

**Follow-up Air Quality Surveys at Beaver Run  
Reservoir near the Mamont Compressor Station  
and the vicinity of the Shaw Pad**

**Survey performed on 2/23/2019**

Submitted by

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**OUTLINE OF REPORT**

- 1. Introduction and Scope of Report**
- 2. Locations and Date of Survey**
- 3. Measurements at the Mamont Compressor Station**
  - 3.1 CO survey results**
  - 3.2 SO<sub>2</sub> survey results**
- 4. ppm, surements at Flare #1 and Flare #2 sites near Shaw Pad**
  - 4.1 CO & SO<sub>2</sub> survey results near Flare #1**
  - 4.2 CO & SO<sub>2</sub> survey results near Flare #2**
- 5. CO and SO<sub>2</sub> survey results at Flare #3 off Route 380**
- 6. Summary of Results**

## **1. Introduction and Scope of Report**

The Municipal Authority of Westmoreland County (MAWC) contracts with the Indiana University of Pennsylvania (IUP) for quarterly air quality monitoring at four fracking pads and the Mamont compressor station at Beaver Run Reservoir. The Principal Investigator of the contract is Dr. John Bradshaw.

The previous air quality report, dated 12 February, reported on air quality surveys at the Mamont compressor station, around the Shaw pad, at flaring sites around the Shaw pad and at nearby conventional the well heads. This report details the results of follow-up surveys at the Mamont compressor station, the vicinity of Shaw pad and near flaring sites where carbon monoxide (CO) and sulfur dioxide (SO<sub>2</sub>) levels were detected on the date of the previous surveys of 7 and 10 February.

## **2. Locations and Dates Surveyed**

The follow-up air quality surveys were made on 23 February 2019. 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 locations relative to landmarks around the Mamont compressor station and the Shaw pad at Beaver Run Reservoir.

At the Mamont compressor station, three follow-up surveys were taken. An Aeroqual Series 500 air quality monitor<sup>1</sup> was used to monitor carbon monoxide and sulfur dioxide concentrations in the air. In Figure 1, the points labeled P1, P3 and P7 mark the present locations of CO data loggers.<sup>2</sup> Point P7 is the closest to a compressor exhaust vent. A 15-minute spot logging for CO at point P7 was recorded. A walking survey recording CO concentrations was made along approximate pathway shown in red in Figure 1. As shown in Figure 1, the survey started at point P7, went to outside the northwest corner of the fencing around the compressor station and then back to P7. A walking survey for SO<sub>2</sub> followed the same approximate path and is shown in blue in Figure 1. The results of these surveys are reported in section 3.

Walking surveys for CO and spot surveys for SO<sub>2</sub> were also conducted in the vicinity of the two flare sites near the Shaw pad. Figure 2 shows an aerial view of the Shaw pad and surroundings. Both flares were extinguished. On the day of these surveys both flaring stacks near the Shaw pad and the flaring stack off of route 380 were being dismantled. A walking survey for CO near the flare site east of the Shaw pad followed the approximate path shown in red in Figure 2. A spot survey for SO<sub>2</sub> near the point labeled P1-F1 was recorded. A second walking survey for CO followed the approximate path shown in blue in Figure 2 to the west of the Shaw pad. A spot survey for SO<sub>2</sub> was taken at the point P4-F2 to the west of the Shaw pad. The results of these surveys are reported in section 4.

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<sup>1</sup> <https://www.aeroqual.com/product/series-500-portable-air-pollution-monitor>

<sup>2</sup> <https://www.lascarelectronics.com/easylog-data-logger-el-usb-co300/>



Figure 1. Aerial image of the Mamont compressor station. The red circles labeled P1, P2 and P7 mark the locations of carbon monoxide data logger placements. The red and blue lines show approximate paths of walking surveys for carbon monoxide and sulfur dioxide, respectively. The aerial image is from Google Maps.



Figure 2. Aerial image of the Shaw pad and surroundings. Walking surveys for carbon monoxide and spot surveys of sulfur dioxide and were conducted on the red and blue paths (for CO) and at points P1 and P5 (for SO<sub>2</sub>). The aerial image is from Google Maps.

Finally, methane (CH<sub>4</sub>), CO and SO<sub>2</sub> spot measurements were made at a third flare site directly off of route 380, approximately 2480 feet east of Beaver Run Road. The results of these measurements are reported in section 5.

### 3. Measurements at the Mamont Compressor Station

#### 3.1 CO survey results

A spot survey for CO was taken near the point labelled P7 in Figure 1 starting at 12:20 pm on 23 February. The results are shown in Figure 3 below. The rising CO concentration signal during the first three minutes of the survey is due to the response time of the detector. The data shows that the CO signal concentration fluctuated between approximately 2.0 and 2.7 ppm.

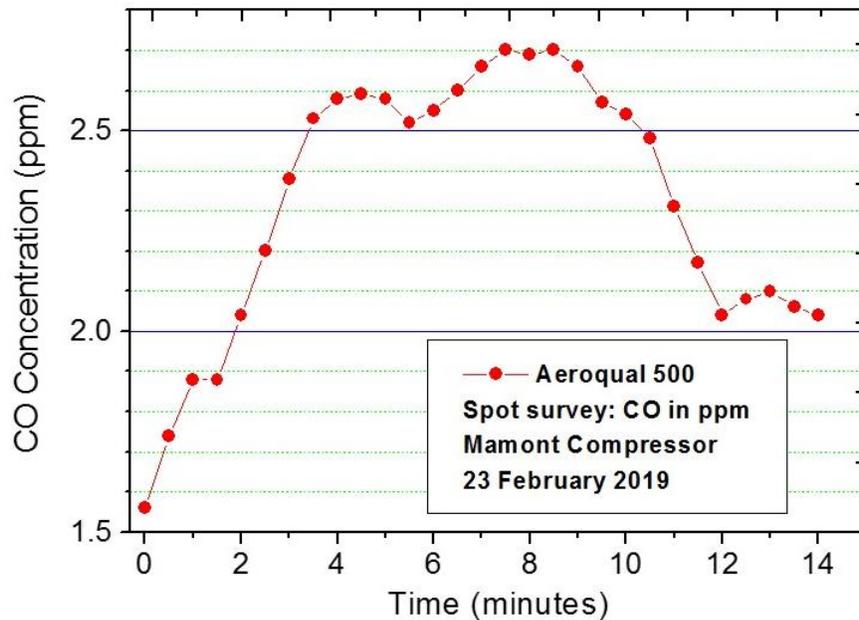


Figure 3. Carbon Monoxide concentrations as recorded using the Aeroqual detector for the spot survey at the Mamont compressor on 23 February.

A walking survey for CO was taken starting at 12:36 pm on 23 February. The results are shown in Figure 4 below. The CO signal in Figure 4 starts near 1.9 ppm at point P7 in Figure 1. The minimum signal near 1.0 ppm at 3½ minutes corresponds to the top of the hill immediately north of the compressor in Figure 1. This is close to the point where the path walked turns left and proceeds along the ridgeline north of the compressor. The peak CO concentration near 1.8 ppm at 6 minutes corresponds to the point closest to the northwest edge of the compressor fencing at the upper left of Figure 1. The path walked then proceeded back to the starting point at P7 and ended there at 12 minutes.

It should be noted that the CO concentration (Figure 4) at any point on the walked pathway (Figure 1) should be interpreted as an approximate average value. The CO

concentration at any point should be expected to show a % fluctuation similar to that exhibited in Figure 3 recorded for the spot survey at point P7 in Figure 1. In other words, the peaks and valleys of the CO concentrations should not be associated with particular points along the walked pathway.

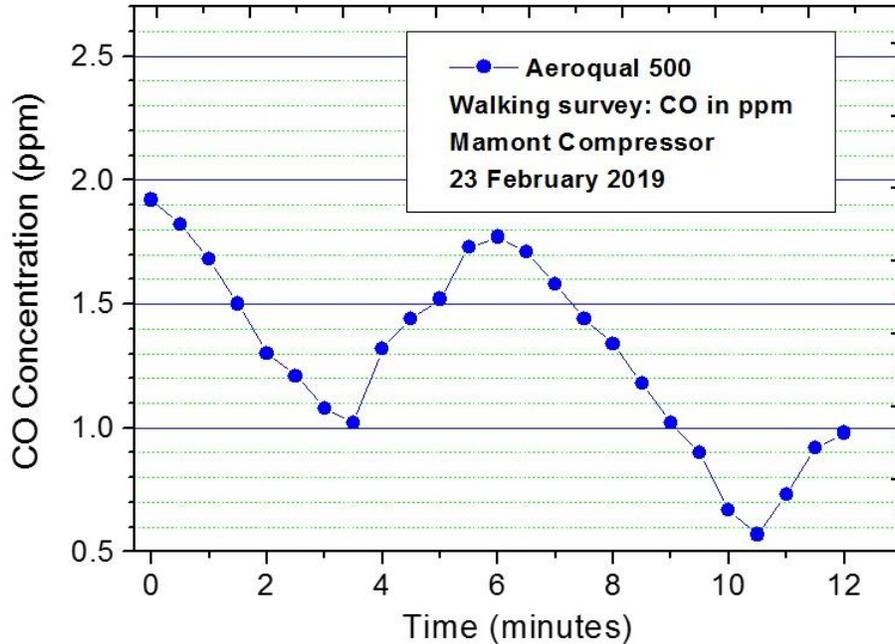


Figure 4. Carbon Monoxide concentrations as recorded using the Aeroqual detector for the walking survey at the Mamont compressor on 23 February.

### 3.2 SO<sub>2</sub> survey results

A similar walking survey for SO<sub>2</sub> along the blue pathway in Figure 1 was conducted immediately after the CO surveys. The detected SO<sub>2</sub> detected concentration varied over a 15-minute walking survey between 0.00 ppm and 0.08 ppm. The minimum detectable concentration of this sensor is 0.04 ppm and about 80% of the readings were below this level. This suggests maximum levels of SO<sub>2</sub> below or near the detection limit of this instrument.

## 4. Measurements at Flare #1 and Flare #2 sites near Shaw Pad

### 4.1 CO & SO<sub>2</sub> survey results near Flare #1

A walking survey for CO starting from Tower Hill Road to a point directly east of the clearing for the flare #1 site east of the Shaw pad and back was conducted starting at 1:40 pm on 23 February. Flare #1 was extinguished between 7 and 10 February. The flare stack was in the process of being dismantled and trucked away on this day. The approximate path followed the red line shown in Figure 2. The CO concentration results

are shown in Figure 5 below. The rising CO concentration signal during the first 2½ minutes of the survey is due mainly to the response time of the detector. The maximum signals between 3.6 and 3.8 ppm were recorded on a narrow dirt road that is about 200 feet north of point P1 in Figure 2. The narrow dirt road is barely

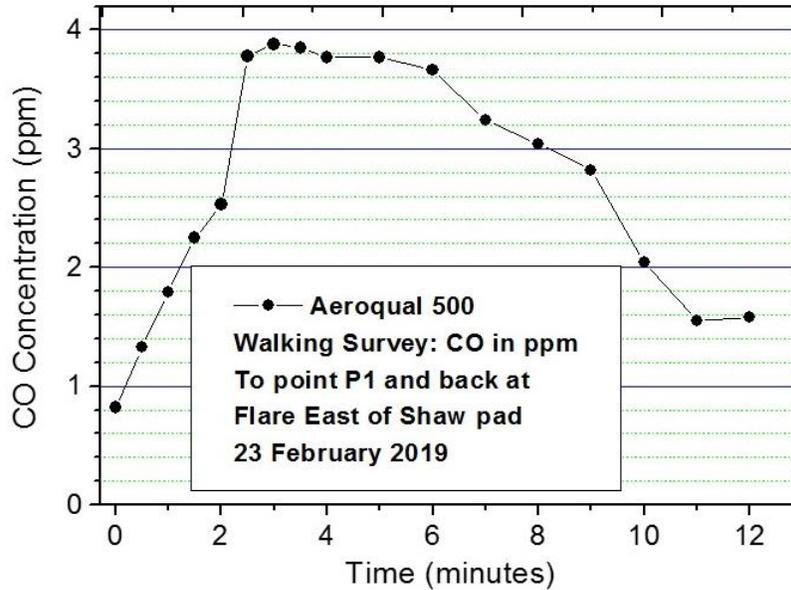


Figure 5. Carbon Monoxide concentrations as recorded using the Aeroqual detector for the walking survey from Tower Hill Road to the point P1 directly east of the Flare #1 location and back to Tower Hill Road.

visible in Figure 2. The walked pathway arrived at P1 at the 8-minute mark and back at Tower Hill Road at the 12-minute mark.

A spot SO<sub>2</sub> survey was conducted in the woods about 100 feet north of point P1 in Figure 2. This was the area where increased SO<sub>2</sub> concentrations were measured on 7 February. The Aeroqual detector read 0.00 ppm over a 7-minute period during this survey.

#### 4.2 CO & SO<sub>2</sub> survey results near Flare #2

A walking survey of the air quality from flare #2, south of Shaw pad was conducted on 23 February along the western path shown in blue in Figure 2. Flare #2 was extinguished between 10 and 23 February. The flare stack was in the process of being dismantled and trucked away on this day. The survey started at P2 on Tower Hill road, next to the guard shack. The dirt roadway walked rises in elevation until it is about 162 feet above flare #2 elevation at point P3 and about 200 feet above the flare #2 elevation at P4. From P4 the walked path begins a steep wooded downhill to P5, which is about 20

feet below the flare.<sup>3</sup> The survey used the Aeroqual monitor with the carbon monoxide detector on the way in and out.

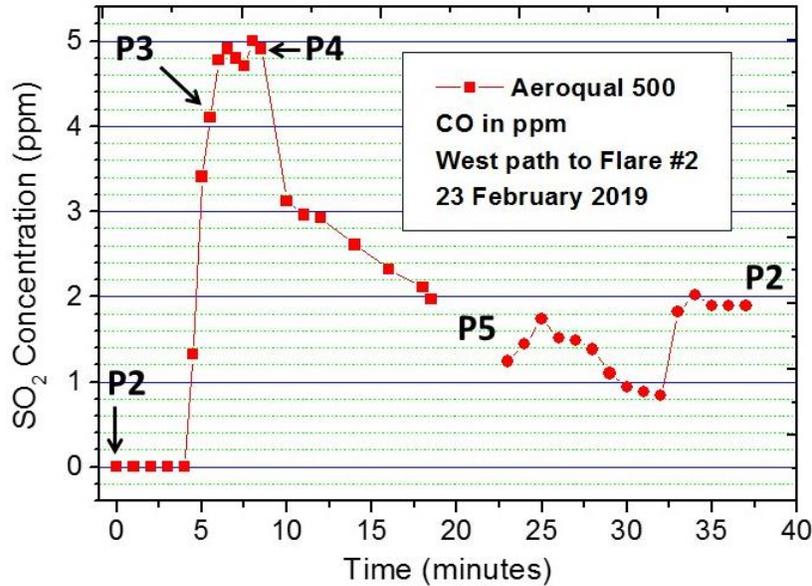


Figure 6. Carbon Monoxide concentrations as recorded using the Aeroqual monitor for the walking survey to flare #2 along the western pathway shown in blue in Figure 2. The labels P2 through P5 mark points on the pathway shown in Figure 2 and the corresponding recorded CO concentrations.

At the point P5, the detector on the Aeroqual monitor was switched to SO<sub>2</sub> and a spot survey of SO<sub>2</sub> was conducted at point P5 for 6 minutes. The detector read 0.00 ppm SO<sub>2</sub> for the entire survey duration.

After the spot SO<sub>2</sub> survey, the CO detector was switched back into the Aeroqual monitor and the CO concentration monitored throughout the walk back through the woods to point P4, then down the dirt roadway back to point P2 at the 37-minute mark.

The overall trends shown in Figure 6 show a remarkable similarity to trends along the walking survey along the same path of 10 February. In particular, both surveys show a rising CO concentration along the uphill dirt roadway from P2 to P3 and P4 and then a decreasing CO concentration as the path walked goes downhill through the woods to point P5.

<sup>3</sup> Elevation data is from Google Earth.

## 5. CO and SO<sub>2</sub> survey results at Flare #3 off Route 380

CO was monitored at the flare site just off route 380 about 2480 feet west of Beaver Run Road. The flare stack was observed as being dismantled at 11:00 am when driving to the Mamont compressor site. The stack was entirely removed by 2:56 pm when the spot survey next to this site was conducted. The results are shown in Figure 7 below. An average concentration of about 7 ppm was observed over a 10-minute scan. Again, the rising concentration from 0.0 ppm to 4.7 ppm over the first 3 minutes of the scan

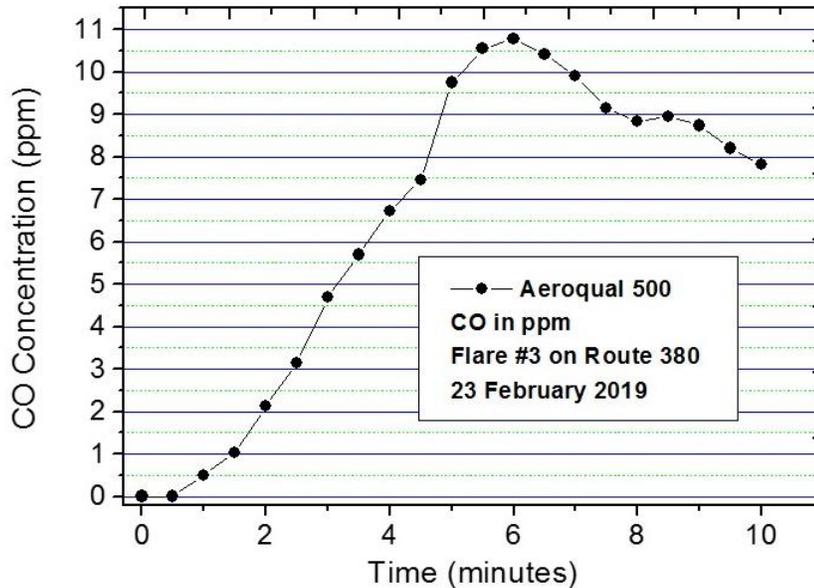


Figure 7. Carbon Monoxide concentrations as recorded using the Aeroqual monitor for flare #3 just off Route 380 on 23 February.

represents the response time of the detector adjusting to the average concentration at the monitor.

After the CO scan at this flare site, a spot survey for CH<sub>4</sub> was conducted at the same place, as a strong smell of mercaptan permeated the area. The monitor read 0 ppm CH<sub>4</sub> for the entirety of the 13-minute scan.

## 6. Summary of Results

During the spot and walking surveys conducted on 23 February at the Mamont compressor and at the two flare sites directly east and south of the Shaw pad, no significant concentrations of SO<sub>2</sub> were detected. (There were a few readings close to the detection limit of the instrument measured along the blue pathway in Figure 1.) Additionally, no CH<sub>4</sub> was detected at the flare site on route 380 despite a strong smell of Mercaptan in the area.

Average CO concentrations around 1.5 to 2.5 ppm around the Mamont compressor, 3 to 4 ppm near the flare site east of the Shaw pad, 1.5 to 5 ppm near the

flare site south of Shaw pad (with higher concentrations at higher elevation) and 8 to 10 ppm at the flare off route 380 were recorded. It should be noted that CO measurements made at these sites on 7, 10 and 23 February have a different character than the CO measurements made at the Mamont compressor station using the Lascar Electronics CO data loggers. During normal operation of the compressor, CO levels between 2 and 10 ppm are recorded using the CO loggers, with steady 10 ppm levels recorded nearest the compressor under ideal conditions. However, when the compressor ends a compression-and-exhaust cycle, the measured CO levels fall to zero within minutes.

In contrast, the CO levels surveyed during and after the flares are also at low levels but are persistent in time and have persisted for relatively long durations after the flares have been extinguished. (This author does not know the dates when the flares were extinguished.)

Finally, the Consumer Product Safety Commission states

*“Most people will not experience any symptoms from prolonged exposure to CO levels of approximately 1 to 70 ppm but some heart patients might experience an increase in chest pain. As CO levels increase and remain above 70 ppm, symptoms become more noticeable and can include headache, fatigue and nausea.”<sup>4</sup>*

All of the CO concentrations recorded on 7, 10 and 23 February are well below 70 ppm. On this basis, the CO levels around the Shaw pad are safe for most people. Additionally, the CO concentrations should be reduced farther away from the flare sites.

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<sup>4</sup> <https://www.cpsc.gov/Safety-Education/Safety-Education-Centers/Carbon-Monoxide-Information-Center/Carbon-Monoxide-Questions-and-Answers>

