December 22, 2023
File No. 01204123.21

Via E-Mail
Mr. Steve Cassulo
District Manager
Chiquita Canyon Landfill
29201 Henry Mayo Drive
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Subject: **Dimethyl Sulfide and Volatile Organic Compound Continuous Monitoring Feasibility and Availability Report, Chiquita Canyon Landfill, Castaic, California**

Dear Steve:

This report has been prepared by **SCS Engineers (SCS)** on behalf of Chiquita Canyon, LLC (Chiquita) to document the investigation of the feasibility of conducting continuous monitoring of total reduced sulfur (TRS) as a potential surrogate for continuous dimethyl sulfide (DMS) monitoring, and the feasibility of continuous monitoring of benzene, toluene, ethylbenzene, and total xylenes (BTEX) in the community surrounding the Chiquita Canyon Landfill (Landfill).

This report was prepared in compliance with our August 25, 2023 Workplan for Enhanced Air Monitoring Plan (EAMP or Workplan), in which we recommended the temporary installation of both continuous total reduced sulfur (TRS) and BTEX monitors to evaluate their overall efficacy.

SCS has completed the required investigation of the feasibility and availability of implementing a continuous community emission monitoring system by conducting a review of both sensor availability and surrogate monitoring capability reflected in this report. The results of both TRS and BTEX monitoring evaluations are discussed separately below.

DMS/TRS MONITORING EVALUATION

Based on SCS's investigation and experience, real-time monitoring for the estimation of DMS concentrations in the community and along the property fenceline is not feasible, as there are no real-time DMS ambient air monitoring sensors currently available commercially. In addition, our trial of surrogate monitoring proved unsuccessful. A summary of the data reviews completed to support this conclusion are provided below.

Sensor Availability Review

SCS performed online searches for potential sensor availability and reviewed the United States Environmental Protection Agency (EPA) Air Sensor Toolbox and the South Coast Air Quality Management District (SCAQMD) Air Quality Sensor Performance Evaluation center (AQ-SPEC) for potential monitoring methods and sensors. A summary of these reviews is presented below.

EPA Air Sensor Toolbox

The EPA Air Sensor Toolbox (Toolbox) website is a compendium of information on the latest science on the performance, operation, and use of air sensor monitoring systems. The Toolbox is community-focused and emphasizes criteria pollutant monitoring. Review of the data on the Toolbox website did not identify any DMS-specific sensors. Several sensor manufacturers listed on the website were contacted by SCS for further inquiry.

SCAQMD AQ-SPEC

The SCAQMD AQ-SPEC website provides a continuously updated listing of, "widely commercially available low-cost air quality sensors," that have been evaluated by the SCAQMD. The AQ-SPEC website is focused primarily on volatile organic compound (VOC) sensors and criteria pollutant sensors. Of these, only Hydrogen Sulfide (H_2S) and Sulfur Dioxide (SO_2) were listed. Similar to the Toolbox website, several sensor manufacturers listed on the AQ-SPEC website were contacted by SCS for further inquiry.

Vendor, Contractor, and Consultant Review

As a result of the review of the Toolbox and AQ-SPEC, as well as our industry knowledge of landfill air sampling and ambient air sampling in general, SCS contacted the following vendors, contractors, and consultants for air monitoring equipment for advice on the direct measurement of DMS.

1. **Teledyne API.** Teledyne specializes in air quality and process gas monitoring instrumentation. Sulfur compound instrumentation available includes H_2S, SO_2, Total Reduced Sulfur (TRS), and Total Sulfur (TS).
2. **Thermo Fisher Scientific.** Thermo Fisher Scientific is a provider of laboratory-grade analytical instrumentation and field instrumentation. Ambient air monitoring capabilities for sulfur compounds include only SO_2.
3. **Aeroqual LTD.** Aeroqual provides real-time air monitoring solutions for multiple constituents. Ambient air monitoring capabilities for sulfur compounds are limited to H_2S and SO_2.
4. **Specto Technology.** Specto Technology provides hardware and software solutions for the geotechnical, structural, and environmental industries. Ambient air monitoring capabilities are limited to SO_2.
5. **Met One Instruments.** Met One Instruments is a provider of ambient air quality monitoring equipment. Ambient air monitoring capabilities for sulfur compounds include H_2S, SO_2, and TRS.
6. **Applied Analytics.** Applied Analytics specializes in industrial process analysis instrumentation. Air monitoring capabilities for sulfur compounds include carbon disulfide (CS_2), H_2S, carbonyl sulfide (COS), SO_2, and ethanethiol (CH_3CH_2SH), or ethyl mercaptan. In addition, detection limits are only down to the part per million (ppm) level and significantly lower detection limits are needed to assess odor impacts.

Of the vendors, contractors, and consultants contacted, none had an ambient air monitor that could be used specifically for continuous DMS detection. Most were focused on either H_2S, SO_2, or TRS analysis in ambient air. Applied Analytics had sensors capable of detecting the most diverse range of sulfur compounds, but none had DMS detection capabilities.

SURROGATE MONITORING

Because we were unable to identify any instruments that were capable of directly monitoring for DMS on a continuous basis, we considered whether it would be feasible to conduct continuous monitoring for a surrogate compound and, using that surrogate, estimate the quantity of DMS in the air (if any) on a continuous basis. TRS is used to detect any sulfur compounds, such as DMS, and can therefore be a surrogate for monitoring DMS. Absence of TRS detections suggests there is no DMS in the environment above the detection limit. However, detectable levels of TRS are not always indicative of DMS, since other reduced sulfur compounds could be causing those detections.

In September 2023, SCS initiated weekly sampling for DMS and TRS at the twelve ambient air monitoring stations located around the perimeter of the Landfill and in the community around the Landfill. SCS also co-located continuous TRS sensors at two of the existing air monitoring stations; one at the Landfill perimeter (MS-04, located on the northwestern area of the Landfill), and one in the Val Verde community (MS-12). These stations were selected for co-location of TRS monitors since they have exhibited the highest H_2S concentrations historically as part of the Community Air Monitoring Program (CAMP), which is implemented pursuant to Chiquita's Conditional Use Permit (CUP), which would be indicative of potential landfill gas impacts. These TRS monitors are located within the same enclosure as the two existing air monitoring stations used for the CAMP.

The goal of the installation was to attempt to determine if a correlation factor could be identified for DMS laboratory analytical from the weekly sampling at MS-04 and MS-12 as compared to TRS continuous monitoring data at MS-04 and MS-12. To this end, SCS has collected a total of 26 grab samples (13 samples from each monitoring station each week) between September 1, 2023 and December 12, 2023. In addition, a total of 14, 24-hour composited samples were collected from monitoring station MS-12, for a total of 40 samples collected. Samples collected were analyzed for TRS and sulfur compounds via SCAQMD Method 307.91.

Out of the 40 samples analyzed, DMS was not detected in any sample. Therefore, given the absence of detectable DMS in air samples, a correlation analysis between DMS and TRS could not be conducted. Copies of the analytical data are included in **Attachment A**.

In addition, it should be noted that there is only a limited dataset of continuous TRS monitoring data due to low power conditions at both MS-04 and MS-12. The continuous TRS monitor requires a climate-controlled enclosure in addition to having significant power requirements for the unit itself. While the existing solar power configuration was expanded to attempt to provide additional power, even with additional solar, there is not enough consistent power to make continuous TRS monitoring reliable.

BTEX MONITORING EVALUATION

Similar to the TRS/DMS evaluation, in September 2023, SCS initiated weekly sampling for BTEX at the twelve ambient air monitoring stations located around the perimeter of the Landfill and in the community around the Landfill. SCS also co-located continuous BTEX sensors at two of the existing air monitoring stations: MS-04 and MS-12. These stations were selected for co-location of BTEX sensors since they have exhibited the highest H_2S concentrations historically as part of the CAMP. These BTEX sensors are located within the same enclosure as the two existing air monitoring stations used for the CAMP.

The goal of the installation was to attempt to evaluate the accuracy of real-time BTEX measurements compared to both grab and time-composited BTEX laboratory analysis. To this end, SCS has collected a total of 26 weekly grab samples (13 samples from each monitoring station) between September 1, 2023 and December 12, 2023. In addition, a total of 14, 24-hour composited samples were collected from off-site monitoring station MS-12, for a total of 40 samples collected. Samples collected were analyzed for VOCs, including BTEX, using EPA Method TO-15.

24-Hour Composite Sample Results

As part of the EAMP, 24-hour composite samples are collected on a weekly basis at MS-12. Between September 1, 2023 and December 12, 2023, a total of 14 weekly composite samples were collected. Out of the 14 samples, Toluene was the only BTEX constituent detected. Comparative continuous data for these detections were all reported below the continuous monitoring instrument detection limit, making a comparison impossible.

Grab Sample Results

As part of the EAMP, discrete grab samples are collected on a weekly basis at MS-04 and MS-12. Between September 1, 2023 and December 12, 2023, a total of 13 weekly grab samples were collected at each location, for a total of 26 samples. Out of the 26 samples analyzed, the BTEX sensor was non-operational for several of the sampling events, due to power issues. **Table 1** provides a comparative summary of continuous and analytical data during instances where samples were collected and the BTEX sensor was online. Copies of the analytical data are included in **Attachment A.**

Table 1. Laboratory and Continuous BTEX Data Comparison

Monitoring Station	Sample Date	Benzene		Toluene		Ethylbenzene		Xylenes	
		Lab	Sensor	Lab	Sensor	Lab	Sensor	Lab	Sensor
		(parts per billion, by volume)							
MS-04	09/26/23	<0.50	4.11	52.0	4.47	<0.50	0.35	<1.00	3.61
	10/03/23	<0.50	0.72	45.3	0.27	0.52	0.05	<1.00	0.82
	10/10/23	5.17	1.60	50.8	0.53	<0.50	0.14	<1.00	1.85
	10/17/23	0.66	2.04	26	1.16	0.76	0.11	1.05	0.58
	10/24/23	<0.50	8.99	35.6	1.08	<0.50	0.27	<1.00	1.11
	11/07/23	<0.50	3.60	27.9	0.78	<0.50	0.14	<1.00	0.51
	11/14/23	2.54	5.21	19.0	7.10	0.58	0.63	2.14	1.12
	11/28/23	<0.50	3.76	0.75	4.86	<0.50	0.57	<1.00	0.24
	12/5/23	<0.50	0.15	18.6	<0.10	<0.50	<0.10	<1.00	0.20
	12/12/23	7.05	5.17	2.95	1.10	<0.50	0.19	<1.00	0.72
MS-12	09/05/23	0.97	0.12	13.6	<0.10	<0.50	<0.10	2.11	<0.10
	09/19/23	<0.50	<0.10	14.8	<0.10	<0.50	<0.10	<1.00	0.18
	10/10/23	<0.50	<0.10	19.4	<0.10	0.56	<0.10	<1.00	0.20
	10/17/23	6.49	<0.10	29.4	<0.10	1.04	<0.10	2.59	0.21
	10/24/23	0.83	<0.10	13	<0.10	0.69	<0.10	<1.00	0.20
	11/14/23	0.54	<0.10	11.7	<0.10	<0.50	<0.10	<1.00	<0.10
	11/21/23	<0.50	<0.10	11.4	<0.10	<0.50	<0.10	<1.00	0.16
	11/28/23	<0.50	<0.10	11.4	<0.10	<0.50	<0.10	<1.00	0.11
	12/05/23	<0.50	<0.10	7.92	<0.10	<0.50	<0.10	<1.00	0.21
	12/12/23	<0.50	<0.10	<0.69	<0.10	<0.50	<0.10	<1.00	0.22

Readings with the symbol "<" indicate sample was below the detection limit listed.

As shown in **Table 1**, there are no direct comparisons between the continuous monitoring data and BTEX grab samples collected. By way of example, in MS-04, Benzene and Xylene levels were generally higher in continuous data, but generally lower for Toluene and Ethylbenzene. For MS-12, there were not enough sensor detections to provide commentary on reliability.

CONCLUSIONS

Continuous TRS Monitoring

Based upon SCS's evaluation of continuous TRS monitoring as a surrogate for DMS monitoring, we cannot establish a correlation between TRS and DMS. This is due to both the lack of TRS detections in laboratory samples and due to the power requirements of the TRS continuous sampling. Therefore, continuous TRS monitoring is not considered a feasible surrogate for continuous DMS monitoring. SCS recommends removal of the TRS continuous monitoring stations. We will continue to collect 24-hour composite and grab samples for laboratory analysis of TRS and DMS as part of the EAMP.

Continuous BTEX Monitoring

Based upon SCS's evaluation of continuous BTEX monitoring, there is no correlation of data in regard to laboratory versus continuous data, and we are concerned that future collection of continuous

BTEX data will only serve to confuse the data review process. Since the laboratory is state-certified and provides quality assurance and quality control (QA/QC) data along with its reports, the laboratory data is much more reliable than the continuous monitoring data. Therefore, we recommend removal of the BTEX continuous monitoring stations. We will continue to collect 24-hour composite and grab samples for laboratory analysis of BTEX as part of the EAMP.

If you have any questions in regard to this submittal, please contact either of the undersigned at (562) 426-9544.

Sincerely,

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