MAWC – IUP Service Contract
Air Quality Monitoring at Beaver Run Reservoir
Quarterly Report #1

Covering the Period from 8/1/2018 – 10/31/2018

Submitted by

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OUTLINE OF REPORT

I. Scope of Contract

The current contract between the Municipal Authority of Westmoreland County (MAWC) and the Indiana University of Pennsylvania (IUP) started on 1 August 2018 and runs until 31 July 2019. The scope of the contract calls for the contractor, IUP, to perform air quality measurement services at Beaver Run Reservoir (BRR) quarterly.

The air quality measurement services include field sampling, laboratory analyses and reporting as follows: (1) Field Sampling: air quality samples and hand-held sensor readings will be taken at the Mamont compressor station and at the Kuhns, DeArmitt, Hutchinson and Mamont (KDHM) pad sites. Background air quality samples will be taken near the Kuhns pad. (2) Laboratory Analyses: The air samples taken from the pad sites will be monitored for methane concentration and compared to the hand-held sensor readings taken at the pads. The air samples taken from the Mamont 1 compressor station will be monitored for the standard compressor gases of CO, NO_2, SO_2, Benzene, Ethylbenzene, Formaldehyde, n-Hexane, Toluene, Xlenes and 2,2,4 Trimethylpentane. (3) Reporting: A report on the results of the field sampling and analyses will be delivered within six weeks after field sampling. After review and approval of the report results by MAWC, the results will then be posted on an IUP web site for public access.

II. Scope of Report

This report covers the first quarter of the contract. Field samples and hand-held sensor readings were taken at the BRR fracking pad sites on 25 August 2018. The data from the Carbon Monoxide (CO) monitors at the Mamont compressor was downloaded, the batteries for three sensors were replaced, the three sensors were reset and replaced into positions around the compressor on 26 August. Field sampling notes and laboratory analyses of the field samples are reported herein.

III. Field Report of Air Quality Sampling

Figure 1 (next page) shows the approximate locations where an air sample was taken or CO monitors were placed at the Mamont compressor station. One air sample was taken at position P7 and the CO data loggers were placed at the positions labeled P7, P1 and P3. Hand-held sensor readings for CO, SO_2, CH_4, NO_2 and CH_2O were taken at position P7. The hand-held sensor reading were taken for 10-minute durations for each gas.

All of the aerial views shown in this section of the report are taken from Google Maps and do not represent the vegetation or construction in the area on the date of the samples, but instead are intended to show the locations of the air and background samples relative to landmarks around the Mamont compressor and the Kuhns, DeArmitt, Hutchinson, and Mamont (KDHM) pad well sites.

In figure 2, the location of the air sample taken at the Kuhns pad is marked with a red square (■). The location of the background sample is marked with a blue square (■) and

Figure 1. Aerial image of the Mamont compressor station. The red squares labeled MC-1 and MC-2 mark the locations of the air samples and PID readings taken on the days indicated in the text. The aerial image is from Google Maps.

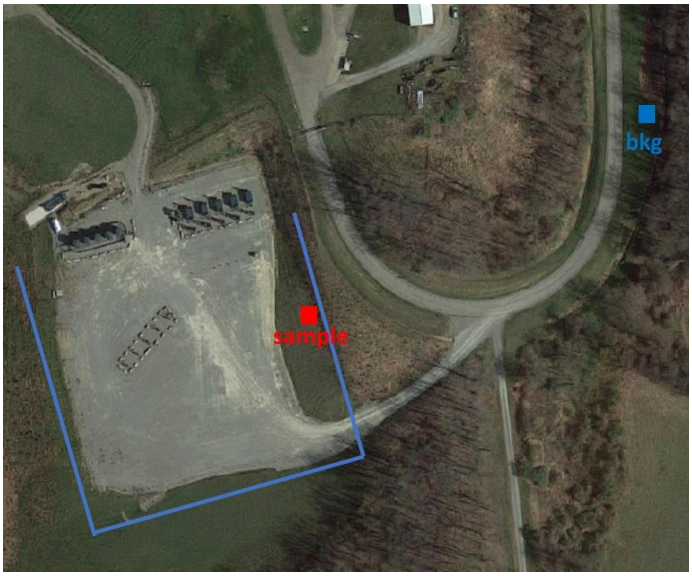

Figure 2. Aerial image of the Kuhns pad and nearby vicinity. The red square marks the location of the air sample taken. The blue line shows the pathway for the walking survey for CH_4. The blue square labeled "bkg" marks the location of the background air sample. The aerial image is from Google Maps.

Figure 3. Aerial image of the Dearmitt pad. The red square marks the location of the air sample taken. The blue line shows the pathway for the walking survey for CH_4. The aerial image is from Google Maps.

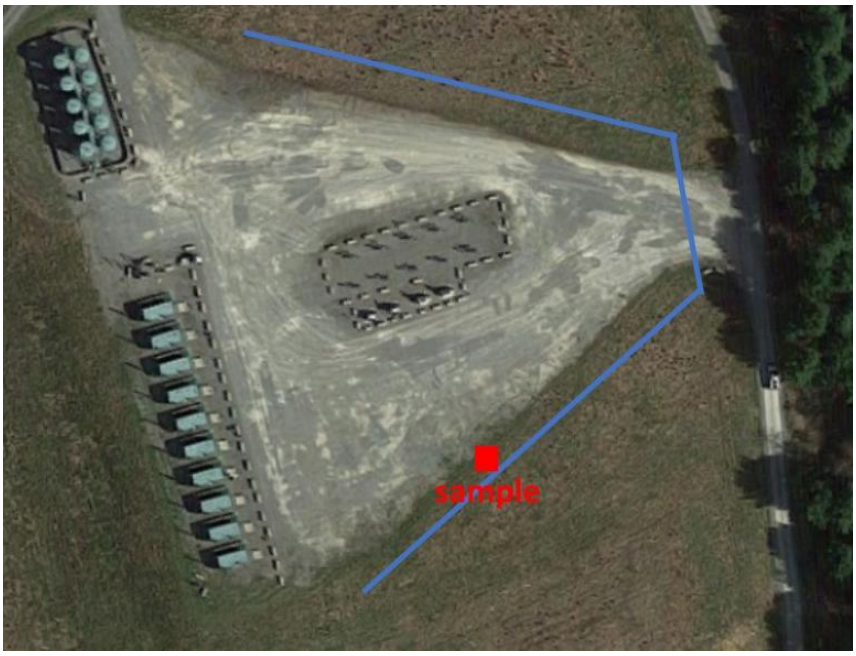

Figure 4. Aerial image of the Hutchinson pad. The red square marks the location of the air sample taken. The blue line shows the pathway for the walking survey for CH_4. The aerial image is from Google Maps.

Figure 5. Aerial image of the Mamont pad. The red square marks the location of the air sample taken. The blue line shows the pathway for the walking survey for CH_4. The aerial image is from Google Maps.

the notation “bkg”. The walked pathway for the handheld monitor (Aeroqual) survey for CH_4 is shown as a blue line.

In figure 3, the location of the air sample taken at the Dearmitt pad is marked with a red square (■). The walked pathway for the handheld monitor survey for CH_4 is shown as a blue line.

In figure 4, the location of the air sample taken at the Hutchinson pad is marked with a red square (■). The walked pathway for the handheld monitor survey for CH_4 is shown as a blue line.

In figure 5, the location of the air sample taken at the Hutchinson pad is marked with a red square (■). The walked pathway for the handheld monitor survey for CH_4 is shown as a blue line.

The results of the field measurements are summarized in table and graphical forms and discussed in the next section.

IV. Results

A. Results of Methane content from air samples at Kuhns, DeArmitt, Hutchinson and Mamont-1 pads and background sampling

i. Air Sample Results

Table 1 below summarizes the results of the methane concentration measurements at the KDHM pads and the background sampling near the Kuhns pad. The sample locations at each pad are shown as the red squares in Figures 2 through 5. Each bag sample was analysed using Fourier-Transform Infrared Spectroscopy for methane presence. When the results are indistinguishable from the atmospheric background (which is approximately 1.8 ppmv), the results are shown as 1.5 ± 1.5 ppmv.

The methane content of all samples was determined to be indistinguishable from background.

Table 1. Summary of results of methane content analysis from air samples at the Kuhns, DeArmitt, Hutchinson and Mamont pads, including the background measurement taken near the Kuhns pad.

Date	sample	Methane concentration (ppmv)
8/25/2018	Kuhns-1	1.5 ± 1.5
8/25/2018	Dearmitt-1	1.5 ± 1.5
8/25/2018	Hutchinson-1	1.5 ± 1.5
8/25/2018	Mamont-1	1.5 ± 1.5
8/25/2018	bkg	1.5 ± 1.5

ii. Example walking survey results

The results for the walking survey for Methane at the Mamont pad is shown in Figure 6. The pathway walked at the Mamont pad is shown in Figure 5. The Aeroqual detector has a minimum detectable level of 10 ppm, which is approximately 5x background. As shown in the figure, the sensor reading was about 5ppm throughout the entire walked path.

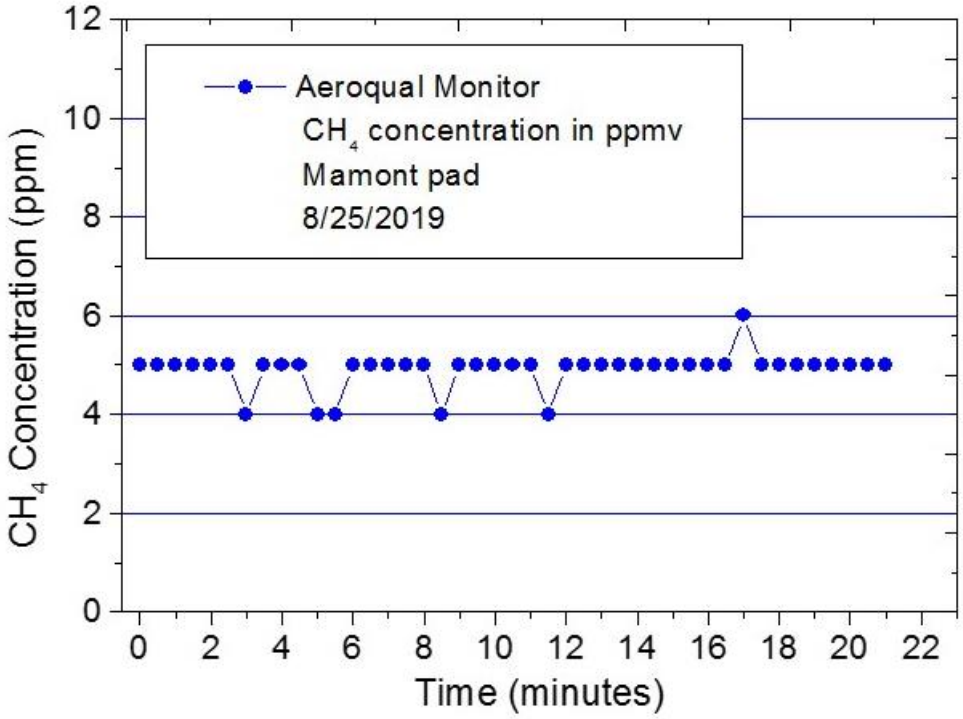

Figure 6. Aeroqual monitor readings for the walking survey about the Mamont pad on 25 August 2018. The reading show no detected methane concentration above the minimum detectable level of the sensor of 10 ppmv.

Very similar results were obtained for the walked paths at the Kuhns, Dearmitt and Hutchinson pads.

B. Results of Air Quality Measurements at the Mamont compressor

i. CO logger data results

Figure 7 shows the recorded CO concentration over a 23-day period in at the beginning of Q1 quarter. Of the three CO data loggers installed on 26 August, this logger (IUP #9), at position P7, showed the cleanest data. Note that position P7 is closest to the compressor and also near a compressor exhaust vent. The data clearly show the turn-on and turn-off cycles of the compressor. Additionally, the CO centration is seen to fall to zero within minutes of the compressor stopping a compression-exhaust cycle.

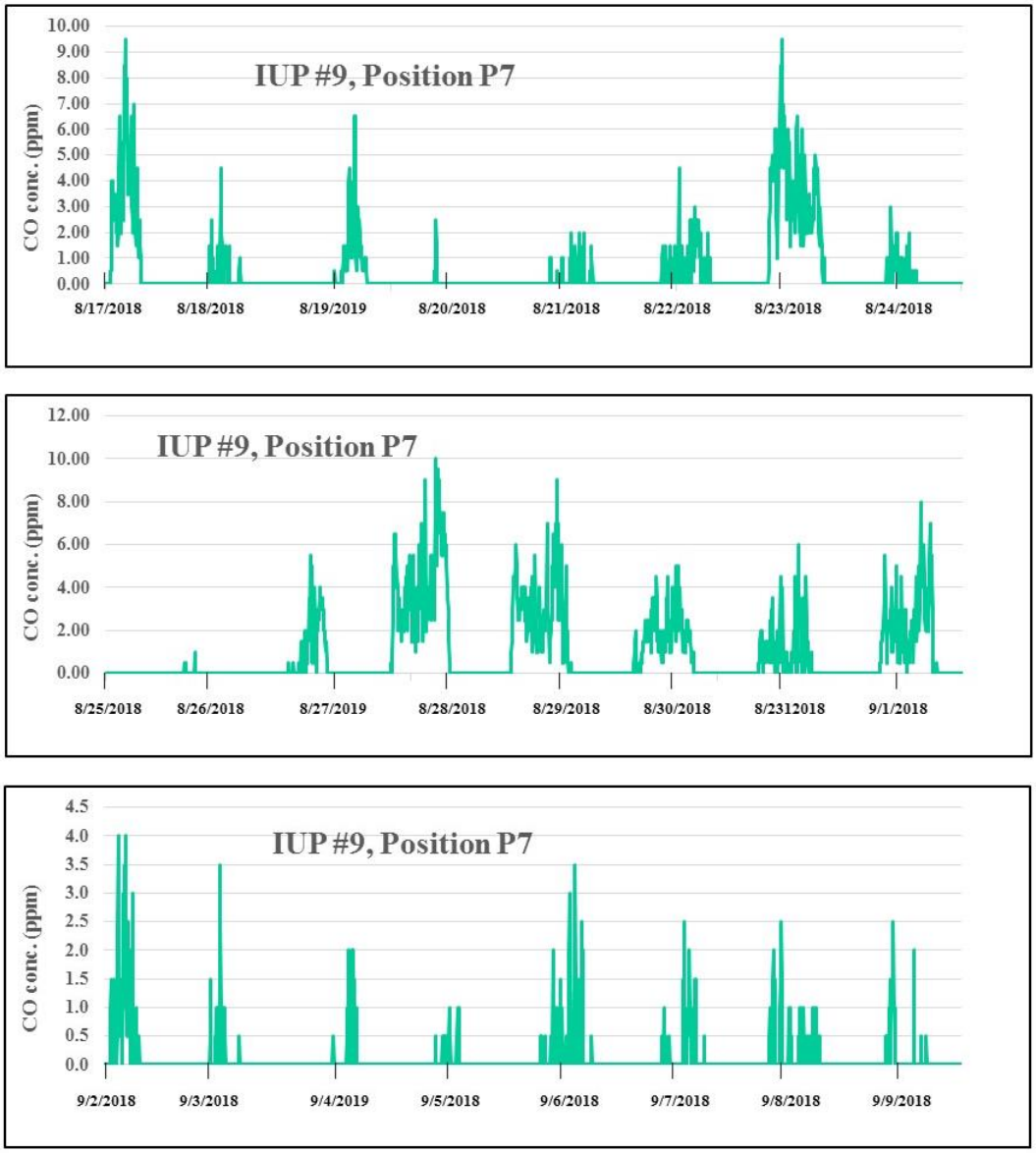

Figure 7. Recorded CO concentration results from data loggers #6 and #7 at sensor positions #6 and #7, respectively.

The data logger at position P3 failed during this quarter, no data was downloadable from this logger. The rest of the quarterly data from this sensor (IUP #9), and all of the data from the other surviving logger (IUP #5) will be later supplied as an addendum appendix to this report.

ii. Aeroqual handheld data

The Aeroqual handheld is a multi-sensor platform. By switching sensor heads, gaseous concentrations of CO, SO_2, NO_2, CH_4, NH_3 and CH_20 at 0.005 to 1.0 ppm sensitivities are recorded. The handheld sensor has the additional advantage of real-time and mobile measurements. It is useful for gauging the concentration of the other compressor gases in proportion to the CO concentration. Ten-minute surveys for each of the compressor gases were taken on 26 August. The compressor was not in operation at the time of the surveys and no concentration above the minimum detectable levels of the instrument were observed. The results are summarized in Table 2 below.

Table 2. Summary of results of compressor gas surveys at the Mamont compressor taken on 26 August using the Aeroqual handheld detector and different sensor heads.

Gas	Measured concentration (ppm)	minimum detectable level (ppm)
CO	0.00	0.05
SO_2	0.00	0.04
NO_2	0.000	0.005
CH_4	5	10
NH_3	0.0	0.2
CH_2O	0.00	0.01

V. Summary of Results

The methane content measurements summarized in table 1 indicate methane levels that vary from 0.0 to 3.0 ppmv at the KDHM pads. These levels are totally consistent with the background atmospheric methane level of approximately 1.8-1.9 ppmv. The estimated uncertainty of the concentrations of ±1.5 ppmv in table 1 are due to normal fluctuations in background and the accuracy of the FTIR method used.

The compressor gas concentration results summarized in Table 2 indicate that no compressor gases were detected. The compressor was not operating in a compression-exhaust cycle at the time of the measurements. The Lascar Electronics CO logger data of Figure 7 indicate a average CO concentrations between about 1 and 5 ppm CO at position P7 in Figure 1. This is the logger position closest to a compressor exhaust vent. Also, note

that the compression-exhaust cycle is observed during mostly the late-night early- morning hours.

VI. Contract Status and Notes

The Lascar Electronics CO data logger results reported here were downloaded on 11 November. At this time the detectors were replaced with three new detectors.