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**PRAMP Technical Working Group**

***Canister Sampling Program: Methane-Based Trigger***

**Recommendation Report**

September 26, 2018

As heavy oil process improvements and vapor mitigation measures were implemented in the Three Creeks area, PRAMP’s air monitoring network showed a marked decline in the ambient concentration of hydrocarbons. A key component of the regional monitoring network is the triggered canister *‘whole air’* sampling program. Results from canister analysis have historically been used to assess potential odours and emissions profiles from different sources.

The canister sampling program collects a 1-hour sample of air when the continuously measured non-methane hydrocarbon (NMHC) concentration reaches a trigger point; the current trigger point for all stations is 0.3 parts per million (ppm) averaged over a 5-minute period. As the ambient concentration of hydrocarbons declined, fewer canisters were collected over time.

In theory, the NMHC component of the continuous hydrocarbon measurement is inclusive of all non-methane gases. However, due to the way in which the continuous sensor operates and is calibrated, some species may not be detected. To address this, PRAMP would like to implement a second trigger point based on methane. Methane is often used as a surrogate performance indicator for fugitive emissions management in areas of oil and gas production. The rationale for implementing a methane-based trigger is predicated on the hypothesis that some non-methane species may be present during elevated methane events, even when the continuous analyzer measures low or sub-detection limit NMHC concentrations.

As a first step to recommending a suitable methane-based trigger, different percentile values for 5-minute average data were examined. Percentiles provide some insight of data spread, particularly in environmental monitoring when most values are either near zero or the regional background. The initial screening of monitoring data showed that the Reno Station had a greater frequency of elevated 5-minute average data compared to Stations 842 and 986 (Table 1). Given this observation, subsequent analysis focused on using the historical continuous monitoring data from the Reno Station to determine a budget-limited network-wide methane-based trigger recommendation.



**Table 1: Summary of selected percentiles for 5-minute average methane concentrations and count of measurements greater than selected percentiles for each station in the PRAMP network in 2015, 2016, 2017.**

The 2017 5-minute average percentile data for the Reno Station indicate that there are 100 measurements greater than 4.58 ppm and 11 measurements greater than 5.98 ppm (the 99.95 and 99.99 percentiles, respectively). The 2017-18 PRAMP budget allows for the collection of 30 paired canister samples and blanks; this budget is inclusive of the existing NMHC-based trigger program. Given the current collection rate of the NMHC-based canisters, the number of possible budget-constrained methane-based canisters is in the 10-20 range. Therefore, using 2017 data as an indicator, a methane-based trigger is likely between 5.00 ppm and 6.00ppm, averaged over a 5-minute period. Table 2 summarizes the number of times the 5-minute average was above or equal to 5.00 ppm, 5.50 ppm, 6.00 ppm.



**Table 2: Summary of 5-minute average counts above or equal to 5.00 ppm, 5.50 ppm, 6.00 ppm at each station in the PRAMP network in 2015, 2016, 2017.**

A closer examination of the counts calculated and summarized in Table 2 reveals that not each 5-minute concentration greater than the respective threshold (5.00 ppm, 5.50 ppm, and 6.00 ppm) is a discrete occurrence. Oftentimes, elevated concentrations occur as events that last for several adjacent or nearly-adjacent 5-minute segments. Table 3 presents two examples of this; seven occurrences of methane concentrations above 5.00 ppm are listed with their respective timestamps. The concentrations presented in Table 3 are adjacent to one another or clustered within an hour, and therefore, the seven 5-minute average concentrations greater 5.00 ppm represent two events that can be sampled. NMHC concentrations are presented only for reference.



**Table 3: Example of ‘clustered’ 5-minute average data greater than 5.00 ppm.**

In order to approximate the effect of *clustering* during events, Table 4 provides a summary of the manual review for each count presented in Table 2; the manual review considers adjacent and near adjacent 5-minute average segments at or above a given threshold. Therefore, counts presented in Table 4 indicate the expected number of canisters collected in 2015, 2016, and 2017 (and 2018 year-to-date for Reno only) for methane-based triggers set at 5.0 ppm, 5.5 ppm, and 6.0 ppm.



**Table 4: Expected count of canisters collected in the PRAMP network using methane-based 5-minute average triggers set at 5.00 ppm, 5.50 ppm, and 6.00 ppm**.

Based on the analysis of historical data, it is recommended that

1. PRAMP implements a 5-minute methane-based trigger of 5.50 ppm to supplement its existing canister sampling program.
2. PRAMP monitors the frequency and total number of canisters collected. A trigger based on a 5-minute average of 5.50 ppm should produce 10-20 samples during elevated methane events over the course of a year (this assumes a continuation of the methane concentration patterns observed in the network over the last three years). 10-20 samples is within budget given the lower number of canisters being collected using the existing NMHC-based trigger.
3. PRAMP compiles and analyzes the data from methane-based triggered canisters to determine if
   1. there are elevated concentrations of non-methane species, and;
   2. the methane-based trigger program should continue, cease, or be modified.

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