SPECIAL COMMUNICATION – TERRAGRAPHICS MOBILE LABORATORY MONITORING FOR SEPTIC REPAIR APRIL 17, 2019, AND APRIL 18, 2019

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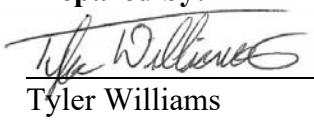

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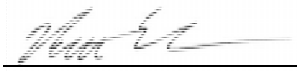

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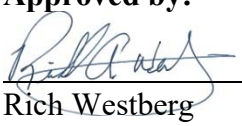

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Acronyms

ML	Mobile Laboratory
MDL	Method Detection Limit
OSC	Organosulfur Compound
SME	Subject Matter Expert

1.0 APRIL 17, 2019 – SEPTIC REPAIR MONITORING

On April 17, 2019, and April 18, 2019 a sewer line repair was performed (2607 E6 Pipe) between the 2607 E6 lift station and the 2607 E1A sewer facility (Figure 1-1). During repair activities, the TerraGraphics Mobile Laboratory (ML) sampled downwind of the activities without interfering with the work. This limited the access available to the ML. On April 17, 2019, the work took place between 12:36 and 13:20; however, the ML Operators were instructed to remain monitoring downwind from 11:40 until 14:00. Figure 1-1 displays the location of the work activity.

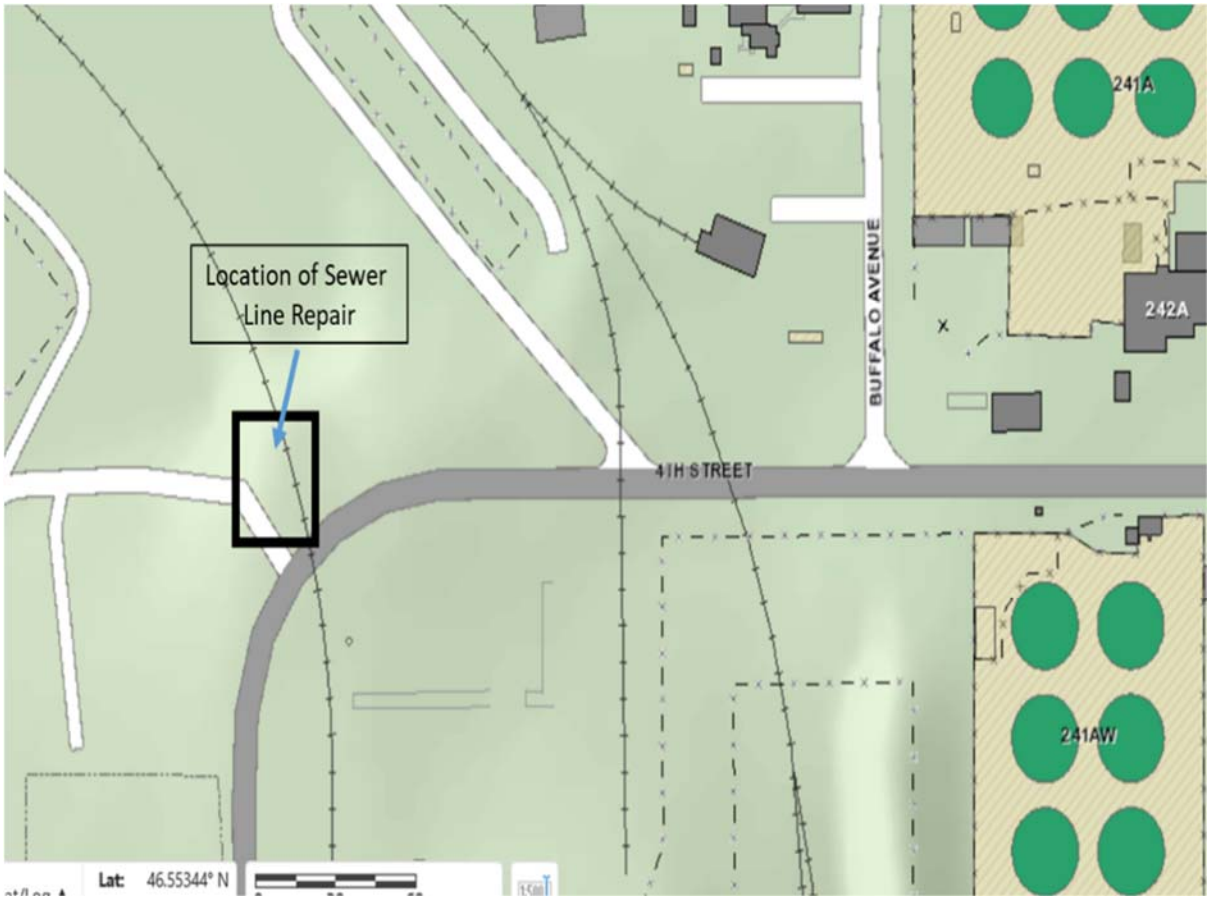

Figure 1-1. Location of the Septic Line Repair on April 17, 2019, and April 18, 2019.

Figure 1-2 shows a mass spectrum of the maximum value observed at all m/z between 11:40 and 14:00.

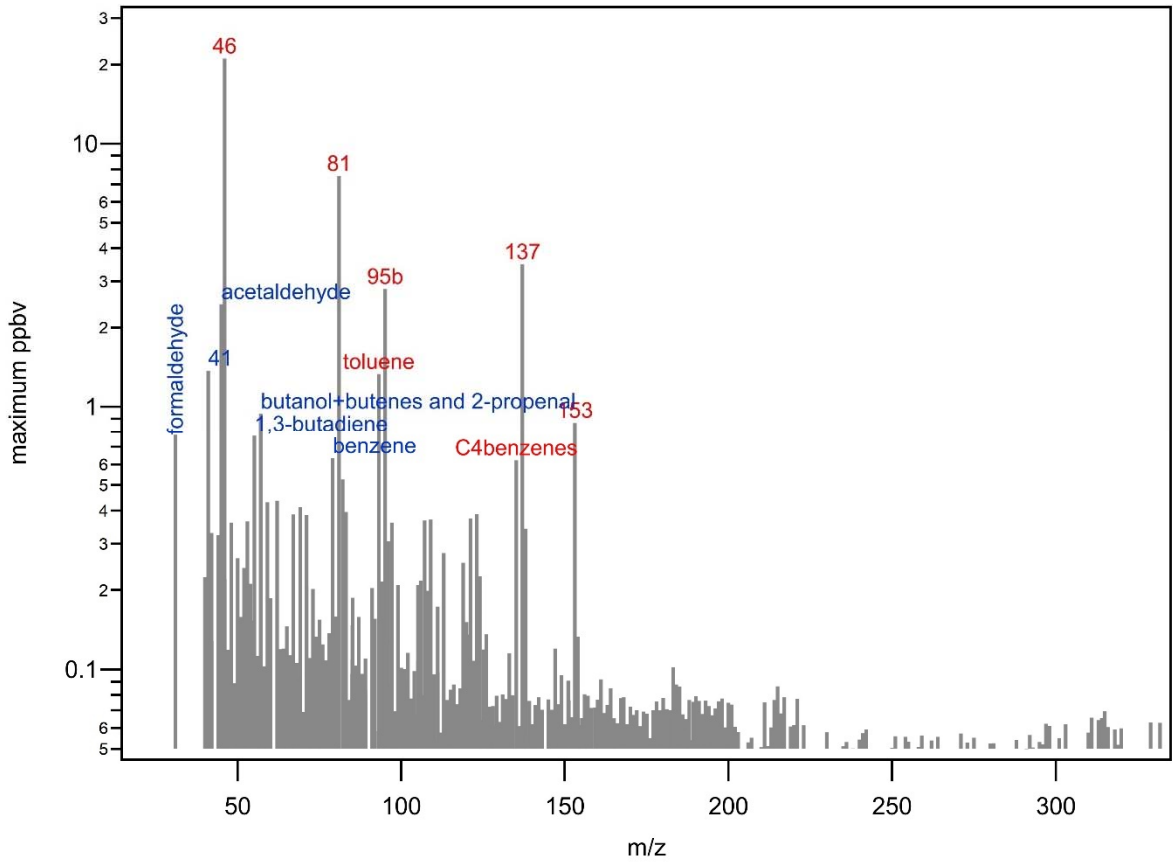

Figure 1-2. Mass Spectrum of the Maximum Value Observed Downwind of the Septic Repair Activities Between 11:40 and 14:00 on April 17, 2019.

The Subject Matter Expert (SME) visually inspected the prominent m/z values in the spectrum to determine if the response was a result of work activity. Species were eliminated if it was determined that there was no response due to those activities. The highest signals occurred at nominal m/z 46, m/z 81, and m/z 137. It is unknown what species responds at m/z 46, but responses at m/z 81 and 137 are typically associated with monoterpenes. The location of the sewer repair was close to sagebrush, shown below in Figure 1-3, which could be the explanation for the presence of monoterpenes.

Figure 1-3. The Location of the Septic Repair Site is Represented by the Coned-off Section.

Looking for maximum values in the spectrum can determine the important observed species, but it provides limited explanation with regard to the behavior of the species. To further investigate this time period, the labels of the species shown in Figure 1-2 were color coded to signify similar behavior in the time series data, then examined separately. Figure 1-4 below shows a time series plot of the species labeled in red in Figure 1-2.

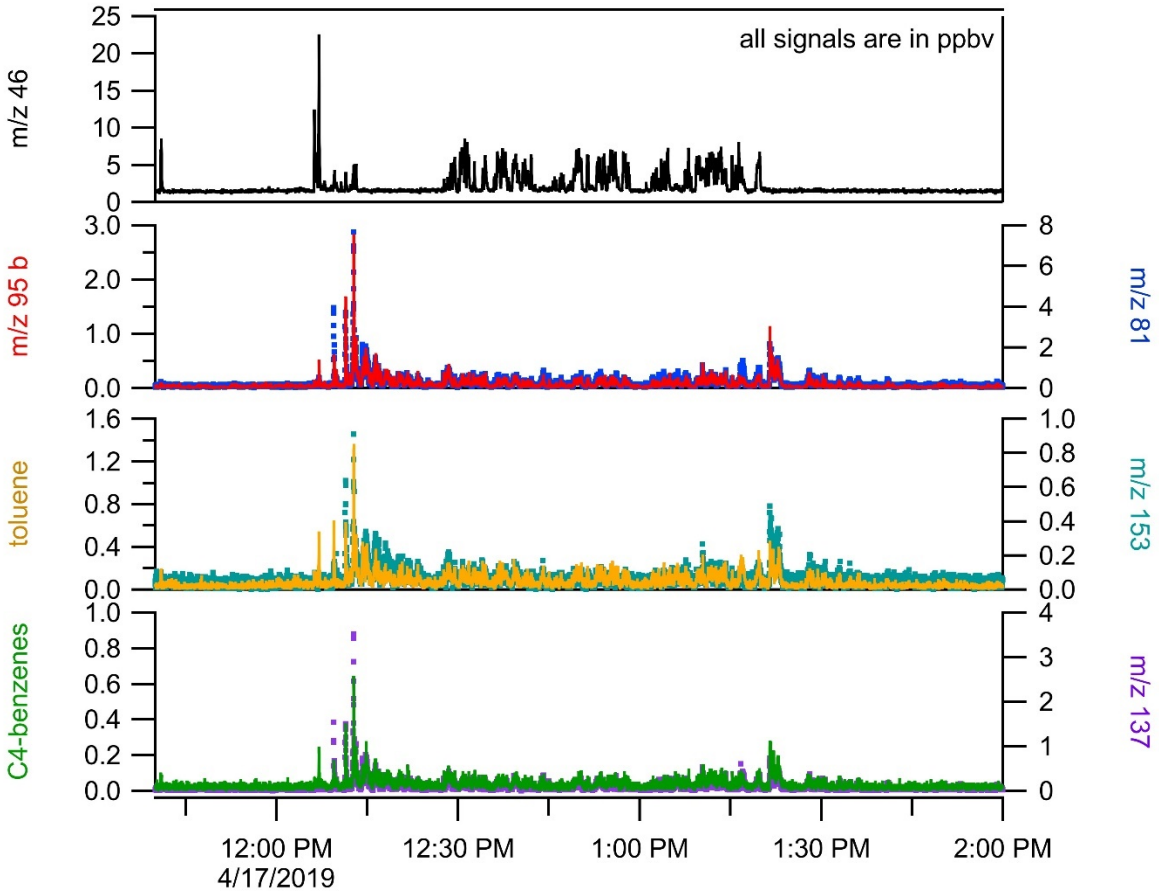

Figure 1-4. Time-series of Key Species Observed During Monitoring Downwind of the Septic Line Repair Activities on April 17, 2019.

Except for nominal m/z 46, all the traces in Figure 1-4 show very similar behavior. The strong presence of both m/z 81 and m/z 137 suggested biogenic emissions from the sagebrush. Toluene and C_4-benzenes are typically anthropogenic with vehicles being a primary explanation for the presence of both. However, vehicle emissions would also include similar emissions of benzene, C_2-benzenes, and C_3-benzenes with their responses typically exceeding the C_4-benzenes, which is not the case during this monitoring period. Previous septic analysis has shown a large response at the toluene m/z 93 peak due to an organosulfur compound (OSC) fragment. However, methyl mercaptan and dihydrogen sulfide, which are dominant species within the septic fingerprint, did not show any response during the monitoring period. Given the location of the ML during monitoring, there is sagebrush between the septic repair site and the ML; therefore, it is likely that the air masses observed are a mixture of sagebrush and septic emissions. If all the traces in Figure 1-4 are a result of septic and sagebrush, then the response at nominal m/z 46 would be from a different source. A dominant signal at m/z 46 has not been observed in previous sources, but the machinery utilized in the work activity could be a potential cause.

Figure 1-5 shows a time series of the species labeled in blue in Figure 1-2.

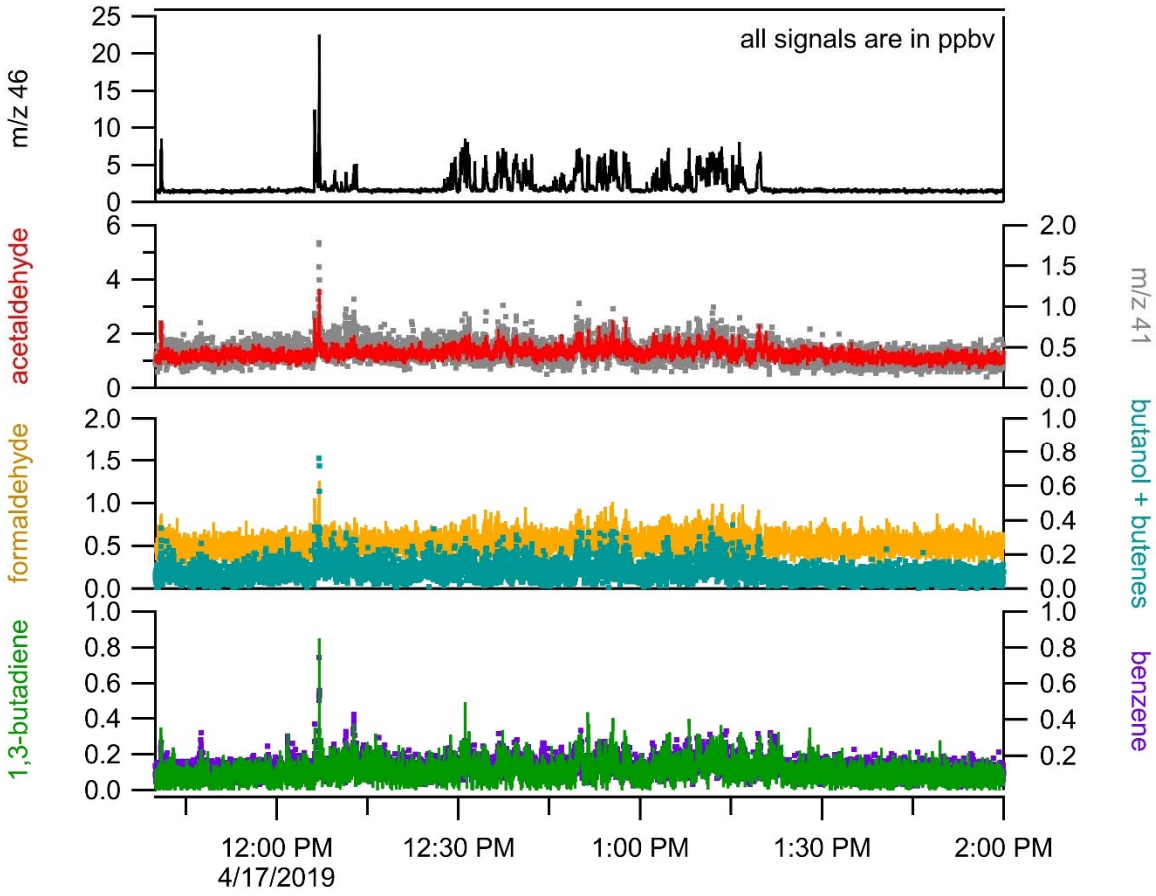

Figure 1-5. Time-series of Key Species Observed During Monitoring Downwind of the Septic Line Repair Activities on April 17, 2019.

These species, except m/z 46, were not very prominent but showed similar response. When compared to the response at m/z 46, there seems to be some similarity. There is a strong plume around 12:07 for all the species that suggests a similar source. In addition, the smaller plumes of m/z 46 between 12:27 and 13:20 seem to be present within the other species although to a minimal extent. The presence of formaldehyde, acetaldehyde, and benzene would suggest some form of fuel combustion, which could be explained by the machinery utilized for the dig. With the species in Figure 1-4 being representative of the expected septic and biogenic emissions, the species in Figure 1-5 complete the list of expected emission sources.

2.0 APRIL 18, 2019 – SEPTIC REPAIR MONITORING

On April 18, 2019, at 07:35, the repair of the septic line began at the same time the ML began sampling from the 208' inlet that was positioned at various points around the septic repair site. The septic repair work was complete by 9:00, but the ML monitoring continued until 10:00. A common effect of connecting to long sample lines is an initial conditioning period. This is a function of evacuating the initial contents with the tube and turning on the heating. By 08:00, all the conditioning effects seemed to be complete. Figure 2-1 shows a mass spectrum of the maximum value observed at all m/z between 08:00 and 10:00.

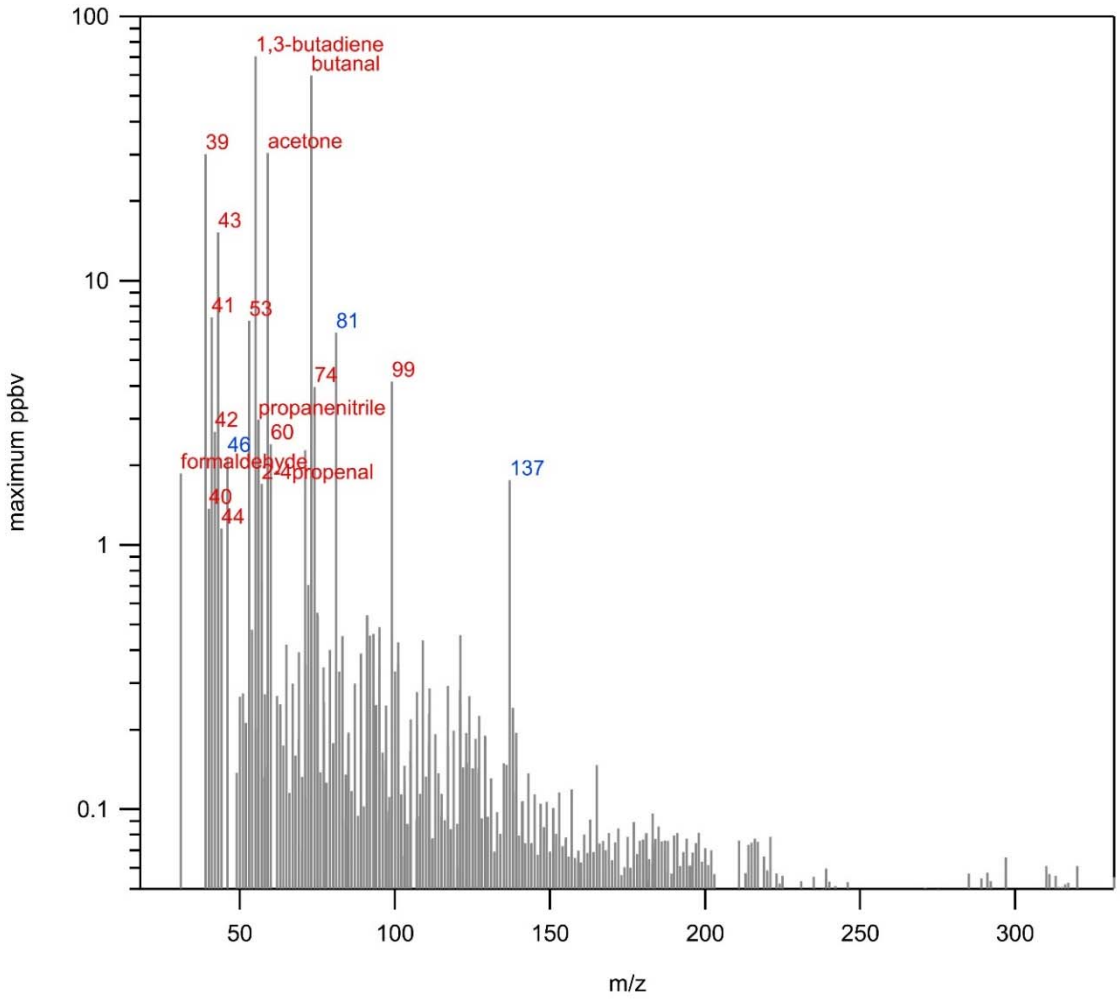

Figure 2-1. Mass Spectrum of the Maximum Value Observed Downwind of the Septic Repair Activities Between 08:00 and 10:00 on April 18, 2019.

The SME visually inspected the prominent m/z values to determine if the response was a result of work activity. Species were eliminated if it was determined there was no response due to those activities. The dominant species observed were 1,3-butadiene, butanal, acetone, nominal m/z 39, and nominal m/z 43. The species labeled in red in Figure 2-1 all showed a similar response while the ones labeled in blue followed different trends.

Figure 2-2 shows the response of the important species from Figure 2-1.

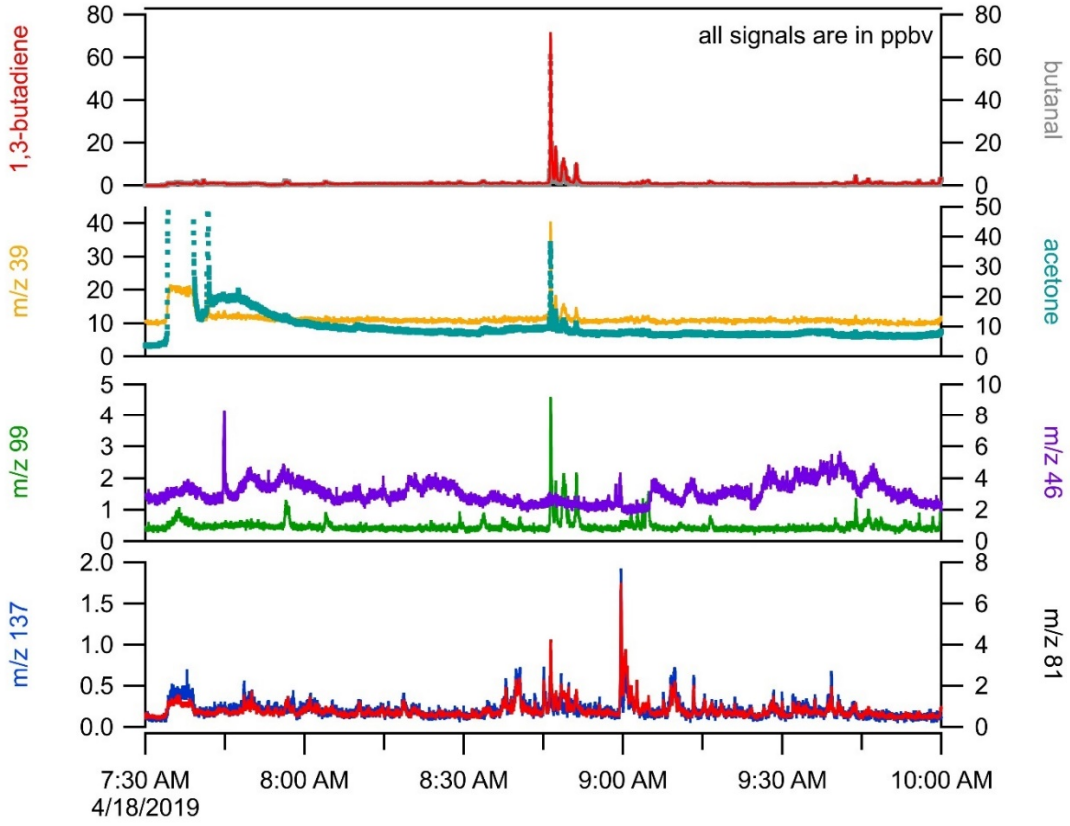

Figure 2-2. Time-series of Key Species Observed During Monitoring Downwind of the Septic Line Repair Activities on April 18, 2019.

The largest responses began at 08:46 which was associated with a strong biogenic smell observed by the ML Operators. This would suggest the 1,3-butadiene, butanal, acetone, m/z 39, and m/z 99 responses are biogenic related, which would suggest that it is not these species causing the response. Methyl ethyl ketone is a known biogenic emission and produces a response at m/z 73, the same as butanal. This is the first observation of a strong signal from the sagebrush observed by the ML and further research is required to determine the cause of the responses for 1,3-butadiene, m/z 39, and m/z 99. However, the presence of m/z 81 and m/z 137 complicates this explanation. As explained with their presence on April 17, 2019, monoterpenes are a biogenic emission and respond at m/z 81 and m/z 137. Given that the sagebrush would be a constant source and m/z 81 and m/z 137 were prominent both days, it is likely that these emissions are typical sagebrush emissions. If this is the case, then it does detract from the explanation of the 1,3-butadiene, butanal, acetone, m/z 39, and m/z 99 responses being from the sagebrush. There was a substantial amount of activity and walking around the septic repair site by the ML Operators and other personnel associated with the work. This inevitably resulted in crushing and breaking of sagebrush branches. Plants under this level of stress can emit different species, which could explain the 1,3-butadiene, butanal, acetone, m/z 39, and m/z 99 responses. This hypothesis could be tested by sampling sagebrush emissions before, during, and after subjecting sagebrush to intentional stress to monitor the differences.

The highest signal on April 17, 2019, was m/z 46, but it was not prominent during the April 18, 2019, observations. However, the trend of m/z 46 in Figure 2-2 shows that there was a slight response and the data from April 17, 2019, suggested the source was fuel combustion related. Given the proximity of the monitoring, the machinery used during the septic repair would have produced much higher and short-lived responses at m/z 46 than the responses in Figure 2-2. It does not appear to be the same source and additional investigation is needed. During the monitoring period, no responses in the dominant species within the septic fingerprint (methyl mercaptan, dihydrogen sulfide, and OSC fragment at m/z 93) were observed.