04	2,383
Outlet	22.7	0.25

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		22.7	183.5
Effluent Concentration			0.25
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	183.5	80.0	4.9	0.25	0.5
Temp.	F		95.8	89.2	87.2	
			44%	**3%**	**0%**	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	87.5
Fraction air emissions	12.3
Fraction remaining in unit effluent	0.1

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: 7/9

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

General

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

TURBULENT
KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	45012	21780	8712
Total TurbArea (m2)	4181.6	2023.4	809.3
Frac. Agitated (by surface aerators)	0.084	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA

These Parameters are used when F/D < 14 **AND** U > 3.25 m/s

DIFFUSED

Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/9

		Surface Aeration										
		Turbulent Area			Quiescient Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	8.79E-06	1.55E-01	2.27E-02	5.38E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	1.04E-06	5.50E-06
Zone 2												
Methanol	7.33E-06	1.55E-01	2.08E-02	4.54E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.00E-07	2.26E-06
Zone 3												
Methanol	6.94E-06	1.55E-01	2.03E-02	4.32E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	8.61E-07	1.33E-06

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Scenario A

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

Data Date: 7/9

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.949
FLOW RATE of condensate to the unit (m3/s)	5	0.046
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.994
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	77.666667
Concentration in the condensates (mg/L)	8	2383.3333
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	183.47641
Concentration in the effluent (mg/L)	9	0.25

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.994	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	200004	2.31 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	80	49506.41	5.49566E-06	21.7656	0.272071
2	4.866666667	66442.8232	2.25654E-06	0.7297	0.149931
3	0.25	72346.0608	1.33445E-06	0.024	0.096542
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	22.52	

Removal by air stripping (g/s). Line 16.	17	22.52
Loading in effluent (g/s). Line 9 times line 10.	18	0.25
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	182.5
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	159.7
Fraction biodegraded: Divide line 20 by line 19.	21	0.875
Fraction air emissions: Divide line 17 by line 19.	22	0.123
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.001

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/10/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	36.2	32.0	31.0
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	21.6	91.7
Condensate Stream	1.06	2,267
Outlet	22.6	0.3

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		22.6	193.7
Effluent Concentration			0.25
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	193.7	58.7	9.5	0.4	0.5
Temp.	F		97.2	89.6	87.8	
			30%	**5%**	**0%**	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	90.5
Fraction air emissions	9.3
Fraction remaining in unit effluent	0.1

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: 7/10

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

General

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

TURBULENT

KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	45012	21780	8712
Total TurbArea (m2)	4181.6	2023.4	809.3
Frac. Agitated (by surface aerators)	0.084	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA

These Parameters are used when F/D < 14 **AND** U > 3.25 m/s

DIFFUSED

Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/10

Surface Aeration												
		Turbulent Area			Quiescient Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	9.11E-06	1.55E-01	2.31E-02	5.57E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	1.07E-06	5.68E-06
Zone 2												
Methanol	7.42E-06	1.55E-01	2.09E-02	4.60E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.08E-07	2.28E-06
Zone 3												
Methanol	7.06E-06	1.55E-01	2.04E-02	4.39E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	8.72E-07	1.35E-06

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Scenario A

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

Data Date: **7/10**

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.946
FLOW RATE of condensate to the unit (m3/s)	5	0.047
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.992
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	91.666667
Concentration in the condensates (mg/L)	8	2266.6667
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	193.73492
Concentration in the effluent (mg/L)	9	0.25

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.992	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	200467	2.32 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	58.66666667	49506.41	5.67764E-06	16.4900	0.28108
2	9.533333333	66442.8232	2.27985E-06	1.4441	0.15148
3	0.351666667	72346.0608	1.35275E-06	0.034	0.097866
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	17.97	

Removal by air stripping (g/s). Line 16.	17	17.97
Loading in effluent (g/s). Line 9 times line 10.	18	0.25
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	192.2
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	174.0
Fraction biodegraded: Divide line 20 by line 19.	21	0.905
Fraction air emissions: Divide line 17 by line 19.	22	0.093
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.001

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/11/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	34.1	33.3	32.0
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	20.8	82.7
Condensate Stream	1.04	2,000
Outlet	21.9	0.8

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		21.9	173.8
Effluent Concentration			0.85
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	173.8	43.7	11.1	0.6	0.5
Temp.	F		93.3	92.0	89.5	
			25%	**6%**	**0%**	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	91.7
Fraction air emissions	7.8
Fraction remaining in unit effluent	0.5

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: 7/11

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

General

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

TURBULENT

KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	45012	21780	8712
Total TurbArea (m2)	4181.6	2023.4	809.3
Frac. Agitated (by surface aerators)	0.084	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
These Parameters are used when F/D < 14 **AND** U > 3.25 m/s			
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA
DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Scenario A

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/11

Surface Aeration												
		Turbulent Area			Quiescient Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	8.22E-06	1.55E-01	2.20E-02	5.05E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	9.90E-07	5.18E-06
Zone 2												
Methanol	7.93E-06	1.55E-01	2.16E-02	4.89E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.53E-07	2.41E-06
Zone 3												
Methanol	7.41E-06	1.55E-01	2.09E-02	4.59E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	9.04E-07	1.41E-06

Scenario A

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

Data Date: 7/11

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.912
FLOW RATE of condensate to the unit (m3/s)	5	0.046
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.958
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	82.666667
Concentration in the condensates (mg/L)	8	2000
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	173.83823
Concentration in the effluent (mg/L)	9	0.8466667

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.958	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	207654	2.40 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	43.66666667	49506.41	5.17574E-06	11.1888	0.256232
2	11.1	66442.8232	2.41222E-06	1.7790	0.160275
3	0.616666667	72346.0608	1.40676E-06	0.063	0.101774
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	13.03	

Removal by air stripping (g/s). Line 16.	17	13.03
Loading in effluent (g/s). Line 9 times line 10.	18	0.81
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	166.5
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	152.7
Fraction biodegraded: Divide line 20 by line 19.	21	0.917
Fraction air emissions: Divide line 17 by line 19.	22	0.078
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.005

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/9/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	35.4	31.8	30.7
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	21.7	77.7
Condensate Stream	1.04	2,383
Outlet	22.7	0.25

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		22.7	183.5
Effluent Concentration			0.25
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	183.5	131.1	4.9	0.25	0.5
Temp.	F		95.8	89.2	87.2	
			71%	**3%**	**0%**	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	79.9
Fraction air emissions	20.0
Fraction remaining in unit effluent	0.1

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: 7/9

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

General

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

TURBULENT

KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	45012	21780	8712
Total TurbArea (m2)	4181.6	2023.4	809.3
Frac. Agitated (by surface aerators)	0.084	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA

These Parameters are used when F/D < 14 **AND** U > 3.25 m/s

DIFFUSED

Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/9

Surface Aeration												
		Turbulent Area			Quiescient Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	8.79E-06	1.55E-01	2.27E-02	5.38E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	1.04E-06	5.50E-06
Zone 2												
Methanol	7.33E-06	1.55E-01	2.08E-02	4.54E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.00E-07	2.26E-06
Zone 3												
Methanol	6.94E-06	1.55E-01	2.03E-02	4.32E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	8.61E-07	1.33E-06

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Scenario B

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

Data Date: **7/9**

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.949
FLOW RATE of condensate to the unit (m3/s)	5	0.046
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.994
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	77.666667
Concentration in the condensates (mg/L)	8	2383.3333
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	183.47641
Concentration in the effluent (mg/L)	9	0.25

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.994	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	200004	2.31 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	131.0622587	49506.41	5.49566E-06	35.6582	0.272071
2	4.866666667	66442.8232	2.25654E-06	0.7297	0.149931
3	0.25	72346.0608	1.33445E-06	0.024	0.096542
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	36.41	

Removal by air stripping (g/s). Line 16.	17	36.41
Loading in effluent (g/s). Line 9 times line 10.	18	0.25
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	182.5
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	145.8
Fraction biodegraded: Divide line 20 by line 19.	21	0.799
Fraction air emissions: Divide line 17 by line 19.	22	0.200
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.001

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/10/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	36.2	32.0	31.0
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	21.6	91.7
Condensate Stream	1.06	2,267
Outlet	22.6	0.3

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		22.6	193.7
Effluent Concentration			0.25
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	193.7	92.1	9.5	0.4	0.5
Temp.	F		97.2	89.6	87.8	
			48%	**5%**	**0%**	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	85.6
Fraction air emissions	14.2
Fraction remaining in unit effluent	0.1

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: 7/10

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

General

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

TURBULENT

KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	45012	21780	8712
Total TurbArea (m2)	4181.6	2023.4	809.3
Frac. Agitated	0.084	0.030	0.011
(by surface aerators)			
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
These Parameters are used when F/D < 14 **AND** U > 3.25 m/s			
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA
DIFFUSED			
Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/10

Surface Aeration												
		Turbulent Area			Quiescient Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	9.11E-06	1.55E-01	2.31E-02	5.57E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	1.07E-06	5.68E-06
Zone 2												
Methanol	7.42E-06	1.55E-01	2.09E-02	4.60E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.08E-07	2.28E-06
Zone 3												
Methanol	7.06E-06	1.55E-01	2.04E-02	4.39E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	8.72E-07	1.35E-06

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Scenario B

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

Data Date: **7/10**

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.946
FLOW RATE of condensate to the unit (m3/s)	5	0.047
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.992
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	91.666667
Concentration in the condensates (mg/L)	8	2266.6667
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	193.73492
Concentration in the effluent (mg/L)	9	0.25

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.992	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	200467	2.32 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	92.11342388	49506.41	5.67764E-06	25.8912	0.28108
2	9.533333333	66442.8232	2.27985E-06	1.4441	0.15148
3	0.351666667	72346.0608	1.35275E-06	0.034	0.097866
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	27.37	

Removal by air stripping (g/s). Line 16.	17	27.37
Loading in effluent (g/s). Line 9 times line 10.	18	0.25
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	192.2
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	164.6
Fraction biodegraded: Divide line 20 by line 19.	21	0.856
Fraction air emissions: Divide line 17 by line 19.	22	0.142
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.001

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Data Date: 7/11/21

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

I. BIOTREATMENT UNIT DESCRIPTION

	Units	Zone 1	Zone 2	Zone 3
Number of 75 HP Aerators	#	31	15	6
Number of 100 HP Aerators	#	0	0	0
Total Horsepower	HP	2325	1125	450
Temperature	C	34.1	33.3	32.0
Length	ft	730	1,196	1,248
Width	ft	730	598	624
Average Depth	ft	4.5	3.2	3
Aerator Rotation	rpm	1200	1200	1200
Agitation Area per 75 HP aerator	ft2	1452	1452	1452
Agitation Area per 100 HP aerator	ft2	2206	2206	2206
Impellor Diameter	in	19.5	19.5	19.5

II. OVERALL PARAMS - individual flows

	Flow MGD	MeOH mg/L
Inlet Stream **	20.8	82.7
Condensate Stream	1.04	2,000
Outlet	21.9	0.8

** *except condensate flow*

NA - individual flow/conc data not available

II. OVERALL PARAMS - total flows

	Flow m3/sec	Flow MGD	MeOH mg/L
Influent Concentration		21.9	173.8
Effluent Concentration			0.85
Wind Speed	mph		3.8

III. HAP DATA

Methanol

	Units	Inlet	Average Zone Concentration Zone 1	Zone 2	Zone 3	Detect Limit
Conc.	mg/L	173.8	67.2	11.1	0.6	0.5
Temp.	F		93.3	92.0	89.5	
			39%	**6%**	**0%**	

IV. RESULTS

fbio - Methanol	%
Fraction biodegraded	88.1
Fraction air emissions	11.4
Fraction remaining in unit effluent	0.5

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

PARAMETERS FOR CALCULATING MASS TRANSFER COEFIICIENTS

Data Date: 7/11

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

General

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

TURBULENT

KL Params

	Zone 1	Zone 2	Zone 3
w	126.3	126.3	126.3
Re	2.07E+06	2.07E+06	2.07E+06
PI	35063	35063	35063
Power Number, p	7.92E-04	7.92E-04	7.92E-04
Fr	8.06E+02	8.06E+02	8.06E+02
Total TurbArea (ft2)	45012	21780	8712
Total TurbArea (m2)	4181.6	2023.4	809.3
Frac. Agitated (by surface aerators)	0.084	0.030	0.011
QUIESCENT			
Depth	1.37	0.98	0.92
SurfArea (ft2)	532900	715208	778752
SurfArea (m2)	49573.02	66532.22	72443.40
F/D Ratio	183	298	332
ScL - Methanol	NA	NA	NA
ScL - Acetaldehyde	NA	NA	NA
ScL - MEK	NA	NA	NA
U* (Friction Velocity)	NA	NA	NA

These Parameters are used when F/D < 14 **AND** U > 3.25 m/s

DIFFUSED

Air flow, cfm	0	0	0
Air flow, m3/s	0.000	0.000	0.000

Scenario B

APPENDIX C FORMS - CALCULATING FRACTION BIODEGRADED

Calculating Mass Transfer Coefficient KL for Various Zones

Data Date: 7/11

Surface Aeration												
		Turbulent Area			Quiescient Area							
						kL, m/s						
	Temp Adj H	kG m/s	kL m/s	KL turb m/s	kG m/s	U10 < 3.25	F/D<14	U10 > 3.25 14<F/D<51.2	F/D>51.2	kL m/s	KL quisc m/s	KL overall m/s
Zone1												
Methanol	8.22E-06	1.55E-01	2.20E-02	5.05E-05	3.94E-03	4.31E-06	NA	2.69E-06	1.16E-06	4.31E-06	9.90E-07	5.18E-06
Zone 2												
Methanol	7.93E-06	1.55E-01	2.16E-02	4.89E-05	3.88E-03	4.31E-06	NA	4.02E-06	1.16E-06	4.31E-06	9.53E-07	2.41E-06
Zone 3												
Methanol	7.41E-06	1.55E-01	2.09E-02	4.59E-05	3.86E-03	4.31E-06	NA	4.41E-06	1.16E-06	4.31E-06	9.04E-07	1.41E-06

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Scenario B

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

Data Date: 7/11

NAME OF THE FACILITY		
COMPOUND for site specific biorate determination		**Methanol**
Number of zones in the biological treatment unit	1	
VOLUME of full-scale system (cubic meters)	2	198890.56
Average DEPTH of the full-scale system (meters)	3	1.0878333
FLOW RATE of wastewater to the unit (m3/s)	4	0.912
FLOW RATE of condensate to the unit (m3/s)	5	0.046
Total wastewater flowrate - (including condensates) (m3/s)	5-A	0.958
ESTIMATE OF KL (m/s)	6	*see table*
Concentration in the wastewater treated in the unit (mg/L)	7	82.666667
Concentration in the condensates (mg/L)	8	2000
Concentration in wastewater (total - inc. cond) in (mg/L)	8-A	173.83823
Concentration in the effluent (mg/L)	9	0.8466667

TOTAL INLET FLOW (m3/s) line 4 plus the number on line 5 (or 5-A)	10	0.958	
TOTAL RESIDENCE TIME (s) line 2 divided by line 10.	11	207654	2.40 days
TOTAL AREA OF IMPOUNDMENT (m2) line 2 divided by line 3	12	182832	

Lines 13 through 15 Not Used

Zone Number	Concentration for zone, Ci (mg/L)	Area of the zone, A (m2)	Estimate of KL in the zone (m/s)	AIR STRIPPING KL A Ci (g/s)	
1	67.20835817	49506.41	5.17574E-06	17.2210	0.256232
2	11.1	66442.8232	2.41222E-06	1.7790	0.160275
3	0.616666667	72346.0608	1.40676E-06	0.063	0.101774
4					
5					
6					
TOTALS - sum for each zone.	15	188295.294	16	19.06	

Removal by air stripping (g/s). Line 16.	17	19.06
Loading in effluent (g/s). Line 9 times line 10.	18	0.81
Total loading (g/s). {(line 5*line 8)+(line 4*line 7)} or {line 5-A*line 8-A}.	19	166.5
Removal by biodegradation (g/s) Line 19 minus (line 17 + line 18).	20	146.6
Fraction biodegraded: Divide line 20 by line 19.	21	0.881
Fraction air emissions: Divide line 17 by line 19.	22	0.114
Fraction remaining in unit effluent. Divide line 18 by 19.	23	0.005