

Joint Venture

101 International Drive, P.O. Box 16655
Missoula, MT 59808

August 11, 2017

TO: Scott Hansen

CC: Jamie Dunn, Eric Ealy, Alan Buell, Denis Roznowski, Steve Garbaciak,
Ken Aukerman, Kris Gamble, Scott Inman, Jim Burton, Tom Perry, Pat Carr

FR: Brian Bell, Andrea Martin

RE: Phase 2 Odor/Emission Control System Status Report #5
Ashland/NSP Lakefront Site

This report provides the performance evaluation of the Odor/Emission Control System (OECS) installed in the sediment processing tent supporting Phase 2 Wet Dredge activities. Data through the following dates are included:

Field Measured Data: August 1, 2017	Laboratory Measured Data: July 21, 2017
-------------------------------------	---

Monitoring the performance of the five modules comprising the OECS was conducted by Foth Infrastructure & Environment/Envirocon Joint Venture (FE JV) personnel. OECS operation was initiated on May 18, 2017. Design and monitoring details and requirements are presented in the *Final (100%) Design for Phase 2 Wet Dredge* (FE JV, 2017).

The primary goal of the OECS performance evaluation is to identify when the granular activated carbon (GAC) in the system adsorption beds should be replaced. Secondly, the evaluation compares OECS emissions to Wisconsin Administrative Code (Wis. Admin. Code) NR 445, Control of Hazardous Air Pollutants. Information provided in the attachments addresses both goals. This report is structured in the following manner:

Attachment 1 OECS Performance Evaluation:

Data are evaluated as it becomes available. Field data for each module include photoionization detector (PID) measurements of total volatile organic compounds (TVOC), air flow, and other operational parameters. Data are made available daily. Approximately twice per week, SUMMA canister sampling is conducted and analyzed by TestAmerica. The analytical results are made available in approximately 5 days. This attachment provides a series of trend graphs documenting module performance of TVOC reduction.

Attachment 2 Wis. Admin. Code NR 445 Comparison:

Emissions of benzene, toluene, ethylbenzene, xylene, and naphthalene are tabulated and compared to NR 445 compliance limits. Benzene is presented graphically because this constituent has the lowest annual compliance limits of the five parameters and therefore is the most sensitive to increasing emissions.

If you have any questions regarding this OECS status report, please contact Steve Garbaciak at (630) 368-3069 or e-mail at steve.garbaciak@foth.com.

References

Foth Infrastructure & Environment/Envirocon Joint Venture, 2017. *Final (100%) Design for Phase 2 Wet Dredge – Ashland/NSP Lakefront Site*. March 2017.

attachments

Attachment 1
OECS Performance Evaluation



Joint Venture

Odor/Emission Control System Log

Client's Name: NSPW	Site Location: Ashland/NSP Lakefront Site	Project No. 17X001
-------------------------------	---	------------------------------

Report #	Through Date	Performance Evaluation Results/ Action Taken	NR 445 Compliance ¹	Prepared By
1	6-5-2017	<p>The Odor Emissions Control System (OECS) operations started on 5/18/17, and consist of five Air Filters Inc. modules (AFU-1 to AFU-5). The fans for the units are turned down for the night-time hours. The AFUs were turned off for the extended holiday break from the night-time hours of 5/25/17 to re-start during the morning hours of 5/31/17.</p> <p>On 5/24/17, the photoionization detector (PID) monitoring instrument was changed out from MiniRAE 3000 to ppbRAE 3000. This allows the total VOC (TVOC) detection level to be lowered from 100 ppb (v/v) to 1 ppb (v/v). As a result, the PID data are more useful from 5/24/17 onwards. Excessive airborne lime dust conditions were experienced within the sediment processing tent as part of early stabilization operations of dredged materials during ramp up of processing operations. The excessive lime loading was captured on the AFU pre-filters which caused extra maintenance of the AFUs. The AFU modules/fans experienced backpressure increases due to the lime dust capture. Maintenance included removing the pre-filters and cleaning the lime fines from the filters. The carbon filter components of the AFUs were not compromised during this time period as no breakthrough of lime dust past the pre-filters was observed.</p> <p>The PID readings and SUMMA samples were taken and analyzed according to the <i>Monitoring Plan for Phase 2 Wet Dredge (Monitoring Plan)</i> (FE JV, 2017). The PID values are much higher than the TVOC values reported by the TO-15 PF analysis, by one or two orders of magnitude for influent concentrations. Additional data will be evaluated to better identify a correlation.</p> <p>In general, after the ppbRAE 3000 PID instrument was used, the removal efficiencies for total VOCs, as measured by PID, are in the 90% to 100% range. Regarding the SUMMA canister TO-15 analysis (for sampling dates up to 5/31/17), TVOC removal efficiencies varied as measured by the TO-15 PF analysis due to a number of likely mitigating factors resulting from actual operations in the field. The effluent TVOC concentrations were quite low in comparison to site perimeter alert and action levels and NR 445 requirements. The SUMMA canister TO-15 analysis also presents some anomalous data where effluent concentrations exceed influent concentrations for some organic constituents. This may indicate actual conditions, however, it is not uncommon to see this type of anomaly when sampling extremely low concentrations.</p>	In	Brian Bell
2	6-19-2017	<p>Monitoring continued for the five air filter units. The TVOC PID readings were taken and SUMMA samples were collected and analyzed according to the <i>Monitoring Plan</i>. There is limited trending correlation discernable while comparing TVOC values from the PID instrument versus SUMMA canister analysis via TO-15 PF analysis. The PID values are much higher than the TVOC values reported by the TO-15 PF analysis, by one or two orders of magnitude for influent concentrations. The SUMMA canisters from the June 13-14, 2017 sampling event were not analyzed as water entered the SUMMA canister regulators via sample tubing during a storm event.</p>	In	Brian Bell/ Andrea Martin



Joint Venture

Odor/Emission Control System Log

Client's Name: NSPW	Site Location: Ashland/NSP Lakefront Site	Project No. 17X001
-------------------------------	---	------------------------------

Report #	Through Date	Performance Evaluation Results/ Action Taken	NR 445 Compliance ¹	Prepared By
		<p>The removal efficiencies for TVOCs as measured by PID ranged from 74.5% to 100%. Regarding the SUMMA canister TO-15 PF analysis (for sampling dates through June 8, 2017), TVOC removal efficiencies varied as measured by the TO-15 PF analysis due to a number of factors resulting from operations in the field. The effluent TVOC concentrations and individual VOCs were lower than site perimeter alert and action levels and NR 445 requirements. The SUMMA canister TO-15 PF analysis at times presents anomalous data where effluent concentrations are greater than influent concentrations for some VOCs. This likely results from field conditions or when constituent concentrations are in the low parts per billion range.</p> <p>Regarding SUMMA TO-15 PF analysis, it should be noted that acetone is a significant contributor to the TVOC concentrations. Acetone is not a known site contaminant of concern, and is known to be both a laboratory artifact and may be contributed by use of silicone in the ductwork. The vapor-phase GAC removal efficiencies for TVOCs especially as measured by PID instrument indicate the majority of TVOCs are being removed. TVOC and individual VOC effluent concentration trending by SUMMA TO-15 PF analysis is also consistent. These factors in addition to low loading of VOCs on the vapor-phase GAC as measured by SUMMA TO-15 PF analysis indicates the GAC is performing as expected and does not require removal and replacement at this time.</p> <p>Note: the SUMMA canister results lag field data availability by approximately 5 to 12 days. The SUMMA data evaluations on a given day are based on the most recent SUMMA data (which may be up to 12 days past). To avoid over-projecting, graphs provided in this report show no values past 6/8/17 for modules AFU-2 through AFU-5. AFU-1 graphs are presented through 6/1/17. Contrary to the AFU-1 PID readings observed on 6/6/17 and 6/8/17, the AFU-1 SUMMA results from those dates show the effluent concentrations exceeding or equal to influent concentrations. FE JV concluded the SUMMA canister results for AFU-1 do not reflect module performance on those days and should not be used as a projection basis.</p>		
3	7/1/2017	<p>Monitoring continued for the five air filter units. The TVOC PID readings were taken and SUMMA samples were collected and analyzed according to the <i>Monitoring Plan</i>. There is limited trending correlation discernable between TVOC values from the PID instrument versus SUMMA canister analysis via TO-15 PF analysis. The PID values are much higher than the TVOC values reported by the TO-15 PF analysis, by one or two orders of magnitude for influent concentrations.</p> <p>The removal efficiencies for TVOCs by vapor phase GAC as measured by PID ranged from 78% to 99%. Regarding the SUMMA canister TO-15 PF analysis (for sampling dates through 7/1/17), TVOC removal efficiencies varied due to a number of factors resulting from operations in the field. The effluent HAP concentrations and emissions are trending well below NR 445 requirements. The SUMMA canister TO-15 PF analysis at times presents anomalous data where effluent concentrations are greater than influent concentrations</p>	In	Brian Bell/ Andrea Martin



Joint Venture

Odor/Emission Control System Log

Client's Name: NSPW	Site Location: Ashland/NSP Lakefront Site	Project No. 17X001
-------------------------------	---	------------------------------

Report #	Through Date	Performance Evaluation Results/ Action Taken	NR 445 Compliance ¹	Prepared By
		<p>for some VOCs. This likely results from field conditions or is because constituent concentrations are in the low parts per billion range which can produce anomalous values.</p> <p>Regarding SUMMA TO-15 PF analysis, it should be noted that acetone is a significant contributor to the TVOC concentrations. Acetone is not a known site contaminant of concern, and is known to be both a laboratory artifact and may be contributed by use of silicone in the ductwork. The acetone detection issue is being investigated with TestAmerica. The vapor-phase GAC removal efficiencies for TVOCs as measured by PID instrument indicate the majority of TVOCs are being removed. TVOC and individual VOC effluent concentration trending by SUMMA TO-15 PF analysis are also relatively consistent. These factors, in addition to low loading of VOCs on the vapor-phase GAC as measured by SUMMA TO-15 PF analysis, indicate the GAC is performing as expected and does not require removal and replacement at this time due to organic loading.</p> <p>During the SUMMA sampling event on 6/21/17, the TO-15 PF effluent value for TVOC from AFU-5 was an anomalous result which was much greater than the influent value, including a significant detection of pentane. TestAmerica is investigating this result and the detection of pentane (in addition to acetone).</p> <p>AFU-1 was shut down at times due to convulsion when operating. The vapor phase GAC media for AFU-1 was removed and replaced on 7/3/17. It is suspected that lime fines have loaded onto the GAC media and caused the unit to convulse when operating. The shaking dissipated when AFU-1 was re-started. The GAC media in additional air filter units will be changed out if lime dust loading is suspected on the GAC media. Additional operations and maintenance procedures are being developed to mitigate the loading of lime dust onto the air filter units. Dust collector systems will be operational in July 2017 in closed loop air circulation systems within the sediment processing tent to filter and reduce airborne lime dust content within the tent structure.</p> <p>Note: the SUMMA canister results lag field data availability by approximately 5 to 12 days. The SUMMA data evaluations on a given day are based on the most recent SUMMA data (which may be up to 12 days past). To avoid over-projecting, SUMMA results graphs provided in this report show no values past 6/27/17.</p>		
4	7/18/2017	<p>Monitoring continued for the five air filter units. The TVOC PID readings were taken and SUMMA samples were collected and analyzed according to the <i>Monitoring Plan</i>. There is limited trending correlation discernable between TVOC values from the PID instrument versus SUMMA canister analysis via TO-15 PF analysis. The PID values are much higher than the TVOC values reported by the TO-15 PF analysis, by one or two orders of magnitude for influent concentrations.</p> <p>The removal efficiencies for TVOCs by vapor phase GAC as measured by PID ranged from 80 to 99%. Regarding the SUMMA canister TO-15 PF analysis (for sampling dates through 7/11/17), TVOC removal</p>	In	Brian Bell/ Andrea Martin



Joint Venture

Odor/Emission Control System Log

Client's Name: NSPW	Site Location: Ashland/NSP Lakefront Site	Project No. 17X001
-------------------------------	---	------------------------------

Report #	Through Date	Performance Evaluation Results/ Action Taken	NR 445 Compliance ¹	Prepared By
		<p>efficiencies varied due to a number of factors resulting from operations in the field. The effluent HAP concentrations and emissions are trending well below NR 445 requirements. The SUMMA canister TO-15 PF analysis at times presents anomalous data where effluent concentrations are greater than influent concentrations for some VOCs. These anomalies likely result from the same reasons listed previously.</p> <p>Regarding SUMMA TO-15 PF analysis, it should be noted that acetone is a significant contributor to the TVOC concentrations. Acetone is not a known site contaminant of concern, and is known to be both a laboratory artifact and may be present from the use of silicone in the ductwork. The vapor-phase granular activated carbon removal efficiencies for TVOCs especially as measured by PID instrument indicate the majority of TVOCs are being removed. TVOC and individual VOC effluent concentration trending by SUMMA TO-15 PF are also consistent. The pre- and post-GAC treatment analysis for VOCs on the air flow, as measured by SUMMA TO-15 analysis, indicate the mass loading of TVOCs on GAC media is very low as compared to theoretical TVOC mass loading capacity on GAC media. However, the TVOC loading on GAC media as measured by PID measurements is higher. The removal efficiencies of TVOC through GAC media as measured by PID remain above 80%. The removal and replacement of the GAC media for AFU-2 through AFU-5 is being contemplated in the near future. AFU-1 media was replaced on 7/3/17, noted in Report #3.</p> <p>Dust collector systems are operational in July 2017 in closed loop air circulation systems within the sediment processing tent to filter and reduce airborne lime dust content within the tent structure. One diesel powered 40,000 acfm dust collector (Dust Bunny #1) was operational during this reporting period and exhausts into AFU-1 and AFU-2 influents as of 7/18/17. The dust collector acts as a pre-treatment unit for dust removal prior to treatment in the two OECS modules. A second electrically powered 20,000 acfm dust collector (Dust Bunny #2) was placed in operation on 7/19/17, and located on the south side of the sediment processing tent as a recirculating treatment system with no discharge point to the outside. A third unit (Dust Bunny #3), electrically powered and having a 40,000 acfm capacity, will be mobilized by 8/1/17 and used as a pre-treatment unit for dust removal with its exhaust vented into AFU-3 on the north side of the sediment processing tent.</p> <p>Note: the SUMMA canister results lag field data availability by approximately 5 to 12 days. The SUMMA data evaluations on a given day are based on the most recent SUMMA data (which may be up to 12 days past). To avoid over-projecting, SUMMA results graphs provided in this report show no values past 7/16/17.</p>		
5	8/1/2017	Monitoring continued for the five air filter units. The TVOC PID readings were taken and SUMMA samples were collected and analyzed according to the <i>Monitoring Plan</i> . There is limited trending correlation discernable between TVOC values from the PID instrument versus SUMMA canister analysis via TO-15 PF analysis. The PID values are much higher than the TVOC values reported by the TO-15 PF analysis, by one or two orders of magnitude for influent concentrations.	In	Brian Bell/ Andrea Martin

Odor/Emission Control System Log

Client's Name: NSPW	Site Location: Ashland/NSP Lakefront Site	Project No. 17X001
-------------------------------	---	------------------------------

Report #	Through Date	Performance Evaluation Results/ Action Taken	NR 445 Compliance ¹	Prepared By
		<p>The removal efficiencies for TVOCs by vapor phase GAC as measured by PID ranged from 83.4 to 98.7%. Regarding the SUMMA canister TO-15 PF analysis (for sampling dates through 7/21/17), TVOC removal efficiencies varied due to a number of factors resulting from operations in the field. The effluent HAP concentrations and emissions are trending well below NR 445 requirements. The SUMMA canister TO-15 PF analysis at times presents anomalous data where effluent concentrations are greater than influent concentrations for some VOCs. These anomalies likely result from the same reasons listed previously.</p> <p>Regarding SUMMA TO-15 PF analysis, it should be noted that acetone is a significant contributor to the TVOC concentrations. Acetone is not a known site contaminant of concern, and is known to be both a laboratory artifact and may be present from the use of silicone in the ductwork. The vapor-phase GAC removal efficiencies for TVOCs, especially as measured by PID instrument, indicate the majority of TVOCs are being removed. TVOC and individual VOC effluent concentration trending by SUMMA TO-15 PF are also consistent. The pre- and post-GAC treatment analysis for VOCs on the air flow, as measured by SUMMA TO-15 PF analysis, indicate the mass loading of TVOCs on GAC media is very low as compared to theoretical TVOC mass loading capacity on GAC media. However, the TVOC loading on GAC media as measured by PID measurements is higher. The removal efficiencies of TVOC through GAC media as measured by PID remain above 80%.</p> <p>The removal and replacement of the GAC media for AFU-2 through AFU-5 was performed and completed on 7/22/17. AFU-1 media was replaced on 7/3/17, noted in Report #3. The removal and replacement of the GAC media in these modules was conducted for the following reasons:</p> <ul style="list-style-type: none"> ◆ Influent and effluent SUMMA data for VOCs is inconsistent, but GAC removal efficiency was declining by a small measure. ◆ Although removal efficiencies as measured by PIDs was and has been very good for these units, overall VOC loading on GAC based on PID readings approached or exceeded theoretical loading capacity of organics on GAC. ◆ AFU-1 GAC was changed out several weeks ago. ◆ There is some lime reagent penetration into GAC media; change-out should improve air flow through the units. ◆ The estimated change-out duration for the GAC media was originally estimated to be every two months of operations; this alone did not dictate the change, but we are on-schedule by performing this GAC removal and replacement on 7/22/17. <p>Dust collector systems are operational in July 2017 in closed loop air circulation systems within the sediment processing tent to filter and reduce airborne lime dust content within the tent structure. Dust Bunny #1 dust</p>		

Odor/Emission Control System Log

Client's Name: NSPW	Site Location: Ashland/NSP Lakefront Site	Project No. 17X001
-------------------------------	---	------------------------------

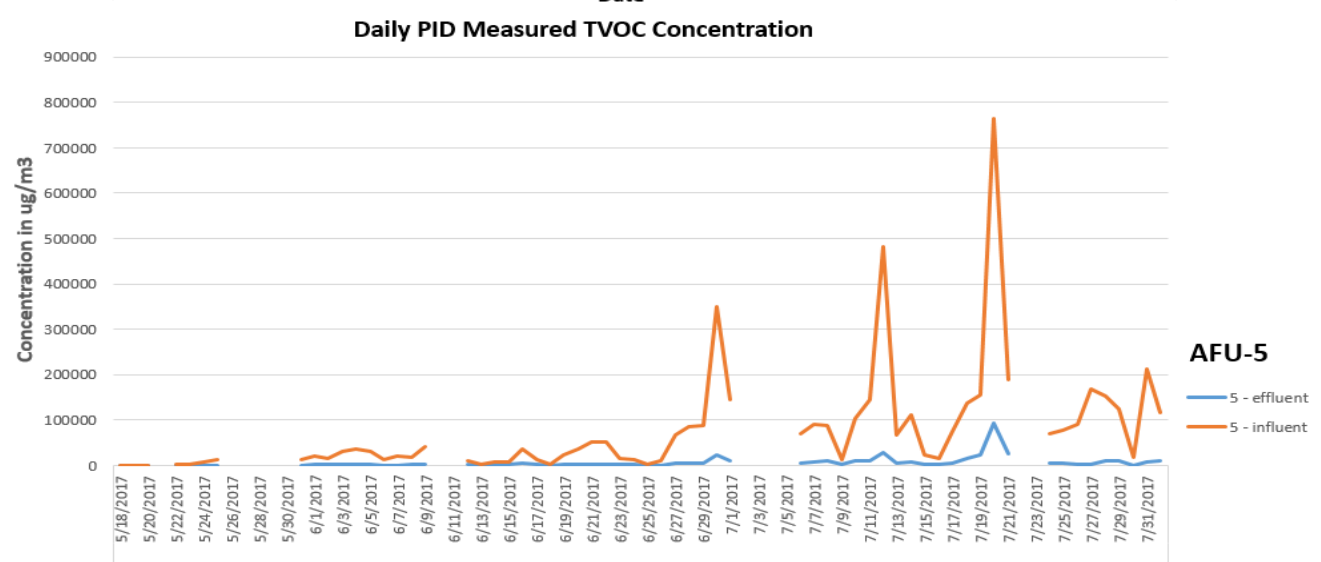
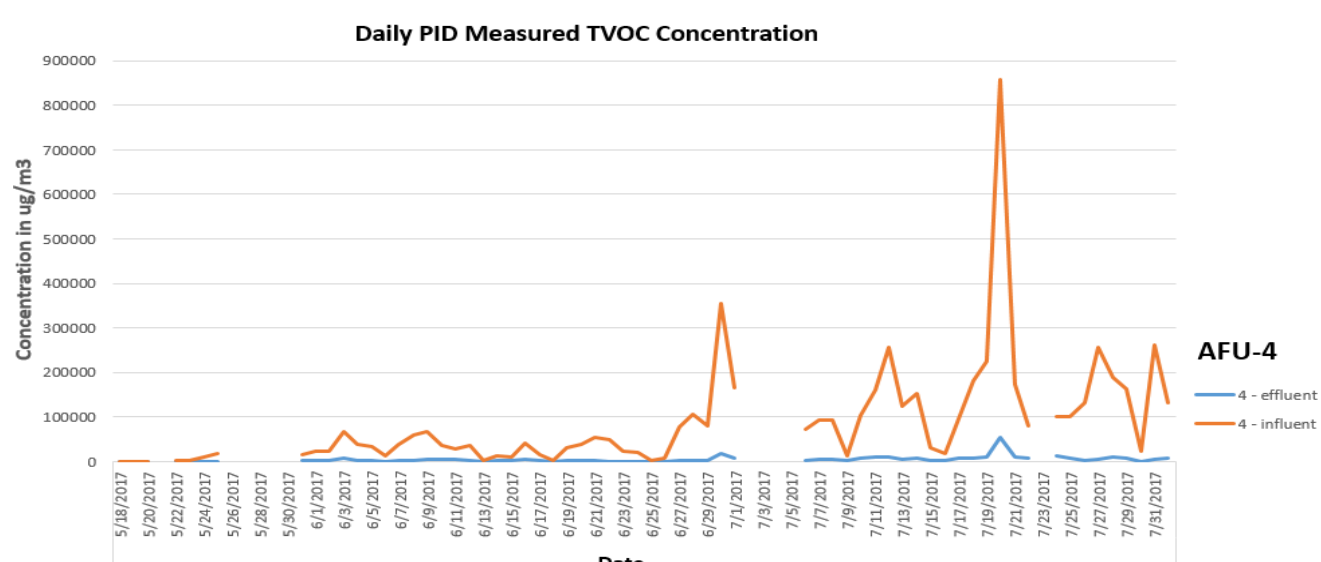
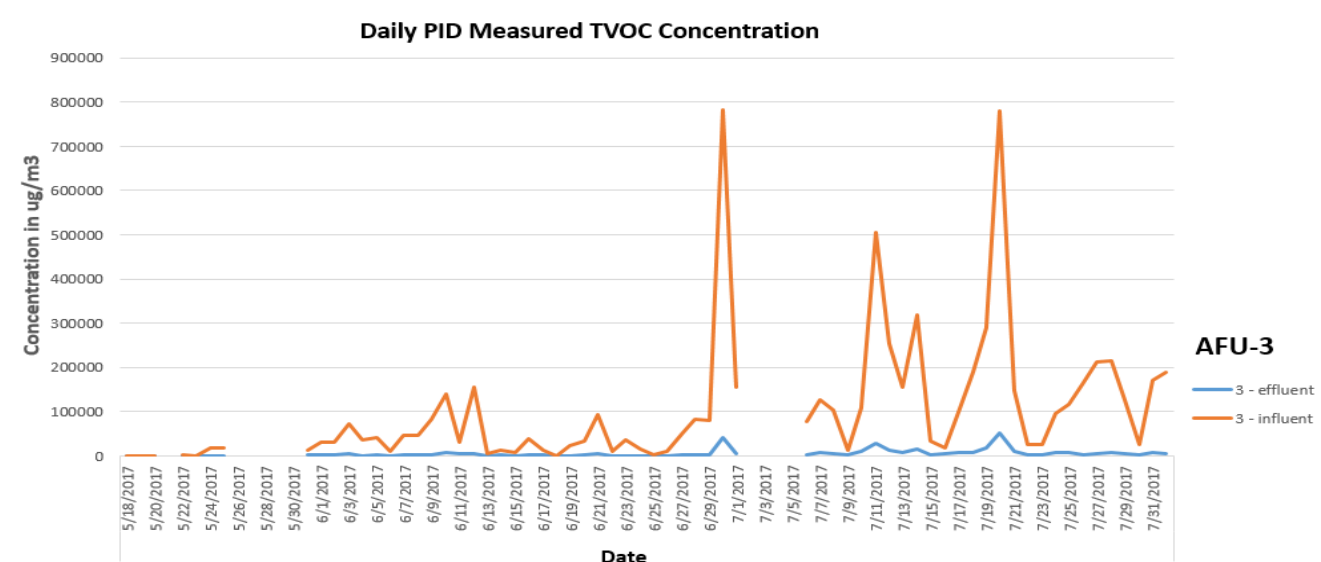
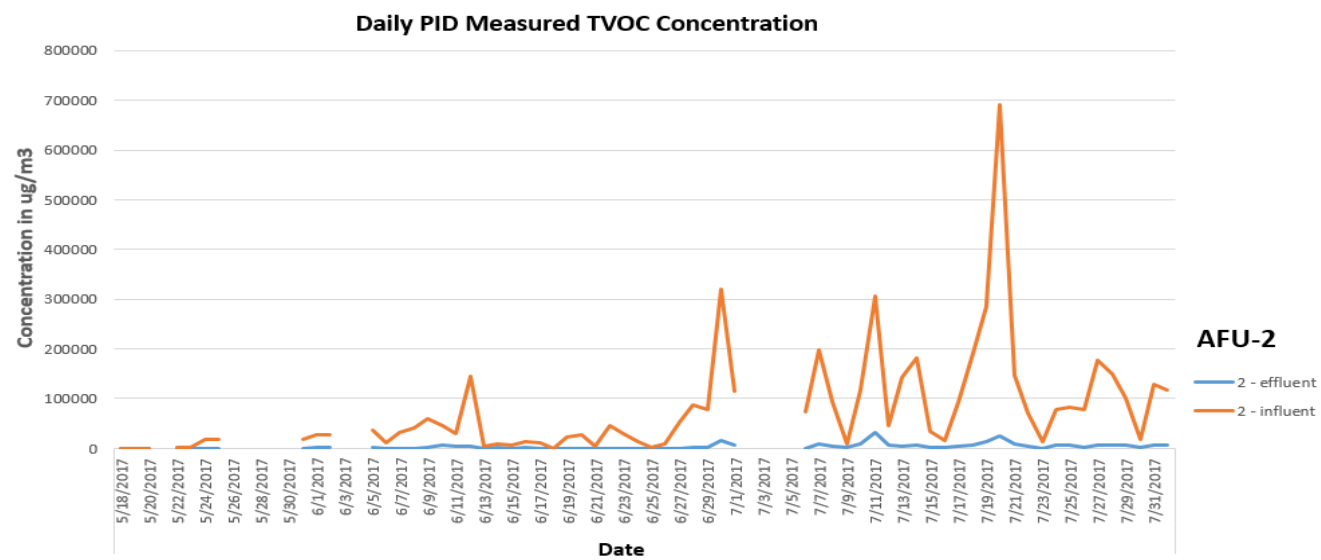
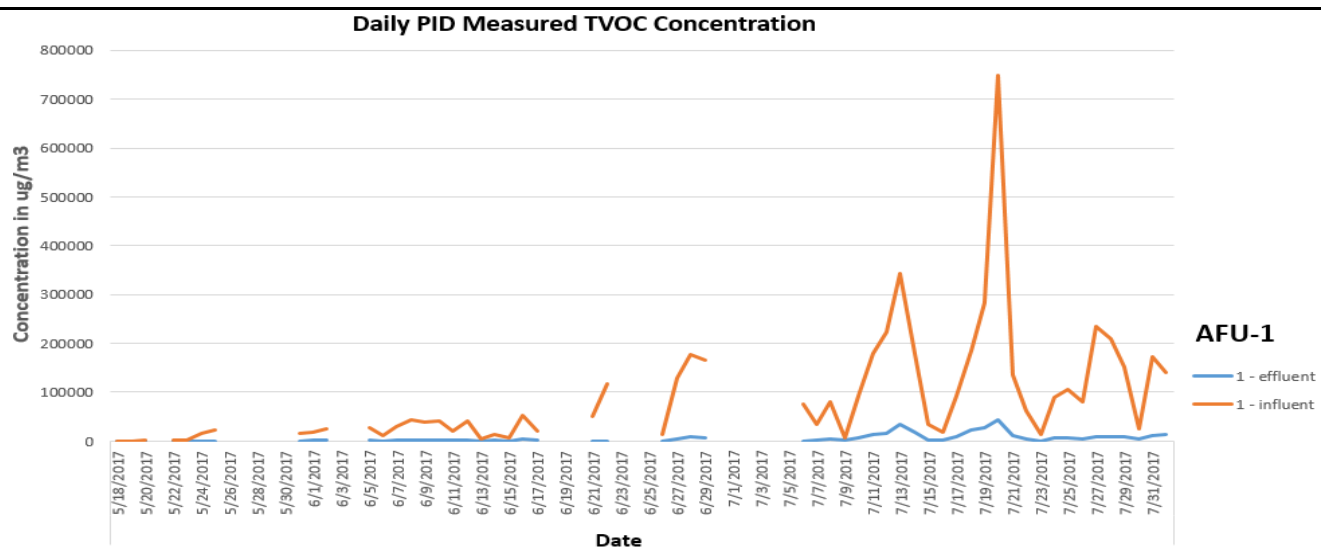
Report #	Through Date	Performance Evaluation Results/ Action Taken	NR 445 Compliance ¹	Prepared By
		<p>collector was mobilized and made operational on 7/10/2017. The Dust Bunny collects airborne particulate matter using compressed-air pulsed poly filter cartridges. The Dust Bunny acts as a pre-treatment unit for dust removal prior to treatment in some of the OECS modules. Dust Bunny #1 is a diesel powered 40,000 acfm dust collector and is exhausted into AFU-1 and AFU-2 intakes. Early the week of 7/31/17, the exhaust from Dust Bunny #1 will be vented directly into AFU-1 intake only. A second electrically powered 20,000 acfm dust collector (Dust Bunny #2) was placed in operation on 7/19/17, and located on the south side and inside the sediment processing tent as a recirculating treatment system with no discharge point to the outside. A third unit (Dust Bunny #3), electrically powered and having a 40,000 acfm capacity, will be mobilized around 8/1/17 and will be used as a pre-treatment unit for dust removal with its exhaust vented into AFU-3 on the north side of the sediment processing tent.</p> <p>Note: the SUMMA canister results lag field data availability by approximately 5 to 12 days. The SUMMA data evaluations on a given day are based on the most recent SUMMA data (which may be up to 12 days past). To avoid over-projecting, SUMMA results graphs provided in this report show no values past 7/24/17.</p>		

Notes:

1. In – facility emissions are in compliance with Wisconsin Administrative Code NR 445.
 Out – facility emissions are not in compliance with Wisconsin Administrative Code NR 445. See comments under “Performance Evaluation Results/Action Taken” column.

Reference(s):

Foth Infrastructure & Environment/Envirocon Joint Venture, 2017. *Monitoring Plan for Phase 2 Wet Dredge – Ashland/NSP Lakefront Site*. March 2017.



NORTHERN STATES POWER COMPANY

Figure 1 Concentration TVOC - Field Measured

Ashland/NSP Lakefront Site

Odor/Emissions Control System Performance thru 8/1/17

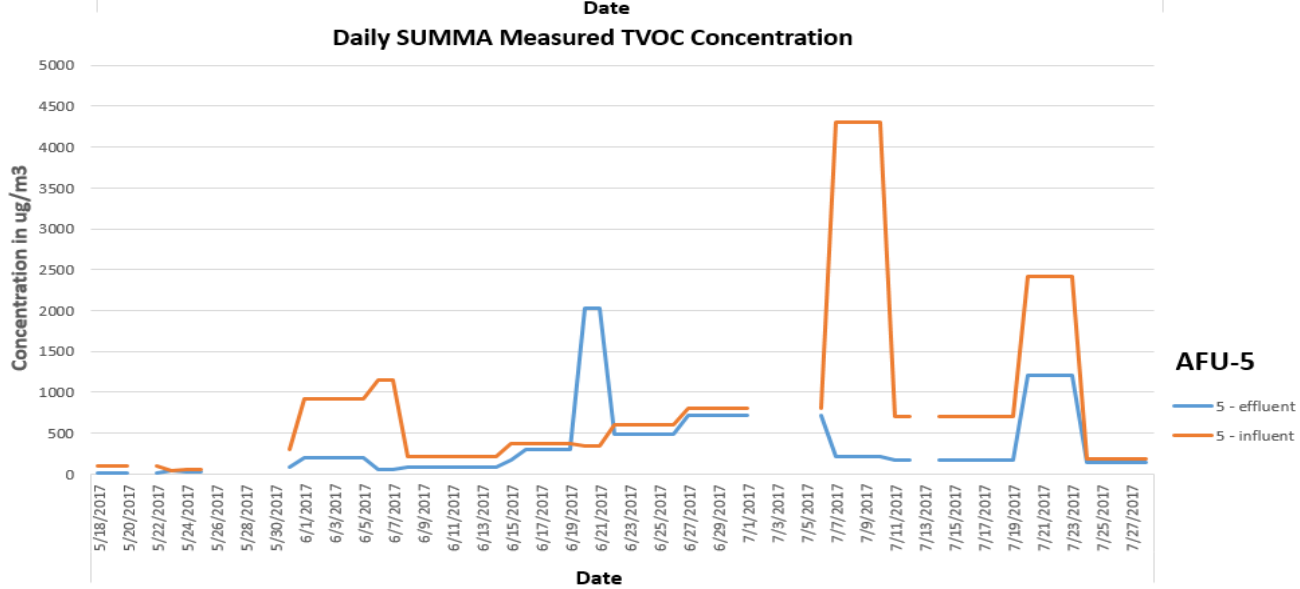
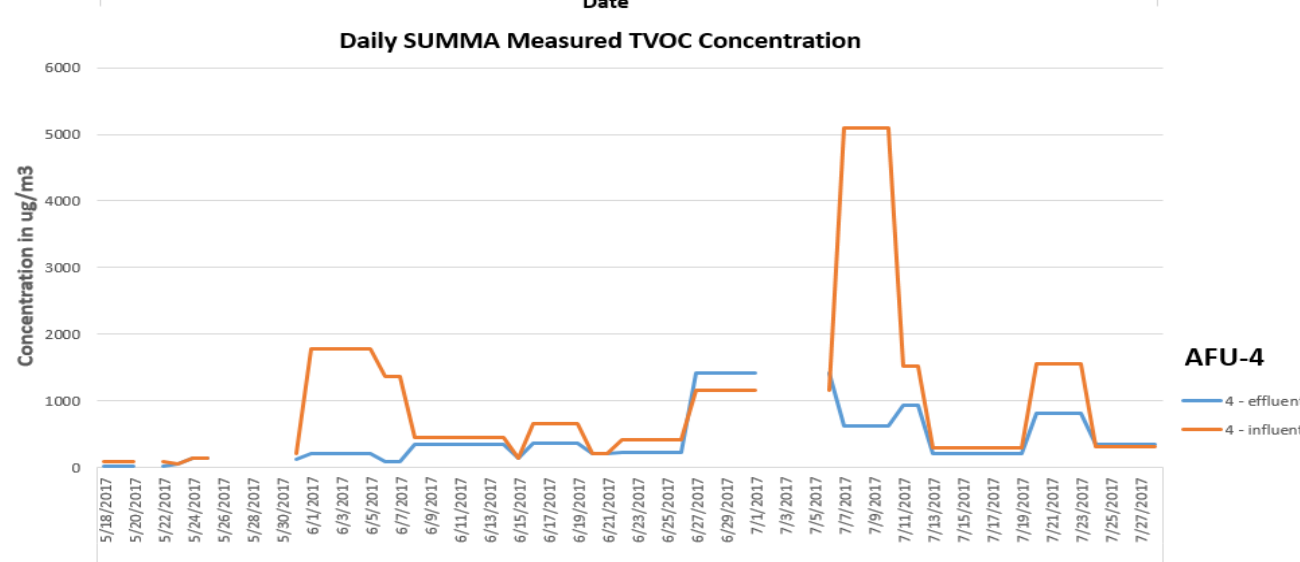
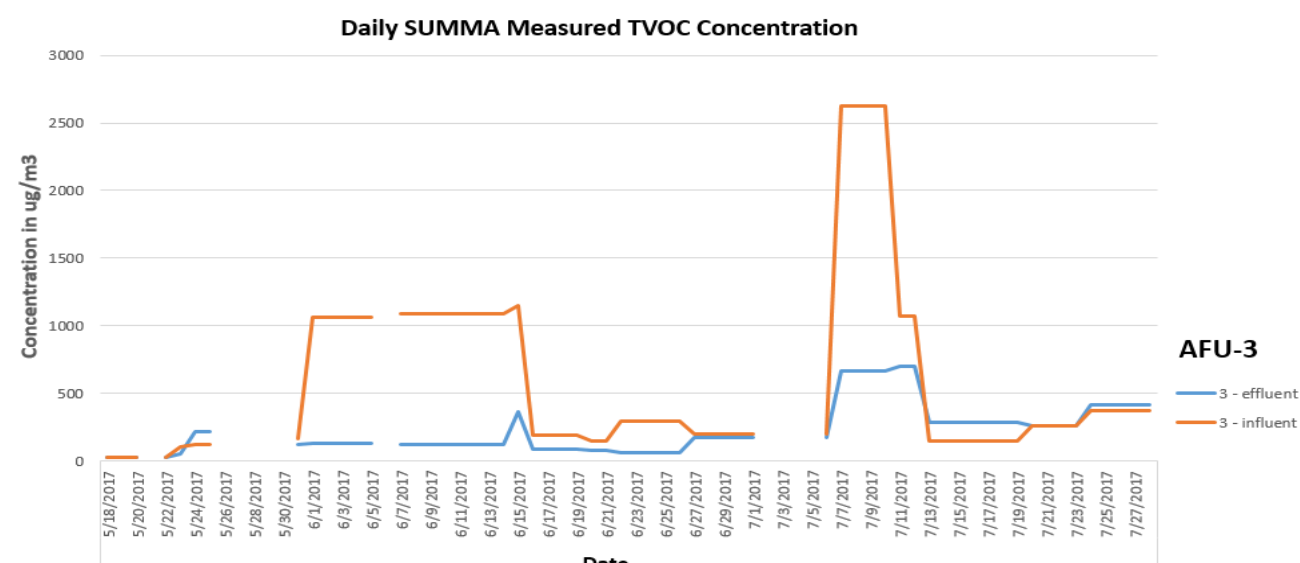
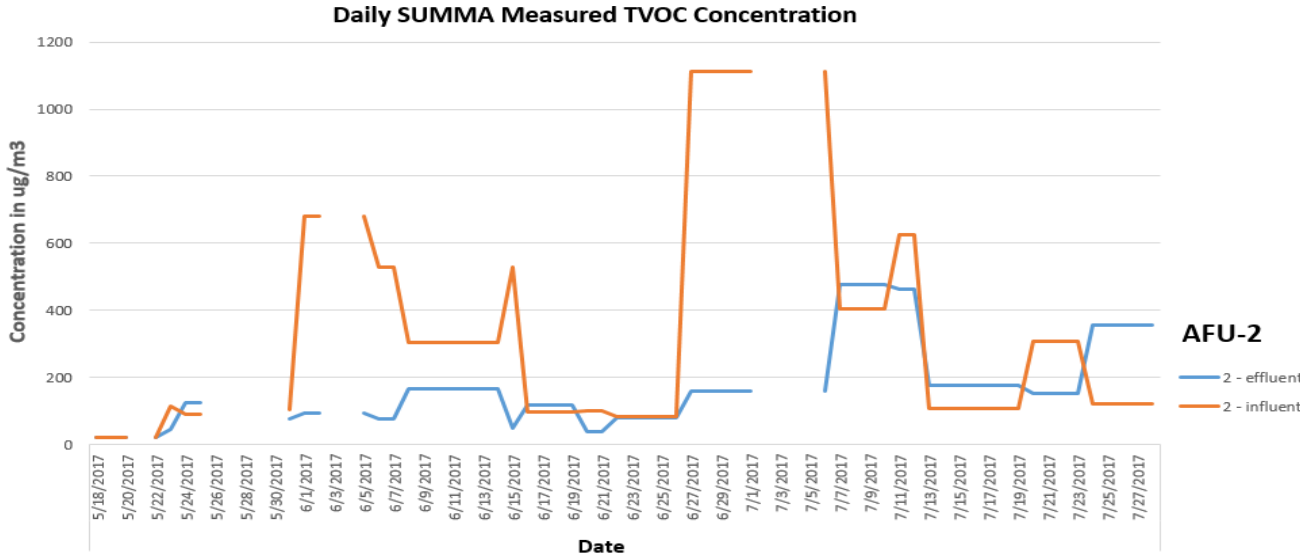
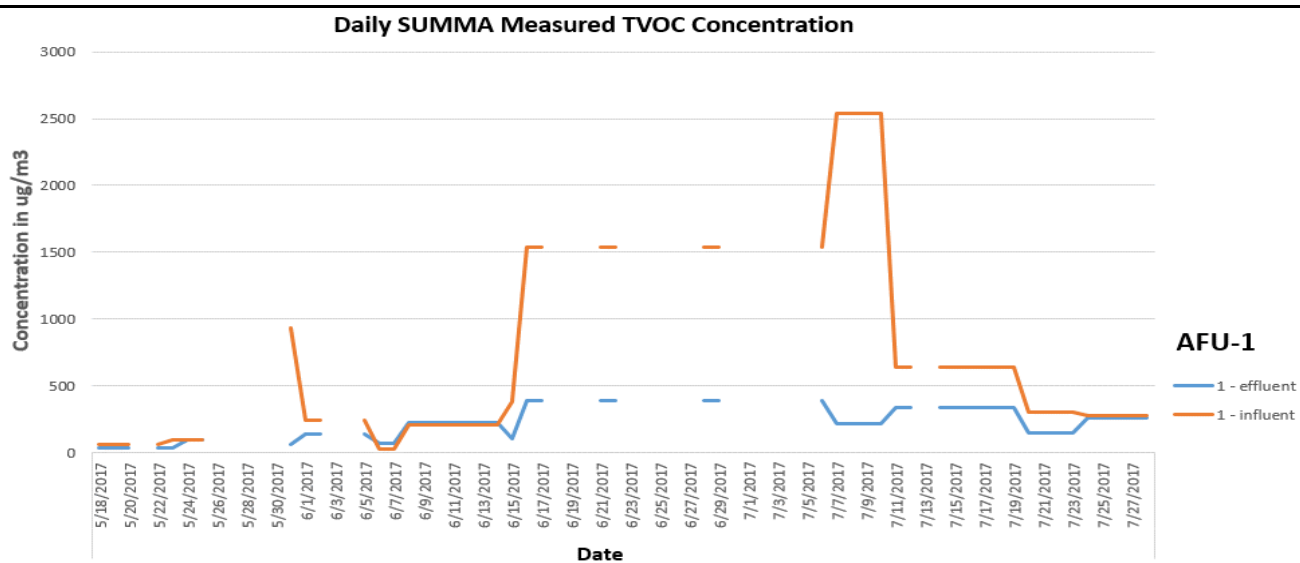
Date: August 2017

Revision Date:

Drawn by: AKM

Checked by: B.Bell

Project ID: 17X001



SUMMA data thru 7/24/2017

NORTHERN STATES POWER COMPANY

Figure 2 - Concentration TVOC Lab Measured

Ashland/NSP Lakefront Site

Odor/Emissions Control System Performance thru 8/1/17

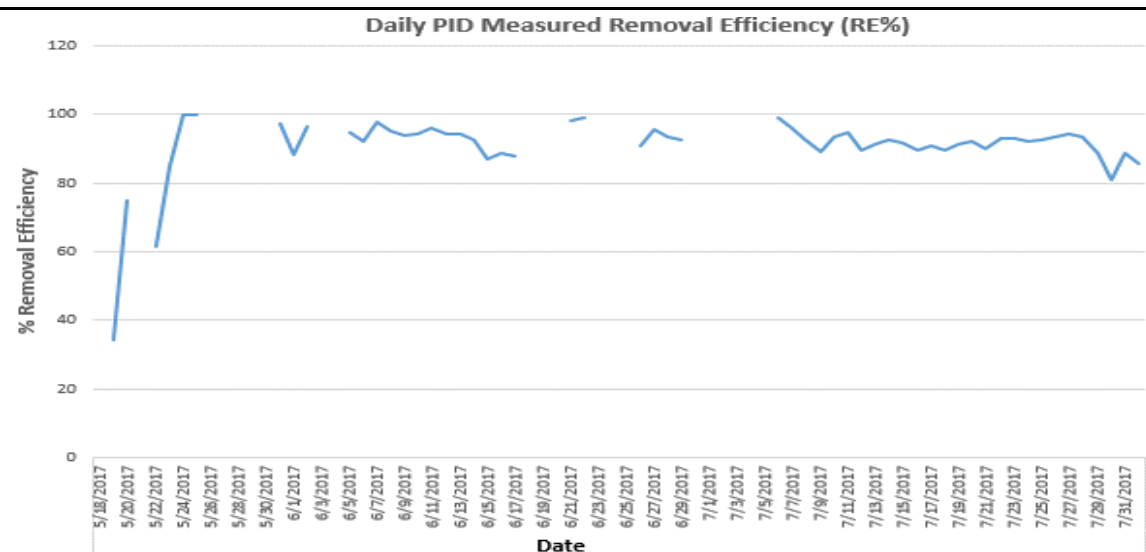
Date: August 2017

Revision Date:

Drawn by: AKM

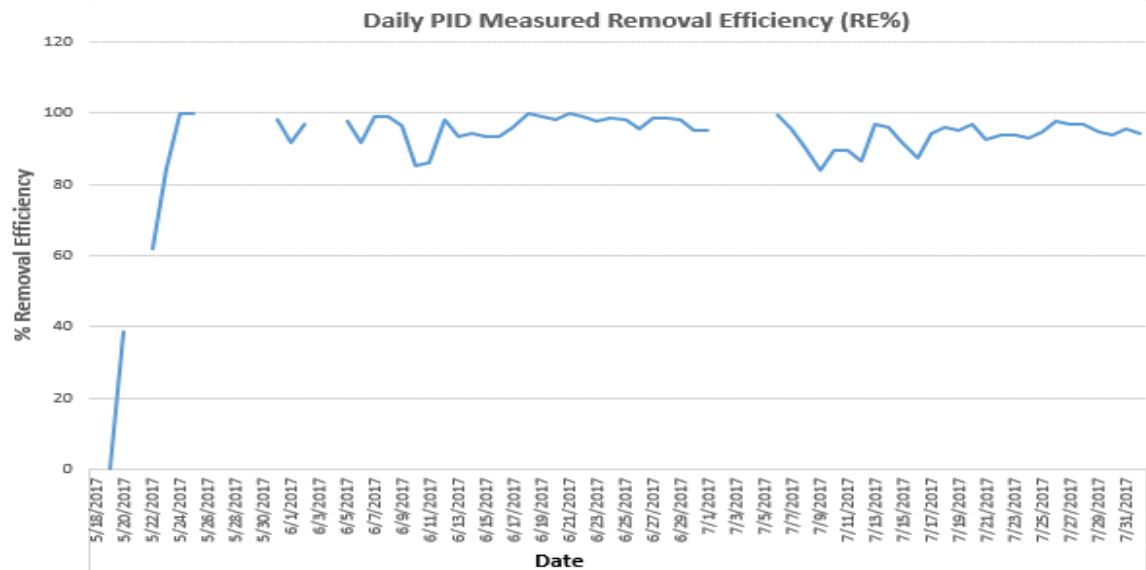
Checked by: B.Bell

Project ID: 17X001



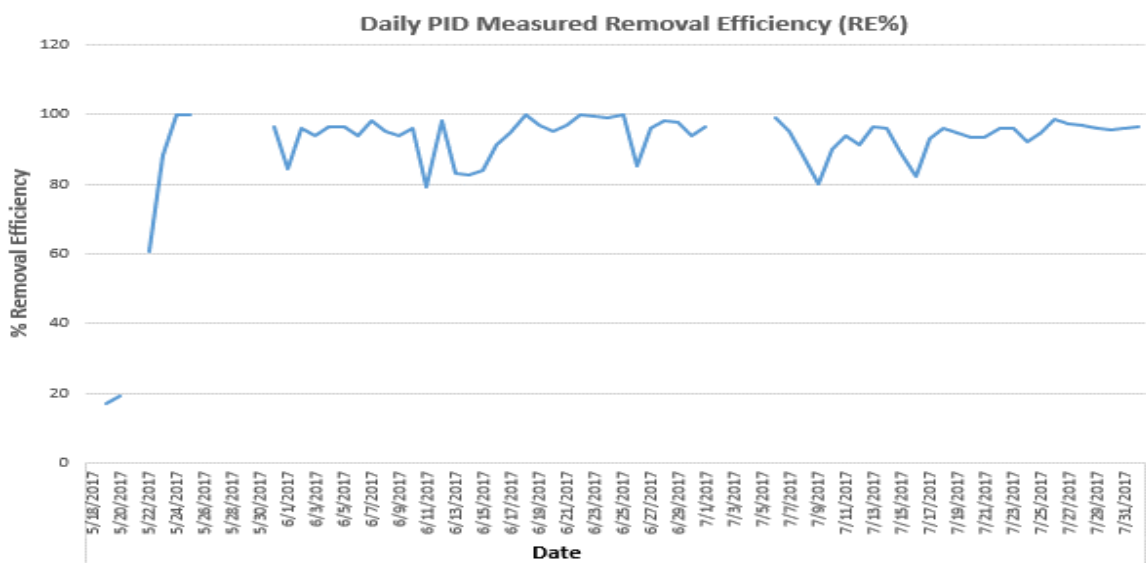
AFU-1

1



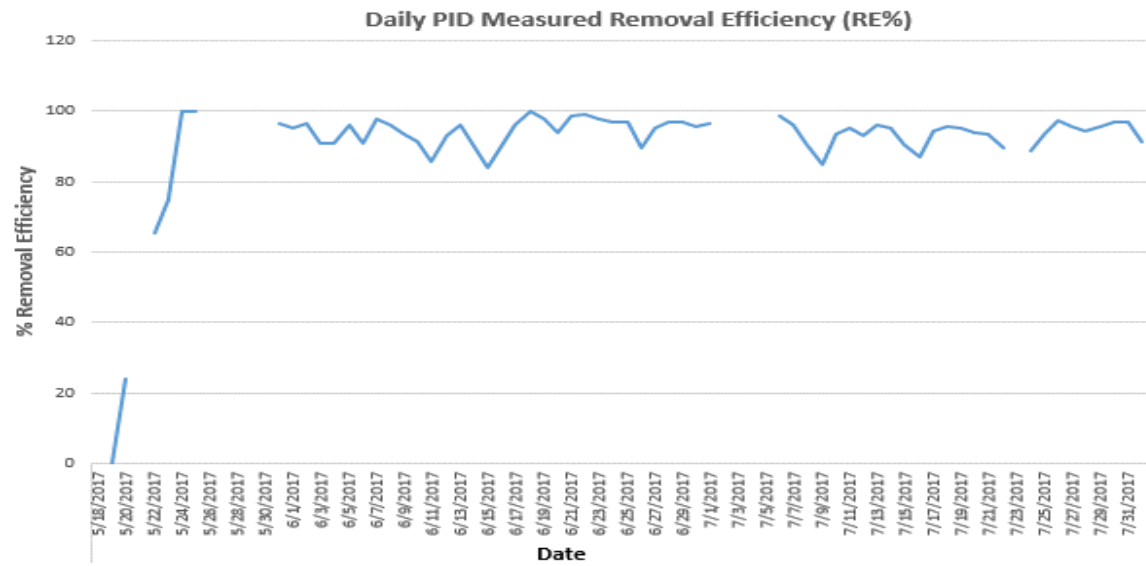
AFU-2

2



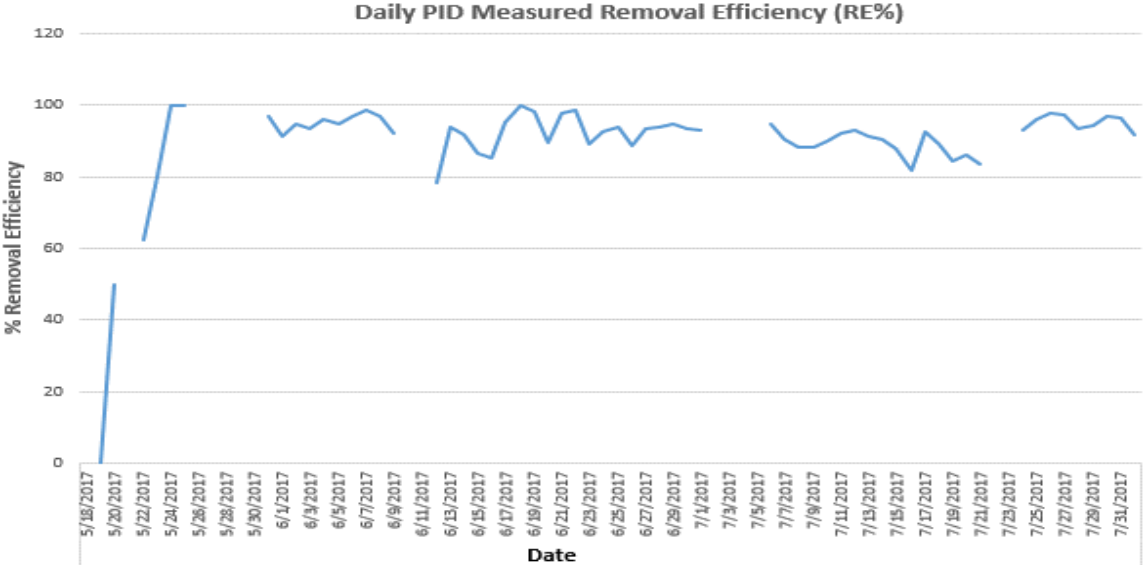
AFU-3

3



AFU-4

4



AFU-5

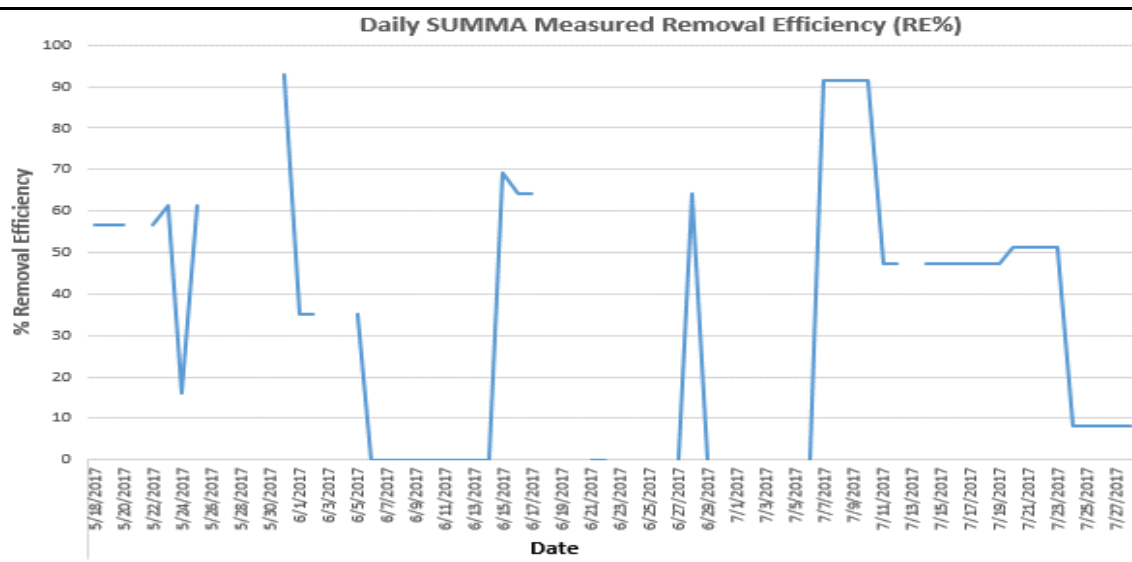
5

% Removal Efficiency



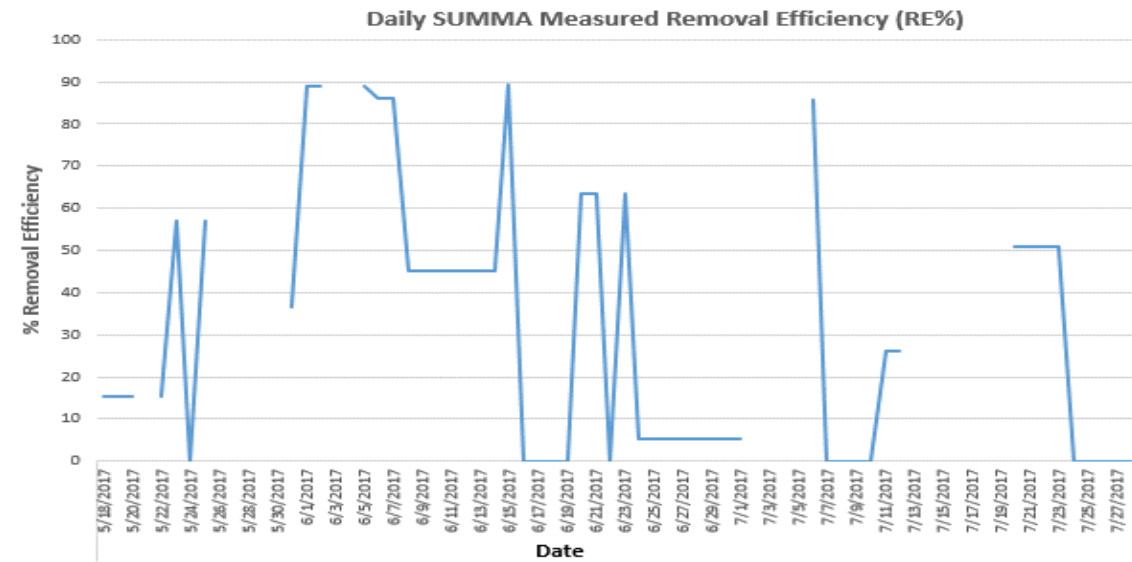
Revision 8/11/17: Corrected graph labels to indicate PID measured Removal Efficiency (RE%)

NORTHERN STATES POWER COMPANY		
Figure 3 Removal Efficiency - Field TVOC (Vol/Vol) Basis		
Ashland/NSP Lakefront Site		
Odor/Emissions Control System Performance thru 8/1/17		
Date: August 2017		Revision Date: 8/11/17
Drawn by: AKM	Checked by: B.Bell	Project ID: 17X001



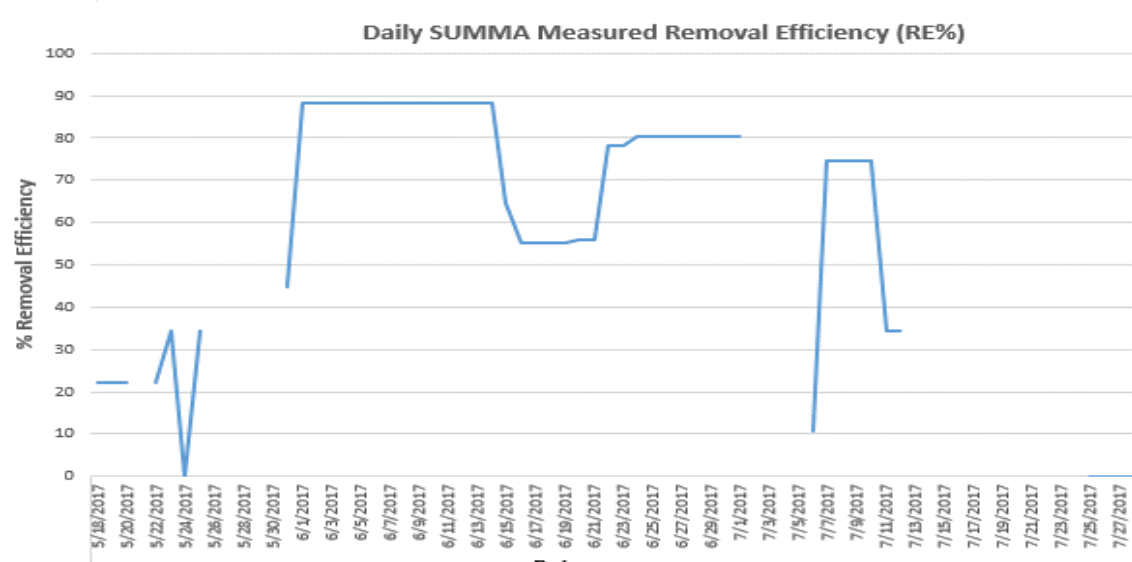
AFU-1

1



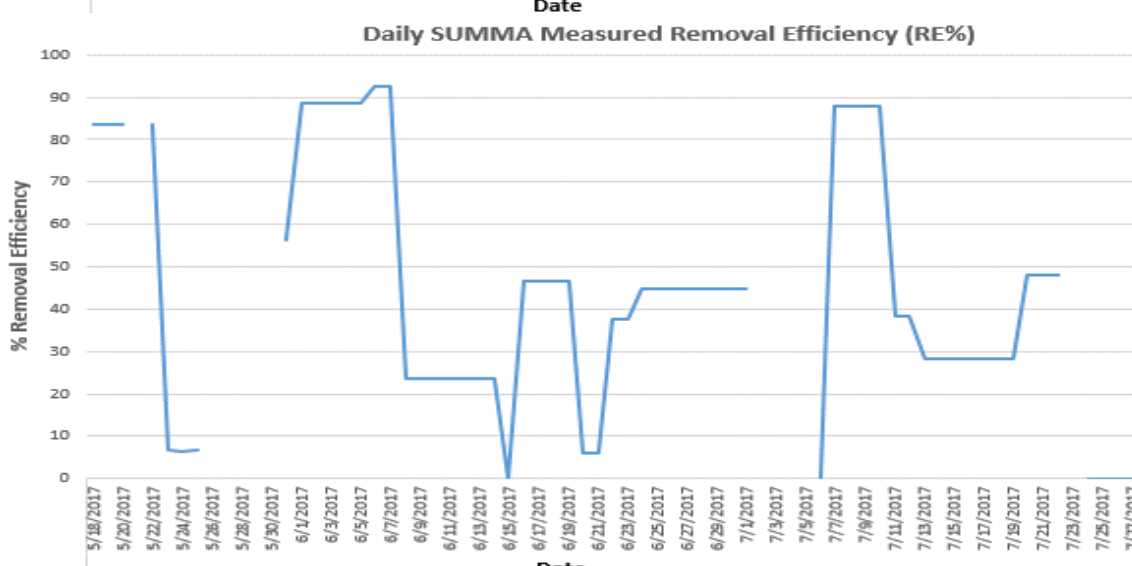
AFU-2

2



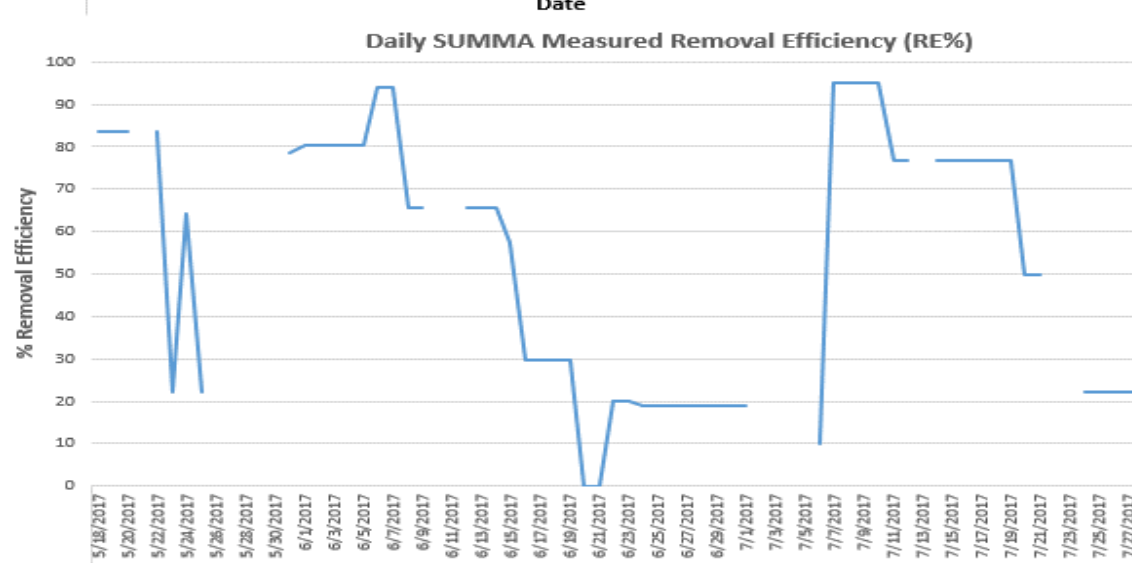
AFU-3

3



AFU-4

4



AFU-5

5



SUMMA data thru 7/24/2017

NORTHERN STATES POWER COMPANY

Figure 4 Removal Efficiency - Lab TVOC (Vol/Vol) Basis

Ashland/NSP Lakefront Site

Odor/Emissions Control System Performance thru 8/1/17

Date: August 2017

Revision Date:

Drawn by: AKM

Checked by: B.Bell

Project ID: 17X001

Attachment 2

Wis. Admin. Code NR 445 Comparison

NR 445.07 Table A Emission Thresholds, Standards, and Control Requirements for All Sources of Hazardous Air Contaminants

Notes:

Parameter	Allowable emission rate
	30 foot stacks
Benzene	936 lb/yr
Ethylbenzene	90.6 lb/hr - 24 hr avg
	730,000 lb/yr
Naphthalene	10.9 lb/hr - 24 hr avg
Toluene	39.3 lb/hr - 24 hr avg
	292,000 lb/yr
Xylene	90.6 lb/hr - 24 hr avg

1. Values appearing in red highlight are those that exceed the applicable limit.
2. Emission rates (24 hr avg) and annual emissions include 5 modules. Emission rate is 0 when system is offline.
3. Annual emissions are the cumulative emissions since start of operations.
4. Annual emissions = $\sum \text{MFR}_{\text{eff}1-5} \times \text{hrs}$ at that MFR
5. Operations are anticipated to span 4 months, therefore the cumulative sum of emissions will be annual emissions.

	Emissions rate in lb/hr (24 hr avg) ²				Annual Emissions in lb/yr ^{2,3}		
	Ethylbenzene	Naphthalene	Toluene	Xylene	Benzene	Ethylbenzene	Toluene
Limit-->	90.6	10.9	39.3	90.6	936	730,000	292,000
5/18/2017	5.01E-05	0.00E+00	1.80E-04	1.41E-04	2.68E-03	1.20E-03	4.31E-03
5/19/2017	5.22E-05	0.00E+00	1.87E-04	1.46E-04	5.46E-03	2.46E-03	8.80E-03
5/20/2017	5.46E-05	0.00E+00	1.70E-04	1.26E-04	8.07E-03	3.77E-03	1.29E-02
5/21/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.07E-03	3.77E-03	1.29E-02
5/22/2017	5.46E-05	0.00E+00	1.88E-04	1.46E-04	1.09E-02	5.08E-03	1.74E-02
5/23/2017	4.05E-04	1.94E-03	3.06E-04	6.23E-04	1.35E-02	1.48E-02	2.47E-02
5/24/2017	3.15E-03	1.18E-02	5.63E-03	3.92E-03	1.85E-02	9.04E-02	1.60E-01
5/25/2017	1.63E-03	5.94E-03	3.09E-03	2.04E-03	2.10E-02	1.30E-01	2.34E-01
5/26/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-02	1.30E-01	2.34E-01
5/27/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-02	1.30E-01	2.34E-01
5/28/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-02	1.30E-01	2.34E-01
5/29/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-02	1.30E-01	2.34E-01
5/30/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-02	1.30E-01	2.34E-01
5/31/2017	1.11E-03	7.41E-03	2.95E-04	1.46E-03	2.43E-02	1.56E-01	2.41E-01
6/1/2017	1.77E-03	1.32E-02	4.45E-04	2.30E-03	2.76E-02	1.99E-01	2.52E-01
6/2/2017	1.51E-03	1.12E-02	3.94E-04	1.98E-03	3.06E-02	2.35E-01	2.61E-01
6/3/2017	7.72E-04	5.72E-03	1.62E-04	9.79E-04	3.18E-02	2.54E-01	2.65E-01
6/4/2017	2.79E-02	2.13E-01	6.18E-03	3.52E-02	7.72E-02	9.23E-01	4.13E-01
6/5/2017	1.75E-02	1.30E-01	4.53E-03	2.29E-02	1.11E-01	1.34E+00	5.22E-01
6/6/2017	7.13E-03	6.12E-02	5.44E-03	1.37E-02	1.54E-01	1.51E+00	6.53E-01
6/7/2017	1.35E-02	1.13E-01	7.01E-03	2.22E-02	2.10E-01	1.84E+00	8.21E-01
6/8/2017	4.95E-02	1.91E-01	8.12E-03	6.05E-02	3.05E-01	3.02E+00	1.02E+00
6/9/2017	6.36E-02	1.61E-01	1.02E-02	7.71E-02	4.23E-01	4.55E+00	1.26E+00
6/10/2017	6.40E-02	1.71E-01	9.91E-03	7.74E-02	5.38E-01	6.09E+00	1.50E+00
6/11/2017	6.25E-02	1.59E-01	9.66E-03	7.56E-02	6.49E-01	7.59E+00	1.73E+00
6/12/2017	6.63E-02	1.76E-01	1.04E-02	8.03E-02	7.68E-01	9.18E+00	1.98E+00
6/13/2017	6.66E-02	1.87E-01	1.06E-02	8.09E-02	8.92E-01	1.08E+01	2.23E+00
6/14/2017	6.88E-02	1.93E-01	1.10E-02	8.36E-02	1.02E+00	1.24E+01	2.50E+00
6/15/2017	8.80E-03	6.46E-02	1.24E-02	2.04E-02	1.19E+00	1.26E+01	2.79E+00
6/16/2017	2.49E-02	1.54E-01	2.13E-02	3.77E-02	1.32E+00	1.32E+01	3.31E+00
6/17/2017	4.26E-02	2.70E-01	2.57E-02	6.09E-02	1.56E+00	1.43E+01	3.92E+00
6/18/2017	3.59E-02	2.40E-01	2.17E-02	5.11E-02	1.73E+00	1.51E+01	4.44E+00
6/19/2017	3.94E-02	2.62E-01	2.35E-02	5.60E-02	1.92E+00	1.61E+01	5.01E+00
6/20/2017	4.30E-02	1.51E-01	1.23E-01	1.05E-01	2.06E+00	1.71E+01	7.95E+00
6/21/2017	1.04E-01	6.07E-01	1.70E-01	2.11E-01	2.79E+00	1.96E+01	1.20E+01
6/22/2017	7.44E-02	1.30E-01	1.99E-02	9.49E-02	3.01E+00	2.14E+01	1.25E+01
6/23/2017	6.84E-02	1.13E-01	1.68E-02	8.64E-02	3.17E+00	2.30E+01	1.29E+01
6/24/2017	6.76E-02	1.09E-01	1.65E-02	8.53E-02	3.33E+00	2.46E+01	1.33E+01

NR 445.07 Table A Emission Thresholds, Standards, and Control Requirements for All Sources of Hazardous Air Contaminants

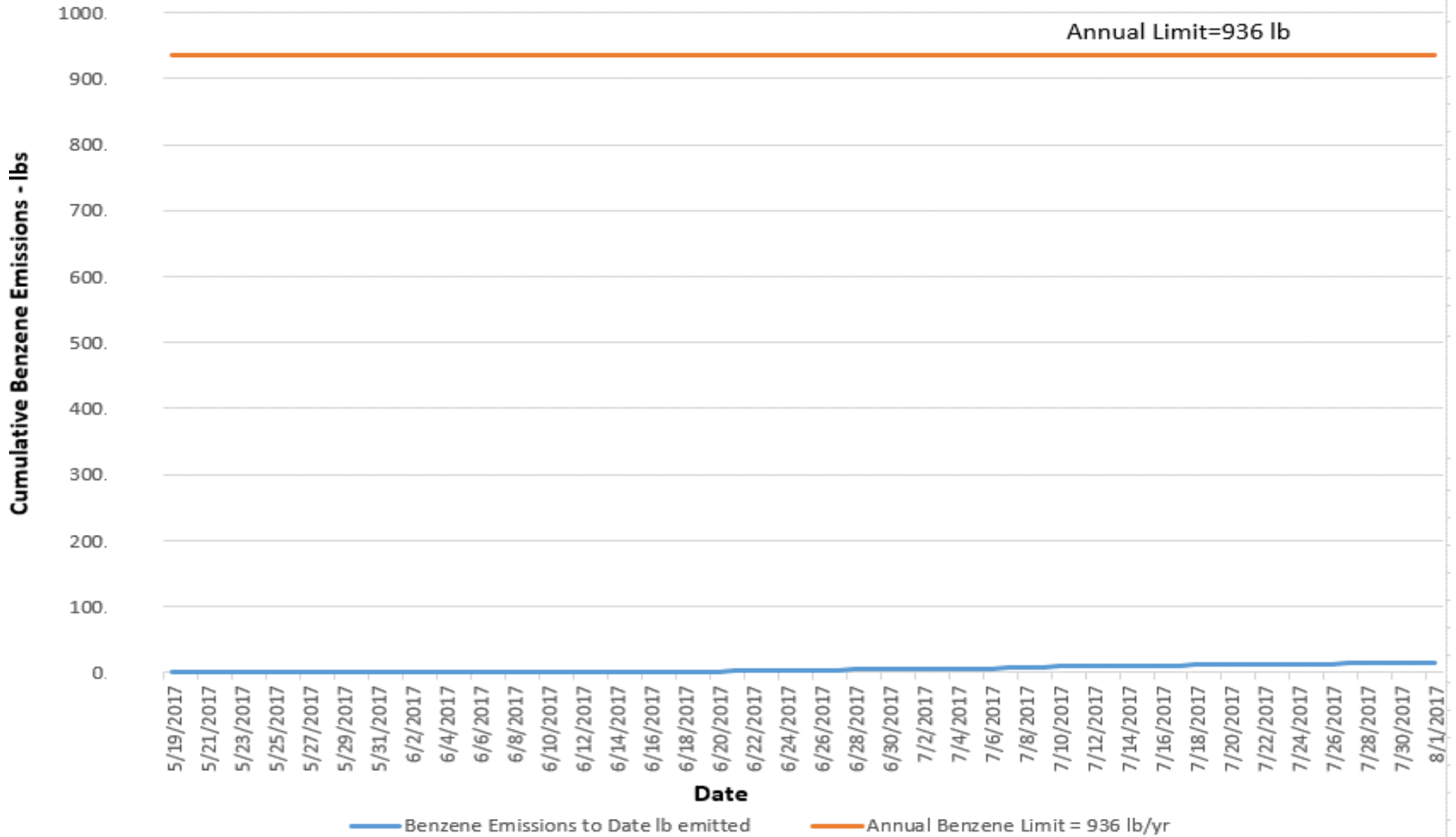
Notes:

Parameter	Allowable emission rate
	30 foot stacks
Benzene	936 lb/yr
Ethylbenzene	90.6 lb/hr - 24 hr avg 730,000 lb/yr
Naphthalene	10.9 lb/hr - 24 hr avg
Toluene	39.3 lb/hr - 24 hr avg 292,000 lb/yr
Xylene	90.6 lb/hr - 24 hr avg

1. Values appearing in red highlight are those that exceed the applicable limit.
2. Emission rates (24 hr avg) and annual emissions include 5 modules. Emission rate is 0 when system is offline.
3. Annual emissions are the cumulative emissions since start of operations.
4. Annual emissions = $\sum MFR_{eff1-5} \times hrs$ at that MFR
5. Operations are anticipated to span 4 months, therefore the cumulative sum of emissions will be annual emissions.

	Emissions rate in lb/hr (24 hr avg) ²				Annual Emissions in lb/yr ^{2,3}		
	Ethylbenzene	Naphthalene	Toluene	Xylene	Benzene	Ethylbenzene	Toluene
Limit-->	90.6	10.9	39.3	90.6	936	730,000	292,000
6/25/2017	6.61E-02	1.07E-01	1.61E-02	8.33E-02	3.49E+00	2.62E+01	1.37E+01
6/26/2017	6.79E-02	1.10E-01	1.65E-02	8.57E-02	3.64E+00	2.79E+01	1.41E+01
6/27/2017	2.16E-01	4.60E-01	5.92E-02	2.63E-01	4.08E+00	3.31E+01	1.55E+01
6/28/2017	2.20E-01	4.74E-01	6.19E-02	2.69E-01	4.57E+00	3.83E+01	1.70E+01
6/29/2017	2.19E-01	4.74E-01	6.05E-02	2.67E-01	5.02E+00	4.36E+01	1.84E+01
6/30/2017	2.16E-01	4.61E-01	5.92E-02	2.63E-01	5.45E+00	4.88E+01	1.99E+01
7/1/2017	1.10E-01	2.37E-01	3.03E-02	1.34E-01	5.67E+00	5.14E+01	2.06E+01
7/2/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.67E+00	5.14E+01	2.06E+01
7/3/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.67E+00	5.14E+01	2.06E+01
7/4/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.67E+00	5.14E+01	2.06E+01
7/5/2017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.67E+00	5.14E+01	2.06E+01
7/6/2017	2.34E-01	4.92E-01	6.72E-02	2.88E-01	6.24E+00	5.70E+01	2.22E+01
7/7/2017	1.79E-01	1.03E+00	6.48E-02	2.02E-01	6.92E+00	6.13E+01	2.38E+01
7/8/2017	2.16E-01	1.22E+00	7.56E-02	2.44E-01	7.69E+00	6.65E+01	2.56E+01
7/9/2017	2.10E-01	1.19E+00	7.36E-02	2.37E-01	8.45E+00	7.15E+01	2.73E+01
7/10/2017	2.18E-01	1.24E+00	7.66E-02	2.47E-01	9.23E+00	7.68E+01	2.92E+01
7/11/2017	2.92E-01	1.11E+00	9.33E-02	3.39E-01	9.83E+00	8.38E+01	3.14E+01
7/12/2017	2.56E-01	9.76E-01	8.19E-02	2.97E-01	1.03E+01	8.99E+01	3.34E+01
7/13/2017	4.69E-02	2.91E-01	1.10E-02	5.45E-02	1.04E+01	9.10E+01	3.37E+01
7/14/2017	1.01E-01	4.59E-01	2.98E-02	1.18E-01	1.06E+01	9.35E+01	3.44E+01
7/15/2017	1.20E-01	5.62E-01	3.43E-02	1.40E-01	1.09E+01	9.63E+01	3.52E+01
7/16/2017	8.44E-02	4.39E-01	2.33E-02	9.90E-02	1.11E+01	9.84E+01	3.58E+01
7/17/2017	1.28E-01	5.98E-01	3.66E-02	1.49E-01	1.13E+01	1.01E+02	3.66E+01
7/18/2017	1.26E-01	5.89E-01	3.62E-02	1.48E-01	1.16E+01	1.04E+02	3.75E+01
7/19/2017	1.15E-01	5.68E-01	3.24E-02	1.34E-01	1.19E+01	1.07E+02	3.83E+01
7/20/2017	1.45E-01	1.18E+00	5.24E-02	2.00E-01	1.23E+01	1.11E+02	3.95E+01
7/21/2017	1.21E-01	9.84E-01	4.51E-02	1.68E-01	1.28E+01	1.14E+02	4.06E+01
7/22/2017	2.57E-02	2.37E-01	1.34E-02	4.00E-02	1.29E+01	1.14E+02	4.09E+01
7/23/2017	1.60E-02	1.87E-01	1.03E-02	2.84E-02	1.31E+01	1.15E+02	4.12E+01
7/24/2017	7.98E-02	5.87E-01	3.07E-02	1.10E-01	1.33E+01	1.17E+02	4.19E+01
7/25/2017	8.11E-02	5.96E-01	3.11E-02	1.12E-01	1.35E+01	1.18E+02	4.27E+01
7/26/2017	7.51E-02	5.49E-01	2.91E-02	1.04E-01	1.37E+01	1.20E+02	4.34E+01
7/27/2017	7.46E-02	5.49E-01	2.97E-02	1.03E-01	1.39E+01	1.22E+02	4.41E+01
7/28/2017	7.64E-02	5.64E-01	2.87E-02	1.05E-01	1.41E+01	1.24E+02	4.48E+01
7/29/2017	7.42E-02	5.44E-01	2.91E-02	1.02E-01	1.43E+01	1.26E+02	4.55E+01
7/30/2017	5.16E-02	3.79E-01	1.96E-02	7.10E-02	1.45E+01	1.27E+02	4.59E+01
7/31/2017	7.69E-02	5.69E-01	2.91E-02	1.06E-01	1.47E+01	1.29E+02	4.66E+01
8/1/2017	7.39E-02	5.47E-01	2.75E-02	1.01E-01	1.49E+01	1.31E+02	4.73E+01

Cumulative Benzene Emissions - lbs



NORTHERN STATES POWER COMPANY		
Figure A2-1 NR 445 Benzene Evaluation		
Ashland/NSP Lakefront Site		
Odor/Emissions Control System Performance thru 8/1/17		
Date: August 2017		Revision Date:
Drawn by: AKM	Checked by: B.Bell	Project ID: 17X001