EXHIBIT 1

COUNTY OF SANTA BARBARA CALIFORNIA

BOARD OF SUPERVISORS
AGENDA LETTER

Agenda Number:

Clerk of the Board of Supervisors
105 E. Anapamu Street, Suite 407
Santa Barbara, CA 93101
(805) 568-2240

Department Name:	Planning and Development
Department No.:	053
For Agenda Of:	August 20, 2019
Placement:	August 20, 2019
Estimated Time:	3 hours
Continued Item:	No
If Yes, date from:	N/A
Vote Required:	Majority

TO:	Board of Supervisors	
FROM:	Department Director	Lisa Plowman, Director, Planning and Development (805) 568-2086
	Contact Info:	Jeff Wilson, Assistant Director, Planning and Development (805) 568-2085
SUBJECT:	**G&K Farm/K&G Flower Cannabis Cultivation Appeal, Case No. 19APL-00000-00018, First Supervisorial District**	

County Counsel Concurrence
As to form: Yes

Auditor-Controller Concurrence
As to form: N/A

Other Concurrence: N/A

Recommended Actions:

On August 20, 2019, staff recommends that your Board take the following actions:

a) Deny the appeal, Case No. 19APL-00000-00018;

b) Make the required findings for approval of the project, Case No. 18CDP-00000-00077, included as Attachment 1, including California Environmental Quality Act (CEQA) findings;

c) Determine that the previously certified Program Environmental Impact Report (PEIR) (17EIR-00000-00003) constitutes adequate environmental review and no subsequent Environmental Impact Report or Negative Declaration is required pursuant to CEQA Guidelines Sections 15162 and 15168(c)(2); and

d) Grant *de novo* approval of the project, Case No. 18CDP-00000-00077, subject to the conditions included as Attachment 2.

Summary Text:

A. Proposed Project

The project is for a proposed cannabis operation by Magu Farms, LLC, to allow the use of 5 existing greenhouses totaling 356,070 square feet for cannabis cultivation, with nursery, mixed-light cultivation, and off-site distribution. A security fence ranging from six to eight feet in height, part of which is existing, is proposed around the perimeter of the cannabis operation. The odor abatement unit would be located within an existing shade structure. Two (2) existing water tanks and four (4) proposed water tanks would be used as part of the cannabis operation. The existing agricultural warehouse of 16,896 square feet is not proposed to be used as part of the cannabis cultivation operations approved under this Coastal Development Permit. The cannabis operation would utilize 15-22 line or contract employees and six to eight managerial and executive staff, depending on the season. The hours of operation would be from 6:00am to 3:30pm for line or contract staff and 6:00am to 8:00pm for managerial and executive staff, depending on the season. Water for the cannabis cultivation operations would be served by an existing agricultural water well. Domestic water will continue to be served by Carpinteria Valley Water District. The parcel will continue to be served by an existing septic system and the Carpinteria/Summerland Fire Protection District. No grading, tree removal, or vegetation removal is proposed as part of this project. Access will continue to be provided off of Via Real. The property is a 14.66 acre parcel zoned AG-I-10 and shown as Assessor Parcel Number 005-280-040, located at 3480 Via Real with a secondary address of 3561 Foothill Road, Carpinteria, First Supervisorial District.

B. Background:

On February 6, 2018 the Santa Barbara County Board of Supervisors adopted a series of ordinances, including Section 35-144U [Cannabis Regulations] of Article II, the Coastal Zoning Ordinance, that regulate commercial cannabis operations within the County's unincorporated area. Section 35-144U of Article II, the Coastal Zoning Ordinance, was certified by the California Coastal Commission on October 10, 2018. The Applicant submitted a Cannabis Coastal Development Permit (CDP) application to the Planning and Development Department on December 14, 2018. Staff reviewed the Cannabis CDP application for compliance with Section 35-144U of Article II, the Coastal Zoning Ordinance, and the Director approved the application on March 6, 2019. The Director's approval was granted based upon the proposed cannabis operation complying with the applicable policies and standards contained in Article II, the Coastal Zoning Ordinance. The Coastal Development Permit was approved on March 6, 2019 with an appeal deadline of March 18, 2019, at 5:00 PM. A timely appeal of the Director's approval was filed by the Appellant on March 18, 2019.

The project was heard by the Planning Commission on June 5, 2019, at which time the Planning Commission denied the appeal, Case No. 19APL-00000-00009 and made the required findings for approval of the project. Upon further review of the Planning Commission Staff Report dated May 28, 2019 (Attachment 4), incorporated herein by reference, staff identified that the third recommended motion was phrased incorrectly. The third motion that was made by the Planning Commission was as follows: "*Determine the project is exempt from CEQA pursuant to CEQA Guidelines Section 15162, 15164, and 15168(c)(2), included as Attachment C of the staff report dated May 29, 2019...*" (see Attachment 6). The motion should have included the following language: "*Determine that the previously certified Program Environmental Impact Report (PEIR) (17EIR-00000-00003) constitutes adequate environmental review and no subsequent Environmental Impact Report or Negative Declaration is required pursuant to CEQA Guidelines Sections 15162 and 15168(c)(2), included as Attachment C of the staff report dated May 28, 2019...*". The motion before the Planning Commission incorrectly used the term "exempt" instead of language stating that the "previously certified PEIR constitutes adequate environmental review". It should be noted that both the findings and Attachment C of the staff report did cite the correct sections of CEQA. Due to the fact that this project is on appeal for a "de novo" review and action by the Board of Supervisors, the corrected language related to CEQA review is being provided to the Board for consideration, as presented in recommended actions above.

During the June 5, 2019 hearing, the Planning Commission granted *de novo* approval of the project, Case No. 18CDP-00000-00077. The Planning Commission Staff Report dated May 28, 2019 and subsequent memorandum dated June 5, 2019 are included as Attachments 4 and 5 and provide an analysis of the project's consistency with Article II, the Coastal Zoning Ordinance. During the June 5, 2019 hearing, the Planning Commission considered evidence in the record, statements given by the Appellant and the Applicant, and public testimony with regard to the proposed project. The Appellant commented primarily on the project's odor and air quality impacts, and on June 17, 2019 the Appellant filed a timely appeal of the Planning Commission's *de novo* approval of the project to the Board of Supervisors.

C. Appellant Appeal Issues and Staff Responses

As noted above, the Appellant filed a timely appeal of the Planning Commission's *de novo* approval of the project, Case No. 18CDP-00000-00077. The appeal application (Attachment 7) contains a letter detailing why the Appellant believes the decision of the Planning Commission is not in accord with applicable law, including Article II, the Coastal Zoning Ordinance. These issues include alleged non-compliance with CEQA, inadequacy of the odor mitigation measures in the PEIR, lack of analysis or mitigation of air quality impacts, and inconsistency with the local coastal land use plan. Planning and Development staff has reviewed the appeal issues raised and has found that they are without merit. These appeal issues and staff's responses are summarized below.

Appeal Issues Regarding Noncompliance with CEQA: The Appellant contends that the County's decision to exempt the project from an EIR violates CEQA for the following reasons: 1) the County failed to conduct an adequate initial study and 2) the County's finding that it was not required to complete a tiered EIR is not supported by the evidence.

Staff Response for Appeal Issues Regarding Noncompliance with CEQA: As indicated above in the Background Section, staff's review of the motions and material presented to the Planning Commission in the staff report dated May 28, 2019 (Attachment 4), incorporated herein by reference, found that the third motion presented to the Planning Commission and the wording in the Environmental Analysis section incorrectly used the term "exempt" instead of stating that the previously certified Program Environmental Impact Report (PEIR) (17EIR-00000-00003) constitutes adequate environmental review and no subsequent Environmental Impact Report or Negative Declaration is required pursuant to CEQA Guidelines Sections 15162 and 15168(c)(2). The analysis and findings presented to the Planning Commission and to your Board in Attachments 3 and 4 discuss how the previously certified PEIR provides adequate environmental review and no subsequent environmental review is needed. The corrected motion is being presented to the Board of Supervisor's for your "de novo" review and action on the project with the appropriate findings (See Attachment 1).

On February 6, 2018, the Santa Barbara County Board of Supervisors certified a Program Environmental Impact Report (PEIR), Case No. 17EIR-00000-00003, which analyzed the environmental impacts of the Cannabis Land Use Ordinance and Licensing Program (Program). The PEIR was prepared in accordance with State CEQA Guidelines Section 15168 and evaluated the Program's impacts with regard to the following environmental resources and subjects:

- Aesthetics and Visual Resources
- Agricultural Resources
- Air Quality and Greenhouse Gas Emissions
- Biological Resources
- Cultural Resources
- Geology and Soils
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use
- Noise
- Transportation and Traffic
- Utilities and Energy Conservation
- Population, Employment, and Housing

The PEIR evaluated the direct and indirect impacts, as well as the project-specific and cumulative impacts, that would result from the implementation of the Program. The PEIR identified a number of significant impacts and set forth feasible mitigation measures that were included as development standards and requirements in the land use and licensing ordinances, which are applied to site-specific land use entitlement and business licensing applications for commercial cannabis operations authorized under the Program.

The PEIR evaluated the potentially significant impacts of cannabis operations, including cultivation, nurseries, manufacturing (volatile and non-volatile), distribution, testing, microbusinesses, and retail, in the unincorporated areas of the County. Impacts in the issue areas of aesthetics and visual resources, agricultural resources, air quality, biological resources, cultural resources, geology, energy conservation, public services, water resources, hazards and public safety, land use, and noise, were found to be reduced to less than significant levels with mitigation. In addition, Class I impacts were identified in the areas of agricultural resources, air quality and greenhouse gas emissions, noise, and transportation. These Class I impacts are listed below and are discussed in more detail in the PEIR's Executive Summary (Attachment 8):

- Impact AG-2. *Cumulative cannabis-related development would potentially result in the loss of prime agricultural soils. However, the Project would not result in conversion to non-agricultural use or impair agricultural land productivity (whether prime or non-prime).*

- Impact AQ-1. *Cannabis activities could be potentially inconsistent with the Clean Air Plan and County Land Use Element Air Quality Supplement.*

- Impact AQ-3. *Emissions from operations of cannabis activities could potentially violate an air quality standard or substantially contribute to an air quality violation, and result in a cumulatively considerable net increase of a criteria pollutant for which the County is in nonattainment.*
- Impact AQ-4. *Cannabis activities could be potentially inconsistent with the Energy and Climate Action Plan.*
- Impact AQ-5. *Cannabis activities could potentially expose sensitive receptors to objectionable odors affecting a substantial number of people.*
- Impact NOI-2. *Cannabis cultivation, distribution, manufacturing, processing, testing, and retail sales facilities would result in long-term increases in noise from traffic on vicinity roadways and from cultivation operations.*
- Impact TRA-1. *Cannabis activities may result in increases of traffic and daily vehicle miles of travel that affect the performance of the existing and planned circulation system.*
- Impact TRA-2. *Cannabis activity operations may result in adverse changes to the traffic safety environment.*

The Board of Supervisors adopted a Statement of Overriding Considerations for these Class I impacts on February 6, 2018.

Section 15168(c)(2) of the State CEQA Guidelines applies to subsequent activities in a Program EIR (such as 17EIR-00000-00003) and states that "[i]f the agency finds that pursuant to Section 15162, no subsequent EIR would be required, the agency can approve the activity as being within the scope of the project covered by the program EIR, and no new environmental document would be required." Section 15162 of the State CEQA Guidelines gives the criteria where a previously certified EIR can be used and when a new EIR may be prepared.

Because an EIR has already been certified, State CEQA Guidelines Sections 15162 and 15168 state that no subsequent Environmental Impact Report or Negative Declaration shall be prepared for the proposed project if it will not have effects that were not examined in the PEIR or unless one or more of the following have occurred: 1) substantial changes are proposed in the project which will require major revisions to the EIR due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; 2) substantial changes will occur with respect to the circumstances under which the project is undertaken which will require major revisions to the EIR due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or 3) new information of substantial importance which was not known and could not have been known at the time the previous EIR was certified as complete has become available.

The Program Environmental Impact Report (17EIR-00000-00003) that analyzed the environmental impacts of the Cannabis Land Use Ordinance and Licensing Program constitutes adequate environmental review for the G&K Farm/K&G Flower Cannabis Cultivation project (Case No. 18CDP-00000-00077). The proposed project presents no additional impacts and clearly falls within the definition of a cannabis cultivation project as studied within the PEIR and has no effects that were not examined in the PEIR (see Attachment 3). The proposed project is consistent with the Land Use Element Air Quality Supplement because there is no increase in the reliance on automobiles or a shift away from alternative modes of transportation, nor does it result in the development of employment opportunities or residential areas outside of the urban/rural boundary. The property is already established as a cultivation site which was previously utilized for the cultivation of cymbidium orchids.

There are no substantial changes or changed circumstances under which the proposed project is to be undertaken as analyzed in the PEIR. No new significant environmental effects or substantial increases in severity of previously identified significant effects under the certified PEIR would result from the proposed project. Further, there is no new information that the proposed project will have one or more significant effects not discussed in the certified PEIR. The analysis contained within the PEIR addresses the cumulative impacts that would be associated with the proposed project and the PEIR identifies the mitigation measures that would mitigate those impacts to the extent feasible. These mitigation measures were included as development standards in Section 35-144U [Cannabis Regulations] of Article II, the Coastal Zoning Ordinance, and have been applied as development standards and as proposed project conditions of approval for the G&K Farm/K&G Flower Cannabis Cultivation project (Case No. 18CDP-00000-00077). Section 6.4.4 of the Planning Commission Staff Report dated May 28, 2019 (Attachment 4), incorporated herein by reference, lists applicable development standards from Section 35-144U of Article II and describes how the proposed project complies with these standards. Proposed project conditions resulting from applicable development standards are included within Attachment 2 (Conditions of Approval), incorporated herein by reference. The proposed project would be monitored by Planning and Development staff to ensure compliance with development standards and approved project conditions (see Condition 27, Attachment 2).

Because none of the conditions in State CEQA Guidelines Section 15162 have occurred, the PEIR constitutes adequate environmental review and no subsequent initial study, negative declaration, or environmental impact report is required for the G&K Farm/K&G Flower Cannabis Cultivation project (Case No. 18CDP-00000-00077).

Appeal Issue Regarding the Inadequacy of the Odor Mitigation Measures in the PEIR: The Appellant contends that "the PEIR failed to adequately assess whether approved odor mitigation measures are actually effective in reducing environmental impacts."

Staff Response for Appeal Issue Regarding the Inadequacy of the Odor Mitigation Measures in the PEIR: As discussed above, the Santa Barbara County Board of Supervisors certified a Program Environmental Impact Report (PEIR), Case No. 17EIR-00000-00003, which analyzed the environmental impacts of the Cannabis Land Use Ordinance and Licensing Program. The PEIR was prepared in accordance with State CEQA Guidelines Section 15168 and evaluated the Cannabis Land Use Ordinance and Licensing Program's impacts. Class I impacts were identified, including the following impact regarding odor: "Impact AQ-5. *Cannabis activities could potentially expose sensitive receptors to objectionable odors affecting a substantial number of people.*" On February 6, 2018 the Board of Supervisors adopted a Statement of Overriding Considerations for the Class I impacts that were identified, including the above Class I impact regarding odor. Additionally, the 30-day statute of limitations to challenge the adequacy of the PEIR, 17EIR-00000-00003, has expired (see CEQA Guidelines Sections 15112(c) and 15094(g)).

The analysis contained within the PEIR addresses the cumulative impacts that would be associated with the proposed project, and the PEIR identified the mitigation measures that would mitigate those impacts to the extent feasible. These mitigation measures have been applied as proposed project conditions of approval and development standards. As discussed in the Planning Commission Staff Report dated May 28, 2019 (Attachment 4), incorporated herein by reference, the development standards regarding odor that are outlined in Subsection 35-144U.C.6 of Article II require the submittal of an Odor Abatement Plan with applications for indoor cannabis cultivation and associated processes. The Plan is reviewed and approved by the Planning and Development Department and is required to be implemented prior to issuance of final building and/or grading inspection and/or throughout operation of the project. The Applicant for the G&K Farm/K&G Flower Cannabis Cultivation project (Case No. 18CDP-00000-00077) submitted the required information to comply with these development standards. The Odor Abatement Plan that was submitted includes a floor plan that specifies all locations of odor-emitting activities and emissions, specifies descriptions of all proposed equipment and methods to be used for reducing odor, and contact information for the designated individual responsible for responding to odor complaints (see Attachments I and L of the Planning Commission Staff Report dated May 28, 2019, incorporated herein by reference). Additionally, during the June 5, 2019 Planning Commission hearing, the Commission added specific language to the Odor Abatement Plan condition of approval in order to ensure compliance with the requirements of Section 35-144U.C.6 of Article II, the Coastal Zoning Ordinance. The language added under the monitoring section of the Odor Abatement Plan condition requires that upon installation of the odor control system and quarterly thereafter for one year, Permit Compliance staff shall conduct an inspection of the system to assess its compliance with the requirements of the condition and Coastal Zoning Ordinance Section 35-144U.C.6. As part of each inspection, the County shall retain a professional engineer or certified industrial hygienist to certify that the odor control system meets all applicable requirements. See Attachment 6 for the June 5, 2019 Planning Commission Action Letter.

Appeal Issue Regarding the Lack of Analysis or Mitigation of Air Quality Impacts: The Appellant asserts that "the PEIR did not adequately examine impacts on air quality or provide sufficient mitigation for such impacts." The Appellant refers to BVOC emissions created by cannabis plants, including terpenes, and their potential to contribute to air pollution and cause health impacts.

Staff Response for Appeal Issue Regarding the Lack of Analysis or Mitigation of Air Quality Impacts: As discussed above, the Santa Barbara County Board of Supervisors certified a Program Environmental Impact Report (PEIR), Case No. 17EIR-00000-00003, which analyzed the environmental impacts of the Cannabis Land Use Ordinance and Licensing Program. The PEIR was prepared in accordance with State CEQA Guidelines Section 15168 and evaluated the Cannabis Land Use Ordinance and Licensing Program's impacts. Class I impacts were identified, including the below impacts regarding air quality:

- Impact AQ-1. *Cannabis activities could be potentially inconsistent with the Clean Air Plan and County Land Use Element Air Quality Supplement.*

- Impact AQ-3. *Emissions from operations of cannabis activities could potentially violate an air quality standard or substantially contribute to an air quality violation, and result in a cumulatively considerable net increase of a criteria pollutant for which the County is in nonattainment.*

- Impact AQ-4. *Cannabis activities could be potentially inconsistent with the Energy and Climate Action Plan.*
- Impact AQ-5. *Cannabis activities could potentially expose sensitive receptors to objectionable odors affecting a substantial number of people.*

On February 6, 2018 the Board of Supervisors adopted a Statement of Overriding Considerations for the Class I impacts that were identified, including the above Class I impacts regarding air quality. These impacts were identified by utilizing thresholds based on Appendix G of the 2017 State CEQA Guidelines and thresholds in the County's *Environmental Thresholds and Guidelines Manual* (County of Santa Barbara 2008, revised July 2015).

Furthermore, the 30-day statute of limitations to challenge the adequacy of the PEIR, 17EIR-00000-00003, has expired (see CEQA Guidelines Sections 15112(c) and 15094(g).

In addition, the Appellant alleges that the PEIR did not adequately address air quality impacts as it relates to the formation of ground level ozone. Ground level ozone is a photochemical pollutant, and is formed from complex chemical reactions involving volatile organic compounds (VOCs), nitrogen oxides (NOx), and sunlight; therefore, VOCs and NOx are ozone precursors. VOCs and NOx are emitted from various sources throughout the County. Significant ozone formation generally requires an adequate amount of precursors in the atmosphere and several hours in a stable atmosphere with strong sunlight. High ozone concentrations can form over large regions when emissions from motor vehicles and stationary sources are carried hundreds of miles from their origins. NOx is produced from the reaction of nitrogen and oxygen gases in the air during combustion, especially at high temperatures. VOCs (and reactive organic compounds) are hydrocarbons and the major sources of hydrocarbons include but are not limited to combustion engines, petroleum fumes, solvents, and paint. The PEIR (Section 3.3) found that: "Emissions from operations of cannabis activities could potentially violate an air quality standard or substantially contribute to an air quality violation, and result in a cumulatively considerable net increase of a criteria pollutant [including ozone] for which the County is in nonattainment." This was determined to be a significant and unavoidable impact and the Board of Supervisors adopted a Statement of Overriding Considerations.

Included in the Appellant's allegation is that the cannabis plants also emit VOCs and Appellant cites to a letter from Patricia Holden, Ph.D. that says terpenes emitted from cannabis plants are categorized as biogenic VOCs. These are called biogenic VOCs and all living things emit these compounds. Biogenic VOCs are ubiquitous. Biogenic VOCs produced by plants are involved in plant growth development, reproduction, and defense. Cannabis plants primarily produce a kind of biogenic VOCs called monoterpenes which are aromatic oils that provide cannabis varieties with distinctive flavors like citrus, berry, mint, and pine. These are the same kind of terpenes that are found in any other plant such as roses, orange trees, rosemary, and pine trees. Terpenes in cannabis began for adaptive purposes: to repel predators and lure pollinators. The emission rates from two strains of cannabis (Critical Mass and Elephant Purple) are 8.6 and 4.5 micrograms of carbon (terpenes) produced per gram of plant per hour, respectively. For comparison, pine trees produce approximately 16 micrograms of terpenes per gram of plant per hour, twice the amount of monoterpenes than either of the two strains of cannabis. Similar to pine trees, oak trees, native to Santa Barbara County, are also significant VOC emitters.

As discussed above, the presence of VOCs was known at the time the PEIR was prepared. VOCs and terpenes are discussed in the PEIR and were considered as part of the Class I air quality impacts. The PEIR discusses that VOCs are precursors to ozone and terpenes as the odor that is produced by cannabis plants. This was part of the consideration of the Class I impact, and the required mitigation measures related to odor and terpenes. Thus, this is an effect that was examined in the PEIR. As stated above, the PEIR found that the Cannabis Program would result in significant and unavoidable air quality impacts and the 30-day statute of limitations to challenge the adequacy of the PEIR, 17EIR-00000-00003, has expired (see CEQA Guidelines Sections 15112(c) and 15094(g).

Appeal Issue Regarding the Coastal Land Use Plan: The Appellant asserts that the "Project, as approved, violates the County's Coastal Land Use Plan."

Staff Response for Appeal Issue Regarding the Coastal Land Use Plan: Section 6.3 of the Planning Commission Staff Report dated May 28, 2019 (Attachment 4), incorporated herein by reference, analyzes the proposed project's consistency with the Comprehensive Plan, including the Coastal Land Use Plan. The G&K Farm/K&G Flower Cannabis Cultivation project (Case No. 18CDP-00000-00077) conforms to the applicable provisions of the Comprehensive Plan, including the Coastal Land Use Plan and the Toro Canyon Plan.

Other Appeal Issues Raised

- **Coastal Zoning Ordinance.** The Appellant asserts that the "Project, as approved, violates the County's Article II Coastal Zoning Ordinance". As noted in Section 6.4 of the Planning Commission Staff Report dated May 28, 2019 (Attachment 4), incorporated herein by reference, the proposed project complies with all applicable development standards from Article II, the Coastal Zoning Ordinance.

  Additionally, the Appellant asserts that "the County failed to recognize that the project changes the previously exempt flower operations and includes changes to development that should require a Development Plan". The existing greenhouses on the subject property were approved as part of a Final Development Plan by the County Planning Commission on September 14, 1983. At that time the existing greenhouses were used for the cultivation of cymbidium orchids. In 2018, a Development Plan Amendment (13AMD-00000-00003 to 82-DP-030) was approved by the Director of the Planning and Development Department. The Amendment allowed changes to the approved Development Plan, including the as-built increase of the height of the existing greenhouses, the as-built construction of a restroom, and the as-built construction of a water well that provides water for irrigation. The existing greenhouses continued to be used for the cultivation of cymbidium orchids. The five existing greenhouses are currently vacant and are not being used for any type of cultivation as confirmed during a site visit to the property on May 1, 2019.

  Section 35-144U.B of Article II, the Coastal Zoning Ordinance, provides a table outlining what permit is required depending on the type of project being proposed and depending on the zone district. The proposed cannabis project (Case No. 18CDP-00000-00077) located in the AG-I zone district which includes cultivation, nursery, distribution, and nonvolatile manufacturing requires a Coastal Development Permit. The changes to the project site would not result in an increase of previously approved development area and the project is in conformance with the original

Development Plan for the site, Case No. 82-DP-30, and subsequent Amendment (Case No. 13AMD-00000-00003). Therefore, no new Development Plan is required.

- **Fencing.** The Appellant asserts that the "Project's fencing plan violates Section 35-144U.C(2)(c) of the Coastal Zoning Ordinance." As noted above and in Section 6.4 of the Planning Commission Staff Report dated May 28, 2019 (Attachment 4), the proposed project complies with all applicable development standards from Article II, the Coastal Zoning Ordinance. Additionally, no portion of the existing or proposed fence is located in a creek bed as indicated by the Appellant.

- **Due Process.** The Appellant asserts that the "County violated Concerned Carpinterians' Due Process Rights" based on 1) non-acceptance of late-submitted comments by Concerned Carpinterian's members and other aggrieved members of the public, 2) receiving a staff report regarding revised recommendations for the project to be debated approximately twenty minutes prior to the hearing, and 3) failure to articulate reasons for denying the appeal. All citizens' due process rights, including the Appellant's, were protected and respected during the Planning Commission hearing as discussed below.

  First, the Planning Commission followed required procedures, which establish a deadline for submissions to the Commission and require a four-fifths vote of the Commission to accept late submissions. The Commission voted to consider late-submitted comment letters but the motion failed as there was not four-fifths support and the letters were not included in the Commission's record in accordance with Resolution 04-243, "*Procedural Rules Governing Hearing Bodies Before the Santa Barbara County Board of Supervisors, County Planning Commission and Montecito Planning Commission.*" Second, a short memorandum recommending minor amendments to two of the proposed project's conditions was submitted at the beginning of the hearing to the Planning Commission, the Appellants, the Applicant, and was made available to the public. Additionally, the recommended amendments included in the memorandum were discussed as part of staff's presentation. The memorandum solely consisted of a recommendation to the Planning Commission to modify two of the project's conditions in order for all of the project's conditions to be consistent with Section 35-144U [*Cannabis Regulations*] of Article II, the Coastal Zoning Ordinance. All members of the public were able to address the memorandum and recommended changes during their appeal presentations or during public comment. Lastly, the Planning Commission adopted findings for denial of the appeal and approval of the project. These findings were included in the Planning Commission Staff Report dated May 28, 2019 (Attachment 4).

- **Light Pollution, Noise Pollution, and Increased Traffic.** The Appellant asserts that the "G&K Project approvals and the PEIR do not adequately address a number of other environmental hazards and issues." As stated above, the 30-day statute of limitations to challenge the adequacy of the PEIR, 17EIR-00000-00003, has expired (see CEQA Guidelines Sections 15112(c) and 15094(g). Furthermore, as discussed in Section 6.4 of the Planning Commission Staff Report dated May 28, 2019, incorporated herein by reference, the Applicant for the G&K Farm/K&G Flower Cannabis Cultivation project (Case No. 18CDP-00000-00077) submitted the required information, including a Lighting Plan, a Site Transportation Demand Management Plan, and an Operational Plan that describes noise-generating equipment, to demonstrate compliance with all applicable development standards.

- **Impacts of Cannabis Operations on Existing Land Uses and Agricultural Operations.** The Appellant asserts that "the PEIR did not adequately assess the impact of cannabis operations on existing land uses and agricultural operations in the Carpinteria area." As discussed above, the Santa Barbara County Board of Supervisors certified a Program Environmental Impact Report (PEIR), Case No. 17EIR-00000-00003, which analyzed the environmental impacts of the Cannabis Land Use Ordinance and Licensing Program. The PEIR was prepared in accordance with State CEQA Guidelines Section 15168 and evaluated the Cannabis Land Use Ordinance and Licensing Program's impacts, including impacts regarding agricultural resources and land use. See the PEIR's Executive Summary, Attachment 8, for specific agricultural resources and land use impacts and associated mitigation measures. Additionally, the 30-day statute of limitations to challenge the adequacy of the PEIR, 17EIR-00000-00003, has expired (see CEQA Guidelines Sections 15112(c) and 15094(g)).

  As discussed in the PEIR for the Cannabis Program, cannabis cultivation is subject to existing laws and regulations governing the cultivation and associated hazardous activities, including pesticide use regulations under the US Environmental Protection Agency (USEPA), the California Environmental Protection Agency (CalEPA) and the California Department of Pesticide Regulation. Existing policies regulate pesticide spray and drift. Any commercial agricultural operations planning on using pesticides must obtain an Operator Identification Number from the Agricultural Commissioner's Office before they can purchase or use pesticides. In addition, with the implementation of Mitigation Measure HWR-1, Cannabis Waste Discharge Requirements General Order and Pest Management Plan, the Planning and Development Department ensures that impacts from pesticides/fertilizers would be minimized by reviewing and approving compliance with the requirements of the State Water Resources Control Board (SWRCB). As part of the submittal materials for the proposed project, Case No. 18CDP-00000-00077, the Applicant provided documentation demonstrating compliance with SWRCB requirements (see documentation included as part of Attachment I of the Planning Commission Staff Report dated May 28, 2019). In addition, a condition of approval regarding compliance with SWRCB requirements was added to the proposed project (see Condition No. 4 of Attachment 2).

  As discussed above, all of the appeal issues raised are meritless and Planning and Development staff recommends that the Board deny the appeal and grant *de novo* approval of the Coastal Development Permit, 18CDP-00000-00077.

Fiscal and Facilities Impacts:

Budgeted: Yes

Funding for this project is budgeted in the Planning and Development's Permitting Budget Program on page D-269 of the County of Santa Barbara Fiscal Year 2019-20 adopted budget.

Special Instructions:

The Clerk of the Board shall publish a legal notice at least 10 days prior to the hearing on August 20, 2019. The notice shall appear in the Santa Barbara News-Press. The Clerk of the Board shall also fulfill mailed noticing requirements. The Clerk of the Board shall forward a minute order of the hearing to the Planning and Development Department, Hearing Support.

Attachments:

1. Findings
2. Conditions of Approval
3. Environmental Document including CEQA Checklist
4. Planning Commission Staff Report dated May 28, 2019
5. Planning Commission Memorandum dated June 5, 2019
6. Planning Commission Action Letter dated June 11, 2019
7. Board of Supervisors Appeal Application dated June 17, 2019
8. PEIR (17EIR-00000-00003) Executive Summary
9. Link to the PEIR for the Cannabis Land Use Ordinance and Licensing Program, 17EIR-00000-00003

Authored by:

Nereyda (Rey) Harmon, Planner, (805) 568-2513
Development Review Division, Planning and Development Department

EXHIBIT 2

Estimated emissions, concentrations, and deposition of monoterpenes from an outdoor *Cannabis* farm

Final Report

Prepared for:
Brett Vapnek
The Hacienda Company, LLC
brett@thehacienda.co

Prepared by:
Dr. William Vizuete
Chief Scientific Officer
Pacific Environmental Analytics LLC
will@pac-enviro.com

December 6, 2019

Pacific Environmental Analytics

5142 Hollister Avenue #507 Santa Barbara, CA 93111
(805) 364-2995 info@pac-enviro.com

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Executive Summary

The purpose of this study is to determine whether or not it is feasible for cannabis monoterpenes from the proposed project ('Hacienda' 3800 Baseline Avenue Santa Ynez California) to taint grapes on a neighboring property (Appellant, 3950 Baseline Avenue).

The appellants cite a peer reviewed publication ("Capone") which identifies 1,8-cineole (eucalyptol) as having a detrimental impact on grapes. (The monoterpene 1,8-cineole is present in eucalyptus trees and some, but not all, cannabis strains.) Averaging across three years of their reported data, the study determined amounts of eucalyptol per grape material of 2.6 ug/kg. We sought to determine if it is possible for cannabis monoterpenes from the Hacienda project to reach this same threshold value of eucalytpol per grape material – 2.6 ug/kg – at the neighboring farm.

It should be noted that 1,8 cineole (eucalyptol) is the only monoterpene to be identified as potentially causing wine taint. No other monoterpenes (such as beta-myrcene, alpha-terpinene, and terpinolene) have been found in peer reviewed studies to cause taint.

To run this model, we completed the following tasks over the last several months:

1) Determination of monoterpene emission factors using measurements from five Cannabis strains.
2) Creation of monoterpene emission rates using emission factors for the proposed Cannabis farm.
3) Prediction of gas-phase concentrations using the Cannabis farm's emission rates simulated over three seasons using local meteorology.
4) Determination of deposition rates from predicted gas-phase concentrations to grape material and comparison with the assumed threshold values.

Our model was based on the size and location of the proposed project – 3800 Baseline Ave – and utilized local meteorological data from the Santa Ynez airport.

The following work describes the results of the estimation of Cannabis farm emissions, the prediction of downwind concentrations, and the deposition to grape material of four monoterpenes produced by certain cannabis strains: 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene. The modeled rates of deposition were then compared with certain assumed threshold values defined for these terpenes.

The major findings from the completion of these tasks are listed below.

- For the cannabis monoterpenes to reach threshold values (that potentially taint the grapes), they would have to emit at the highest rate, at the average predicted gas-phase concentrations, for 1,121 days straight for 1,8-cineole. Therefore, it is highly unlikely that cannabis from the Hacienda project would taint any grapes at 3950 Baseline Ave because cannabis is only grown seasonally, not year-round, and grapes are grown seasonally, not all year long. Furthermore, the cannabis is only emitting monoterpenes for 21 days prior to harvest. And if Hacienda had a maximum of 3 harvests per year, that would roughly only result in 63 days of emissions – compared to the 1,121 that would be required to taint the grapes. In other words, it would take 1,121 continual days of cannabis strains that have eucalyptol (not all strains have eucalyptol) emitting at the highest rate, without real world deposition loss (such as photochemistry) to result in grape absorption of terpenes at the threshold level, identified in the Capone study (of 2.6 ug/kg).

- Assuming mature Cannabis plants are emitting monoterpenes for 21 days prior to harvest, we estimate the fraction of the threshold values reached would be 1.9% for 1,8-cineole.
- Our model was very conservative and did not include real-world losses of gas-phase concentrations due to photochemistry and deposition during transport and thus are upper bound estimations. In reality, gas-phase concentrations of monoterpenes in the atmosphere have an average lifetime of minutes to hours in full sunlight, further reducing the possibility that the emission would travel to the nearby farm and taint the grapes. Our study did not include the real world losses due to photochemistry.
- Only 3 out of the 5 cannabis strains we evaluated had emission factors of eucalyptol. No 1,8-cineole emissions were found in two strains – Banjo, Presidential OG. The remaining strains had very small emission factors of eucalyptol ranging from 0.001-0.01 ug /g/hr.

Background

There currently exists only one peer-reviewed study that has linked the influence of 1,8-cineole in vineyards to taint in corresponding red wines [1]. This study (Capone) examined the effects that eucalyptus trees had on nearby vineyard operations. The study found the largest concentrations of 1,8-cineole in samples closest to eucalyptus trees. The study results were used to determine a threshold value for 1,8-cineole against which modeled deposition rates from predicted gas-phase concentrations could be compared.

Data from this study in Figure 1 shows 1,8-cineole concentrations in grape tissue from four grapevine rows over three vintages. Triplicate sampling was conducted at each of the three positions within each row. Using the highest measured values closest to the eucalyptus trees, a three year average was calculated of 2.6 ug/kg of 1,8-cineole per grape material. This average concentration was used as the threshold value for 1,8-cineole in the present modeling analysis.

Similarly, at the County of Santa Barbara Board of Supervisors meeting on August 20, 2019, data was publicly presented as shown in Figure 2. The figure shows terpene concentrations in grape material from two farms, one near a cannabis farm, and the second without a cannabis farm. There are three monoterpenes highlighted in yellow that were only found in the grape tissue near the cannabis farm. The data suggests the source of the monoterpenes was from the cannabis farm. The data does not suggest these monoterpenes had a deleterious effect on the quality of grape tissue, or the resulting wine produced. Nevertheless, for purposes of the present modeling analysis, the data presented was used to determine threshold values for the three monoterpenes identified: (i) 0.3801 mg/kg for beta-myrcene, (ii) 0.1931 mg/kg for alpha-terpinene, and (iii) 0.5632 mg/kg for terpinolene.

The goal of this work was to determine the amount of deposition of gas-phase concentrations of 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene that could occur on grape material located approximately 700 feet downwind, and then compare those concentrations with the assumed threshold values previously discussed. This goal was achieved by accomplishing the following tasks:

1) Determine emission factors using leaf enclosure measurements for five different strains of Cannabis;
2) Estimate emission rates for the proposed Cannabis farm based on the anticipated canopy size;
3) Predict gas-phase concentrations using EPA-approved dispersion modeling; and
4) Estimate deposition rates onto grape material located approximately 700 feet downwind.

Details on the methodology used in these tasks and results are described below.

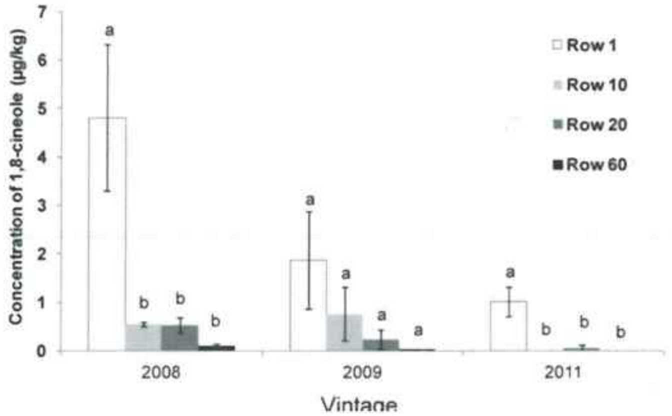
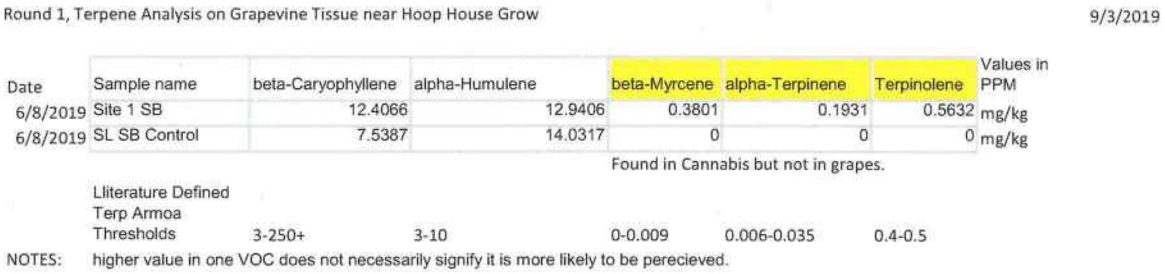


Figure 1. Concentration of 1,8-cineole (ug/kg) in grapes from different rows at set distances from the Eucalyptus trees over three vintages. Error bars represent the standard error of the mean for three replicates. Different letters indicate significant differences between the means (p < 0.05).



Round 1, Terpene Analysis on Grapevine Tissue near Hoop House Grow 9/3/2019

Date	Sample name	beta-Caryophyllene	alpha-Humulene	beta-Myrcene	alpha-Terpinene	Terpinolene	Values in PPM
6/8/2019	Site 1 SB	12.4066	12.9406	0.3801	0.1931	0.5632	mg/kg
6/8/2019	SL SB Control	7.5387	14.0317	0	0	0	mg/kg
				Found in Cannabis but not in grapes.			
	Lliterature Defined Terp Armoa Thresholds	3-250+	3-10	0-0.009	0.006-0.035	0.4-0.5	
NOTES:	higher value in one VOC does not necessarily signify it is more likely to be perecieved.						

Figure 2. Monoterpene analysis on grapevine tissue at two vineyards near a hoop house grow (Site 1 SB) and a second away from a Cannabis grow (SL SB Control).

1: Emission Factors Using Leaf Enclosure Measurements

The efforts to accomplish this task were completed by Synergy Environmental Solutions (SES) and led by Dr. Alex Guenther. Dr. Guenther is an international leader in atmospheric and terrestrial ecosystem research who has published more than 280 peer-reviewed journal articles. He has led more than 40 integrative field studies on six continents in tropical, temperate, and boreal ecosystems to provide observations to advance understanding of biogenic emissions and their role in air quality and climate. Dr. Guenther led Pacific Northwest National Laboratory's Environmental Molecular Science Laboratory and was Senior Scientist and Section Head at the National Center for Atmospheric Research (NCAR). The overall goal for SES was to quantify the emission capacities of five Cannabis strains at the mature growth stage to investigate their potential impact on atmospheric distributions of specific biogenic volatile organic compounds (BVOCs). Although there are existing models available for estimating BVOC emissions from plants generally, the lack of emission factors for specific Cannabis strains limits accurate estimation of their emission rates. Therefore, the quantification of speciated emission factors is required to know the impact of a specific strain of Cannabis.

Figure 3. Example of leaf enclosure system used to develop emission factors.

To determine emission factors for 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene we conducted enclosure measurements from five (5) different Cannabis strains growing in a greenhouse environment (Forbidden Fruit, Banjo, Wedding Cake, Presidential OG, and Gorilla Glue), and calculated emission factors in μg/g/h (at leaf conditions of temperature= 30° C and light = 1000 μmol visible light m^{-1} s^{-1}). An example of the leaf enclosure used in this study is shown in Figure 3. The primary output is a dataset of terpenoid emission factors that is suitable for use in biogenic emission models that drive air quality simulations. We found that a bag enclosure system with TD-GC-MS/FID analysis is a suitable approach for characterizing Cannabis terpenoid emission factors and leaf cuvette measurements generally agree with bag measurements. However, there are uncertainties associated with potential emission perturbations that should be further investigated. Our results found ninety-seven terpenoid compounds including: 1 homoterpene, 30 monoterpenes, 5 aromatic monoterpenes, 21 oxygenated monoterpenes, and 40 sesquiterpenes. On average, monoterpenes contributed 69% and sesquiterpenes 31% of the total terpenoid emission.

Based on measurement data emission factors were developed for 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene. It is important to note that there was a complete lack of 1,8-cineole emissions from two strains: Banjo, Presidential OG. The other strains had relatively small emission factors ranging from 0.001-0.01 ug /g/hr.

2: Emission rates for *Cannabis* Farm

Hacienda reported 20,000 plants based on 2,000 plants per acre and a total canopy acreage of 10 (or 15 acres of cultivation area as defined by the County). The farm also reported that the 20,000 plants were evenly distributed (4,000 plants) among five strains: Forbidden Fruit, Banjo, Wedding Cake, Presidential OG, and Gorilla Glue. We were also provided, based on grower provided information, the dry plant weight of a mature plant in the outdoor grow for each strain. Using these data, and measured emission factors, emission rates of 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene were determined from the proposed *Cannabis* farm.

3: Predicted Gas-Phase Concentrations

Air dispersion modeling was completed using AERMOD version 19191 to determine the 1-hour gas-phase concentration of 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene using the emission rates described above. AERMOD is a U.S. EPA approved steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain [2].

It was assumed that 10 acres of canopy will be spread over roughly 15 acres as shown in red shade in Figure 4. All model predictions were completed for August through October in 2016, 2017, and 2018 using observed meteorological data derived from Santa Ynez airport monitoring station resulting in 2,160 simulated hours. September and October are also the days with the lowest wind speed, and the highest chance for deposition. Figure 4 provides the location of the farm at 3800 Baseline Avenue Santa Ynez, CA 93460 that was modeled as an area source denoted in a red shade. The receptor location where 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene concentrations were predicted is at 34°37'57.4"N 120°04'09.8"W (located approximately 700 feet downwind) and is shown in Figure 4 as a red cross.

Figure 4. The location of the farm, modeled as an area source, shown as a red shade. Also shown the receptor where model predictions were made denoted by a red cross.

The model predicted 2,160 hourly averaged model predictions of concentrations at the receptor location for 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene. Table 1 shows the average concentrations for the entire modeling period. Beta-myrcene is the strongest emitter and thus had the largest predicted downwind concentrations. Given the relatively small emissions of 1,8-cineole, the predicted concentrations of this monoterpene were three orders of magnitude smaller than beta-myrcene.

Table 1. Identified monoterpenes and their fraction of total monoterpene emissions from the Cannabis farm and the AERMOD predicted concentrations averaged over 2,160 hours.

Monoterpene	Fraction of total Emissions	Concentration (ug/m3)
1,8-cineole	1.0E-04	2.7E-04
Beta-myrcene	2.2E-01	5.8E-01
Alpha-terpinene	1.7E-02	4.4E-02
Terpinolene	1.6E-02	4.2E-02

4: Deposition Rates

Comparison with threshold values requires estimation of deposition rates of the gas-phase molecules into the grape tissue. Deposition from the gas-phase is an important process that has to be addressed in all air-quality models. Wesely (1989) developed a parameterization scheme for estimating gaseous dry deposition velocities, which has been widely used in a number of models [3]. A review of available dry deposition models has been reported by Wesely and Hicks (2000) [4]. Most existing dry deposition models utilize the multiple resistance analogy approach when parameterizing the deposition velocity to vegetation and other surfaces.

This analysis relied on the deposition velocities estimated in the Comprehensive Air Quality Model with Extensions, CAMx6.10 [5, 6] for this location. The model and protocols used in this study are based on the Western Air Quality Modeling Study (WAQS) for 2011 [6, 7]. The WAQS 2011b baseline model simulation period runs from June 15th to September 15th, 2011. All data and supporting documentation are publicly available via the Intermountain West Data Warehouse (IWDW) website [8]. At the location of the receptor this study predicted an average deposition velocity for the terpene (TERP) species of 6.7 e-5 m/s [6, 7]. Using this velocity, and predicted gas-phase concentrations, a flux of 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene can be determined. Assuming a yield of 3 tons of grapes per acre [9] the rate of 1,8-cineole, beta-myrcene, alpha-terpinene, and terpinolene per mass of grape tissue was calculated. These results were then used to determine how long it would take to reach the threshold values and results are shown in Table 2.

It should be noted that although terpenes, once released, are highly reactive to sunlight and other environmental factors, the modeling did not account for photochemical or other types of degradation and loss that can often occur during transport. In addition, the modeling assumed a smaller plume rise than one would normally expect from a cannabis farm of this size, and for these reasons the modeling results should be considered very conservative.

As shown in Table 2 to reach threshold values would require, at the predicted average gas-phase concentrations, 1,121 days for 1,8-cineole, 75.9 days for beta-myrcene, 1,005 days for alpha-terpinene, and 1,486 days for terpinolene. Assuming that mature *Cannabis* plants are emitting for 21 days prior to harvest, the fraction of the threshold values reached would be 1.9% for 1,8-cineole, 27.7% for beta-myrcene, 4.1% for alpha-terpinene, and 1.4% for terpinolene.

Table 2. The identified monoterpenes and their reported threshold values (THV) used in this study. Also shown are the number of days to achieve the THV at average gas-phase concentrations. Assuming a 21-day growing season for emissions of a mature Cannabis plant, data is shown as the percentage of THV values that are achieved in that time period.

Monoterpene	Threshold Value (ug/kg)	Time to reach THV (days)	Season fraction of THV (%)
1,8-cineole	2.6	1121	1.9
Beta-myrcene	381	75.9	27.7
Alpha-terpinene	193	1005	4.1
Terpinolene	563	1486	1.4

Reference:

1. Capone, D.L., D.W. Jeffery, and M.A. Sefton, *Vineyard and Fermentation Studies To Elucidate the Origin of 1,8-Cineole in Australian Red Wine.* Journal of Agricultural and Food Chemistry, 2012. **60**(9): p. 2281-2287.
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3. Wesely, M.L., *Parameterization of Surface Resistances to Gaseous Dry Deposition in Regional-Scale Numerical-Models.* Atmospheric Environment, 1989. **23**(6): p. 1293-1304.
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6. ENVIRON and Alpine., *Attainment Demonstration Modeling for the Denver Metro/North Front Range 2017 8-Hour Ozone State Implementation Plan*. 2017: Western Air Quality Study - Intermountain West Data Warehouse.
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8. WAQS, W.A.Q.S. *IWDW-WAQS Wiki*. 2017 2 May, 2019]; Available from: http://views.cira.colostate.edu/wiki/#WAQS.
9. EViticulture. *How many grapes can I produce per acre?* 2019; Available from: https://grapes.extension.org/how-many-grapes-can-i-produce-per-acre-how-much-yield-can-i-expect-when-they-are-in-full-production/.

EXHIBIT 3

BUSY BEE'S
ORGANICS

June 13, 2019

Dear Ray,

As you know, we received a copy of the letter you sent to the Planning and Development Central Board and are writing to try to resolve the issue you raised. First of all, you are a fabulous neighbor and we value our relationship and we were deeply distressed to learn that we may have caused you any cause for concern. You and your family are extremely important to us and we will work with you to ensure our great relationship stays positive. We believe that the misunderstanding regarding the spraying of pesticides stems from a complaint that we filed with Nutrien due to their activities on your property on May 20, 2019. The weather that day was extremely windy, causing concern that our plants could be contaminated by overspray or drift.

We simply reached out to Nutrien to request that their spraying be done when whether conditions would not result in harm to us or other neighboring properties. In addition, we asked that Nutrien provide us with advanced notice each time they are scheduled to spray on your property, which they have been doing which helps ease our concerns. In no way did we suggest that all spraying had to cease, simply that it must comply with state law. In an effort to work collaboratively with you to support each other as neighbors, we propose the following:

1) We agree not to hold you personally liable for any overspray performed by your tenant.

2) We agree that we will not hold your tenant liable for any pesticide spray activity that is lawfully executed according to state and county regulations;

3) We agree not to hold the spray vendor (Nutrien or other entity) liable for any spray activity that is lawfully executed according to state and county regulations.

4) We agree that in the event that your existing tenant farmer desires to terminate his lease prematurely with you, the landowner, we agree to take over the lease for an annual rental rate that is greater than the rental rate under the existing lease; and

5) Upon the expiration of the term of the existing lease between you and your tenant, we agree to lease your land for an annual rental rate that is greater than the rental rate under the existing lease. Terms to be negotiated.

If you agree with these terms, and require something more formal than this letter, please let me know and we can draft up a short agreement for your review and signature.

We apologize for any understanding and we are looking forward to our continued friendship and mutually productive farming!

Best regards,

Sara Rotman and Nate Diaz
Busy Bee's Organics, Inc.

EXHIBIT 4

Subject: Busy Bee's Organics; SYVCP Odor Abatement Plan
18:LUP-00000-00496; 1180 W Highway 246; 099-240-072

Under the County's current Land Use & Development Code, Section 35.42.075-Cannabis Regulations, Development Standard 6, properties zoned AG-II that apply for a Land Use Permit (LUP) for cannabis cultivation are **exempt** from Odor Abatement Plans (OAP). The County properly processed and approved a Land Use Permit for Busy Bee's Organics (the "Project"), therefore, the Project is exempt from an OAP.

"35.42.075.C.6 *No odor abatement plan shall be required in AG-II zoning, unless a CUP is required.*"

The Project site is located within the Santa Ynez Valley and is compliant with all applicable Santa Ynez Valley Community Plan (SYVCP) goals, policies, and development standards. The SYVCP requires odor generators to provide additional information and details about the Project to the County, which the Applicant submitted as part of the LUP process.

"LUG-SYV-8.11: *Future applicants for wineries or other odor generators, based on the nature of the operations shall develop and implement an Odor Abatement Plan.*"

The Board of Supervisors has not amended the LUDC to clarify that Community Plan requirements pertaining to OAPs supersede the LUDC's clearly defined exemption for cannabis cultivators on AG-II parcels. Further, the SYVCP does not explicitly state that cannabis cultivators are required to provide an OAP to the County or define an "odor generator." The SYVCP was last updated in October 2009, long before recreational cannabis cultivation was permitted in the County. Therefore, it is clear that the SYVCP Odor Abatement Plan requirements were not intended to address potential cannabis odors, and that OAP requirements should be determined by the LUDC regulations which exempt AG-II properties from OAPs.

Despite being exempt from an OAP and never having received a single odor related complaint as of October 2019, the Applicant carefully prepared the following Odor Abatement Plan, in compliance with SYVCP requirements.

Name and telephone number of contact person(s) responsible for logging and responding to odor complaints:

Please contact Sara Rotman at (917) 886-7889 to report an odor complaint.[1] Ms. Rotman lives onsite and is available to address any concerns.

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[1] Busy Bee's Organics has been cultivating cannabis for the past four years, which has resulted in a total of eight harvests. Neither Busy Bee's Organics nor the County of Santa Barbara have received a single odor related complaint as of October 2019.

Policy and procedure describing the actions to be taken when an odor complaint is received, including the training provided to the responsible party on how to respond to an odor complaint

Ms. Rotman will be responsible for recording and responding to written odor complaints. The procedure for receiving a complaint will begin with documenting the time and date the odor was observed. Other pertinent data will be collected, such as the location of where the odor was observed. Within 72 hours, the complaint will then be verified by a third party licensed environmental hygienist to confirm that such odors are attributable to the Project and result in odors at the individual receptor site. If such odors are determined not to be attributable to Project operations, no further action will be taken.

If such odors are determined to be attributable to Project operations, Ms. Rotman, who is the most knowledgeable person about the farm's operations, will then take the time to walk through the various measures that have been implemented to reduce odors (cited below). Then she will work with her staff to identify recommended actions for improving or implementing any additional odor abatement measures, and those that are determined feasible will be studied and implemented. If a "continuous public nuisance" is deemed to be caused by Busy Bee's Organics cannabis cultivation, the below listed contingency measures will be implemented to abate the nuisance.

Busy Bee's Organics strives to maintain a good neighbor policy and has received 25 letters of support from adjacent property owners, local farmers, businesses, and residents of Buellton. Additionally, Ms. Rotman is engaged in several community organizations that advocate for positive community engagement with the cannabis industry including serving as the secretary of the Lompoc Valley Cannabis Association, co-founding the North County Farmer's Guild and participating in the collective, Good Farmers Great Neighbors.

Description of potential odor sources (i.e. fermentation and aging processes and the resultant ethanol emissions; odors associated with a fast food restaurant may include cooking and grease aromas)

Busy Bee's Organics has implemented a variety of strategies to avoid creating potential odors from cannabis cultivation (see below). The greatest potential for odor is during harvest when the plants are fully flowering, which will generally average twice per year. Harvests will not be staggered in order to reduce potential odors. Plants reach full flowering stage (the stage at which they potentially emit odor) approximately ten days before harvest. Nonetheless, in an abundance of caution, Busy Bee's Organics retained two third-party odor experts to further study the potential for odor generation.

First, Bosarge Environmental, LLC, a third-party odor expert, performed an Odor Assessment Study for the Project. The Odor Assessment Study, attached hereto, documents the results of ambient odor studies conducted over three days in July (July 22–24, 2019). This time period was selected because the plants were at the full flowering stage. In other words, this period represents the "worst-case scenario" because it is the stage at which odors from terpenes is the greatest. As summarized in the Odor Assessment Study, the third-party expert conducted odor surveys using a Nasal Ranger field olfactometer in the Project area to quantify odor strength at each monitoring location. Five offsite ambient odor surveys were conducted across the three-day study period, along with two studies within the property lines. In all, approximately two hundred odor observations were conducted and recorded. The Odor Assessment Study concluded that no discernible cannabis odor was detected outside of the Project area and that the cannabis odors are barely discernible at the perimeter of the property during the "worst-case scenario." No odors were detected at any of the other designated locations throughout the Buellton community. Therefore, the Odor Assessment Study concludes that odor from the Project should not adversely affect the surrounding community.

Second, Ms. Rotman and Busy Bee's Organics retained Sespe Consulting, Inc. to perform an independent air quality analysis and modeling to further evaluate the Project's potential to generate odor. The enclosed Sespe Consulting, Inc. Cannabis Odor Modeling Memorandum assesses the existing setting, documents the results of odor modeling, and sets forth a tiered mitigation approach that could be used to abate odor, if necessary. With respect to the existing setting, the Memorandum includes a finding that there have been eight harvests of cannabis grown on the Project site since 2015 and the County has not received any odor complaints alleging that odor from the site is problematic. Similarly, the Memorandum concludes that the model results are consistent with the history of the Project site, which has received no past odor complaints, demonstrating that odor should not be present under most conditions.

Description of potential methods for reducing odors, including minimizing potential add-on air pollution control equipment; and contingency measures to curtail emissions in the event of a continuous public nuisance.

- The drying of cannabis plants is responsible for most odor creation. Cannabis plants drying can off gas up to 90% of the terpene content during this process.
- Busy Bee's Organics does not traditionally dry cannabis onsite.
- Busy Bee's Organics' standard operating procedure is to harvest fresh plants and immediately flash freeze them in temporary freezers on wheels or to box and ship them as fresh cut flowers upon harvest.
- All plant material is either vacuum-sealed and flash frozen or shipped offsite within two hours of harvest.
- Odor from live cannabis plants only occurs when plants are in full bloom and agitated (i.e. during harvest). Most harvest cycles are approximately ten days in length. To reduce odor impacts of fully blooming and agitated plants, Busy Bee's Organics traditionally does not stagger harvest periods throughout the property.
- This practice reduces the number of days the plants are agitated/odor emitting which in turn reduces to the degree possible the number of days odor can occur.
- Busy Bee's Organics, Inc. grows predominantly for concentrates as an end

product. This market prefers flavor profiles that are more fruit or floral based. As such, we generally grow genetics that feature citrus, pine and floral flavor profiles, reducing the potential for the 'skunk' odor anecdotally associated with cannabis cultivation.

- The only indoor cultivation onsite occurs within the one existing greenhouse and is for plants in vegetative state only. These plants are not scheduled to mature to the flower stage and therefore do not emit any odor.
- The subject property lies within the Santa Ynez Valley and has a naturally occurring strong and constant ocean breeze that blows 365 days a year. Known locally as the 'air conditioner' it is part of what makes Buellton so beneficial to all agricultural crops. This is what makes Buellton so windy, keeps it cool and provides the most effective solution for odor; dilution combined with evacuation of air. Most potential odors are prevented from stagnating and evacuated by this high volume of airflow and constant breeze. Additionally, Buellton has very low humidity (areas with high humidity can intensify odor). Supporting this fact is the report by industrial hygienist, SESPE, outlining the site-specific meteorological conditions which demonstrate that the potential for odor is non-existent 98 percent of each year.

Contingency measures to curtail emissions in the event of a continuous public nuisance:

If a continuous public nuisance(2) is verified as emanating from this property, Busy Bee's Organics will take the following tiered approach to curtail the nuisance:

1. Install wind screens that direct ground-level air upward thereby increasing dispersion through turbulence and elevating the most odorous air to heights above that of an individual's nose.
2. Install and/or operate fans normally used to protect orchards from frost to increase dispersion and direct ground-level air to heights above that of an individual's nose.
3. In the event that Tiers 1 and 2 above are insufficient to abate a continuous public nuisance, then the Project would install and/or operate the best available vapor-phase odor control system along the length of property boundary or another more beneficial location between the cultivation activities and the individual receptor(s) that have lodged the complaint. All installation would comply with County requirements.

Technical Reports:

Odor Assessment Study prepared by Bosarge Environmental, LLC
Cannabis Odor Modeling Memorandum prepared by Sespe Consulting, Inc.

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2 California Civil Code 3480 ("A public nuisance is one which affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.")

EXHIBIT 5

Bosarge Environmental, LLC
707 Bienville Blvd.
Ocean Springs, MS 39564
(228) 217-3180

July 30, 2019

Sara Rotman
1180 West Highway 246
Buellton, CA 93427

RE: Odor Assessment Study

Introduction

Sara Rotman retained Bosarge Environmental, LLC, as a third-party Odor Expert, to perform an Odor Assessment Study of property in the vicinity of 1180 West Highway 246 in Buellton, California. Ms. Melanie Bosarge conducted ambient odor surveys the three days of July 22- 24, 2019. This time frame was selected because the facility was in full flowering stage. During this period, the facility would have a crop of fully formed plants at the stage when terpene odor is the greatest, creating a "worst-case-scenario" of odor for the facility.

Ms. Bosarge is a Chemical Engineer and Owner/Manager of Bosarge Environmental, LLC. She has represented St. Croix Sensory (St. Croix) as a certified instructor and provided client training and odor assessment services, as an independent contractor, since 2002. For more than thirty-five (35) years, St. Croix has been assisting facility owners, consulting engineering firms, and regulatory agencies to quantify odors from a variety of industrial, agricultural, and municipal operations, including wastewater treatment, landfills, composting, and manufacturing in both field and laboratory settings. St. Croix manufactures and markets state-of-the-art odor sampling and measurement equipment, including the Nasal Ranger Olfactometer. St. Croix's "ODOR SCHOOL"® is an internationally recognized program to prepare inspectors to conduct field evaluations of ambient odors.

Ambient Odor Assessment Methodology

Odor surveys were conducted using a Nasal Ranger field olfactometer to quantify odor strength when odor was noticed at each monitoring location. Prior to odor observations, a carbon mask respirator was utilized to "zero" nose to 100%. Upon arrival at each separate location, ambient odor was assessed with the "naked nose". If no odor was detected, the current time and "non-detected" (ND) was recorded. If an odor was detected, a reading was then taken with Nasal Ranger Olfactometer.

Using the Nasal Ranger, odor strength is measured as dilution ratios, reported as Dilution-to-Threshold (D/T) values. The Nasal Ranger Dilution-to-Threshold odor measurement is an "instantaneous" measurement, which is a recognition threshold. For example, a 4-D/T is the dilution ratio of 4-volumes of carbon filtered odor free air mixed with one-volume of ambient (odorous) air that makes the ambient odorous air "just-barely-recognizable" as an odor.

The D/T dilution ratio steps of the Nasal Ranger olfactometer used for the odor surveys were 2, 4, 7, 15, 30, and 60. If an odor was detected with the "naked nose" at a location, a measurement was taken with the Nasal Ranger. An odor in the air that is not measured at the 2-D/T dilution ratio is reported as less than 2-D/T (<2). The absence of ambient odor is reported as "non-detected" (ND).

Odor Survey – Introduction and Mapping

Upon arrival at the facility on the afternoon of July 22, 2019, Ms. Bosarge was taken on an extensive tour of the site. Each area of the property and cannabis process was identified and explained. A plan of action was developed and coordinated. Ms. Bosarge investigated the area within the security fenced area, the property outside of the fenced area along accessible property lines, and residential, commercial and agricultural areas throughout Buellton. Meteorological conditions were recorded and several locations were mapped and designated as survey locations. No odors were detected past the perimeter of the property during this initial investigation.

After the initial tour, Ms. Bosarge continued independently to develop a monitoring plan and complete several additional surveys during the three-day odor assessment study. Approximately twenty-five (25) locations within the property lines, approximately twelve (12) locations close to the facility along Highway 246, approximately twelve (12) locations along the Santa Rosa Road property line and approximately twenty-five (25) locations in the surrounding community were designated and mapped by recording latitude and longitude coordinates at each location. Unique identification codes were assigned to each location. Latitude and longitude coordinates for each location are being entered into Odor Tracker software to produce Google Earth Maps of the areas within the property, along the perimeter of the property and the surrounding community.

Odor Survey – Discussion

Five (5) ambient odor surveys were conducted offsite during the three-day study. Two (2) odor surveys were conducted within the property lines. During each survey, the date, time, odor reading and meteorological conditions, including temperature, humidity, precipitation, sky conditions, wind speed and wind direction were recorded at each location. Each survey was recorded separately and odor survey data reports will appear in the final report.

Approximately two hundred (200) odor observations were conducted and recorded. Since odor detection was so low during the first day of the Odor Study, Ms. Bosarge elected to designate a few locations along the fence line just within the facility and areas next to the crops. Odors ranged from “non-detected” to <2 D/T, to 2 D/T and up to 4 D/T at one area. These areas were next to the fully formed and flowering plants. These levels are extremely low for onsite operations.

Odor Survey Conclusions

In most cases of odor detection, within of the facility, the odor was faint and intermittent at each of the locations where <2 D/T was recorded. These locations were generally directly downwind of growing operations. This value indicates a barely discernible odor with the “naked nose”, but under the threshold to be considered a recognizable odor with the Nasal Ranger Olfactometer on the lowest setting of 2-D/T. Odors ranged from “non-detected” to <2 D/T, to 2 D/T and up to 4 D/T at areas next to the fully formed and flowering plants.

No odors were detected at any of the other designated locations throughout the Buellton Community, during the three-day Odor Study.

Based on the findings in this Odor Study, Bosarge Environmental, LLC, concludes that “no discernible cannabis odor” was detected outside of the facility and is barely recognizable at the perimeter of the property and should not adversely affect the surrounding community.

Bosarge Environmental, LLC,

Submitted by,

Melanie Bosarge

Melanie Bosarge
Bosarge Environmental, LLC

EXHIBIT 6

Bosarge Environmental, LLC
707 Bienville Blvd.
Ocean Springs, MS 39564
(228) 217-3180

October 18, 2019

Sara Rotman
1180 West Highway 246
Buellton, CA 93427

RE: Odor Assessment Study

Introduction

Sara Rotman retained Bosarge Environmental, LLC, as a third-party Odor Expert, to perform an Odor Assessment Study of a property in the vicinity of 1180 West Highway 246 in Buellton, California. Ms. Melanie Bosarge conducted ambient odor surveys the three days of July 22- 24, 2019. This time frame was selected because the farm was in full flowering stage. During this period, the farm would have a crop of fully formed flowering cannabis plants at the stage when terpene odor is the greatest, creating a "worst-case-scenario" of odor for the farm.

Ms. Bosarge is a Chemical Engineer and Owner/Manager of Bosarge Environmental, LLC. She has represented St. Croix Sensory (St. Croix) as a certified instructor and provided client training and odor assessment services, as an independent contractor, since 2002. For more than thirty-five (35) years, St. Croix has been assisting facility owners, consulting engineering firms, and regulatory agencies to quantify odors from a variety of industrial, agricultural, and municipal operations, including wastewater treatment, landfills, composting, and manufacturing in both field and laboratory settings. St. Croix manufactures and markets state-of-the-art odor sampling and measurement equipment, including the Nasal Ranger Olfactometer. St. Croix's "ODOR SCHOOL"® is an internationally recognized program to prepare inspectors to conduct field evaluations of ambient odors.

Ambient Odor Assessment Methodology

Odor surveys were conducted using a Nasal Ranger field olfactometer to quantify odor strength when odor was noticed at each monitoring location. Prior to odor observations, a carbon mask respirator was utilized to "zero" nose to 100%. Upon arrival at each separate location, ambient odor was assessed with the "naked nose". If no odor was detected, the current time and "non-detected" (ND) was recorded. If an odor was detected, a reading was then taken with Nasal Ranger Olfactometer.

Using the Nasal Ranger, odor strength is measured as dilution ratios, reported as Dilution-to-Threshold (D/T) values. The Nasal Ranger Dilution-to-Threshold odor measurement is an "instantaneous" measurement, which is a recognition threshold. For example, a 4-D/T is the dilution ratio of 4-volumes of carbon filtered odor free air mixed with one-volume of ambient (odorous) air that makes the ambient odorous air "just-barely-recognizable" as an odor.

The D/T dilution ratio steps of the Nasal Ranger olfactometer used for the odor surveys were 2, 4, 7, 15, 30, and 60. If an odor was detected with the "naked nose" at a location, a measurement was taken with the Nasal Ranger. An odor in the air that is not measured at the 2-D/T dilution ratio is reported as less than 2-D/T (<2). The absence of ambient odor is reported as "non-detected" (ND).

Odor Survey – Introduction and Mapping

Upon arrival at the farm on the afternoon of July 22, 2019, Ms. Bosarge was taken on an extensive tour of the site. Each area of the property and cannabis process was identified and explained. A plan of action was developed and coordinated. Ms. Bosarge investigated the area within the security fenced area, the property outside of the fenced area along accessible property lines, and residential, commercial and agricultural areas throughout Buellton. Meteorological conditions were recorded and several locations were mapped and designated as survey locations. No odors were detected past the perimeter of the property during this initial investigation.

After the initial tour, Ms. Bosarge continued independently to develop a monitoring plan and complete several additional surveys during the three-day odor assessment study. Approximately twenty-five (25) locations within the property lines, approximately twelve (12) locations close to the facility along Highway 246, approximately twelve (12) locations along Santa Rosa Road and approximately twenty-five (25) locations in the surrounding residential community were designated and mapped by recording latitude and longitude coordinates at each location. Unique identification codes were assigned to each location. Latitude and longitude coordinates for each location are being entered into Odor Tracker software to produce Google Earth Maps of the areas within the property, along the perimeter of the property and the surrounding community.

Odor Survey – Discussion

Five (5) ambient odor surveys were conducted offsite during the three-day study. Two (2) odor surveys were conducted within the property lines. During each survey, the date, time, odor reading and meteorological conditions, including temperature, humidity, precipitation, sky conditions, wind speed and wind direction were recorded at each location. Each survey was recorded separately and odor survey data reports will appear in the final report.

Approximately two hundred (200) odor observations were conducted and recorded. Since odor detection was so low during the first day of the Odor Study, Ms. Bosarge elected to designate a few locations along the fence line just within the farm and areas next to the crops. Odors ranged from "non-detected" to <2 D/T, to 2 D/T and up to 4 D/T at one area. These areas were next to the fully formed and flowering plants. These levels are extremely low for onsite operations.

Odor Survey Conclusions

In most cases of odor detection, within property boundaries, the odor was faint and intermittent at each of the locations where <2 D/T was recorded. These locations were generally directly downwind of growing operations. This value indicates a barely discernible odor with the "naked nose", but under the threshold to be considered a recognizable odor with the Nasal Ranger Olfactometer on the lowest setting of 2-D/T. Odors ranged from "non-detected" to <2 D/T, to 2 D/T and up to 4 D/T at areas next to the fully formed and flowering plants.

No odors were detected at any of the other designated locations throughout the Buellton Community, during the three-day Odor Study.

Based on the findings in this Odor Study, Bosarge Environmental, LLC, concludes that "no discernible cannabis odor" was detected outside the property's boundaries and is barely recognizable at the perimeter of the property and should not adversely affect the surrounding community.

Submitted by,

Melanie Bosarge

Melanie Bosarge
Bosarge Environmental, LLC

EXHIBIT 7

Bosarge Environmental, LLC
707 Bienville Blvd.
Ocean Springs, MS 39564
(228) 217-3180

October 24, 2019

Sara Rotman
1180 West Highway 246
Buellton, CA 93427

RE: Odor Assessment Study

Introduction

Sara Rotman retained Bosarge Environmental, LLC, as a third-party Odor Expert, to perform an Odor Assessment Study of a property in the vicinity of 1180 West Highway 246 in Buellton, California. Ms. Melanie Bosarge conducted ambient odor surveys the three days of July 22- 24, 2019 and the three days of October 7 – 9, 2019. The time frame of the first trip was selected because the farm was in full flowering stage. During this period, the farm would have a crop of fully formed flowering cannabis plants at the stage when terpene odor is the greatest, creating a "worst-case-scenario" of odor for the farm. Initially, there were no plans for a second trip; however, farm owners had recently expanded and planted in the field closer to Highway 246. Ms. Rotman and Ms. Bosarge agreed that an additional trip was needed to document any effects the new plantings might have on cannabis odor leaving the boundaries of the property.

Ms. Bosarge is a Chemical Engineer and Owner/Manager of Bosarge Environmental, LLC. She has represented St. Croix Sensory (St. Croix) as a certified instructor and provided client training and odor assessment services, as an independent contractor, since 2002. For more than thirty-five (35) years, St. Croix has been assisting facility owners, consulting engineering firms, and regulatory agencies to quantify odors from a variety of industrial, agricultural, and municipal operations, including wastewater treatment, landfills, composting, and manufacturing in both field and laboratory settings. St. Croix manufactures and markets state-of-the-art odor sampling and measurement equipment, including the Nasal Ranger Olfactometer. St. Croix's "ODOR SCHOOL"® is an internationally recognized program to prepare inspectors to conduct field evaluations of ambient odors.

Ambient Odor Assessment Methodology

Odor surveys were conducted using a Nasal Ranger field olfactometer to quantify odor strength when odor was noticed at each monitoring location. Prior to odor observations, a carbon mask respirator was utilized to "zero" nose to 100%. Upon arrival at each separate location, ambient odor was assessed with the "naked nose". If no odor was detected, the current time and "non-detected" (ND) was recorded. If an odor was detected, a reading was then taken with Nasal Ranger Olfactometer.

Using the Nasal Ranger, odor strength is measured as dilution ratios, reported as Dilution-to-Threshold (D/T) values. The Nasal Ranger Dilution-to-Threshold odor measurement is an "instantaneous" measurement, which is a recognition threshold. For example, a 4-D/T is the dilution ratio of 4-volumes of carbon filtered odor free air mixed with one-volume of ambient (odorous) air that makes the ambient odorous air "just-barely-recognizable" as an odor.

The D/T dilution ratio steps of the Nasal Ranger olfactometer used for the odor surveys were 2, 4, 7, 15, 30, and 60. If an odor was detected with the "naked nose" at a location, a measurement was taken with the Nasal Ranger. An odor in the air that is not measured at the 2-D/T dilution ratio is reported as less than 2-D/T (<2). The absence of ambient odor is reported as "non-detected" (ND).

Figure 1 – Nasal Ranger Olfactometer is a photograph taken during an odor survey at a cannabis growing operation in Colorado.

Figure No. 1 – Nasal Ranger Olfactometer

Odor Survey – Introduction and Mapping

Upon arrival at the farm on the afternoon of July 22, 2019, Ms. Bosarge was taken on an extensive tour of the site. Each area of the property and cannabis process was identified and explained. A plan of action was developed and coordinated. Ms. Bosarge investigated the area within the security fenced area, the property outside of the fenced area along accessible property lines, and residential, commercial and agricultural areas throughout Buellton. Meteorological conditions were recorded and several locations were mapped and designated as survey locations. No odors were detected past the perimeter of the property during this initial investigation.

After the initial tour, Ms. Bosarge continued independently to develop a monitoring plan and complete several additional surveys during the first three-day odor assessment study. During the second trip, a few more locations were added. Prior to the trip on July 22 – 24, 2019, Ms. Bosarge visited the Buellton area July 1 -5, 2019, to perform an Odor Study of a client's property on Santa Rosa Road. Each of the offsite odor monitoring locations established for the Santa Rosa Road property were included in this Odor Survey.

A total of seventy-seven (77) odor survey locations in the surrounding residential, commercial and agricultural community were designated and mapped by recording latitude and longitude coordinates at each location. Unique identification codes were assigned to each location. Latitude and longitude coordinates for each location were entered into Odor Tracker software to produce Google Earth Maps of the areas along the perimeter of the property and the surrounding community. ***Table No. 1 Odor Monitoring Locations*** lists the center of the cannabis farm as Location X, along with Seventy-seven (77) ambient odor survey locations. The table specifies an identification number, the latitude and longitude coordinates for each location. Table No. 1 is attached as an electronic file as Exhibit 2 in the Appendix.

Figure No. 2 - Odor Inspection Locations Full View identifies the center of the cannabis facility as Location X and each of the seventy-seven (77) monitoring locations on a Google Earth map.

Figure No. 2 - Odor Inspection Locations Full View

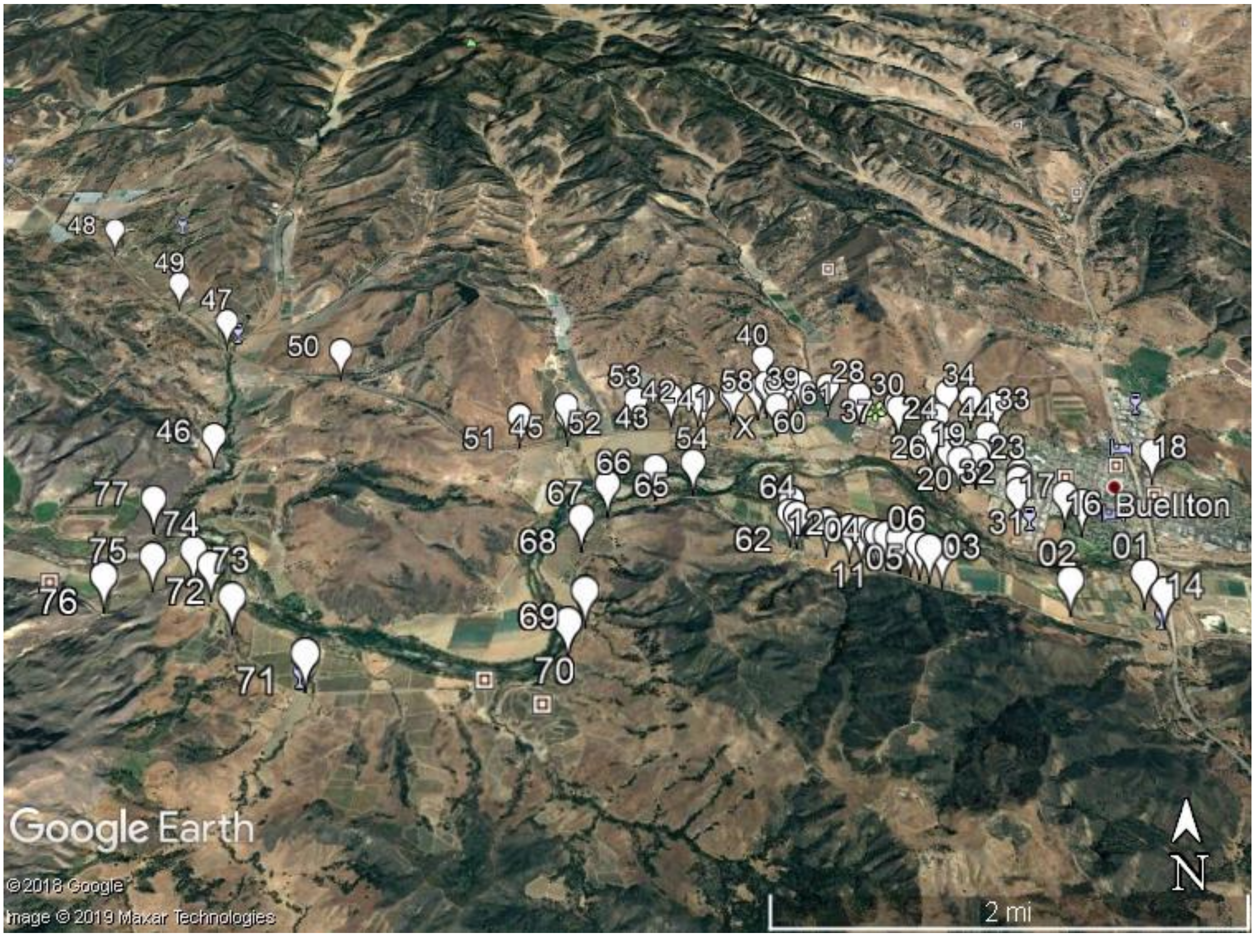


Figure No. 3 - Odor Inspection Locations Full View identifies the center of the cannabis facility as Location X and each of the monitoring locations west of the farm on a Google Earth map. Locations 72 through 76 were established during the second trip because cannabis odors were detected along Santa Rosa Road during one of the surveys. After investigating the odor, a large cannabis farm was found in the area.

Figure No. 3 - Odor Inspection Locations West of TOR Farm

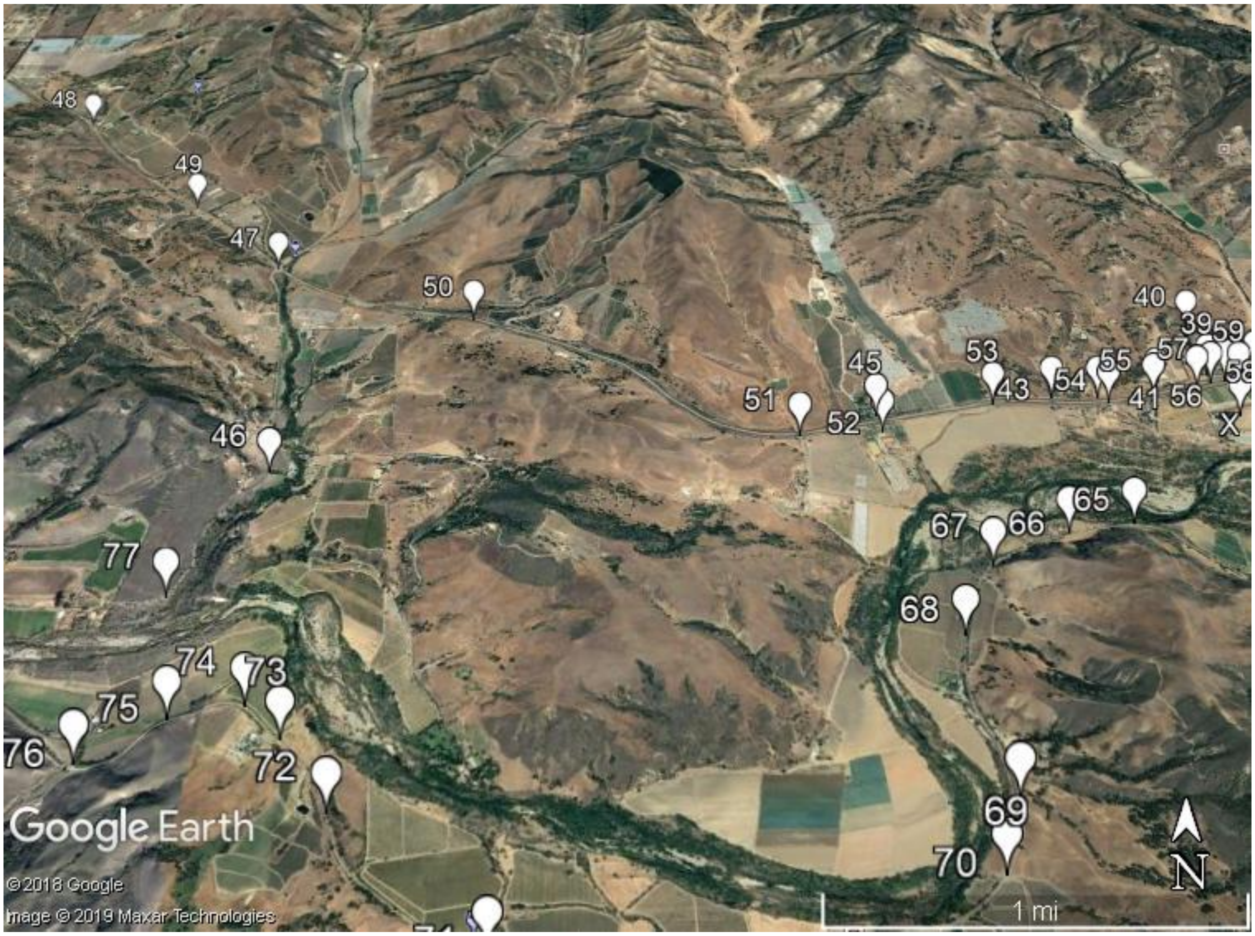


Figure No. 4 - Odor Inspection Locations Full View identifies the center of the cannabis facility as Location X and each of the monitoring locations east of the farm on a Google Earth map.

Figure No. 4 - Odor Inspection Locations East of TOR Farm

Figure No. 5 - Odor Inspection Locations Full View identifies the center of the cannabis facility as Location X and each of the monitoring locations north of the farm on a Google Earth map.

Figure No. 5 - Odor Inspection Locations North of TOR Farm

Figure No. 6 - Odor Inspection Locations Full View identifies the center of the cannabis facility as Location X and each of the monitoring locations south of the farm on a Google Earth map.

Figure No. 6 - Odor Inspection Locations South of TOR Farm

Figure No. 7 - Odor Inspection Locations Full View identifies the center of the cannabis facility as Location X and each of the monitoring locations in the Buellton Community on a Google Earth map.

Figure No. 7 - Odor Inspection Locations in the Buellton Community

Figure No. 8 - Odor Inspection Locations Full View identifies the center of the cannabis facility as Location X and each of the monitoring locations close the Waste Water Treatment Facility (WWTF) on a Google Earth map. Readings at the WWTF ranged from N.D. to 60 D/T.

Figure No. 8 - Odor Inspection Locations Close to the Waste Water Treatment Facility

Figure No. 9 - Odor Inspection Locations Full View identifies the center of the cannabis facility as Location X and each of the monitoring locations in close proximity to the farm on a Google Earth map.

Figure No. 9 - Odor Inspection Locations in Close Proximity of TOR Farm

Odor Survey – Discussion

During the first trip, five (5) ambient odor surveys were conducted offsite during the three-day study. Two (2) odor surveys were conducted within the property lines. During the second trip, five (5) ambient odor surveys were conducted offsite during the three-day study. Two (2) odor surveys were conducted within the property lines. During each survey, the date, time, odor reading and meteorological conditions, including temperature, humidity, precipitation, sky conditions, wind speed and wind direction were recorded. Each survey was recorded separately and odor survey data reports were generated.

Approximately four hundred (400) odor observations were conducted and recorded. Since odor detection was so low during the first day of the Odor Study, Ms. Bosarge elected to designate a few locations along the fence line just within the farm and areas next to the crops. During the first trip, onsite odors ranged from "non-detected" to <2 D/T, to 2 D/T and up to 4 D/T at one area. These areas were next to the fully formed and flowering plants. These levels are extremely low for onsite operations. During the second trip, odors ranged from "non-detected" to <2 D/T, and up to 2 D/T at areas next to the fully formed and flowering plants in the fields.

Four locations along Highway 246, next to the property perimeter were also added. No cannabis odor was detected at any of these locations, even when downwind of the farm. These locations are within approximately two hundred feet of the north cannabis crop.

Odor Survey Conclusions

In most cases of odor detection, within property boundaries, the odor was faint and intermittent at each of the locations where <2 D/T was recorded. These locations were generally directly downwind of growing operations. This value indicates a barely discernible odor with the "naked nose", but under the threshold to be considered a recognizable odor with the Nasal Ranger Olfactometer on the lowest setting of 2-D/T.

No cannabis odors were detected at any of the other designated locations throughout the Buellton Community, during either Odor Study trip, other than locations along Santa Rosa Road at or near the other two cannabis farms.

Based on the findings in this Odor Study, Bosarge Environmental, LLC, concludes that "no discernible cannabis odor" from this farm was detected outside the property's boundaries and is barely recognizable at the perimeter of the property and should not adversely affect the surrounding community.

Submitted by,

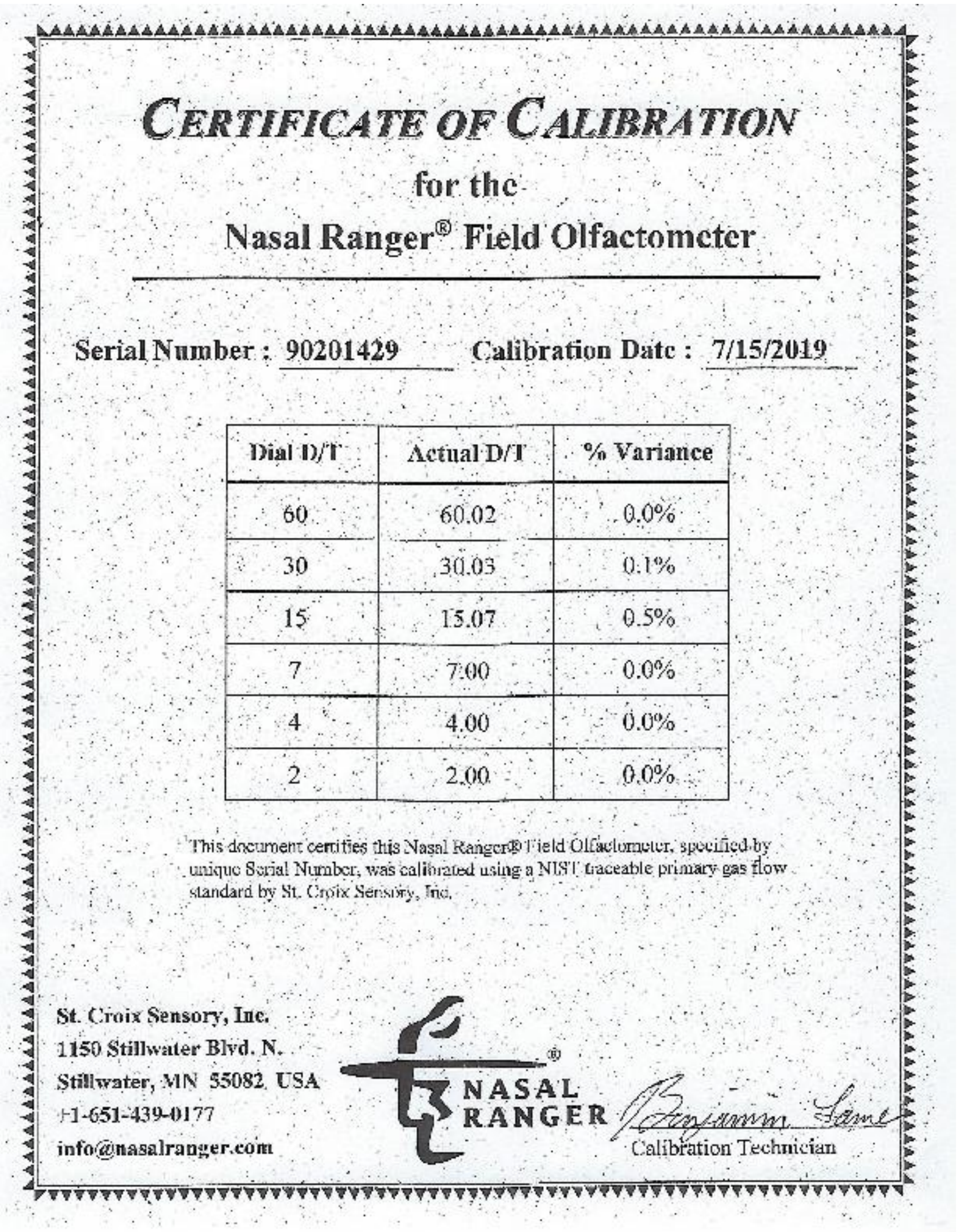
Melanie Bosarge

Melanie Bosarge
Bosarge Environmental, LLC

APPENDIX

EXHIBIT 1

Nasal Ranger Olfactometer Calibration Certificate



CERTIFICATE OF CALIBRATION

for the

Nasal Ranger® Field Olfactometer

Serial Number : 90201429 **Calibration Date : 7/15/2019**

Dial D/T	Actual D/T	% Variance
60	60.02	0.0%
30	30.03	0.1%
15	15.07	0.5%
7	7.00	0.0%
4	4.00	0.0%
2	2.00	0.0%

This document certifies this Nasal Ranger® Field Olfactometer, specified by unique Serial Number, was calibrated using a NIST traceable primary gas flow standard by St. Croix Sensory, Inc.

St. Croix Sensory, Inc.
1150 Stillwater Blvd. N.
Stillwater, MN 55082 USA
+1-651-439-0177
info@nasalranger.com

NASAL RANGER®

Benjamin Lame
Calibration Technician

Exhibit 2

Odor Monitoring Locations in the Buellton Community

Loc #	Name	Latitude	Longitude
1	Drive Way Off Santa Rosa Road	34.60211	-120.19427
2	Santa Rosa Road @ 1527-74	34.60137	-120.20136
3	9000A Santa Rosa Road	34.60414	-120.21247
4	Santa Rosa Road @ CCA Entrance	34.60581	-120.21733
5	Santa Rosa Road @ Double Poles	34.60448	-120.21361
6	Santa Rosa Road @ Pole by Field	34.60480	-120.21446
7	Santa Rosa Road @ Pole w/Tripod	34.60509	-120.21523
8	Santa Rosa Road @ Pole before CCA	34.60543	-120.21619
9	Santa Rosa Road @ CCA Brown Trailer	34.60606	-120.21802
10	Santa Rosa Road @ Pole 54901	34.60621	-120.21867
11	Santa Rosa Road @ Mailbox 8729	34.60642	-120.21964
12	8660 Santa Rosa Road Yellow House	34.60677	-120.22075
13	8669 Santa Rosa @ Vineyard Drive	34.60725	-120.22285
14	Santa Rosa Road @ Wine Taste Sign	34.60030	-120.19321
15	595 Shadow Mountain by Golf Course	34.60940	-120.19744
16	Basketball Court @ Golf Course	34.61032	-120.19879
17	Industrial Way @ Al Star Heat & Air	34.61073	-120.20325
18	Courtyard Marriot Hotel	34.61514	-120.18822
19	River View Park @ Back Gate	34.61444	-120.20805
20	River View Park @ Back Far Left	34.61479	-120.20636
21	545 Meadowview Above Park	34.61690	-120.20839
22	Meadowview @ Valley Dairy	34.61524	-120.20583
23	Ranch Club Estates @ Dumpster	34.61287	-120.20248
24	595 Meadowview @ Riverview	34.61768	-120.21012
25	River View Park @ Gate by Dumpster	34.61518	-120.20741
26	River view Park @ Back Bench	34.61526	-120.20891
27	River View Park Far Right Back Trail	34.61705	-120.21068
28	Hwy 246 @ Vet Clinic	34.62247	-120.21690
29	Hwy 246 @ Valley Compost	34.62376	-120.22510
30	Hwy 246 @ Emu Farm	34.62074	-120.21300
31	Industrial Way - Waste Water Plant	34.61202	-120.20282
32	Industrial Way - WWTF Top of Hill	34.61229	-120.20268
33	Via Corona @ Valley Dairy	34.62110	-120.20250
34	Via Corona @ Cliffrose	34.62190	-120.20500
35	Via Corona @ Riverview	34.62260	-120.20740
36	Hwy 246 @ Riverview	34.61970	-120.20910
37	795 Hwy 246 - Brick Barn Winery	34.62131	-120.21314
38	Hwy 246 Past Mailbox 1089	34.62436	-120.22361

39	Hwy 246 @ Mailbox 1255	34.62408	-120.22680
40	Hwy 246 Mailbox 1255 @ End	34.62750	-120.22680
41	Hwy 246 @ Mailbox 1331	34.62300	-120.23050
42	Hwy 246 @ Mailbox 1459	34.62240	-120.23440
43	Hwy 246 @ Mailbox 1607	34.62240	-120.23730
44	Hwy 246 @ Valley Dairy	34.61739	-120.20440
45	Hwy 246 @ Pence Ranch	34.62110	-120.24860
46	Mail Road @ Coyote Creek	34.61711	-120.28510
47	Hwy 246 @ Mail Road	34.63290	-120.28870
48	Hwy 246 @ Foley Estate Winery	34.64810	-120.30780
49	Hwy 246 @ Spear Winery	34.63880	-120.29630
50	Hwy 246 @ Williams Ranch	34.62810	-120.27430
51	Hwy 246 @ Mailbox 2200	34.61970	-120.25350
52	Hwy 246 @ Crimson Farm	34.61997	-120.24840
53	Hwy 246 Abandoned Drive	34.62200	-120.24110
54	Hwy 246 @ Mailbox 1450 Red House	34.62210	-120.23380
55	Hwy 246 @ Windmill	34.62260	-120.23080
56	Hwy 246 @ NW Perimeter	34.62320	-120.22780
57	Hwy 246 @ TOR Yellow Reflector	34.62350	-120.22680
58	Hwy 246 @ TOR White Post	34.62370	-120.22580
59	Keypad before Gate to TOR	34.62351	-120.22500
60	Hwy 246 Driveway Past TOR	34.62410	-120.22300
61	Hwy 246 @ Mailbox 1050	34.62370	-120.22010
62	Santa Rosa @ Mailbox 8550	34.60799	-120.22560
63	Santa Rosa @ Tree Orchard in Field	34.60968	-120.22585
64	Santa Rosa @ Drive to Tree Orchard	34.60825	-120.22623
65	Santa Rosa by Culvert PP S20012Y	34.61394	-120.23535
66	Santa Rosa @ Mailbox 8201	34.61340	-120.23920
67	Santa Rosa @ Rio Vista Vineyard	34.61150	-120.24400
68	Santa Rosa @ Mailbox 7820	34.60777	-120.24647
69	Santa Rosa @ Mailbox 7801	34.60036	-120.24585
70	Santa Rosa @ Peake Ranch	34.59748	-120.24729
71	LaFond Winery	34.59481	-120.26992
72	Santa Rosa @ Mailbox 6725	34.59980	-120.27781
73	Santa Rosa By Water Well	34.60294	-120.28080
74	Santa Rosa On Hill	34.60447	-120.28295
75	Santa Rosa before Cannabis Farm	34.60382	-120.28656
76	Santa Rosa @ Cannabis Farm	34.60184	-120.29029
77	Mail Road @ Curve on Hill	34.60989	-120.28874
X	TOR Center of Reference	34.62116	-120.22597

EXHIBIT 8

SESPE
CONSULTING, INC.

468 Poli Street, Suite 2E • Ventura, California 93001

MEMORANDUM

Date: October 18, 2019

To: Ms. Sara Rotman, Busy Bee Organics

From: Scott Cohen, P.E., C.I.H. and Andre Almeida, P.E.

Re: Cannabis Odor Modeling

Sespe was hired to perform independent air quality analysis to clarify relative odor impacts from the subject property (Figure 1) and provide expert testimony regarding methods that were used and findings of the analytical effort.

Methods used in preparing this memo are the same as those used for industrial projects that emit air pollutants. Air pollution engineering and analysis is one of Sespe's core services and staff has assessed many industrial projects for significance of air quality impacts and air quality health risk assessment impacts. Resumes for Sespe staff that performed this work and briefs describing similar air quality projects are provided in Attachment 3.

In order to determine the relative impact of odor on various locations surrounding the Busy Bee Organics site, this document describes the existing setting and quantifies the severity and frequency of potential odor episodes.

1.0 EXISTING SETTING

The Project proposes to cultivate cannabis on 22 acres of the 64 acre parcel or approximately one-third of the available space. The parcel is located within lands zoned for agricultural use and specifically cannabis cultivation as described in applicable County Ordinances, Programs guidelines, and an existing programmatic environmental impact report (PEIR) that assessed impacts from cannabis cultivation during approval of those ordinances and programs. As discussed in the Staff Report, the Project including potential odor is consistent with the Ordinance and PEIR. Thus, additional analysis may not be required.

In addition to the land use and cannabis related ordinances and requirements, the County Air Pollution Control District Rule 303 (and California Health & Safety Code from which it derives its authority) prohibits nuisance as follows:

> *A person shall not discharge from any source whatsoever such quantities of air contaminants or other material in violation of Section 41700 of the Health and Safety Code which cause injury, detriment, nuisance or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health or safety or any such persons or the public or which cause or have a natural tendency to cause injury or damage to business or property.*
> https://www.ourair.org/wp-content/uploads/rule303.pdf

Accordingly, odor emissions may be a nuisance if the following are true:

1. Injury, detriment, nuisance or annoyance results from the odor and the odor affects a considerable number of persons or the public; or
2. The odor endangers the comfort, repose, health or safety or any such [considerable number of] persons or the public; or
3. The odor causes or has a natural tendency to cause injury or damage to business or property.

If the County were to receive an odor complaint, Rule 303 is a standard by which the complaint and conditions on the ground would be evaluated. There have been eight (8) harvests of cannabis grown on the property since 2014. The County has not received any odor complaints related to this site.

Various documents relevant to cannabis are available on the APCD land use webpage under the subheading “Cannabis and Air Quality.”[1]

2.0 ODOR MODELING

Information regarding cannabis odor was collected from resources referenced herein. In general, research indicates that the state-of-science remains lacking for this nascent industry. Nevertheless, Sespe was able to exercise some professional judgment and collect sufficient information from several sources to prepare an air dispersion model. Model results are consistent with the history of the site in which no complaints have been made. Model background, parameters and results are discussed below.

The United States Environmental Protection Agency (EPA) AERMOD (version 19191) gaussian dispersion model as implemented by the Lakes Environmental AERMOD View software package was used to predict concentrations of several odorous compounds that were described in the literature review. The AERMOD dispersion model is the preferred model by EPA (see Title 40 Code of Federal

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[1] https://www.ourair.org/land-use/

Regulations Section 51, Appendix W)[2], CARB (see HARP webpage)[3], and Santa Barbara County APCD (Modeling Guidelines for Air Quality Impact Assessment, April 2019)[4]. AERMOD is used by all types of industrial sources that emit pollutants to demonstrate that new and modified sources will not result in concentrations that exceed or contribute to an existing exceedance of an ambient air quality standard (AAQS). In addition, California agencies and air districts throughout the State use AERMOD to assess health risk from toxic air contaminants (TACs) under the AB 2588 Air Toxics Hot Spot Program and as needed to evaluate potential impacts under CEQA. Thus, it is appropriate to use AERMOD to evaluate potential for odor conditions around the Busy Bee Organics Project site.

2.1 Meteorological Data

One of the primary inputs to AERMOD is hourly wind data. Generally, meteorological stations should be within ten miles of a model domain (i.e., site and receptors) to possibly be considered representative. If no station exists, then prognostic wind data sets generated by the EPA processor software, MMIF, may be used to generate Mesoscale Meteorological 5 (MM5) datasets for use in modeling. In this case, the closest station with wind data is located on H Street in Lompoc. Given the distance and differences in terrain between Lompoc and the model domain, it was determined that MM5 generated wind data would be more representative. Therefore, Lakes Environmental was contracted to generate wind data that would be representative of conditions near the Project site. As discussed above, Lakes Environmental packages EPA AERMOD code and would be expert in assessing the representativeness and of wind datasets and in preparing MM5 data as was done in this case.

Site specific meteorological data for the time period of Jan 1, 2014 to Dec 31, 2018 (Attachment 2) was purchased from Lakes Environmental and used in the AERMOD model to calculate concentration of odorous chemicals in and around the Project site.

Flowering season generally occurs twice a year in June / July and in October / November but can vary depending on seasonal weather conditions. It is during this time that odor is a concern. Wind data was modeled for each of the five (5) years contained in the dataset. Normally, low wind speed results in stagnation and plumes remain more cohesive during stagnation producing the highest model concentrations. High wind periods result in greater dispersion of pollutants and lower concentrations.

Review of the wind dataset shows the frequency of Calm Winds (wind less than 0.97 Knots) was 0.51% during the flowering period. This means that throughout the course of a year, calm winds and potential for related high concentrations of odorous emissions from flowering cannabis may occur simultaneously for 0.1% of the time.

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[2] https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol2/pdf/CFR-2018-title40-vol2-part51-appW.pdf

[3] https://ww3.arb.ca.gov/toxics/harp/harp.htm

[4] https://www.ourair.org/wp-content/uploads/aqia.pdf

2.2 Cannabis Emissions Rates

The model contains a single area source with initial vertical dimension of 3 meters and initial release height of 1.5 meters emitting uniformly at a constant rate of 0.172 gram per second (g/s). The emissions rate was derived from an assumption that one (1) acre yields 200 kg of dry cannabis product (Kern County Cannabis Land Use Ordinance Project FEIR, July 2017).[5]

A pre-print copy of an article authored by researchers at University of North Carolina at Chapel Hill, University of Colorado at Boulder, Lancaster Environment Centre in United Kingdom, and University of California at Irvine titled "Potential Regional Air Quality Impacts of Cannabis Cultivation Facilities in Denver, Colorado" is under review for possible publication in the journal, Atmospheric Chemistry and Physics (ACP).[6] The article presents "emissions capacity" on a dry weight basis of 100 µg of organic emissions per gram of dry weight cannabis product per hour (µg gdw^{-1} hr^{-1}) which was used with the dry weight per acre to determine the 31-acre site specific emissions rate used in the model (0.172 g/s).[7]

2.3 Odor Thresholds

The Kern County FEIR contains data showing the relative amounts of various odorous chemicals associated with cannabis cultivation and an "ODT" odor threshold for each. The ODT is defined as the concentration of a compound that may be detectable by fifty-percent (50%) of the population and states that "nuisance levels typically occur at concentrations that are several multiples higher than the ODT." Thus, using the ODT as a threshold for nuisance should be overly conservative and is the approach taken in evaluating the model results. Table 1 presents the relative rate of emissions and ODTs used to obtain the weighted ODT of 28.1 ppb that was applied to modeled data in order to produce an isopleth representative of the ODT for the mixture of odorous chemicals.

Table 1. Odor Thresholds

Chemical	Emissions Rate (g/s)	Relative Emissions	ODT (ppm)	Weighted ODT (ppm)
Benzaldehyde	2.59E-05	53.7%	4.17E-02	0.02240
Myrcene	2.05E-05	42.5%	1.30E-02	0.00553
Decanal	1.72E-07	0.4%	8.97E-04	0.00000
Heptanal	1.64E-06	3.4%	4.79E-03	0.00016
Mixture ODT:				0.02810

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[5] https://kernplanning.com/environmental-doc/kern-county-cannabis-land-use-ordinance-project/

[6] https://www.atmos-chem-phys-discuss.net/acp-2019-479/

[7] The Project site is 64 acres of which 31 acres are outside the riverbed and 22 acres (about one-third of the Project site) would be used for cannabis cultivation. The cannabis emissions modeled are based on the 31-acre value. Thus, the mass of emissions in the model is approximately 30% greater than necessary leading to odor estimates that are overly conservative.

2.4 Model Results

AERMOD produces output in units of µg/m^3 and the Lakes Environmental software contains a tool for converting results to other units. It was assumed that the average chemical weight for these compounds is 136.1 grams per gram-mole (g/g-mole) which is a value reported for myrcene and several other terpenes.[8] Using the chemical weight, the model results were converted to parts per billion (ppb). Parts per billion concentration of the mixture was then divided by the mixture ODT (28.1 ppb) calculated in Table 1 to produce results normalized to the mixture ODT where a value of 1.0 is equal to the ODT, values lower than 1.0 are less than the ODT, and values greater than 1.0 exceed the ODT and are thus much more likely to be detected as odor. Figure 2 shows the model results which indicate that 99.8% of the time the odor is less than 1.0 ODT index at any point in the model domain (i.e., on- or off-site). In addition, the 0.8 odor index isopleth remains within the Project site.

Table 2. Discrete Receptors Including Residences

ID	UTM Zone 11 East (m)	UTM Zone 11 North (m)	Odor Index
1	754344	3834885	0.4497
2	754290	3834924	0.3363
3	754194	3834953	0.2664
4	754392	3834910	0.331
5	754753	3834810	0.2264
6	753826	3834793	0.2447
7	753605	3834813	0.1859
8	753488	3834726	0.1538
9	753451	3834684	0.1443
10	754075	3834453	0.4118
11	753806	3834560	0.2219
12	753812	3834512	0.2064
13	753830	3834454	0.2119
14	754428	3833184	0.06878
15	754658	3833639	0.1277
16	755046	3832953	0.06577
17	755665	3832724	0.06041
18	755090	3834525	0.1791
19	752248	3834465	0.05271
20	752255	3834520	0.05472

Source: Air dispersion modeling (Attachment 3).

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[8] https://www.steephill.com/science/terpenes

The two-tenths of one percent (0.2%) of time that ODT may be greater than shown in the model is appropriate given analogous EPA ambient air quality standards which are promulgated as statistical standards. For instance, PM_{10} and $PM_{2.5}$ each are evaluated at the 98th percentile rather than then highest concentration output by the model or measured by an air agency. The form and values of ambient air quality standards are summarized by CARB[9] and contain a footnote which states:

> *National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m^3 is equal to or less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard….*

3.0 CONCLUSION

Air dispersion modeling was performed to estimate the level of odor near the Project site. Concentrations of common odorous compounds found in cannabis and comprising the model output were then converted to an odor index using the odor detection thresholds and weighted amounts of the compounds. Odor indices greater than one (1.0) indicate a greater than 50% likelihood that odor would be detected and indices less than one (1.0) indicates less than 50% likelihood that odor would be detected. As shown on Figure 2, 99.8% of the time the odor index on-site is less than one (i.e., 0.8715 O.I.) and odor index is less than 0.8 O.I. at each location outside the property boundary. The greatest odor index value predicted by the model to occur at a residence is 0.45 O.I. which is exceeded less than 0.2% of the time at UTM Zone 11, 754344 m E, 3834885 m N. Given only half of people would detect odor at 1.0 O.I., much less than half of people would detect odor at residential locations surrounding the Project site. Given the range of odor indices at residences, detection of odor by occupants is considered unlikely resulting in compliance with APCD’s Nuisance Rule discussed above and corresponding to a less than significant impact due to odorous emissions from the Project site.

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[9] https://ww3.arb.ca.gov/research/aaqs/aaqs2.pdf

ATTACHMENT 1
Figures

PROJECT TITLE:

Discrete Sources & Receptors
Busy Bee Organics

COMMENTS:

SOURCES:

1

RECEPTORS:

1576

NOTICE:

MODELER:

SDC

DATE:

9/13/2019

SCALE:

1:32,437

0 1 km

SESPE
CONSULTING, INC.

PROJECT NO.:

AERMOD View - Lakes Environmental Software

I:\z_AERMOD\BusyBeeOrganics\BBO_SiteMetData.isc

PROJECT TITLE:

99.8%tile Peak Hour Odor Index
Busy Bee Organics

COMMENTS:

SOURCES:

1

RECEPTORS:

3257

OUTPUT TYPE:

Concentration

NOTICE:

Values are relative.

MODELER:

SDC

DATE:

10/18/2019

SCALE: 1:9,593

0 0.2 km

SESPE CONSULTING, INC.

PROJECT NO.:

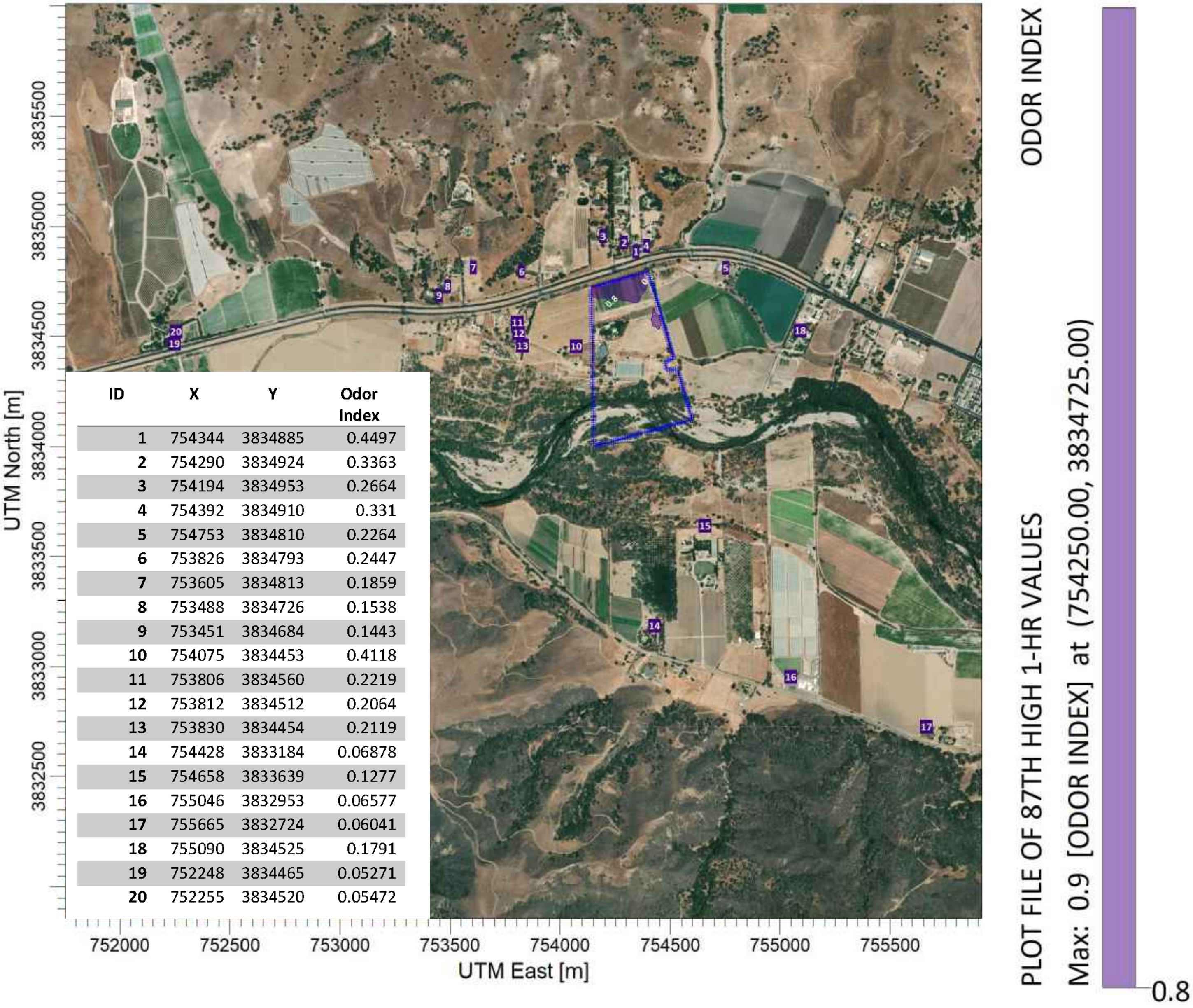
BU03.19.01

AERMOD View - Lakes Environmental Software

I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SiteMetData.isc

PROJECT TITLE:

99.8%tile Peak Hour Odor Index
Busy Bee Organics



ID	X	Y	Odor Index
1	754344	3834885	0.4497
2	754290	3834924	0.3363
3	754194	3834953	0.2664
4	754392	3834910	0.331
5	754753	3834810	0.2264
6	753826	3834793	0.2447
7	753605	3834813	0.1859
8	753488	3834726	0.1538
9	753451	3834684	0.1443
10	754075	3834453	0.4118
11	753806	3834560	0.2219
12	753812	3834512	0.2064
13	753830	3834454	0.2119
14	754428	3833184	0.06878
15	754658	3833639	0.1277
16	755046	3832953	0.06577
17	755665	3832724	0.06041
18	755090	3834525	0.1791
19	752248	3834465	0.05271
20	752255	3834520	0.05472

COMMENTS:

Figure 3

SOURCES:

1

RECEPTORS:

3257

OUTPUT TYPE:

Concentration

NOTICE:

Values are relative to the Odor Detection Threshold for the mixture of terpene compounds assessed.

MODELER:

SDC

DATE:

10/18/2019

SCALE: 1:28,286

0 0.5 km

SESPE CONSULTING, INC.

PROJECT NO.:

BU03.19.01

AERMOD View - Lakes Environmental Software

I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SiteMetData.isc

ATTACHMENT 2
Meteorological Data

AERMOD-Ready Station Met Data

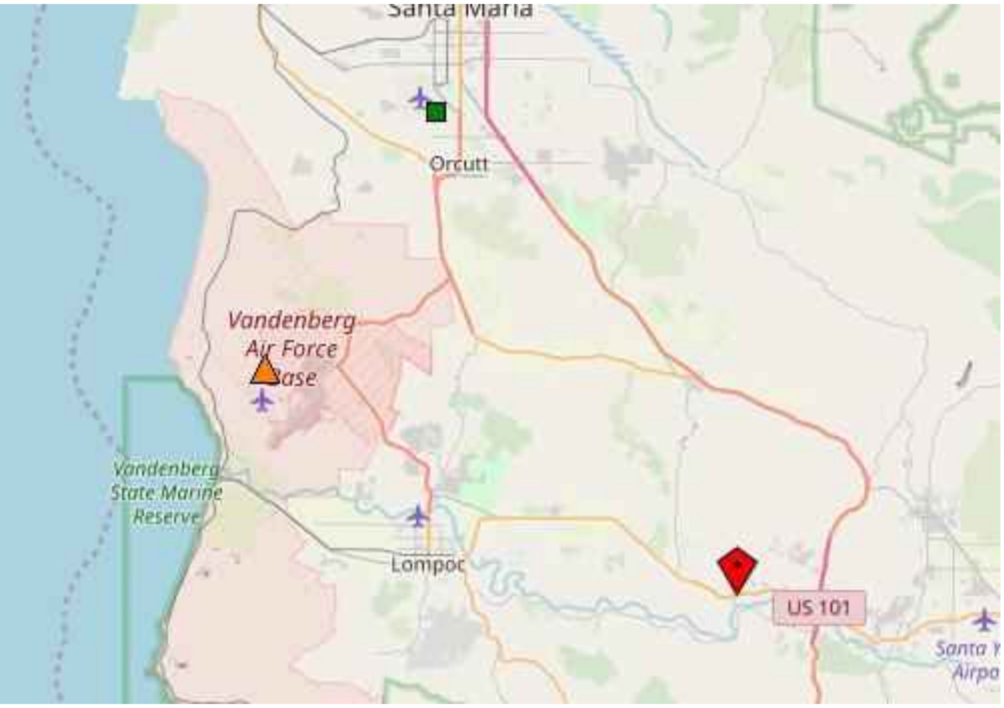
SFC and PFL Met Data Files

August 1, 2019

Met Data Order Information

Order #	MET1914753
Ordered by	Andre Almeida
Company	Sespe Consulting
Met Data Type	AERMOD-Ready Station Met Data (Surface & Profile Met Data Files)
Start-End Date	Jan 1, 2014 to Dec 31, 2018
Modeling Site Latitude	34.62083 N
Modeling Site Longitude	120.24722 W
Datum	WGS 84
Site Time Zone	UTC/GMT UTC-0800 hour(s)
Closest City & State	Buellton, California - USA

◆ Modeling Site 🟩 Surface Met Station ▲ Upper Air Met Station



Location of Modeling Site, Surface Station, and Upper Air Station

Model Versions Used for Met Data Preprocessing

Parameter	Value
AERMET	Version 18081
AERMINUTE	Version 15272
AERSURFACE	Version 13016

Hourly Surface Station Met Data Information

Parameter	Value
Surface Station Name	SANTA MARIA PUBLIC, CA
Latitude, Longitude	34.89406 N, 120.45216 W
Station ID (WBAN)	23273
ASOS Station?	Yes
File Format	NCDC TD-3505 (ISHD)
Base Elevation	72.5 m
Adjustment to Local Time	8 hours
Anemometer Height	10 m

1-Minute & 5-Minute ASOS Wind Data Information

Parameter	Value
AERMINUTE Data Used?	Yes
Station Name	SANTA MARIA PUBLIC, CA
Latitude, Longitude	34.89406 N, 120.45216 W
Station Code	SMX
Station ID (WBAN)	23273
File Format	NCDC TD-6405
IFW Installation Date	June 6, 2007

Upper Air Station Met Data Information

Parameter	Value
Upper Air Station Name	VANDENBERG, CA
Latitude, Longitude	34.75 N, 120.57 W
Station ID (WBAN)	93214
File Format	FSL
Adjustment to Local Time	8 hours

AERSURFACE Parameters

Parameter	Value
Land Use Data File	USGS NLCD92 – Binary Format
Center Lat/Long	34.89406 N, 120.45216 W
Datum	NAD83
Radius for Surface Roughness	1km
Number of Sectors	12 sectors of 30° (starting at 0°)
Period	Monthly
Surface Moisture	Year 2014: Average Year 2015: Dry Year 2016: Average Year 2017: Average Year 2018: Average
Other Settings	Continuous Snow: No Airport Site: Yes Arid Region: No

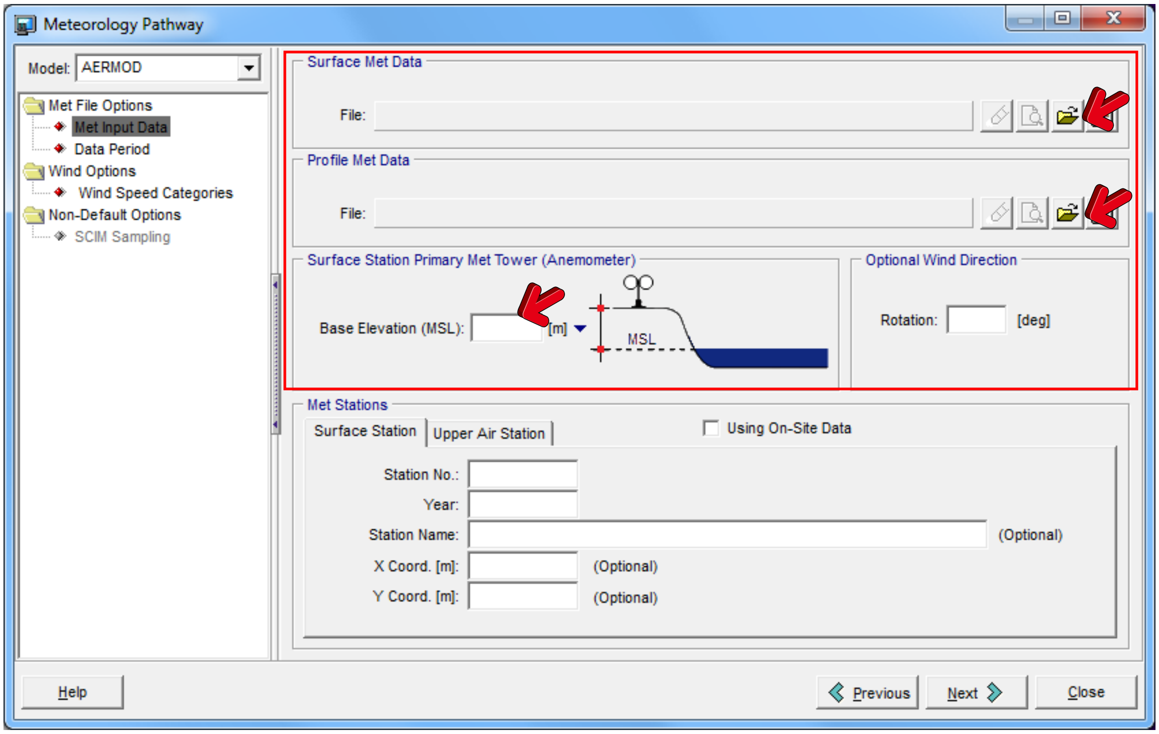
AERMOD View Instructions

Start your **AERMOD View** project and go to the **Meteorology Pathway – Met Input Data** window.

Under the **Meteorology Pathway – Met Input Data** window, specify the Surface Met Data file (*.SFC) and the Profile Met Data file (*.PFL) you received from Lakes Environmental according to table below:

AERMOD Parameters

Parameter	Value
Surface Met Data File	MET1914753_2014_2018.SFC
Profile Met Data File	MET1914753_2014_2018.PFL
Station Base Elevation (MSL)	72.5 m
Surface Station No.	23273
Surface Station Name	SANTA MARIA PUBLIC, CA
Start Year	2014
Upper Air Station No.	93214
Upper Air Station Name	VANDENBERG, CA
Start Year	2014



Having Problems?

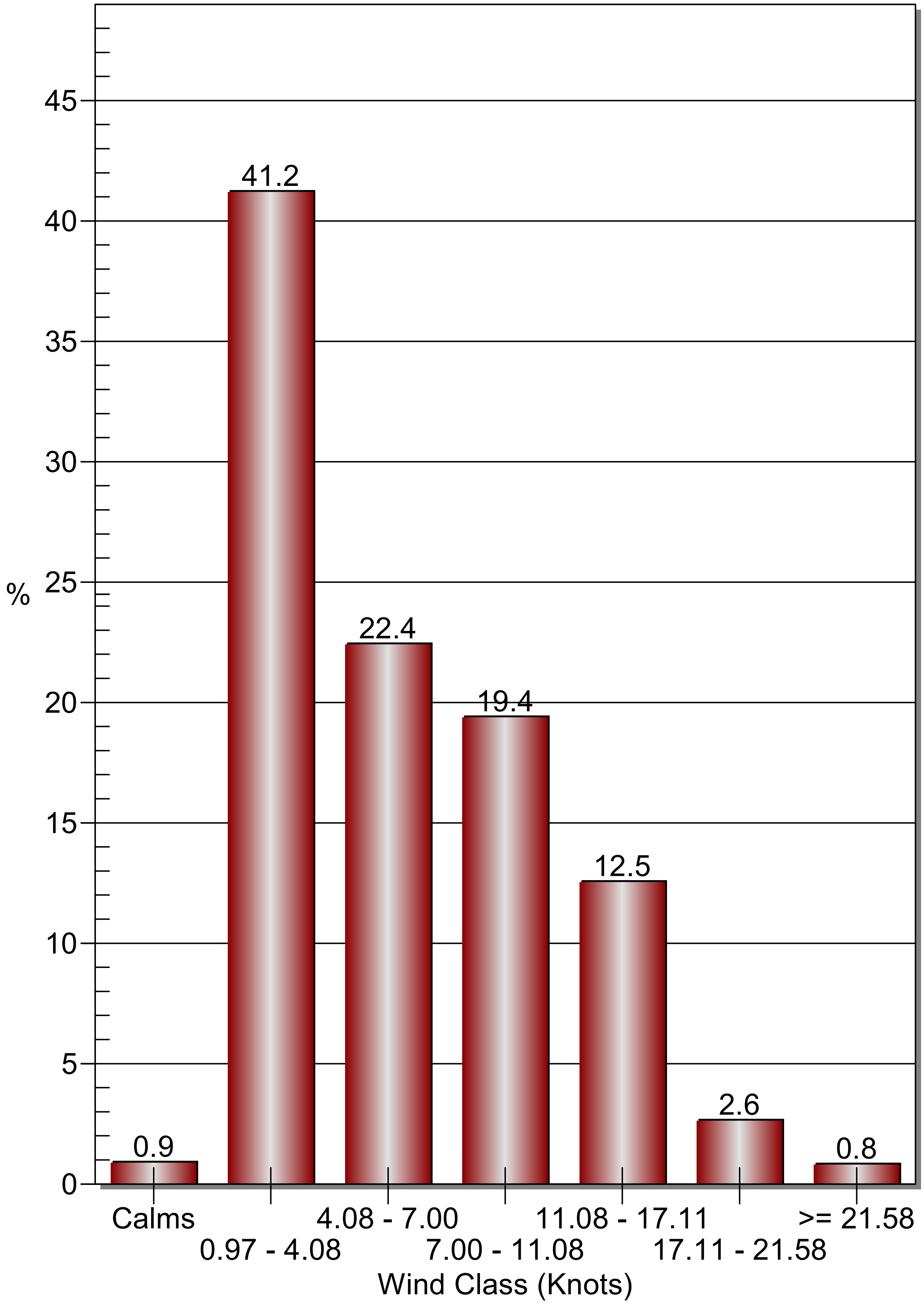
If you have any problems with the met data you received from us or need additional information on the above steps, please do not hesitate to contact us by sending an email to:

sales@webLakes.com

When contacting us, please provide:

- Met data Order # MET1914753
- Detailed description of the problem

Wind Class Frequency Distribution



WRPLOT View 9.6.5 - Lakes Environmental Software

Station ID: 23273 Run ID:
Start Date: 1/1/2014 - 00:00
End Date: 12/31/2018 - 23:59

Frequency Distribution
(Count)

Wind Direction (Blowing From) / Wind Speed (Knots)

	0.97 - 4.08	4.08 - 7.00	7.00 - 11.08	11.08 - 17.11	17.11 - 21.58	>= 21.58	Total
355-5	204	96	93	107	2	0	502
5-15	184	69	99	135	12	0	499
15-25	148	43	69	164	28	0	452
25-35	176	32	61	147	21	0	437
35-45	146	35	42	57	3	0	283
45-55	178	41	19	14	1	0	253
55-65	181	48	10	0	0	0	239
65-75	177	54	11	0	0	0	242
75-85	270	59	6	0	0	0	335
85-95	293	81	2	0	0	0	376
95-105	397	101	12	1	0	0	511
105-115	654	130	12	0	0	0	796
115-125	845	227	18	2	2	0	1094
125-135	1034	243	32	15	1	1	1326
135-145	1064	288	64	43	12	6	1477
145-155	1081	324	96	69	8	1	1579
155-165	977	353	75	91	9	1	1506
165-175	749	274	67	73	12	0	1175
175-185	616	189	70	39	1	0	915
185-195	446	120	53	29	0	0	648
195-205	403	76	30	10	1	0	520
205-215	351	49	21	7	0	0	428
215-225	307	66	33	7	0	0	413
225-235	319	83	52	9	0	0	463
235-245	366	97	87	21	1	0	572
245-255	397	116	132	33	2	0	680
255-265	468	145	107	28	0	0	748
265-275	593	204	102	9	1	0	909
275-285	782	449	138	34	3	0	1406
285-295	901	943	532	386	184	34	2980
295-305	934	1461	1820	1530	661	262	6668
305-315	800	1529	2570	1560	160	40	6659
315-325	613	944	1284	559	11	3	3414
325-335	422	463	382	153	3	0	1423
335-345	320	245	183	76	4	1	829
345-355	254	138	103	83	3	0	581
Total	18050	9815	8487	5491	1146	349	43824

Frequency of Calm Winds: 381
Average Wind Speed: 6.49 Knots

Station ID: 23273 Run ID:
Start Date: 1/1/2014 - 00:00
End Date: 12/31/2018 - 23:59

Frequency Distribution
(Normalized)

Wind Direction (Blowing From) / Wind Speed (Knots)

	0.97 - 4.08	4.08 - 7.00	7.00 - 11.08	11.08 - 17.11	17.11 - 21.58	>= 21.58	Total
355-5	0.004655	0.002191	0.002122	0.002442	0.000046	0.000000	0.011455
5-15	0.004199	0.001574	0.002259	0.003081	0.000274	0.000000	0.011386
15-25	0.003377	0.000981	0.001574	0.003742	0.000639	0.000000	0.010314
25-35	0.004016	0.000730	0.001392	0.003354	0.000479	0.000000	0.009972
35-45	0.003332	0.000799	0.000958	0.001301	0.000068	0.000000	0.006458
45-55	0.004062	0.000936	0.000434	0.000319	0.000023	0.000000	0.005773
55-65	0.004130	0.001095	0.000228	0.000000	0.000000	0.000000	0.005454
65-75	0.004039	0.001232	0.000251	0.000000	0.000000	0.000000	0.005522
75-85	0.006161	0.001346	0.000137	0.000000	0.000000	0.000000	0.007644
85-95	0.006686	0.001848	0.000046	0.000000	0.000000	0.000000	0.008580
95-105	0.009059	0.002305	0.000274	0.000023	0.000000	0.000000	0.011660
105-115	0.014923	0.002966	0.000274	0.000000	0.000000	0.000000	0.018164
115-125	0.019282	0.005180	0.000411	0.000046	0.000046	0.000000	0.024963
125-135	0.023594	0.005545	0.000730	0.000342	0.000023	0.000023	0.030257
135-145	0.024279	0.006572	0.001460	0.000981	0.000274	0.000137	0.033703
145-155	0.024667	0.007393	0.002191	0.001574	0.000183	0.000023	0.036030
155-165	0.022294	0.008055	0.001711	0.002076	0.000205	0.000023	0.034365
165-175	0.017091	0.006252	0.001529	0.001666	0.000274	0.000000	0.026812
175-185	0.014056	0.004313	0.001597	0.000890	0.000023	0.000000	0.020879
185-195	0.010177	0.002738	0.001209	0.000662	0.000000	0.000000	0.014786
195-205	0.009196	0.001734	0.000685	0.000228	0.000023	0.000000	0.011866
205-215	0.008009	0.001118	0.000479	0.000160	0.000000	0.000000	0.009766
215-225	0.007005	0.001506	0.000753	0.000160	0.000000	0.000000	0.009424
225-235	0.007279	0.001894	0.001187	0.000205	0.000000	0.000000	0.010565
235-245	0.008352	0.002213	0.001985	0.000479	0.000023	0.000000	0.013052
245-255	0.009059	0.002647	0.003012	0.000753	0.000046	0.000000	0.015517
255-265	0.010679	0.003309	0.002442	0.000639	0.000000	0.000000	0.017068
265-275	0.013531	0.004655	0.002327	0.000205	0.000023	0.000000	0.020742
275-285	0.017844	0.010246	0.003149	0.000776	0.000068	0.000000	0.032083
285-295	0.020560	0.021518	0.012139	0.008808	0.004199	0.000776	0.067999
295-305	0.021313	0.033338	0.041530	0.034912	0.015083	0.005978	0.152154
305-315	0.018255	0.034890	0.058644	0.035597	0.003651	0.000913	0.151949
315-325	0.013988	0.021541	0.029299	0.012756	0.000251	0.000068	0.077903
325-335	0.009629	0.010565	0.008717	0.003491	0.000068	0.000000	0.032471
335-345	0.007302	0.005591	0.004176	0.001734	0.000091	0.000023	0.018917
345-355	0.005796	0.003149	0.002350	0.001894	0.000068	0.000000	0.013258
Total	0.411875	0.223964	0.193661	0.125297	0.026150	0.007964	0.988910

Frequency of Calm Winds: 0.87%
Average Wind Speed: 6.49 Knots

WIND ROSE PLOT:

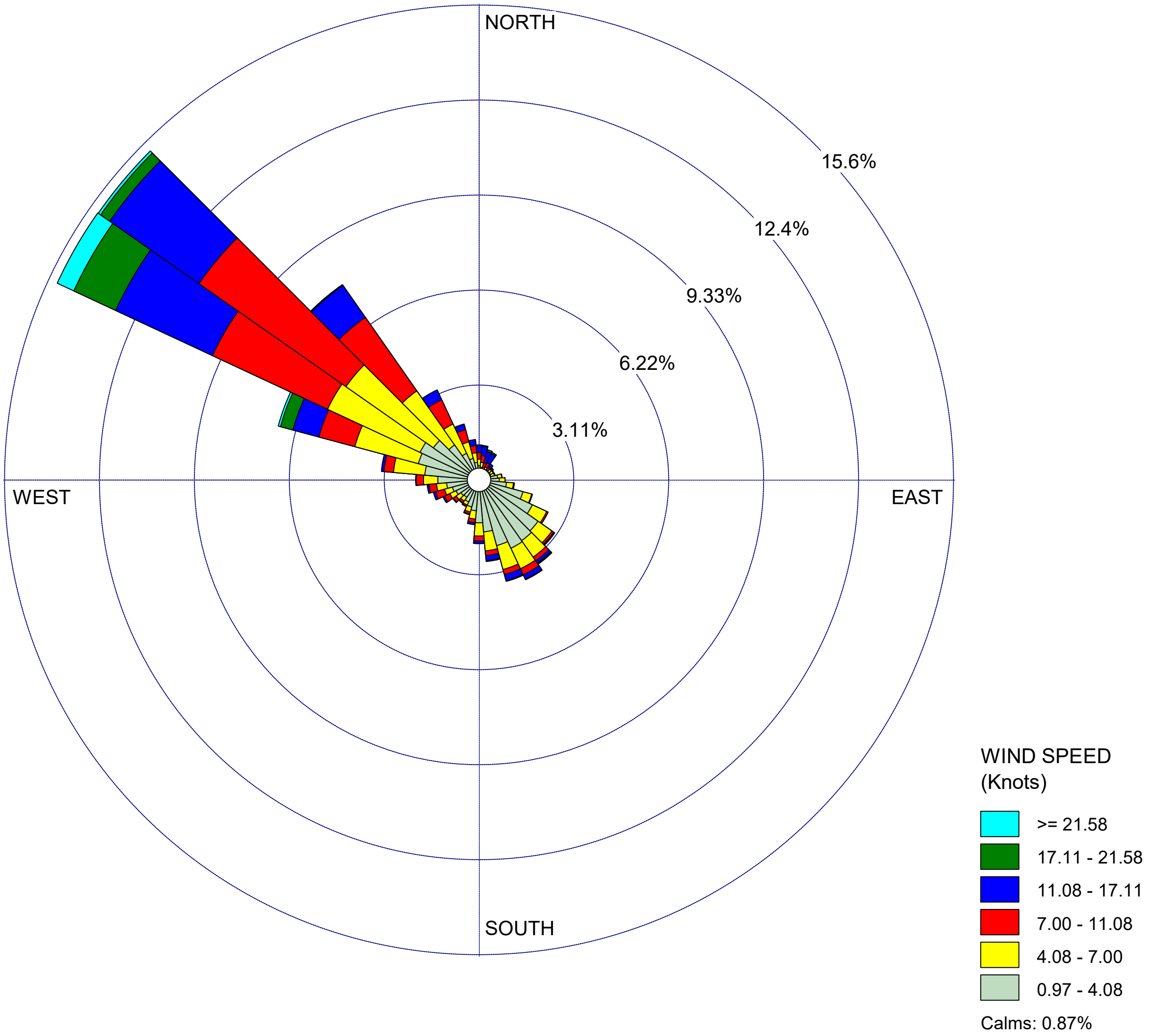
Busy Bee Organics

MM5 Wind Data (WGS 84 : 34.62083 N, 120.24722 W)

DISPLAY:

Wind Speed

Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 1/1/2014 - 00:00
End Date: 12/31/2018 - 23:59

COMPANY NAME:

MODELER:

SESPE CONSULTING, INC.

CALM WINDS:

0.87%

TOTAL COUNT:

43719 hrs.

AVG. WIND SPEED:

6.49 Knots

DATE:

8/4/2019

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Wind Direction	0.00 - 2.62	>= 2.62	Total
348.75 - 11.25	544	1,018	1,562
11.25 - 33.75	145	862	1,007
33.75 - 56.25	154	459	613
56.25 - 78.75	189	385	574
78.75 - 101.25	259	648	907
101.25 - 123.75	433	1,524	1,957
123.75 - 146.25	563	2,668	3,231
146.25 - 168.75	621	2,665	3,286
168.75 - 191.25	590	1,436	2,026
191.25 - 213.75	471	637	1,108
213.75 - 236.25	370	658	1,028
236.25 - 258.75	427	1,009	1,436
258.75 - 281.25	501	1,787	2,288
281.25 - 303.75	568	8,792	9,360
303.75 - 326.25	440	10,818	11,258
326.25 - 348.75	232	1,846	2,078
Sub-Total:	6,507	37,212	43,719
Calms:			0
Missing/Incomplete:			105
Total:			43,824

Hours in Two Month Flowering Period:	1,084.5
Hours in Dataset:	43,719
Hours with Conditions Adverse to Inversion or Outside the Two Months Flowering Period:	97.5%

ATTACHMENT 3
Model Input File

(Download model output and other files at: https://www.dropbox.com/sh/82ihcrr8o3bqijs/AAAWXAhBYCjNnLucLteF4eb-a?dl=0).

```
**
****************************************
**
** AERMOD Input Produced by:
** AERMOD View Ver. 9.8.0
** Lakes Environmental Software Inc.
** Date: 10/18/2019
** File: I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SiteMetData.inp
**
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** AERMOD Control Pathway
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**
**
CO STARTING
   TITLEONE BusyBeeOrganics
   TITLETWO Lompoc H Street MetData
   MODELOPT DFAULT CONC
   AVERTIME 1 PERIOD
   POLLUTID ODOR
   RUNORNOT RUN
   SAVEFILE I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SiteMetData.sv1 5
   ERRORFIL BBO_SiteMetData.err
CO FINISHED
**
****************************************
** AERMOD Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION PAREA1       AREAPOLY   754157.477  3834711.136       98.200
** Source Parameters **
   SRCPARAM PAREA1       1.9477E-06     1.500        12     3.000
   AREAVERT PAREA1       754157.477 3834711.136 754384.427 3834784.312
   AREAVERT PAREA1       754497.902 3834417.373 754396.093 3834396.163
   AREAVERT PAREA1       754228.531 3834424.796 754154.295 3834362.226
   AREAVERT PAREA1       754152.174 3834479.943 754279.436 3834487.367
   AREAVERT PAREA1       754308.070 3834567.966 754241.257 3834582.813
   AREAVERT PAREA1       754155.356 3834561.603 754153.235 3834711.136
   SRCGROUP ALL
SO FINISHED
**
****************************************
** AERMOD Receptor Pathway
****************************************
**
**
RE STARTING
   INCLUDED BBO_SiteMetData.rou
RE FINISHED
**
****************************************
** AERMOD Meteorology Pathway
****************************************
**
**
ME STARTING
** Surface File Path: I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\
   SURFFILE MET1914753_2014_2018.SFC
** Profile File Path: I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\
```

```
   PROFFILE MET1914753_2014_2018.PFL
   SURFDATA 23273 2014
   UAIRDATA 93214 2014
   PROFBASE 72.5 METERS
ME FINISHED
**
****************************************
** AERMOD Output Pathway
****************************************
**
**
OU STARTING
   RECTABLE ALLAVE 1ST-10TH 87
   RECTABLE 1 1ST-10TH 87
** Auto-Generated Plotfiles
   PLOTFILE 1 ALL 1ST
   I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SITEMETDATA.AD\01H1GALL.PLT 31
   PLOTFILE 1 ALL 2ND
   I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SITEMETDATA.AD\01H2GALL.PLT 32
   PLOTFILE 1 ALL 3RD
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   PLOTFILE 1 ALL 5TH
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   PLOTFILE 1 ALL 6TH
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   PLOTFILE 1 ALL 8TH
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   PLOTFILE 1 ALL 9TH
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   PLOTFILE 1 ALL 10TH
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   PLOTFILE 1 ALL 87
   I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SITEMETDATA.AD\01H87GALL.PLT 41
   PLOTFILE PERIOD ALL
   I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SITEMETDATA.AD\PE00GALL.PLT 42
   SUMMFILE I:\z_AERMOD\BU03-BusyBeeOrganics\BBO_SiteMetData(3)\BBO_SiteMetData.sum
OU FINISHED
**
****************************************
** Project Parameters
****************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    World Geodetic System 1984
** DTMRGN   Global Definition
** UNITS    m
** ZONE     10
** ZONEINX  0
**
```

ATTACHMENT 4
Sespe Staff Resumes And Project Briefs

SESPE
CONSULTING, INC.
1565 Hotel Circle South, Ste. 370 • San Diego, California 92108
Office: (619) 894-8669 Fax: (805) 667-8104

Andre Almeida, P.E.

Engineer II
aalmeida@sespe.com

EDUCATION

UNIVERSITY OF CALIFORNIA, SAN DIEGO — La Jolla, CA
B.S., Chemical Engineering — 2016

WORK HISTORY

SESPE CONSULTING, INC. — San Diego, CA
Engineer I, Engineer II — September 2016 – Present

UNIVERSITY OF CALIFORNIA, SAN DIEGO, FACILITIES MANAGEMENT — San Diego, CA
Energy Management Systems Engineer — January 2016 – September 2016

ALLIANCE TO SAVE ENERGY — San Diego, CA
Project Manager — February 2013 – December 2015

SCRIPPS INSTITUTION OF OCEANOGRAPHY — San Diego, CA
Thermodynamics Engineering Consultant — April 2013 – January 2014

EXPERIENCE

AIR QUALITY

Experience in modeling air pollutant diffusion from industrial projects and preparation of technical reports. Familiarity with applicable federal, state, and county guidance for air quality modeling, including guidance from 6+ California air districts.

Prepared air dispersion models using AERMOD and assessed health risk using CARB HARP software for many projects and purposes including as part of air permitting and CEQA impact analysis.

Proficiency writing Health Risk Assessments for CEQA Environmental Impact Reports that involve calculations of:

- The pollution output levels of facility devices;
- Resulting ground level concentrations of pollutants at various receptors;
- Health impact to receptors, including;
    - Acute impact,
    - Chronic impact,
    - Long term cancer risk.

Prepared various compliance reporting documents and provided consultation related to compliance issues. Specifically, emissions inventory (GHG, criteria and air toxics) protocols and reporting; violation response and negotiation, and annual compliance certifications/renewals.

COMPUTATIONAL MODELING

Experience modeling natural and industrial systems, including:
- Health risk assessment and criteria pollutant modeling using software including AERMOD, HARP2, and CalEEMod;
- Industrial project toxics, criteria pollutant, and GHG emissions estimating using CalEEMod software;
- Developing and implementing energy use optimization models for high energy use industrial equipment, including HVAC equipment, lab fume hoods, -80°C freezers ; and
- Preparing energy production potential calculations and reports on geological heat flow.

Data Science, Software Development, and Automation

Scripting Experience in the following languages:

Python (specialization in “NumPy” and “PANDAS” Modules)
Visual Basic for Applications (VBA)
Matrix Laboratory (MATLAB)

Successful design, production, and implementation of software for:
- Automated dataset analysis and manipulation;
- health risk assessment modeling; and
- stormwater chemical compliance assessment.

ENERGY AUDITING AND OPTIMIZATION

Experience analyzing office, laboratory, and industrial spaces and providing recommendations for reducing energy use and increasing efficiency, including:
- Behavioral changes;
- Process adjustments;
- Retrofits.

INDUSTRIAL HYGIENE

Experience in worker health and safety including:
- Sampling for Silica and Noise in mining environments;
- Conducting assessments of employee exposure to hazardous materials during industrial operations; and
- Providing safety training to lab occupants working with volatile reagents in a lab setting.

REGISTRATIONS AND CERTIFICATIONS

Registered Chemical Engineer: California CH6933

SESPE
CONSULTING, INC.

1565 Hotel Circle South, Ste. 370 • San Diego, California 92108
Office: (619) 894-8670 • Fax: (805) 667-8104

Scott D. Cohen, P.E., C.I.H.
Principal Engineer
scohen@sespe.com

EDUCATION

UNIVERSITY OF CALIFORNIA, SANTA BARBARA — Santa Barbara, CA
B. S. Mechanical Engineering — June 1993

WORK HISTORY

SESPE CONSULTING, INC. — Ventura, CA; San Diego, CA
Principal Engineer — May 2019 – Present
Project Manager III — June 2009 – May 2019

COUNTY OF SAN DIEGO. — San Diego, CA
Air Pollution Control District Hearing Board Member — September 2014 – September 2018

WEST COAST ENVIRONMENTAL AND ENGINEERING — Ventura, CA; San Diego, CA
Managing Engineer — 1996 – May 2009

LOS ALAMOS NATIONAL LABORATORY — Los Alamos, NM
Hazardous Waste Technician IV — 1994 – 1995
Graduate Research Assistant, Hydrology Group — 1993 – 1994

Recent work history includes:

- Provision of EH&S permitting and compliance services for industrial and municipal clientele.
- Management of southern California branch office(s) and staff including acquisition of office space, furniture, equipment, and consumables; installation and maintenance of network infrastructure and information systems; human resource functions such as hiring, firing, and policy enforcement; transitional duties during acquisition of another small consulting company; and interface with property manager(s).
- Management of multiple, simultaneous consulting projects of various sizes, durations, locations, complexities, and subject matter. Tasks include proposal scoping, costing, writing and interviewing; primary contact for client, agency staff and other stakeholders; budget and schedule tracking; invoice preparation and distribution.
- Interpretation and tracking of regulatory, planning and legal developments and documentation to identify potential opportunities and challenges; ensure that work product is prepared using the most current and defensible method available; and illuminate alternative and/or novel approaches that may be implemented.
- Marketing through active participation in various associations and other groups including volunteering to serve as chair, secretary, host, or another role in committees and for meetings; public speaking, booth attendance, and entertainment of clients during conferences; writing articles for trade journals; and donation of professional services as may be needed to track issues, attend meetings, strategize and communicate when an undesirable restriction has been proposed.

- Using and learning to use computers to most efficiently accomplish work at-hand including specialized software (e.g., AERMOD, HARP, EMFAC, CalEEMod, GIS, RTNM, SoundPlan, AggFlow); office productivity software (e.g., Word, Excel, Access, VBA); graphics software (e.g., Photoshop/Illustrator, 2D CAD, etc.); networking software (e.g., LAMP stack).
- Technical support and process development for publishing large environmental documents (EIRs).
- Core skill set includes:
    - Project Management
    - Technical Writing
    - Air Quality and Greenhouse Gases
    - Noise and Vibration
    - CEQA/NEPA
    - Dispersion Modeling and Health Risk Assessment
    - Construction and Mining
    - Industrial Hygiene

EXPERIENCE

Technical Analysis for CEQA/NEPA and Special Studies

- Practiced in the subject areas of air quality, health risk assessment, climate change, noise, vibration, and hazardous materials. Emphasis in assessing fugitive dust and diesel exhaust.
- Applied CEQA requirements in light of existing case law to assess baseline, cumulative effects, and project fair share of mitigation for cumulative effects.
- Developed feasible, enforceable mitigation measure language including some creative solutions.
- Successfully defended work-product through litigation of several project EIRs by supporting efforts of legal counsel in the analysis of opposition arguments and the development counter arguments.
- Experienced a variety of project types including mining, asphalt, ready mix concrete, residential/commercial developments, arterial-freeway interchange improvements, and a university long range development plan.

Industrial Environmental Compliance and Permitting

- Involved in most aspects of environmental compliance for industrial clients including development of management systems and policy.
- Permitted air emissions sources in local and federal (Title V) programs including all aspects of new source review, emissions calculations and modeling, health risk assessment, best available control technology (BACT) cost effectiveness, and portable equipment regulation.
- Permitted industrial process water discharge to land under National Pollutant Discharge Elimination System (NPDES) and to sewer.

- Prepared storm water pollution prevention plans (SWPPP) and related documents including notices of intent, annual reports, and notification to regional water board of illicit discharges.
- Performed services related to characterization and management of hazardous materials and wastes including:
  - Release investigation and sampling.
  - Storage, use and transport as regulated by EPA, OSHA, DOT and the Uniform Fire Code.
  - Risk management plans (RMPs) for facilities with acutely hazardous material.
  - Emergency response plans and spill pollution control and countermeasures (SPCC) plans for facilities with bulk petroleum storage.

Air Quality Expertise

- Prepared air permit applications and negotiated conditions on permits to construct and operate various types of sources and facilities (including those in Title V) in each major California air district, some smaller districts, and several states. Work included each facet of new source review including cost effectiveness and feasibility for BACT, offsets, modeling and coordination of start-up/initial source testing.
- Prepared air dispersion models using AERMOD and assessed health risk using CARB HARP software for many projects and purposes including as part of air permitting and CEQA impact analysis.
- Represented California Mining Association and provided consultation to Arizona Rock Products Association during fugitive dust rulemaking in South Coast AQMD (Rule 1157) and Maricopa County (Rule 316).
- Prepared various compliance reporting documents and provided consultation related to compliance issues. Specifically, emissions inventory (GHG, criteria and air toxics) protocols and reporting; violation response and negotiation, and annual compliance certifications/renewals under Title V.

Worker Safety and Industrial Hygiene

- Provided regulatory analysis and technical support to clients with issues in the areas of indoor air quality (IAQ) and other employee exposure investigations.
- Process hazard analysis, injury and illness prevention (IIPP), safety program management, OSHA violation response, employee training, hazard communication (HAZCOM), personal protective equipment (PPE) selection, confined space, lockout/tagout, health risk assessment, noise, and fall protection.

REGISTRATIONS AND CERTIFICATIONS

Registered Mechanical Engineer: California M30545

Certified Industrial Hygienist: 8162CP

County of San Diego CEQA Air Quality and Noise Consultant Lists

PUBLISHED ARTICLES AND PRESENTATIONS

California Construction and Industrial Mineral Association Education Conference or Meeting
The Air UP There – Positive Health Impacts from Industry's Investments in Diesel Truck Engines (2018).
Distance Matters – Assessing Regional Air and GHG Impacts of Mining Projects Under CEQA (2015).
Industrial Hygiene Statistics and Exposure Assessment (H&S Committee Meeting, 7/2015).
Navigating the Rocky Road to Portable Permitting in California (2013).
Community Noise Impact Assessment Primer (2011).
Portable Plant Air Permitting, What You Need to Know (2009).
Case Study – CEQA Analysis of Air Quality, Greenhouse Gas, and Health Risk Impacts (2008).

Industrial Environmental Association Education Conference or Meeting
Air Permitting 101 & 102 (2015 & 2016).
California Health Risk Assessment Methodology Changes (Air Committee Meeting, 4/2014).

California Asphalt Magazine
Health Risk Assessment – What to Expect and How to Prepare (July 2017).
Portable Equipment Air Permitting and Compliance Status Update (July 2012).
Can California Afford its Climate Change Policies? (July 2011).

California Precast Concrete Association (CPCA) Member Meeting
Current Air Quality Issues Facing Processors of Non-Metallic Minerals (November 2005).

AFFILIATIONS AND MEMBERSHIPS

California Construction and Industrial Materials Association Member and *Associate of the Year in 2015*

California Asphalt Pavement Association Environmental Committee Co-chair (2010 to present)

Industrial Environmental Association Member

Industrial Minerals Association of North America Member

American Industrial Hygiene Association Member

San Diego APCD Air Pollution Permit Streamlining Committee/Compliance Improvement Team (APPS/CIT) Meeting Chair (7/2012 to 7/2017)

SESPE
CONSULTING, INC.
374 Poli St., Ste. 200 • Ventura, California 93001
Office: (805) 275-1515 Fax: (805) 667-8104

Rob Dal Farra, P.E.

Vice President
rdalfarra@sespe.com

EDUCATION

<u>UNIVERSITY OF WINDSOR,</u>	Windsor, Ontario, Canada
BASc, Chemical Engineering	1981

REGISTRATIONS

- Professional Engineer, Chemical Engineering, California (#CH005847)
- South Coast Air Quality Management District Certified Permitting Professional (#B4317)

WORK HISTORY

<u>SESPE CONSULTING, INC.</u>	Ventura, CA
Vice President	Present

- Provide executive management and company quality assurance/quality control.
- Develop work product methodologies, procedures and formats for numerous company services including site assessment, regulatory compliance, hazardous materials, hazardous waste, etc.
- Hiring, training, developing, and managing junior staff.
- Client management.
- Project management including scheduling, coordination, budgeting, and quality control.

EXPERIENCE

35 years of professional experience including 30 years of wide ranging consulting experience covering all aspects of environmental compliance, assessment and management.

INDUSTRY EXPERIENCE

- Provided consulting services to a wide variety of industries, including:
    - Aggregate mining and processing
    - Ready mixed and asphaltic concrete production
    - Crude oil production and processing
    - Refined oil bulk storage, blending and distribution
    - Scrap metal recycling
    - Metal forging and forming
    - Food processing and agricultural
    - Water purveyors
    - Semiconductor manufacturing
    - Real estate development
    - Power generation
    - Glass production

WATER QUALITY

- National Pollutant Discharge Elimination System (NPDES) and Waste Discharge Requirements (WDR) permitting, monitoring, reporting and compliance support including evaluation of technical issues such as ion imbalance toxicity and mixing zones.
- Discharge treatment studies for various manufacturing facilities, in particular ion exchange pilot testing for removal of toxic metals to meet CTR/NPDES permit limits for inland surface waters.
- Industrial sewer discharge support including preparing baseline monitoring reports, obtaining local sewer permits, Notice of Violation (NOV) resolution and treatment system evaluations.
- Preparation of Storm Water Pollution Prevention Plans (SWPPPs) for a variety of industrial and manufacturing facilities.

SITE ASSESSMENT AND ENVIRONMENTAL AUDITS

- Completed environmental compliance audits for numerous manufacturing operations including construction materials, wastepaper recycling, circuit board manufacturing, electronics equipment manufacturing, and bottled water production.
- Conducted pre-acquisition due diligence compliance audits for aggregate mining, ready mixed and asphaltic concrete production facilities.
- Provided project management for more than 1,000 Phase I Site Assessment projects including agricultural parcels, heavy and light manufacturing sites, oil and gas production facilities, and commercial and residential lands.

HAZARDOUS MATERIALS

- Hazard Communication Program development and implementation including conducting hazardous material audits and creating MSDS tracking and reporting systems.
- Hazardous Material Business Plan preparation and Tier II reporting.
- Prepared and/or certified Spill Prevention Control and Countermeasure (SPCC)
- Prepared Facility Response Plans for large oil blending and packaging facilities.
- Prepared Toxic Release Inventory (TRI) reports for a variety of manufacturing facilities and reported emissions using Form R/Form A.
- Risk Management Plan (RMP) preparation for facilities storing anhydrous ammonia and chlorine gas.
- Facility design support for California Fire Code (CFC) and California Building Code (CBC) requirements.

HAZARDOUS WASTE

- Hazardous waste compliance support.
- Waste Minimization (SB14) Plan and Report preparation.
- California Tiered Permitting support including preparation of necessary reporting forms, developing closure cost estimates, and certifying hazardous waste treatment tanks and containment areas.

LAND USE PLANNING AND PERMITTING

- Conditional Use Permitting (CUP) support
- Managing the preparation of technical studies in support of environmental impact reports
- Permitting of new crude oil wells and production facilities

Project: Azusa Rock Quarry Expansion Project EIR **Dates**: 2006 to 2011

Air Quality and Climate Change Studies and Subsequent Litigation Support

Client: Vulcan Materials Company – Western Division

Location: City of Azusa **Contract Value:** $ 150,000

Contact: Jim Gore, Permitting and Government Relations
323.474.3231
gorej@vmcmail.com

Description: Vulcan Materials Company was proposing to increase mining from approximately 1.5 million tons per year (MTPY) to an estimated 10.8 MTPY and increase material processing, which required amending the existing Reclamation Plan and Conditional Use Permit, and preparing an Environmental Impact Report (EIR). SESPE employees, while at another firm, were hired to prepare stand-alone technical reports in support of the EIR. This effort included developing impact reduction strategies and creating Project Design Features that were incorporated into the project to reduce potentially significant impacts to air quality.

The Project sought to process up to 6 MTPY at a rate of 50 percent above the average day on the peak day in a 312-day year (i.e. 28,800 tons per day on the peak day). This peak day amount coincided with the maximum throughput that could be processed by mining equipment and haul trucks that load the processing plant as determined by cycle time analysis for the process. Peak day assumptions are important because they are used to estimate regional air quality impacts in the South Coast Air Quality Management District.

Distinctive Characteristics: Several distinctive characteristics are associated with the Azusa Rock Quarry. Two residential neighborhoods are located within one and one-half miles from the site. The northern quarry boundary is adjacent to the Angeles National Forest. Reclamation included a new process known as “micro benching” that will allow for native vegetation to be planted in benches on the previously mined slopes thereby integrating the facility with the surrounding topography.

Outcome: Project Design Features were successfully developed that were incorporated in the EIR, which eliminated the need to develop mitigation measures.

Project: Lebata Big Rock Creek Project Surface Mine Reclamation Plan and EIR Air Quality and Climate Change Impact Assessments

Dates: 2004-2014

Client: McGee and Associates

Location: Los Angeles County, CA

Contract Value: ≈ $150,000

Contact: Jim McGee, Esq.
McGee and Associates
949.640.0050
jimmcgee@mcgee-law.com

Description: A newly proposed mine, this project involves mining approximately 275 acres of a 310-acre site over a 50-year permit period. Approximately 42.3 million gross tons of sand and gravel would be excavated in two phases at an extraction rate ranging from 0.5 million and 2.5 million tons per year. In addition to aggregate surface mining and processing facilities, the project would include a ready-mixed concrete plant, a Vac-Lite plant (producing lightweight concrete), an asphalt mixing plant, a raw cement and aggregate transfer and distribution facility (via existing rail), and water reclamation and fines recovery facilities. The reclaimed end use for disturbed lands would be open space/groundwater recharge and/or stormwater retention basins. Beginning with a previous employer, SESPE staff members have been working on this project since 2004. Lebata submitted an application to the County for the Surface Mining Permit and Reclamation Plan in 2007. From 2009 to 2014, regulatory issues and project design changes led to numerous revisions to the Reclamation Plan, the environmental impact report (EIR), and supporting technical studies. SESPE was actively involved in addressing those changes, and circulated a Draft EIR for public review in February 2014.

A - Existing conditions

B - View after proposed facility is installed.

Distinctive Characteristics: At the conclusion of a pre-production phase of mining (up to 5 years), the project facilities pad would be about 25 to 35 feet below surrounding natural grade and thus shielded to reduce noise and to minimize visibility of processing facilities and off-site lighting impacts. In addition to minimizing distance setbacks and maintaining aggregate reserve volume, mining and reclamation phasing are timed so at least 71 percent of the site will be available as undisturbed and/or reclaimed habitat areas at any point in time.

Outcome: The County of Los Angeles certified the Final EIR in 2014 and approved the Draft EIR's "environmentally superior" alternative. SESPE finalized the Reclamation Plan consistent with the County approval.

EXHIBIT 9

EXHIBIT B

EXHIBIT C

EXHIBIT D

EXHIBIT E

EXHIBIT F

EXHIBIT G

EXHIBIT H

EXHIBIT I

EXHIBIT J

EXHIBIT K

EXHIBIT L

EXHIBIT M

EXHIBIT N

EXHIBIT O

EXHIBIT P

EXHIBIT Q

EXHIBIT R

EXHIBIT S

EXHIBIT T

EXHIBIT U

EXHIBIT V

EXHIBIT W

EXHIBIT X

EXHIBIT Y

EXHIBIT Z

Volatile Organic Carbon and Odor Concentration Measurements For The Busy Bee Cannabis Farm
– Data Report –

To:

Ms. Amy M. Steinfeld
Brownstein Hyatt Fraber Schreck, LLP
1021 Anacapa Street, 2nd Floor
Santa Barbara, CA 93101
via e-mail at ASteinfeld@bhfs.com

SCS ENGINEERS

24219162.00 | October 21, 2019

2370 Skyway Drive, Suite 101
Santa Maria, CA 93455
805-346-6591

Table of Contents

Section Page

Figures

Tables

Appendices

1.0 INTRODUCTION

SCS Engineers has been retained to assess the relative emissions of odors and volatile organic carbons (VOCs) from the Busy Bee Cannabis Farm located at 1180 W. HWY 246, Buellton, CA 93427. A general vicinity map is provided as Figure 1.

This report is a presentation of quality assured field measurement data relating to ambient and workspace concentrations of Volatile Organic Compounds (VOCs) and Odors. All measurements have been conducted with regard to established EPA and ASTM standards and methods. All equipment utilized in this study had confirmed and updated calibration records to ensure accuracy in sampling. All sample analyses were performed by certified independent laboratories. The measurement study has been performed to provide real world measurements of odors as well as ambient VOC concentrations in areas of cannabis cultivation at the facility as well as downwind of such operations. These measured concentrations of VOCs have subsequently been compared to published health standards, when available, relative to the compounds detected by the program.

The sections to follow outline the field activities, the dates and times when sampling occurred, the exact location of each sample collected, and concentration values of the analytes measured. In addition, conclusions and data limitations are provided in the last section. Supporting backup information and raw data are provided in the appendices.

1.1 BACKGROUND

Cannabis, just like many crops and flora, have the potential to emit various terpenes and terpenoids. Cannabis contains over 100 different terpenes and terpenoids. Different cannabis strains include various levels of specific terpenes leading to distinct aromas and flavors. For most cannabis strains, beta-myrcene, D-limonene, and alpha-pinene are the terpenes present in greatest concentration for non-dried flower. Terpene emissions from cannabis operations are highly dependent on several factors. First, cannabis plants have little to no terpene emissions until they are mature and begin to flower. While flowering, they have the potential to release terpenes, and the characteristic odor of the strain can be identified. The greatest potential for emissions occur when the mature flowering plant is harvested, processed and dried. Limiting the handling and drying of flowering cannabis plants at a cannabis cultivation facility can significantly reduce potential emissions. Terpene emissions from vegetation are also dependent on temperature and light intensity.

1.1.1 Sources of Terpenes

Terpenes are ubiquitous and naturally occurring compounds in the environment and have many biogenic sources. For example, alpha-pinene is emitted by coniferous trees such as pine trees as well as by rosemary, eucalyptus, and orange peel. Alpha-pinene is considered the most abundant terpene in nature. Beta-myrcene is emitted from bay, lemon grass, mango, as well as hops and many other plants. Wild Thyme's leaves can contain up to 40% by weight mycrene. Limonene is a central component of citrus fruit peels and is used as a flavoring agent in food manufacturing. Limonene is also emitted naturally by red and silver maple trees, cottonwoods, aspens, sumac, spruce, various pines, Douglas fir, hemlocks, cedars, larches, and true fir trees. Limonene is also used in many types of cosmetics, medicines, and food manufacturing and is approved by FDA in these applications.

1.1.2 Terpenes and Ozone

Ground level ozone, or photochemical smog, is created through a process of chemical reactions in the atmosphere. Through these reactions, primary pollutants such as Nitric Oxide (NO*) and VOCs react with sunlight to form secondary pollutants such as Nitric Acid and Ozone. In order for a location or region to be subjected to photochemical smog, several conditions must be fulfilled. First, there must be substantial vehicle traffic or other combustion sources in order to emit sufficient NO*. Second, there must be ample sunlight in order for the photochemical reactions to take place at a rapid rate. Finally, there must be limited dilution of the air mass such that the reactants are not diluted. In the case of the Central Coast of California and Santa Barbara County in particular, ozone formation is constrained by the atmospheric availability of NO*. In other words, nitrogen oxides, rather than hydrocarbons are the rate limiting species for ground level ozone in the region.

1.1.3 Odor Assessments

Defining the odor impact generated by a large area source can be difficult. This is due to the fact that there are multiple sources of odors and discontinuous odor emissions from each. Odor concentration is often used in odor regulation, with 7 dilution to threshold (D/T) or odor units (OU) being a common regulatory threshold. A goal of this assessment was to measure the extent to which the Busy Bee emissions, generate downwind concentrations of odors at, or above, the 7 OU threshold above background. Table 1 below provides some of the odor dimensions used in odor assessments and regulatory studies.

Table 1: Odor Dimensions and Descriptions

Odor Dimension	Description
Concentration	• Dilution to Threshold Ratio (D/T). • 50% of Population Registers an Odor Detection. • Defined as the Minimum Odor Stimulus. • Detection Threshold. • Recognition Threshold.
Character	• What does the Substance Smell Like? • ASTM Data Series DS 61. • Profiles for 180 Chemicals on 146 Descriptor Scale. • Examples of Descriptors: Fishy, hay, nutty, oily, creosote, turpentine, rancid, sewer, sweet, ammonia, wet grass, burnt hair, etc

1.3 SPECIFIC GOALS AND OBJECTIVES

The following are the main goals and objectives of this air-monitoring project:

1.3.1 VOC Measurements:

1. Measure the concentration of specific air pollutants relative to cannabis operations both at cultivation areas of flowering plants as well as downwind from these areas.

2. Compare the measured concentrations of these pollutants to published permissible exposure limits (PELs) and recommended exposure limits (RELs).

3. Determine if the measured concentrations indicate the presence of a possible health hazard to employees at the facility or downwind receptors.

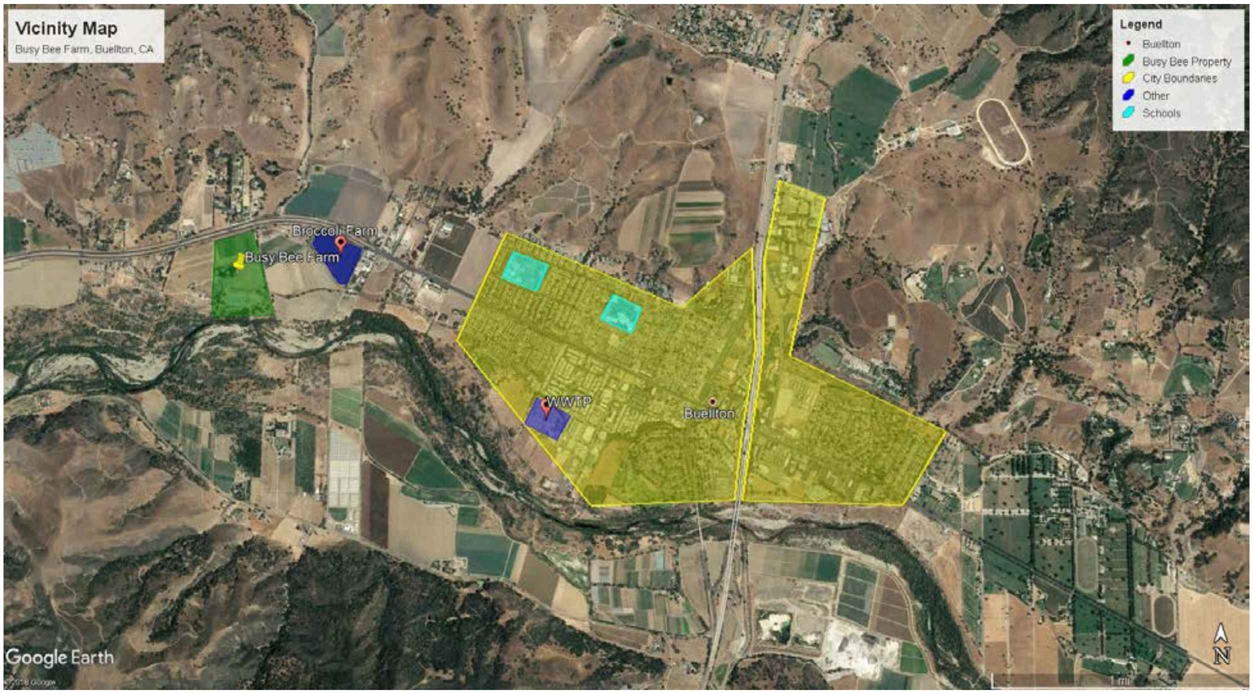
1.3.2 Odor Measurements:

1. Measure the odor concentration (D/T) of ambient air at the Busy Bee facility in the cultivation areas of flowering plants, upwind from the facility, as well as in the surrounding community.

2. Compare the measured odor concentrations from the Busy Bee facility, at receptor locations, and upwind from the facility to assess the relative impacts from the facility at the time of sampling.

3. Assess the character of the odor samples to determine if the Busy Bee facility is affecting the character of the odors at the measured receptor locations at the time of sampling.

Figure 1. Busy Bee Vicinity Map



2.0 OVERVIEW OF FIELD TESTING

SCS Engineers (SCS) conducted a limited field measurement program at the Busy Bee Facility ("Facility") to determine ambient concentrations of a specific list of gaseous compounds that are considered VOCs by the Environmental Protection agency (EPA) and the California Air Resources Board (CARB). This measurement program was conducted on September 18th, 2019. In addition, SCS collected odor samples at locations on the property, upwind from the property, and in the areas downwind from the property to assess the relative odor impacts of the Busy Bee facility on downwind receptors. This odor measurements were conducted on September 30th, 2019. It should be noted that this region is dense with agriculture and multiple sources of odor exist in the region. Additional odor sources in the region include the following:

- 150 Acre broccoli farm directly to the East of Busy Bee,
- Horse Boarding Operations
- Buellton Waste Water Treatment, and
- Pig Farm to the West of Busy Bee.

Sampling occurred in areas of, or downwind of, mature flowering plants. These flowering plants were in their final stage of maturing prior to harvest. The goal of the sampling was to capture worst-case emission results from cannabis operations at this facility as it was operating at the time of sampling.

2.1 VOC MEASUREMENTS

The SCS team collected VOC samples at three locations within the cultivation area of the facility, two samples downwind of the facility but within property lines, and one sample upwind of the facility for comparison purposes. Sampling exercises followed established EPA protocols and used recognized EPA and ASTM standards in determining concentration values in the samples collected. In summary, the primary methods employed in this field study are listed below:

- Speciated Volatile Organic Compounds (VOCs) via EPA TO-15

The actual sampling locations are shown in Figure 2 below. Table 2 provides the actual sampling details such as GPS location, time sampled, and relevant wind parameters.

Figure 2. VOC Sampling Locations

Table 2: VOC Sample Details

Sample ID	General Sample Info			Location		Approx. Wind Data	
	Date Sampled	Approx. Time	Near	Latitude	Longitude	WS [m/s]	WD [from]
Upwind	18-Sep	13:58	Western Fence line	34◦37.231'	120◦13.672'	Lite	NW
GH-1	18-Sep	13:30	Inside GH	34◦37.179'	'120◦13.540'	Lite	W
GH-2	18-Sep	13:22	Inside GH	34◦37.177'	120◦13.550'	Lite	W
GH-3	18-Sep	13:49	Inside GH	34◦37.181'	120◦13.593'	Lite	WNW
Down-1	18-Sep	13:10	East of GH	34◦37.169'	120◦13.498'	Lite	W
Down-2	18-Sep	13:02	East of GH	34◦37.157'	120◦13.435'	Lite	WNW

2.2 ODOR CONCENTRATION MEASUREMENTS

The SCS team collected odor samples upwind from the facility, in the immediate vicinity of flowering cannabis at the facility, and at multiple receptor locations in the surrounding areas of the facility at downwind locations. The actual sampling locations are shown in Figure 3 below. Table 3 provides the actual sampling details such as GPS location, time sampled, and relevant wind parameters.

Figure 3. Odor Sampling Locations

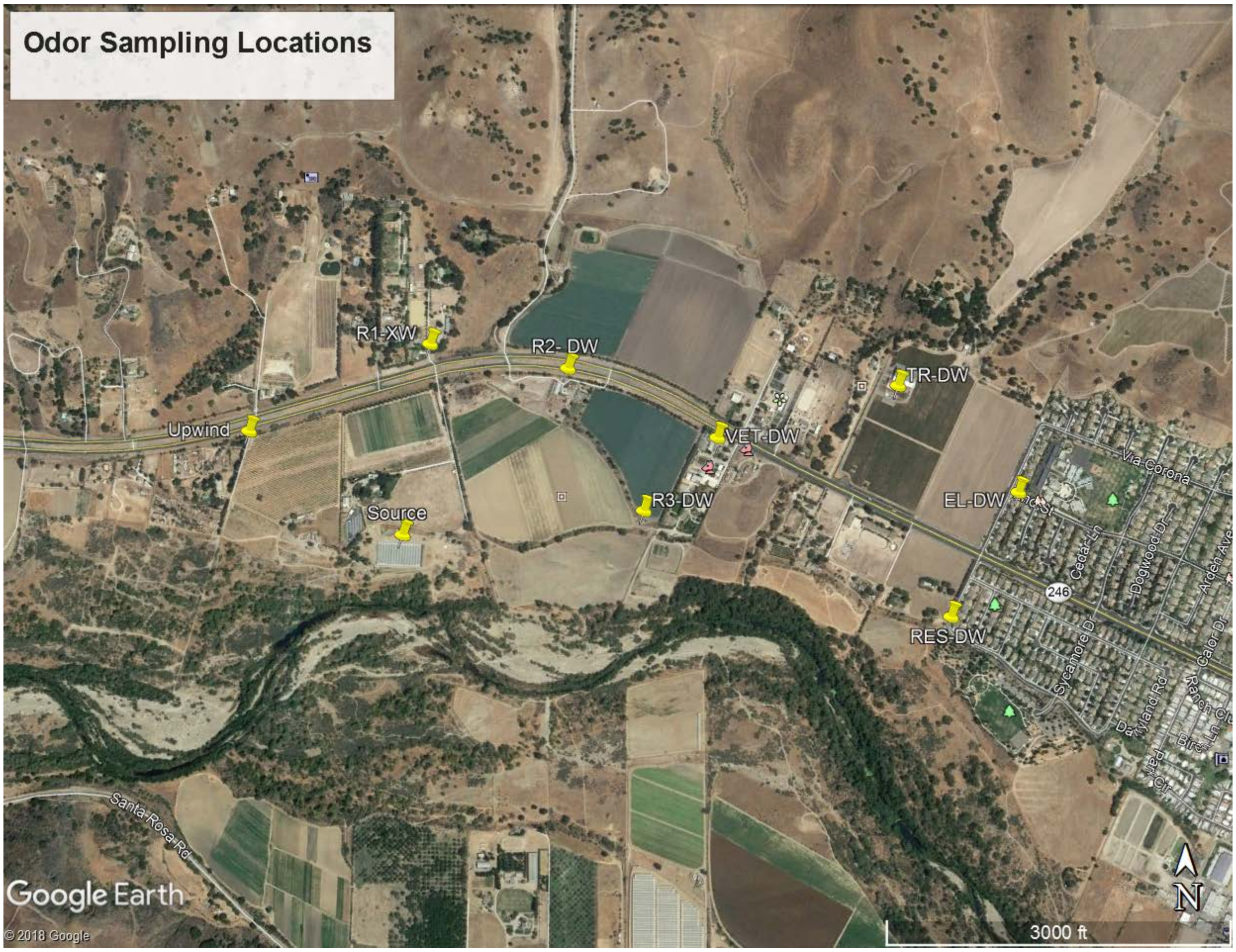


Table 3: Odor Sample Details

Sample ID	General Sample Info		Location		Approx. Wind Data	
	Date Sampled	Approx. Time	Latitude	Longitude	WS [mph]	WD [from]
Upwind	30-Sep	14:23	34◦37.333'	120◦13.846'	10-15	W
Source	30-Sep	13:36	34◦37.182'	'120◦13.574'	10-15	W
R1-XW	30-Sep	14:12	34◦37.450'	120◦13.526'	10-15	W
R2-DW	30-Sep	14:02	34◦37.424'	'120◦13.282'	10-15	W
R3-DW	30-Sep	15:40	34◦37.217'	120◦13.148'	10-15	W
VET-DW	30-Sep	14:37	34◦37.323'	'120◦13.018'	10-15	W
TR-DW	30-Sep	15:12	34◦37.398'	120◦12.700'	10-15	W
EL-DW	30-Sep	15:02	34◦37.257'	'120◦12.490'	10-15	W
RES-DW	30-Sep	14:53	34◦37.064'	'120◦12.610'	10-15	W

3.0 FIELD AND ANALYTICAL METHODS USED

The following sections detail the methods utilized in the study.

3.1 FIELD SAMPLING FOR VOCS

VOC samples were collected directly from the ambient air at breathing level in evacuated 5-liter Summa canisters and allowed to come to just under ambient pressure. Each sample was collected in under 1-minute. Samples were shipped to Atmospheric Analysis and Consulting, Inc. (AAC) and were analyzed for VOCs according to EPA TO-15, as well as TICs listed in Table 2 below. Field logs are provided in Appendix C.

Atmospheric Analysis and Consulting, Inc. (AAC Lab) was founded as an air quality laboratory in June of 1993 by Dr. Sucha Parmar in Ventura, California. AAC Lab is a privately-owned Small Minority Business certified through the Small Business Administration (SBA). AAC Lab holds NELAP and South Coast Air Quality Management District (SCAQMD) certifications.

3.2 FIELD SAMPLING FOR ODORS

Odor samples were collected with a 10 liter Tedlar® bag and in conjunction with an air displacement sampler, also known as a lung sampler. The sample bag is placed into the sealed lung sampler and connected through a feed-through fitting to the sample inlet through PTFE tubing. A second fitting is located in the wall of the lung sampler and is connected to a vacuum pump. The container is then closed and sealed. As the pump withdraws air from the container, an equal volume of air from the sample hood chamber is drawn into the sample bag without ever making contact with the pump. The bag is first purged by pulling ambient air through it. Samples were collected from the sample hood chamber in less than 1-minute per sampling location, to 60% of the bag's full volume. Following sampling, the sample bag was placed in opaque storage bags to prevent light exposure. Samples were shipped on the same day via overnight carrier to Odor Sciences and Engineering, Inc. to ensure they were analyzed according to ASTM methods.

3.3 ANALYTICAL METHODS EMPLOYED

3.3.1 Analytical Method for VOCs

TO-15 is one of EPA's Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. This method is designed for samples collected in Summa® canisters and analyzed by gas chromatography/mass spectrometry (GCMS). VOCs are defined by the method as organic compounds having a vapor pressure greater than 10^{-1} Torr at 25°C and 760 mmHG. The method compound list includes 59 VOC's which are also identified as hazardous air pollutants (HAP's) in Title III of the Clean Air Act amendments of 1990. In addition to the 59 VOCs listed by the method as The Target Compound List, Tentatively Identified Compounds (TICs) were also analyzed for that include a library of over 250,000 compounds. The identification of TICs in the sample is not considered "absolute" or "confirmed" but rather an estimate. However, it is still a useful tool for identifying the presence of possible compounds above detection limits. In this case, many terpenes that are known to be emitted by cannabis plants can be identified as TICs. See Appendix A for further description of method.

Table 4: Complete List of Analyzed VOCs

TO-15 (VOC)					
CAS#	**Compound**	**CAS#**	**Compound**	**CAS#**	**Compound**
115-07-1	Propene	156-59-2	cis-1,2-Dichloroethene	111-65-9	n-Octane
75-71-8	Dichlorodifluoromethane (CFC 12)	141-78-6	Ethyl Acetate	127-18-4	Tetrachloroethene
74-87-3	Chloromethane	110-54-3	n-Hexane	108-90-7	Chlorobenzene
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	67-66-3	Chloroform	100-41-4	Ethylbenzene
75-01-4	Vinyl Chloride	109-99-9	Tetrahydrofuran (THF)	179601-23-1	m,p-Xylenes
106-99-0	1,3-Butadiene	107-06-2	1,2-Dichloroethane	75-25-2	Bromoform
74-83-9	Bromomethane	71-55-6	1,1,1-Trichloroethane	100-42-5	Styrene
75-00-3	Chloroethane	71-43-2	Benzene	95-47-6	o-Xylene
64-17-5	Ethanol	56-23-5	Carbon Tetrachloride	111-84-2	n-Nonane
75-05-8	Acetonitrile	110-82-7	Cyclohexane	79-34-5	1,1,2,2-Tetrachloroethane
107-02-8	Acrolein	78-87-5	1,2-Dichloropropane	98-82-8	Cumene
67-64-1	Acetone	75-27-4	Bromodichloromethane	80-56-8	alpha-Pinene
75-69-4	Trichlorofluoromethane (CFC 11)	79-01-6	Trichloroethene	103-65-1	n-Propylbenzene
67-63-0	2-Propanol (Isopropyl Alcohol)	123-91-1	1,4-Dioxane	622-96-8	4-Ethyltoluene
107-13-1	Acrylonitrile	80-62-6	Methyl Methacrylate	108-67-8	1,3,5-Trimethylbenzene
75-35-4	1,1-Dichloroethene	142-82-5	n-Heptane	95-63-6	1,2,4-Trimethylbenzene
75-09-2	Methylene Chloride	10061-01-5	cis-1,3-Dichloropropene	100-44-7	Benzyl Chloride
107-05-1	3-Chloro-1-propene (Allyl Chloride)	108-10-1	4-Methyl-2-pentanone	541-73-1	1,3-Dichlorobenzene
76-13-1	Trichlorotrifluoroethane (CFC 113)	10061-02-6	trans-1,3-Dichloropropene	106-46-7	1,4-Dichlorobenzene
75-15-0	Carbon Disulfide	79-00-5	1,1,2-Trichloroethane	95-50-1	1,2-Dichlorobenzene
156-60-5	trans-1,2-Dichloroethene	108-88-3	Toluene	5989-27-5	d-Limonene
75-34-3	1,1-Dichloroethane	591-78-6	2-Hexanone	96-12-8	1,2-Dibromo-3-chloropropane
1634-04-4	Methyl tert-Butyl Ether	124-48-1	Dibromochloromethane	120-82-1	1,2,4-Trichlorobenzene
108-05-4	Vinyl Acetate	106-93-4	1,2-Dibromoethane	91-20-3	Naphthalene
78-93-3	2-Butanone (MEK)	123-86-4	n-Butyl Acetate	87-68-3	Hexachlorobutadiene

3.3.2 Analytical Method for Odor Samples

All samples were analyzed by Odor Sciences and Engineering, Inc. (OS&E). The samples were analyzed by dynamic dilution olfactometry using a trained and screened odor panel of eight members. The odor panelists were chosen from OS&E's pool of panelists from the greater Hartford, CT area who actively participate in ongoing olfactory research and represent an average to above average sensitivity when compared to a large population. The samples were quantified in terms of dilution-to-threshold (D/T) ratio and odor intensity in accordance with ASTM Methods E-679-04 and E-544-10, respectively. The odor panelists were also asked to describe the odor character of the samples at varying dilution levels.

4.0 QUALITY ASSURANCE MEASURES AND DOCUMENTATION

The following sections detail some of the quality assurance measures utilized by this sampling and measurement program to ensure the defensibility of the data collected. These measures include lab control samples, and chains of custody documentation. Flow calibrations are not required or necessary for collection of TO-15 samples.

4.1 CHAIN OF CUSTODY DOCUMENTATION

The integrity and traceability of samples from the time they are collected through the time data are reported is essential in any sampling and analysis program. The handling of the samples and transfer of custody must be well documented. A sample is considered to be in one's custody if it meets any of the following criteria:

1. In actual possession or in view of the person who collected the sample.
2. Locked in a secure area.
3. Placed in an area restricted to authorized personnel.

4.1.1 Field Sample Custody and Documentation

In order to maintain the integrity and traceability of samples, all information pertinent to field sampling was recorded in field logs. All samples were properly labeled prior to transport to respective laboratories, and were accompanied by completed chain-of-custody documentation. All documentation was recorded in indelible ink. See Appendix C.

4.1.2 Sample Labeling

Sample labels are necessary to prevent misidentification of samples. Labels were completed and affixed to sample containers at the time of sample collection.

4.1.3 Chain-of-Custody Records

To establish the documentation necessary to trace the sample possession from the time of collection, a chain-of-custody record was completely filled out and accompanied every sample. See Appendix C for these records.

5.0 SAMPLING RESULTS

The sections below provide the analytical results from the collected measurements. The following acronyms and abbreviations are used throughout the tables.

REL:	Recommended Exposure Limit (NIOSH)	INV:	Invalid
PEL:	Permissible Exposure Limit (OSHA)	µg:	Microgram
ND:	Non-Detect	m^3:	Cubic Meter
ppb:	Parts Per Billion	SRL:	Sample Reporting Limit
ppm:	Parts Per Million		

5.1 VOC SAMPLING RESULTS

There were many VOC's analyzed for, listed in Section 3.2, above; however, tables only show the compounds that were detected in samples above Sample Reporting Limits (SRLs). The actual analytical results from Atmospheric Analysis and Consulting (AAC) are provided in Appendix B.

In addition to concentration values, the Tables provide regulatory benchmarks for comparative purposes when available.

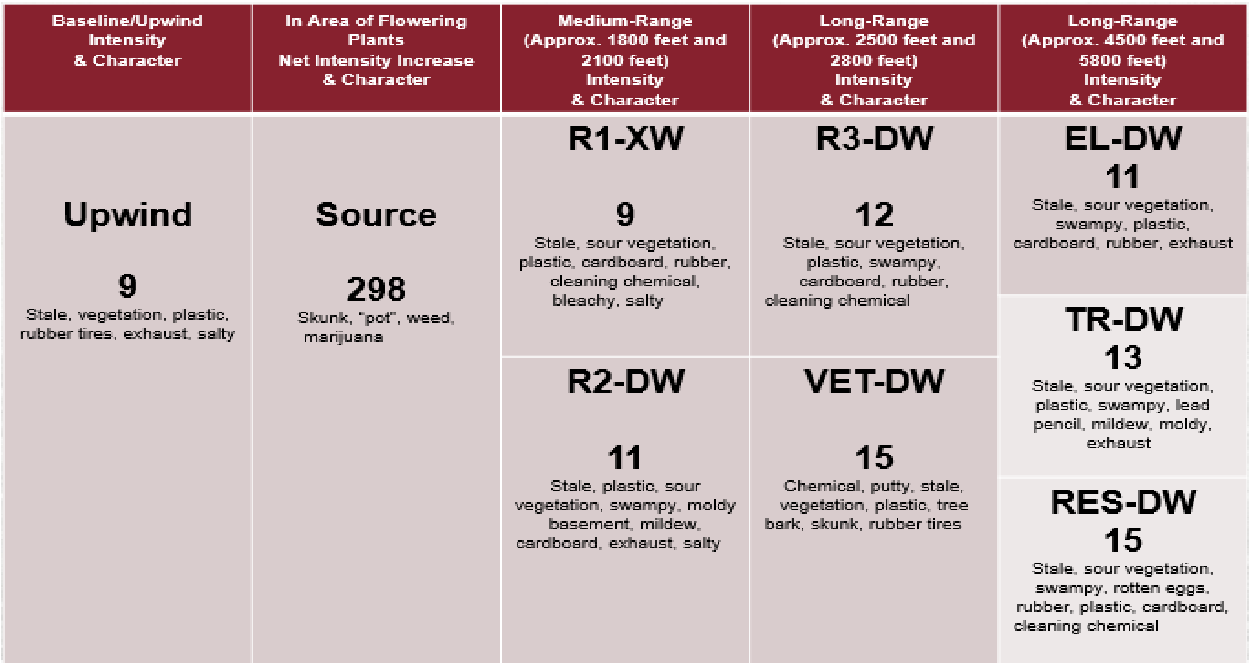
Table 5: VOCs Detected At Or Above Sample Reporting Limits

Sample ID	TO-15 Compounds (Detection compounds), PPB					TO-15 Compounds (Tentatively Identified Compounds), PPB		
	Chloromethane	Methanol	Ethanol	Acetone		alpha-Pinene	beta-Myrcene	D-Limonene
NIOSH REL	NA	200000	1000000	250000		100000	NA	NA
OSHA PEL	100000	200000	1000000	1000000		100000	NA	NA
Upwind	0.7	10.2	<SRL	8.64		ND	ND	ND
GH-1	<SRL	11.20	3.60	4.62		1.89	8.93	2.41
GH-2	<SRL	9.14	4.69	3.11		ND	ND	ND
GH-3	<SRL	13.30	3.76	5.12		ND	ND	ND
Down-1	<SRL	<SRL	<SRL	<SRL		ND	ND	ND
Down-2	<SRL	9.84	<SRL	<SRL		ND	ND	ND

5.2 ODOR SAMPLING RESULTS

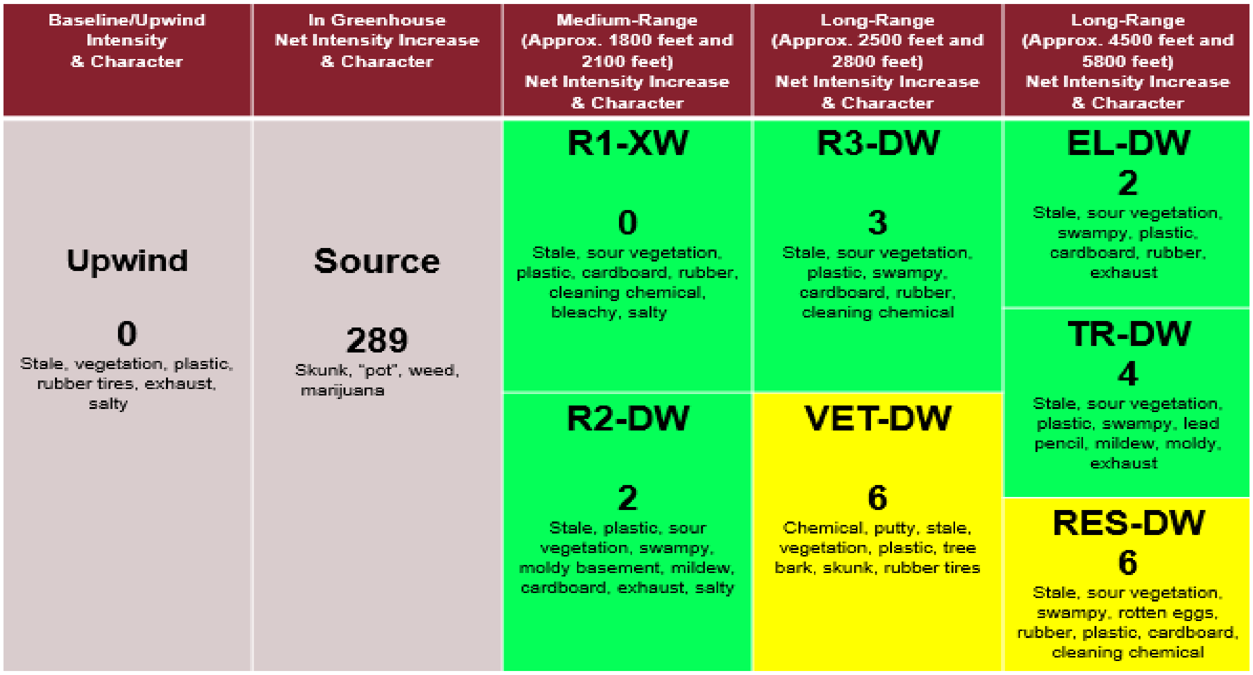
The following tables provide the odor sampling results in regards to both raw data (Table 6) and Net Odor (Table 7). Table 7 results simply subtract the upwind or background odor concentration from downwind samples to assess the potential for the net increase in odors. The actual sample results from OS&E are provided in Appendix B.

Table 6: Raw Odor Data



Baseline/Upwind Intensity & Character	In Area of Flowering Plants Net Intensity Increase & Character	Medium-Range (Approx. 1800 feet and 2100 feet) Intensity & Character	Long-Range (Approx. 2500 feet and 2800 feet) Intensity & Character	Long-Range (Approx. 4500 feet and 5800 feet) Intensity & Character
Upwind **9** Stale, vegetation, plastic, rubber tires, exhaust, salty	**Source** **298** Skunk, "pot", weed, marijuana	**R1-XW** **9** Stale, sour vegetation, plastic, cardboard, rubber, cleaning chemical, bleachy, salty	**R3-DW** **12** Stale, sour vegetation, plastic, swampy, cardboard, rubber, cleaning chemical	**EL-DW** **11** Stale, sour vegetation, swampy, plastic, cardboard, rubber, exhaust
		R2-DW **11** Stale, plastic, sour vegetation, swampy, moldy basement, mildew, cardboard, exhaust, salty	**VET-DW** **15** Chemical, putty, stale, vegetation, plastic, tree bark, skunk, rubber tires	**TR-DW** **13** Stale, sour vegetation, plastic, swampy, lead pencil, mildew, moldy, exhaust
				RES-DW **15** Stale, sour vegetation, swampy, rotten eggs, rubber, plastic, cardboard, cleaning chemical

Table 7: Net Odor Data



Baseline/Upwind Intensity & Character	In Greenhouse Net Intensity Increase & Character	Medium-Range (Approx. 1800 feet and 2100 feet) Net Intensity Increase & Character	Long-Range (Approx. 2500 feet and 2800 feet) Net Intensity Increase & Character	Long-Range (Approx. 4500 feet and 5800 feet) Net Intensity Increase & Character
Upwind **0** Stale, vegetation, plastic, rubber tires, exhaust, salty	**Source** **289** Skunk, "pot", weed, marijuana	**R1-XW** **0** Stale, sour vegetation, plastic, cardboard, rubber, cleaning chemical, bleachy, salty	**R3-DW** **3** Stale, sour vegetation, plastic, swampy, cardboard, rubber, cleaning chemical	**EL-DW** **2** Stale, sour vegetation, swampy, plastic, cardboard, rubber, exhaust
		R2-DW **2** Stale, plastic, sour vegetation, swampy, moldy basement, mildew, cardboard, exhaust, salty	**VET-DW** **6** Chemical, putty, stale, vegetation, plastic, tree bark, skunk, rubber tires	**TR-DW** **4** Stale, sour vegetation, plastic, swampy, lead pencil, mildew, moldy, exhaust
				RES-DW **6** Stale, sour vegetation, swampy, rotten eggs, rubber, plastic, cardboard, cleaning chemical

5.2.1 Upwind Vs Downwind Comparison

For this project, the region has multiple sources of odor in the region. This is due to the large amount of agricultural operations in the region. For all of the samples collected on 09/30 the odor concentration (D/T) was not significantly elevated relative to that of the background sample. In addition, the odor character for the odor samples at downwind locations was fairly consistent when comparing the background sample (upwind) to that of the receptor based samples.

The following descriptors were utilized for all non-source related samples: Vegetation, Plastic, Stale, Rubber, and Exhaust. These descriptors are common for background samples and were also present in most receptor based odor samples. The source sample, taken in the immediate vicinity of flowering plants, was expectedly elevated. This sample was taken to show the odor concentration in close proximity to flowering plants as well as to define the odor character of the source. In this case, the odor concentration was strong enough that background character did not influence the sample and only the cannabis related descriptors were identified. A cannabis related descriptor (skunk) showed up in only 1 receptor based sample (VET-DW). However, the descriptor was not dominant. In addition, samples collected closer to Busy Bee were lower in odor concentration and did not have this character descriptor indicating this location was likely impacted by another odor source.

The descriptor “Sour Vegetation” showed up in all downwind samples. This character could indicate an impact from another local source such as the broccoli farm immediately to the East of the Busy Bee facility.

5.2.2 Comparison to 7 D/T Nuisance Threshold

All of the samples collected including background samples had D/T concentrations over 7. However, this is typical for ambient air sampling as all ambient air has an odor when compared to purified air. In addition, the sampling bag and tubing can also emit small amounts of gasses that contribute to the odor profile. The sample collected on 9/30 had a background concentrations of 9 D/T. Odor samples did not elevate significantly in regards to concentration relative to background with the highest net increase of odor concentration being 6 D/T. The 2 samples with 6 D/T increases in odor concentration above background are likely influenced by local agriculture sources in the immediate vicinity. The 150 acre broccoli farm upwind from these samples emits a noticeable odor.

6.0 CONCLUSIONS AND DATA LIMITATIONS

None of the samples collected during the course of this sampling project exceeded published NIOSH or OSHA exposure standards. The following sections provide discussions in regards to the sampling results.

6.1 CONCLUSIONS

6.1.1 VOC Sampling

All of the TO-15 area samples collected had measured concentrations of VOCs that were either below the limits of detection or significantly below the published NIOSH RELs and/or OSHA PELs. These samples were all representative of background concentrations in the area.

- The measured concentrations do not indicate the presence of a possible health concern in relation to employees or receptors downwind form the facility.

- Only one sample had detectable concentrations of terpenes as TIC's. However, the estimated concentrations are in the low PPB range. NIOSH and OSHA do not have health standards related to beta-myrcene or d-limonene. NIOSH and OSHA do have health standards for alpha-pinene, but the estimated concentration is at least four orders of magnitude below this standard. This sample was taken directly in the vicinity (within 1 foot) of flowering plants.

- Concentrations of downwind samples were all either less than the SRL for every compound or less than the measured background, indicating that the facility is not an appreciable source for the listed compounds.

6.1.2 Odor Sampling

The following provide some conclusions relative to the odor sampling event 09-30.

- Busy Bee was not a source of nuisance odor conditions downwind from its operations at the time of sampling on 09/30.

- There are multiple sources of odor in the region due to agricultural operations un-related to cannabis. Differentiating the individual contributions of these odor sources to downwind odor impacts would be very difficult and expensive.

- The odor controls Busy Bee has in place such as limited processing, handling, and drying of cannabis on site effectively reduce the potential of odor impacts downwind from the facility.

6.2 EXPOSURE LIMITS

There is often confusion between exposure limits put out by different agencies even within the same administration. For example, the National Institute for Occupational Safety and Health (NIOSH) establishes Recommended Exposure Limits (RELs) whereas the Occupational Safety and Health Administration (OSHA) issues Permissible Exposure Limits (PELs).

NIOSH RELs are supposed to be based on the best available science (using human or animal health effects data). According to the CDC's website, "To the extent feasible, NIOSH will project not only a no-effect exposure, but also exposure levels at which there may be residual risks. This policy applies to all workplace hazards, including carcinogens, and is responsive to Section 20(a)(3) of the Occupational Safety and Health Act of 1970, which charges NIOSH to '… .describe exposure levels that are safe for various periods of employment, including but not limited to the exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience.'"

OSHA PELs, on the other hand, are subject to the rulemaking and political process, meaning that the interests of all parties involved are taken into consideration. Thus, OSHA does not have the luxury of relying strictly on science. Establishing PELs sometimes may come down to court rulings.

NIOSH Recommended Exposure Limits (RELs):

These values are TWA concentrations for up to a 10-hour workday during a 40-hour workweek.

OSHA Permissible Exposure Limits (PELs):

These values are TWA concentrations for up to an 8-hour workday during a 40-hour workweek.

6.3 DATA LIMITATIONS

There are several limitations associated with this sampling project. The major limitations are as follows:

- The results correspond to one particular period of time. These results may not necessarily be reproducible at another given period of time.
- Data obtained during this sampling project are averaged concentrations over short terms (Approximately 1 minute). Different averaging periods may lead to different results.
- Pollutant concentrations are highly dependent on dispersion parameters (i.e. winds, relative humidity, proximity to source).

Appendix A

References of Methods

EPA/625/R-96/010b

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air

Second Edition

Compendium Method TO-15

Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS)

Center for Environmental Research Information
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, OH 45268

January 1999

Method TO-15
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- Robert G. Lewis, U.S. EPA, NERL, RTP, NC
- Justice A. Manning, U.S. EPA, ORD, Cincinnati, OH
- William A. McClenny, U.S. EPA, NERL, RTP, NC
- Frank F. McElroy, U.S. EPA, NERL, RTP, NC
- Heidi Schultz, ERG, Lexington, MA
- William T. "Jerry" Winberry, Jr., EnviroTech Solutions, Cary, NC

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Author(s)

- William A. McClenny, U.S. EPA, NERL, RTP, NC
- Michael W. Holdren, Battelle, Columbus, OH

Peer Reviewers

- Karen Oliver, ManTech, RTP, NC
- Jim Cheney, Corps of Engineers, Omaha, NB
- Elizabeth Almasi, Varian Chromatography Systems, Walnut Creek, CA
- Norm Kirshen, Varian Chromatography Systems, Walnut Creek, CA
- Richard Jesser, Graseby, Smyrna, GA
- Bill Taylor, Graseby, Smyrna, GA
- Lauren Drees, U.S. EPA, NRMRL, Cincinnati, OH

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DISCLAIMER

METHOD TO-15

Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS)

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METHOD TO-15

Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS)

1. Scope

1.1 This method documents sampling and analytical procedures for the measurement of subsets of the 97 volatile organic compounds (VOCs) that are included in the 189 hazardous air pollutants (HAPs) listed in Title III of the Clean Air Act Amendments of 1990. VOCs are defined here as organic compounds having a vapor pressure greater than 10^{-1} Torr at 25°C and 760 mm Hg. Table 1 is the list of the target VOCs along with their CAS number, boiling point, vapor pressure and an indication of their membership in both the list of VOCs covered by Compendium Method TO-14A (1) and the list of VOCs in EPA's Contract Laboratory Program (CLP) document entitled: *Statement-of-Work (SOW) for the Analysis of Air Toxics from Superfund Sites (2)*.

Many of these compounds have been tested for stability in concentration when stored in specially-prepared canisters (see Section 8) under conditions typical of those encountered in routine ambient air analysis. The stability of these compounds under all possible conditions is not known. However, a model to predict compound losses due to physical adsorption of VOCs on canister walls and to dissolution of VOCs in water condensed in the canisters has been developed (3). Losses due to physical adsorption require only the establishment of equilibrium between the condensed and gas phases and are generally considered short term losses, (i.e., losses occurring over minutes to hours). Losses due to chemical reactions of the VOCs with cocollected ozone or other gas phase species also account for some short term losses. Chemical reactions between VOCs and substances inside the canister are generally assumed to cause the gradual decrease of concentration over time (i.e., long term losses over days to weeks). Loss mechanisms such as aqueous hydrolysis and biological degradation (4) also exist. No models are currently known to be available to estimate and characterize all these potential losses, although a number of experimental observations are referenced in Section 8. Some of the VOCs listed in Title III have short atmospheric lifetimes and may not be present except near sources.

1.2 This method applies to ambient concentrations of VOCs above 0.5 ppbv and typically requires VOC enrichment by concentrating up to one liter of a sample volume. The VOC concentration range for ambient air in many cases includes the concentration at which continuous exposure over a lifetime is estimated to constitute a 10^{-6} or higher lifetime risk of developing cancer in humans. Under circumstances in which many hazardous VOCs are present at 10^{-6} risk concentrations, the total risk may be significantly greater.

1.3 This method applies under most conditions encountered in sampling of ambient air into canisters. However, the composition of a gas mixture in a canister, under unique or unusual conditions, will change so that the sample is known not to be a true representation of the ambient air from which it was taken. For example, low humidity conditions in the sample may lead to losses of certain VOCs on the canister walls, losses that would not happen if the humidity were higher. If the canister is pressurized, then condensation of water from high humidity samples may cause fractional losses of water-soluble compounds. Since the canister surface area is limited, all gases are in competition for the available active sites. Hence an absolute storage stability cannot be assigned to a specific gas. Fortunately, under conditions of normal usage for sampling ambient air, most VOCs can be recovered from canisters near their original concentrations after storage times of up to thirty days (see Section 8).

1.4 Use of the Compendium Method TO-15 for many of the VOCs listed in Table 1 is likely to present two difficulties: (1) what calibration standard to use for establishing a basis for testing and quantitation, and (2) how to obtain an audit standard. In certain cases a chemical similarity exists between a thoroughly tested compound and others on the Title III list. In this case, what works for one is likely to work for the other in terms of making standards. However, this is not always the case and some compound standards will be troublesome. The reader is referred to the Section 9.2 on standards for guidance. Calibration of compounds such as formaldehyde, diazomethane, and many of the others represents a challenge.

1.5 Compendium Method TO-15 should be considered for use when a subset of the 97 Title III VOCs constitute the target list. Typical situations involve ambient air testing associated with the permitting procedures for emission sources. In this case sampling and analysis of VOCs is performed to determine the impact of dispersing source emissions in the surrounding areas. Other important applications are prevalence and trend monitoring for hazardous VOCs in urban areas and risk assessments downwind of industrialized or source-impacted areas.

1.6 Solid adsorbents can be used in lieu of canisters for sampling of VOCs, provided the solid adsorbent packings, usually multisorbent packings in metal or glass tubes, can meet the performance criteria specified in Compendium Method TO-17 which specifically addresses the use of multisorbent packings. The two sample collection techniques are different but become the same upon movement of the sample from the collection medium (canister or multisorbent tubes) onto the sample concentrator. Sample collection directly from the atmosphere by automated gas chromatographs can be used in lieu of collection in canisters or on solid adsorbents.

2. Summary of Method

2.1 The atmosphere is sampled by introduction of air into a specially-prepared stainless steel canister. Both subatmospheric pressure and pressurized sampling modes use an initially evacuated canister. A pump ventilated sampling line is used during sample collection with most commercially available samplers. Pressurized sampling requires an additional pump to provide positive pressure to the sample canister. A sample of air is drawn through a sampling train comprised of components that regulate the rate and duration of sampling into the pre-evacuated and passivated canister.

2.2 After the air sample is collected, the canister valve is closed, an identification tag is attached to the canister, and the canister is transported to the laboratory for analysis.

2.3 Upon receipt at the laboratory, the canister tag data is recorded and the canister is stored until analysis. Storage times of up to thirty days have been demonstrated for many of the VOCs (5).

2.4 To analyze the sample, a known volume of sample is directed from the canister through a solid multisorbent concentrator. A portion of the water vapor in the sample breaks through the concentrator during sampling, to a degree depending on the multisorbent composition, duration of sampling, and other factors. Water content of the sample can be further reduced by dry purging the concentrator with helium while retaining target compounds. After the concentration and drying steps are completed, the VOCs are thermally desorbed, entrained in a carrier gas stream, and then focused in a small volume by trapping on a reduced temperature trap or small volume multisorbent trap. The sample is then released by thermal desorption and carried onto a gas chromatographic column for separation.

As a simple alternative to the multisorbent/dry purge water management technique, the amount of water vapor in the sample can be reduced below any threshold for affecting the proper operation of the analytical system by reducing the sample size. For example, a small sample can be concentrated on a cold trap and released directly to the gas chromatographic column. The reduction in sample volume may require an enhancement of detector sensitivity.

Other water management approaches are also acceptable as long as their use does not compromise the attainment of the performance criteria listed in Section 11. A listing of some commercial water management systems is provided in Appendix A. One of the alternative ways to dry the sample is to separate VOCs from condensate on a low temperature trap by heating and purging the trap.

2.5 The analytical strategy for Compendium Method TO-15 involves using a high resolution gas chromatograph (GC) coupled to a mass spectrometer. If the mass spectrometer is a linear quadrupole system, it is operated either by continuously scanning a wide range of mass to charge ratios (SCAN mode) or by monitoring select ion monitoring mode (SIM) of compounds on the target list. If the mass spectrometer is based on a standard ion trap design, only a scanning mode is used (note however, that the Selected Ion Storage (SIS) mode for the ion trap has features of the SIM mode). Mass spectra for individual peaks in the total ion chromatogram are examined with respect to the fragmentation pattern of ions corresponding to various VOCs including the intensity of primary and secondary ions. The fragmentation pattern is compared with stored spectra taken under similar conditions, in order to identify the compound. For any given compound, the intensity of the primary fragment is compared with the system response to the primary fragment for known amounts of the compound. This establishes the compound concentration that exists in the sample.

Mass spectrometry is considered a more definitive identification technique than single specific detectors such as flame ionization detector (FID), electron capture detector (ECD), photoionization detector (PID), or a multidetector arrangement of these (see discussion in Compendium Method TO-14A). The use of both gas chromatographic retention time and the generally unique mass fragmentation patterns reduce the chances for misidentification. If the technique is supported by a comprehensive mass spectral database and a knowledgeable operator, then the correct identification and quantification of VOCs is further enhanced.

3. Significance

3.1 Compendium Method TO-15 is significant in that it extends the Compendium Method TO-14A description for using canister-based sampling and gas chromatographic analysis in the following ways:

- Compendium Method TO-15 incorporates a multisorbent/dry purge technique or equivalent (see Appendix A) for water management thereby addressing a more extensive set of compounds (the VOCs mentioned in Title III of the CAAA of 1990) than addressed by Compendium Method TO-14A. Compendium Method TO-14A approach to water management alters the structure or reduces the sample stream concentration of some VOCs, especially water-soluble VOCs.
- Compendium Method TO-15 uses the GC/MS technique as the only means to identify and quantitate target compounds. The GC/MS approach provides a more scientifically-defensible detection scheme which is generally more desirable than the use of single or even multiple specific detectors.
- In addition, Compendium Method TO-15 establishes method performance criteria for acceptance of data, allowing the use of alternate but equivalent sampling and analytical equipment. There are several new and viable commercial approaches for water management as noted in Appendix A of this method on which to base a VOC monitoring technique as well as other approaches to sampling (i.e., autoGCs and solid

adsorbents) that are often used. This method lists performance criteria that these alternatives must meet to be acceptable alternatives for monitoring ambient VOCs.

- Finally, Compendium Method TO-15 includes enhanced provisions for inherent quality control. The method uses internal analytical standards and frequent verification of analytical system performance to assure control of the analytical system. This more formal and better documented approach to quality control guarantees a higher percentage of good data.

3.2 With these features, Compendium Method TO-15 is a more general yet better defined method for VOCs than Compendium Method TO-14A. As such, the method can be applied with a higher confidence to reduce the uncertainty in risk assessments in environments where the hazardous volatile gases listed in the Title III of the Clean Air Act Amendments of 1990 are being monitored. An emphasis on risk assessments for human health and effects on the ecology is a current goal for the U.S. EPA.

4. Applicable Documents

4.1 ASTM Standards

- **Method D1356** *Definitions of Terms Relating to Atmospheric Sampling and Analysis*.
- **Method E260** *Recommended Practice for General Gas Chromatography Procedures*.
- **Method E355** *Practice for Gas Chromatography Terms and Relationships*.
- **Method D5466** *Standard Test Method of Determination of Volatile Organic Compounds in Atmospheres (Canister Sampling Methodology)*.

4.2 EPA Documents

- *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II,* U. S. Environmental Protection Agency, EPA-600/R-94-038b, May 1994.
- *Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air*, U. S. Environmental Protection Agency, EPA-600/4-83-027, June 1983.
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-14, Second Supplement*, U. S. Environmental Protection Agency, EPA-600/4-89-018, March 1989.
- *Statement-of-Work (SOW) for the Analysis of Air Toxics from Superfund Sites*, U. S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C., Draft Report, June 1990.
- *Clean Air Act Amendments of 1990*, U. S. Congress, Washington, D.C., November 1990.

5. Definitions

[*Note*: *Definitions used in this document and any user-prepared standard operating procedures (SOPs) should be consistent with ASTM Methods D1356, E260, and E355. Aside from the definitions given below, all pertinent abbreviations and symbols are defined within this document at point of use.*]

5.1 Gauge Pressure—pressure measured with reference to the surrounding atmospheric pressure, usually expressed in units of kPa or psi. Zero gauge pressure is equal to atmospheric (barometric) pressure.

5.2 Absolute Pressure—pressure measured with reference to absolute zero pressure, usually expressed in units of kPa, or psi.

5.3 Cryogen—a refrigerant used to obtain sub-ambient temperatures in the VOC concentrator and/or on front of the analytical column. Typical cryogens are liquid nitrogen (bp -195.8°C), liquid argon (bp -185.7°C), and liquid CO_2 (bp -79.5°C).

5.4 Dynamic Calibration—calibration of an analytical system using calibration gas standard concentrations in a form identical or very similar to the samples to be analyzed and by introducing such standards into the inlet of the sampling or analytical system from a manifold through which the gas standards are flowing.

5.5 Dynamic Dilution—means of preparing calibration mixtures in which standard gas(es) from pressurized cylinders are continuously blended with humidified zero air in a manifold so that a flowing stream of calibration mixture is available at the inlet of the analytical system.

5.6 MS-SCAN—mass spectrometric mode of operation in which the gas chromatograph (GC) is coupled to a mass spectrometer (MS) programmed to SCAN all ions repeatedly over a specified mass range.

5.7 MS-SIM—mass spectrometric mode of operation in which the GC is coupled to a MS that is programmed to scan a selected number of ions repeatedly [i.e., selected ion monitoring (SIM) mode].

5.8 Qualitative Accuracy—the degree of measurement accuracy required to correctly identify compounds with an analytical system.

5.9 Quantitative Accuracy—the degree of measurement accuracy required to correctly measure the concentration of an identified compound with an analytical system with known uncertainty.

5.10 Replicate Precision—precision determined from two canisters filled from the same air mass over the same time period and determined as the absolute value of the difference between the analyses of canisters divided by their average value and expressed as a percentage (see Section 11 for performance criteria for replicate precision).

5.11 Duplicate Precision—precision determined from the analysis of two samples taken from the same canister. The duplicate precision is determined as the absolute value of the difference between the canister analyses divided by their average value and expressed as a percentage.

5.12 Audit Accuracy—the difference between the analysis of a sample provided in an audit canister and the nominal value as determined by the audit authority, divided by the audit value and expressed as a percentage (see Section 11 for performance criteria for audit accuracy).

6. Interferences and Contamination

6.1 Very volatile compounds, such as chloromethane and vinyl chloride can display peak broadening and co-elution with other species if the compounds are not delivered to the GC column in a small volume of carrier gas. Refocusing of the sample after collection on the primary trap, either on a separate focusing trap or at the head of the gas chromatographic column, mitigates this problem.

6.2 Interferences in canister samples may result from improper use or from contamination of: (1) the canisters due to poor manufacturing practices, (2) the canister cleaning apparatus, and (3) the sampling or analytical system. Attention to the following details will help to minimize the possibility of contamination of canisters.

6.2.1 Canisters should be manufactured using high quality welding and cleaning techniques, and new canisters should be filled with humidified zero air and then analyzed, after "aging" for 24 hours, to determine cleanliness. The cleaning apparatus, sampling system, and analytical system should be assembled of clean, high quality components and each system should be shown to be free of contamination.

6.2.2 Canisters should be stored in a contaminant-free location and should be capped tightly during shipment to prevent leakage and minimize any compromise of the sample.

6.2.3 Impurities in the calibration dilution gas (if applicable) and carrier gas, organic compounds out-gassing from the system components ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running humidified zero air blanks. The use of non-chromatographic grade stainless steel tubing, non-PTFE thread sealants, or flow controllers with Buna-N rubber components must be avoided.

6.2.4 Significant contamination of the analytical equipment can occur whenever samples containing high VOC concentrations are analyzed. This in turn can result in carryover contamination in subsequent analyses. Whenever a high concentration (>25 ppbv of a trace species) sample is encountered, it should be followed by an analysis of humid zero air to check for carry-over contamination.

6.2.5 In cases when solid sorbents are used to concentrate the sample prior to analysis, the sorbents should be tested to identify artifact formation (see Compendium Method TO-17 for more information on artifacts).

7. Apparatus and Reagents

[Note: Compendium Method To-14A list more specific requirements for sampling and analysis apparatus which may be of help in identifying options. The listings below are generic.]

7.1 Sampling Apparatus

[Note: Subatmospheric pressure and pressurized canister sampling systems are commercially available and have been used as part of U.S. Environmental Protection Agency's Toxic Air Monitoring Stations (TAMS), Urban Air Toxic Monitoring Program (UATMP), the non-methane organic compound (NMOC) sampling and analysis program, and the Photochemical Assessment Monitoring Stations (PAMS).]

7.1.1 Subatmospheric Pressure (see Figure 1, without metal bellows type pump).

7.1.1.1 Sampling Inlet Line. Stainless steel tubing to connect the sampler to the sample inlet.

7.1.1.2 Sample Canister. Leak-free stainless steel pressure vessels of desired volume (e.g., 6 L), with valve and specially prepared interior surfaces (see Appendix B for a listing of known manufacturers/resellers of canisters).

7.1.1.3 Stainless Steel Vacuum/Pressure Gauges. Two types are required, one capable of measuring vacuum (–100 to 0 kPa or 0 to - 30 in Hg) and pressure (0–206 kPa or 0–30 psig) in the sampling system and a second type (for checking the vacuum of canisters during cleaning) capable of measuring at 0.05 mm Hg (see Appendix B) within 20%. Gauges should be tested clean and leak tight.

7.1.1.4 Electronic Mass Flow Controller. Capable of maintaining a constant flow rate (± 10%) over a sampling period of up to 24 hours and under conditions of changing temperature (20–40°C) and humidity.

7.1.1.5 Particulate Matter Filter. 2-μm sintered stainless steel in-line filter.

7.1.1.6 Electronic Timer. For unattended sample collection.

7.1.1.7 Solenoid Valve. Electrically-operated, bi-stable solenoid valve with Viton® seat and O-rings. A Skinner Magnelatch valve is used for purposes of illustration in the text (see Figure 2).

7.1.1.8 Chromatographic Grade Stainless Steel Tubing and Fittings. For interconnections. All such materials in contact with sample, analyte, and support gases prior to analysis should be chromatographic grade stainless steel or equivalent.

7.1.1.9 Thermostatically Controlled Heater. To maintain above ambient temperature inside insulated sampler enclosure.

7.1.1.10 Heater Thermostat. Automatically regulates heater temperature.

7.1.1.11 Fan. For cooling sampling system.

7.1.1.12 Fan Thermostat. Automatically regulates fan operation.

7.1.1.13 Maximum-Minimum Thermometer. Records highest and lowest temperatures during sampling period.

7.1.1.14 Stainless Steel Shut-off Valve. Leak free, for vacuum/pressure gauge.

7.1.1.15 Auxiliary Vacuum Pump. Continuously draws air through the inlet manifold at 10 L/min. or higher flow rate. Sample is extracted from the manifold at a lower rate, and excess air is exhausted.

[Note: The use of higher inlet flow rates dilutes any contamination present in the inlet and reduces the possibility of sample contamination as a result of contact with active adsorption sites on inlet walls.]

7.1.1.16 Elapsed Time Meter. Measures duration of sampling.

7.1.1.17 Optional Fixed Orifice, Capillary, or Adjustable Micrometering Valve. May be used in lieu of the electronic flow controller for grab samples or short duration time-integrated samples. Usually appropriate only in situations where screening samples are taken to assess future sampling activity.

7.1.2 Pressurized (see Figure 1 with metal bellows type pump and Figure 3).

7.1.2.1 Sample Pump. Stainless steel, metal bellows type, capable of 2 atmospheres output pressure. Pump must be free of leaks, clean, and uncontaminated by oil or organic compounds.

[Note: An alternative sampling system has been developed by Dr. R. Rasmussen, The Oregon Graduate Institute of Science and Technology, 20000 N.W. Walker Rd., Beaverton, Oregon 97006, 503-690-1077, and is illustrated in Figure 3. This flow system uses, in order, a pump, a mechanical flow regulator, and a mechanical compensation flow restrictive device. In this configuration the pump is purged with a large sample flow, thereby eliminating the need for an auxiliary vacuum pump to flush the sample inlet.]

7.1.2.2 Other Supporting Materials. All other components of the pressurized sampling system are similar to components discussed in Sections 7.1.1.1 through 7.1.1.17.

7.2 Analytical Apparatus

7.2.1 Sampling/Concentrator System (many commercial alternatives are available).

7.2.1.1 Electronic Mass Flow Controllers. Used to maintain constant flow (for purge gas, carrier gas and sample gas) and to provide an analog output to monitor flow anomalies.

7.2.1.2 Vacuum Pump. General purpose laboratory pump, capable of reducing the downstream pressure of the flow controller to provide the pressure differential necessary to maintain controlled flow rates of sample air.

7.2.1.3 Stainless Steel Tubing and Stainless Steel Fittings. Coated with fused silica to minimize active adsorption sites.

7.2.1.4 Stainless Steel Cylinder Pressure Regulators. Standard, two-stage cylinder regulators with pressure gauges.

7.2.1.5 Gas Purifiers. Used to remove organic impurities and moisture from gas streams.

7.2.1.6 Six-port Gas Chromatographic Valve. For routing sample and carrier gas flows.

7.2.1.7 Multisorbent Concentrator. Solid adsorbent packing with various retentive properties for adsorbing trace gases are commercially available from several sources. The packing contains more than one type of adsorbent packed in series.

7.2.1.7.1A pre-packed adsorbent trap (Supelco 2-0321) containing 200 mg Carbopack B (60/80 mesh) and 50 mg Carbosieve S-III (60/80 mesh) has been found to retain VOCs and allow some water vapor to pass through (6). The addition of a dry purging step allows for further water removal from the adsorbent trap. The steps constituting the dry purge technique that are normally used with multisorbent traps are illustrated in Figure 4. The optimum trapping and dry purging procedure for the Supelco trap consists of a sample volume of 320 mL and a dry nitrogen purge of 1300 mL. Sample trapping and drying is carried out at 25°C. The trap is back-flushed with helium and heated to 220°C to transfer material onto the GC column. A trap bake-out at 260°C for 5 minutes is conducted after each run.

7.2.1.7.2 An example of the effectiveness of dry purging is shown in Figure 5. The multisorbent used in this case is Tenax/Ambersorb 340/Charcoal (7). Approximately 20% of the initial water content in the sample remains after sampling 500 mL of air. The detector response to water vapor (hydrogen atoms detected by atomic emission detection) is plotted versus purge gas volume. Additional water reduction by a factor of 8 is indicated at temperatures of 45°C or higher. Still further water reduction is possible using a two-stage concentration/dryer system.

7.2.1.8 Cryogenic Concentrator. Complete units are commercially available from several vendor sources. The characteristics of the latest concentrators include a rapid, "ballistic" heating of the concentrator to release any trapped VOCs into a small carrier gas volume. This facilitates the separation of compounds on the gas chromatographic column.

7.2.2 Gas Chromatographic/Mass Spectrometric (GC/MS) System.

7.2.2.1 Gas Chromatograph. The gas chromatographic (GC) system must be capable of temperature programming. The column oven can be cooled to subambient temperature (e.g., -50°C) at the start of the gas chromatographic run to effect a resolution of the very volatile organic compounds. In other designs, the rate of release of compounds from the focusing trap in a two stage system obviates the need for retrapping of compounds on the column. The system must include or be interfaced to a concentrator and have all required accessories including analytical columns and gases. All GC carrier gas lines must be constructed from stainless steel or copper tubing. Non-polytetrafluoroethylene (PTFE) thread sealants or flow controllers with Buna-N rubber components must not be used.

7.2.2.2 Chromatographic Columns. 100% methyl silicone or 5% phenyl, 95% methyl silicone fused silica capillary columns of 0.25- to 0.53-mm I.D. of varying lengths are recommended for separation of many of the possible subsets of target compounds involving nonpolar compounds. However, considering the diversity of the target list, the choice is left to the operator subject to the performance standards given in Section 11.

7.2.2.3 Mass Spectrometer. Either a linear quadrupole or ion trap mass spectrometer can be used as long as it is capable of scanning from 35 to 300 amu every 1 second or less, utilizing 70 volts (nominal) electron energy in the electron impact ionization mode, and producing a mass spectrum which meets all the instrument performance acceptance criteria when 50 ng or less of p-bromofluorobenzene (BFB) is analyzed.

7.2.2.3.1Linear Quadrupole Technology. A simplified diagram of the heart of the quadrupole mass spectrometer is shown in Figure 6. The quadrupole consists of a parallel set of four rod electrodes mounted in a square configuration. The field within the analyzer is created by coupling opposite pairs of rods together and applying radiofrequency (RF) and direct current (DC) potentials between the pairs of rods. Ions created in the ion source from the reaction of column eluates with electrons from the electron source are moved through the parallel array of rods under the influence of the generated field. Ions which are successfully transmitted through the quadrupole are said to possess stable trajectories and are subsequently recorded with the detection system. When the DC potential is zero, a wide band of m/z values is transmitted through the quadrupole. This "RF only" mode is referred to as the "total-ion" mode. In this mode, the quadrupole acts as a strong focusing lens analogous to a high pass filter. The amplitude of the RF determines the low mass cutoff. A mass spectrum is generated by scanning the DC and RF voltages using a fixed DC/RF ratio and a constant drive frequency or by scanning the frequency and holding the DC and RF constant. With the quadrupole system only 0.1 to 0.2 percent of the ions formed in the ion source actually reach the detector.

7.2.2.3.2Ion Trap Technology. An ion-trap mass spectrometer consists of a chamber formed between two metal surfaces in the shape of a hyperboloid of one sheet (ring electrode) and a hyperboloid of two sheets (the two end-cap electrodes). Ions are created within the chamber by electron impact from an electron beam admitted through a small aperture in one of the end caps. Radio frequency (RF) (and sometimes direct current voltage offsets) are applied between the ring electrode and the two end-cap electrodes establishing a quadrupole electric field. This field is uncoupled in three directions so that ion motion can be considered independently in each direction; the force acting upon an ion increases with the displacement of the ion from the center of the field but the direction of the force depends on the instantaneous voltage applied to the ring electrode. A restoring force along one coordinate (such as the distance, r, from the ion-trap's axis of radial symmetry) will exist concurrently with a repelling force along another coordinate (such as the distance, z, along the ion traps axis), and if the field were static the ions would eventually strike an electrode. However, in an RF field the force along each coordinate alternates direction so that a stable trajectory may be possible in which the ions do not strike a surface. In practice, ions of appropriate mass-to-charge ratios may be trapped within the device for periods of milliseconds to hours. A diagram of a typical ion trap is illustrated in Figure 7. Analysis of stored ions is performed by increasing the RF voltage, which makes the ions successively unstable. The effect of the RF voltage on the ring electrode is to "squeeze" the ions in the xy plane so that they move along the z axis. Half the ions are lost to the top cap (held at ground potential); the remaining ions exit the lower end cap to be detected by the electron multiplier. As the energy applied to the ring electrode is increased, the ions are collected in order of increasing mass to produce a conventional mass spectrum. With the ion trap, approximately 50 percent of the generated ions are detected. As a result, a significant increase in sensitivity can be achieved when compared to a full scan linear quadrupole system.

7.2.2.4 GC/MS Interface. Any gas chromatograph to mass spectrometer interface that gives acceptable calibration points for each of the analytes of interest and can be used to achieve all acceptable performance criteria may be used. Gas chromatograph to mass spectrometer interfaces constructed of all-glass, glass-lined, or fused silica-lined materials are recommended. Glass and fused silica should be deactivated.

7.2.2.5 Data System. The computer system that is interfaced to the mass spectrometer must allow the continuous acquisition and storage, on machine readable media, of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that allows searching any GC/MS data file for ions of a specified mass and plotting such ion abundances versus time or scan number. This type of plot is defined as a Selected Ion Current Profile (SICP). Software must also be available that allows integrating the abundance in any SICP between specified time or scan number limits. Also, software must be available that allows for the comparison of sample spectra with reference library spectra. The National Institute of Standards and Technology (NIST) or Wiley Libraries or equivalent are recommended as reference libraries.

7.2.2.6 Off-line Data Storage Device. Device must be capable of rapid recording and retrieval of data and must be suitable for long-term, off-line data storage.

7.3 Calibration System and Manifold Apparatus (see Figure 8)

7.3.1 Calibration Manifold. Stainless steel, glass, or high purity quartz manifold, (e.g.,1.25-cm I.D. x 66-cm) with sampling ports and internal baffles for flow disturbance to ensure proper mixing. The manifold should be heated to ~50°C.

7.3.2 Humidifier. 500-mL impinger flask containing HPLC grade deionized water.

7.3.3 Electronic Mass Flow Controllers. One 0 to 5 L/min unit and one or more 0 to 100 mL/min units for air, depending on number of cylinders in use for calibration.

7.3.4 Teflon Filter(s). 47-mm Teflon® filter for particulate collection.

7.4 Reagents

7.4.1 Neat Materials or Manufacturer-Certified Solutions/Mixtures. Best source (see Section 9).

7.4.2 Helium and Air. Ultra-high purity grade in gas cylinders. He is used as carrier gas in the GC.

7.4.3 Liquid Nitrogen or Liquid Carbon Dioxide. Used to cool secondary trap.

7.4.4 Deionized Water. High performance liquid chromatography (HPLC) grade, ultra-high purity (for humidifier).

8. Collection of Samples in Canisters

8.1 Introduction

8.1.1 Canister samplers, sampling procedures, and canister cleaning procedures have not changed very much from the description given in the original Compendium Method TO-14. Much of the material in this section is therefore simply a restatement of the material given in Compendium Method TO-14, repeated here in order to have all the relevant information in one place.

8.1.2 Recent notable additions to the canister technology has been in the application of canister-based systems for example, to microenvironmental monitoring (8), the capture of breath samples (9), and sector sampling to identify emission sources of VOCs (10).

8.1.3 EPA has also sponsored the development of a mathematical model to predict the storage stability of arbitrary mixtures of trace gases in humidified air (3), and the investigation of the SilcoSteel™ process of coating the canister interior with a film of fused silica to reduce surface activity (11). A recent summary of storage stability data for VOCs in canisters is given in the open literature (5).

8.2 Sampling System Description

8.2.1 Subatmospheric Pressure Sampling [see Figure 1 (without metal bellows type pump)].

8.2.1.1 In preparation for subatmospheric sample collection in a canister, the canister is evacuated to 0.05 mm Hg (see Appendix C for discussion of evacuation pressure). When the canister is opened to the atmosphere containing the VOCs to be sampled, the differential pressure causes the sample to flow into the canister. This technique may be used to collect grab samples (duration of 10 to 30 seconds) or time-weighted-average (TWA) samples (duration of 1-24 hours) taken through a flow-restrictive inlet (e.g., mass flow controller, critical orifice).

8.2.1.2 With a critical orifice flow restrictor, there will be a decrease in the flow rate as the pressure approaches atmospheric. However, with a mass flow controller, the subatmospheric sampling system can maintain a constant flow rate from full vacuum to within about 7 kPa (1.0 psi) or less below ambient pressure.

8.2.2 Pressurized Sampling [see Figure 1 (with metal bellows type pump)].

8.2.2.1 Pressurized sampling is used when longer-term integrated samples or higher volume samples are required. The sample is collected in a canister using a pump and flow control arrangement to achieve a typical 101-202 kPa (15-30 psig) final canister pressure. For example, a 6-liter evacuated canister can be filled at 10 mL/min for 24 hours to achieve a final pressure of 144 kPa (21 psig).

8.2.2.2 In pressurized canister sampling, a metal bellows type pump draws in air from the sampling manifold to fill and pressurize the sample canister.

8.2.3 All Samplers.

8.2.3.1 A flow control device is chosen to maintain a constant flow into the canister over the desired sample period. This flow rate is determined so the canister is filled (to about 88.1 kPa for subatmospheric pressure sampling or to about one atmosphere above ambient pressure for pressurized sampling) over the desired sample period. The flow rate can be calculated by:

$$F = \frac{P \times V}{T \times 60}$$

where:

F = flow rate, mL/min.
P = final canister pressure, atmospheres absolute. P is approximately equal to

$$\frac{\text{kPa gauge}}{101.2} + 1$$

V = volume of the canister, mL.
T = sample period, hours.

For example, if a 6-L canister is to be filled to 202 kPa (2 atmospheres) absolute pressure in 24 hours, the flow rate can be calculated by:

$$F = \frac{2 \times 6000}{24 \times 60} = 8.3 \text{ mL/min}$$

8.2.3.2 For automatic operation, the timer is designed to start and stop the pump at appropriate times for the desired sample period. The timer must also control the solenoid valve, to open the valve when starting the pump and to close the valve when stopping the pump.

8.2.3.3 The use of the Skinner Magnelatch valve (see Figure 2) avoids any substantial temperature rise that would occur with a conventional, normally closed solenoid valve that would have to be energized during the entire sample period. The temperature rise in the valve could cause outgassing of organic compounds from the Viton® valve seat material. The Skinner Magnelatch valve requires only a brief electrical pulse to open or close at the appropriate start and stop times and therefore experiences no temperature increase. The pulses may be obtained either with an electronic timer that can be programmed for short (5 to 60 seconds) ON periods, or with a conventional mechanical timer and a special pulse circuit. A simple electrical pulse circuit for operating the Skinner Magnelatch solenoid valve with a conventional mechanical timer is illustrated in Figure 2(a). However, with this simple circuit, the valve may operate unreliably during brief power interruptions or if the timer is manually switched on and off too fast. A better circuit incorporating a time-delay relay to provide more reliable valve operation is shown in Figure 2(b).

8.2.3.4 The connecting lines between the sample inlet and the canister should be as short as possible to minimize their volume. The flow rate into the canister should remain relatively constant over the entire sampling period.

8.2.3.5 As an option, a second electronic timer may be used to start the auxiliary pump several hours prior to the sampling period to flush and condition the inlet line.

8.2.3.6 Prior to field use, each sampling system must pass a humid zero air certification (see Section 8.4.3). All plumbing should be checked carefully for leaks. The canisters must also pass a humid zero air certification before use (see Section 8.4.1).

8.3 Sampling Procedure

8.3.1 The sample canister should be cleaned and tested according to the procedure in Section 8.4.1.

8.3.2 A sample collection system is assembled as shown in Figures 1 and 3 and must be cleaned according to the procedure outlined in Sections 8.4.2 and 8.4.4.

[Note: The sampling system should be contained in an appropriate enclosure.]

8.3.3 Prior to locating the sampling system, the user may want to perform "screening analyses" using a portable GC system, as outlined in Appendix B of Compendium Method TO-14A, to determine potential volatile organics present and potential "hot spots." The information gathered from the portable GC screening analysis would be used in developing a monitoring protocol, which includes the sampling system location, based upon the "screening analysis" results.

8.3.4 After "screening analysis," the sampling system is located. Temperatures of ambient air and sampler box interior are recorded on the canister sampling field test data sheet (FTDS), as documented in Figure 9.

[Note: The following discussion is related to Figure 1]

8.3.5 To verify correct sample flow, a "practice" (evacuated) canister is used in the sampling system.

[Note: For a subatmospheric sampler, a flow meter and practice canister are needed. For the pump-driven system, the practice canister is not needed, as the flow can be measured at the outlet of the system.]

A certified mass flow meter is attached to the inlet line of the manifold, just in front of the filter. The canister is opened. The sampler is turned on and the reading of the certified mass flow meter is compared to the sampler mass flow controller. The values should agree within ±10%. If not, the sampler mass flow meter needs to be recalibrated or there is a leak in the system. This should be investigated and corrected.

[Note: Mass flow meter readings may drift. Check the zero reading carefully and add or subtract the zero reading when reading or adjusting the sampler flow rate to compensate for any zero drift.]

After 2 minutes, the desired canister flow rate is adjusted to the proper value (as indicated by the certified mass flow meter) by the sampler flow control unit controller (e.g., 3.5 mL/min for 24 hr, 7.0 mL/min for 12 hr). Record final flow under "CANISTER FLOW RATE" on the FTDS.

8.3.6 The sampler is turned off and the elapsed time meter is reset to 000.0.

[Note: Whenever the sampler is turned off, wait at least 30 seconds to turn the sampler back on.]

8.3.7 The "practice" canister and certified mass flow meter are disconnected and a clean certified (see Section 8.4.1) canister is attached to the system.

8.3.8 The canister valve and vacuum/pressure gauge valve are opened.

8.3.9 Pressure/vacuum in the canister is recorded on the canister FTDS (see Figure 9) as indicated by the sampler vacuum/pressure gauge.

8.3.10 The vacuum/pressure gauge valve is closed and the maximum-minimum thermometer is reset to current temperature. Time of day and elapsed time meter readings are recorded on the canister FTDS.

8.3.11 The electronic timer is set to start and stop the sampling period at the appropriate times. Sampling starts and stops by the programmed electronic timer.

8.3.12 After the desired sampling period, the maximum, minimum, current interior temperature and current ambient temperature are recorded on the FTDS. The current reading from the flow controller is recorded.

8.3.13 At the end of the sampling period, the vacuum/pressure gauge valve on the sampler is briefly opened and closed and the pressure/vacuum is recorded on the FTDS. Pressure should be close to desired pressure.

[Note: For a subatmospheric sampling system, if the canister is at atmospheric pressure when the field final pressure check is performed, the sampling period may be suspect. This information should be noted on the sampling field data sheet.]

Time of day and elapsed time meter readings are also recorded.

8.3.14 The canister valve is closed. The sampling line is disconnected from the canister and the canister is removed from the system. For a subatmospheric system, a certified mass flow meter is once again connected to the inlet manifold in front of the in-line filter and a "practice" canister is attached to the Magnelatch valve of the sampling system. The final flow rate is recorded on the canister FTDS (see Figure 9).

[Note: For a pressurized system, the final flow may be measured directly.]

The sampler is turned off.

8.3.15 An identification tag is attached to the canister. Canister serial number, sample number, location, and date, as a minimum, are recorded on the tag. The canister is routinely transported back to the analytical laboratory with other canisters in a canister shipping case.

8.4 Cleaning and Certification Program

8.4.1 Canister Cleaning and Certification.

8.4.1.1 All canisters must be clean and free of any contaminants before sample collection.

8.4.1.2 All canisters are leak tested by pressurizing them to approximately 206 kPa (30 psig) with zero air.

[Note: The canister cleaning system in Figure 10 can be used for this task.]

The initial pressure is measured, the canister valve is closed, and the final pressure is checked after 24 hours. If acceptable, the pressure should not vary more than ± 13.8 kPa (± 2 psig) over the 24 hour period.

8.4.1.3 A canister cleaning system may be assembled as illustrated in Figure 10. Cryogen is added to both the vacuum pump and zero air supply traps. The canister(s) are connected to the manifold. The vent shut-off valve and the canister valve(s) are opened to release any remaining pressure in the canister(s). The vacuum pump is started and the vent shut-off valve is then closed and the vacuum shut-off valve is opened. The canister(s) are evacuated to <0.05 mm Hg (see Appendix B) for at least 1 hour.

[Note: On a daily basis or more often if necessary, the cryogenic traps should be purged with zero air to remove any trapped water from previous canister cleaning cycles.]

Air released/evacuated from canisters should be diverted to a fume hood.

8.4.1.4 The vacuum and vacuum/pressure gauge shut-off valves are closed and the zero air shut-off valve is opened to pressurize the canister(s) with humid zero air to approximately 206 kPa (30 psig). If a zero gas generator system is used, the flow rate may need to be limited to maintain the zero air quality.

8.4.1.5 The zero air shut-off valve is closed and the canister(s) is allowed to vent down to atmospheric pressure through the vent shut-off valve. The vent shut-off valve is closed. Repeat Sections 8.4.1.3 through 8.4.1.5 two additional times for a total of three (3) evacuation/pressurization cycles for each set of canisters.

8.4.1.6 At the end of the evacuation/pressurization cycle, the canister is pressurized to 206 kPa (30 psig) with humid zero air. The canister is then analyzed by a GC/MS analytical system. Any canister that has not tested clean (compared to direct analysis of humidified zero air of less than 0.2 ppbv of targeted VOCs) should not be used. As a "blank" check of the canister(s) and cleanup procedure, the final humid zero air fill of 100% of the canisters is analyzed until the cleanup system and canisters are proven reliable (less than 0.2 ppbv of any target VOCs). The check can then be reduced to a lower percentage of canisters.

8.4.1.7 The canister is reattached to the cleaning manifold and is then reevacuated to <0.05 mm Hg (see Appendix B) and remains in this condition until used. The canister valve is closed. The canister is removed from the cleaning system and the canister connection is capped with a stainless steel fitting. The canister is now ready for collection of an air sample. An identification tag is attached to the inlet of each canister for field notes and chain-of-custody purposes. An alternative to evacuating the canister at this point is to store the canisters and reevacuate them just prior to the next use.

8.4.1.8 As an option to the humid zero air cleaning procedures, the canisters are heated in an isothermal oven not to exceed 100°C during evacuation of the canister to ensure that higher molecular weight compounds are not retained on the walls of the canister.

[Note: For sampling more complex VOC mixtures the canisters should be heated to higher temperatures during the cleaning procedure although a special high temperature valve would be needed].

Once heated, the canisters are evacuated to <0.05 mm Hg (see Appendix B) and maintained there for 1 hour. At the end of the heated/evacuated cycle, the canisters are pressurized with humid zero air and analyzed by a GC/MS system after a minimum of 12 hrs of "aging." Any canister that has not tested clean (less than 0.2 ppbv each of targeted compounds) should not be used. Once tested clean, the canisters are reevacuated to <0.05 mm Hg (see Appendix B) and remain in the evacuated state until used. As noted in Section 8.4.1.7, reevacuation can occur just prior to the next use.

8.4.2 Cleaning Sampling System Components.

8.4.2.1 Sample components are disassembled and cleaned before the sampler is assembled. Nonmetallic parts are rinsed with HPLC grade deionized water and dried in a vacuum oven at 50°C. Typically, stainless steel parts and fittings are cleaned by placing them in a beaker of methanol in an ultrasonic bath for 15 minutes. This procedure is repeated with hexane as the solvent.

8.4.2.2 The parts are then rinsed with HPLC grade deionized water and dried in a vacuum oven at 100°C for 12 to 24 hours.

8.4.2.3 Once the sampler is assembled, the entire system is purged with humid zero air for 24 hours.

8.4.3 Zero Air Certification.

[Note: In the following sections, "certification" is defined as evaluating the sampling system with humid zero air and humid calibration gases that pass through all active components of the sampling system. The system is "certified" if no significant additions or deletions (less than 0.2 ppbv each of target compounds) have occurred when challenged with the test gas stream.]

8.4.3.1 The cleanliness of the sampling system is determined by testing the sampler with humid zero air without an evacuated gas sampling canister, as follows.

8.4.3.2 The calibration system and manifold are assembled, as illustrated in Figure 8. The sampler (without an evacuated gas canister) is connected to the manifold and the zero air cylinder is activated to generate a humid gas stream (2 L/min) to the calibration manifold [see Figure 8(b)].

8.4.3.3 The humid zero gas stream passes through the calibration manifold, through the sampling system (without an evacuated canister) to the water management system/VOC preconcentrator of an analytical system.

[*Note: The exit of the sampling system (without the canister) replaces the canister in Figure 11.*]

After the sample volume (e.g., 500 mL) is preconcentrated on the trap, the trap is heated and the VOCs are thermally desorbed and refocussed on a cold trap. This trap is heated and the VOCs are thermally desorbed onto the head of the capillary column. The VOCs are refocussed prior to gas chromatographic separation. Then, the oven temperature (programmed) increases and the VOCs begin to elute and are detected by a GC/MS (see Section 10) system. The analytical system should not detect greater than 0.2 ppbv of any targeted VOCs in order for the sampling system to pass the humid zero air certification test. Chromatograms (using an FID) of a certified sampler and contaminated sampler are illustrated in Figures 12(a) and 12(b), respectively. If the sampler passes the humid zero air test, it is then tested with humid calibration gas standards containing selected VOCs at concentration levels expected in field sampling (e.g., 0.5 to 2 ppbv) as outlined in Section 8.4.4.

8.4.4 Sampler System Certification with Humid Calibration Gas Standards from a Dynamic Calibration System

8.4.4.1 Assemble the dynamic calibration system and manifold as illustrated in Figure 8.

8.4.4.2 Verify that the calibration system is clean (less than 0.2 ppbv of any target compounds) by sampling a humidified gas stream, *without* gas calibration standards, with a previously certified clean canister (see Section 8.1).

8.4.4.3 The assembled dynamic calibration system is certified clean if less than 0.2 ppbv of any targeted compounds is found.

8.4.4.4 For generating the humidified calibration standards, the calibration gas cylinder(s) containing nominal concentrations of 10 ppmv in nitrogen of selected VOCs is attached to the calibration system as illustrated in Figure 8. The gas cylinders are opened and the gas mixtures are passed through 0 to 10 mL/min certified mass flow controllers to generate ppb levels of calibration standards.

8.4.4.5 After the appropriate equilibrium period, attach the sampling system (containing a certified evacuated canister) to the manifold, as illustrated in Figure 8(b).

8.4.4.6 Sample the dynamic calibration gas stream with the sampling system.

8.4.4.7 Concurrent with the sampling system operation, realtime monitoring of the calibration gas stream is accomplished by the on-line GC/MS analytical system [Figure 8(a)] to provide reference concentrations of generated VOCs.

8.4.4.8 At the end of the sampling period (normally the same time period used for experiments), the sampling system canister is analyzed and compared to the reference GC/MS analytical system to determine if the concentration of the targeted VOCs was increased or decreased by the sampling system.

8.4.4.9 A recovery of between 90% and 110% is expected for all targeted VOCs.

8.4.5 Sampler System Certification without Compressed Gas Cylinder Standards.

8.4.5.1 Not all the gases on the Title III list are available/compatible with compressed gas standards. In these cases sampler certification must be approached by different means.

8.4.5.2 Definitive guidance is not currently available in these cases; however, Section 9.2 lists several ways to generate gas standards. In general, Compendium Method TO-14A compounds (see Table 1) are available commercially as compressed gas standards.

9. GC/MS Analysis of Volatiles from Canisters

9.1 Introduction

9.1.1 The analysis of canister samples is accomplished with a GC/MS system. Fused silica capillary columns are used to achieve high temporal resolution of target compounds. Linear quadrupole or ion trap mass spectrometers are employed for compound detection. The heart of the system is composed of the sample inlet concentrating device that is needed to increase sample loading into a detectable range. Two examples of concentrating systems are discussed. Other approaches are acceptable as long as they are compatible with achieving the system performance criteria given in Section 11.

9.1.2 With the first technique, a whole air sample from the canister is passed through a multisorbent packing (including single adsorbent packings) contained within a metal or glass tube maintained at or above the surrounding air temperature. Depending on the water retention properties of the packing, some or most of the water vapor passes completely through the trap during sampling. Additional drying of the sample is accomplished after the sample concentration is completed by forward purging the trap with clean, dry helium or another inert gas (air is not used). The sample is then thermally desorbed from the packing and backflushed from the trap onto a gas chromatographic column. In some systems a "refocusing" trap is placed between the primary trap and the gas chromatographic column. The specific system design downstream of the primary trap depends on technical factors such as the rate of thermal desorption and sampled volume, but the objective in most cases is to enhance chromatographic resolution of the individual sample components before detection on a mass spectrometer.

9.1.3 Sample drying strategies depend on the target list of compounds. For some target compound lists, the multisorbent packing of the concentrator can be selected from hydrophobic adsorbents which allow a high percentage of water vapor in the sample to pass through the concentrator during sampling and without significant loss of the target compounds. However, if very volatile organic compounds are on the target list, the adsorbents required for their retention may also strongly retain water vapor and a more lengthy dry purge is necessary prior to analysis.

9.1.4 With the second technique, a whole air sample is passed through a concentrator where the VOCs are condensed on a reduced temperature surface (cold trap). Subsequently, the condensed gases are thermally desorbed and backflushed from the trap with an inert gas onto a gas chromatographic column. This concentration technique is similar to that discussed in Compendium Method TO-14, although a membrane dryer is not used. The sample size is reduced in volume to limit the amount of water vapor that is also collected (100 mL or less may be necessary). The attendant reduction in sensitivity is offset by enhancing the sensitivity of detection, for example by using an ion trap detector.

9.2 Preparation of Standards

9.2.1 Introduction.

9.2.1.1 When available, standard mixtures of target gases in high pressure cylinders must be certified traceable to a NIST Standard Reference Material (SRM) or to a NIST/EPA approved Certified Reference Material (CRM). Manufacturer's certificates of analysis must be retained to track the expiration date.

9.2.1.2 The neat standards that are used for making trace gas standards must be of high purity; generally a purity of 98 percent or better is commercially available.

9.2.1.3 Cylinder(s) containing approximately 10 ppmv of each of the target compounds are typically used as primary stock standards. The components may be purchased in one cylinder or in separate cylinders depending on compatibility of the compounds and the pressure of the mixture in the cylinder. Refer to manufacturer's specifications for guidance on purchasing and mixing VOCs in gas cylinders.

9.2.2 Preparing Working Standards.

9.2.2.1 Instrument Performance Check Standard. Prepare a standard solution of BFB in humidified zero air at a concentration which will allow collection of 50 ng of BFB or less under the optimized concentration parameters.

9.2.2.2 Calibration Standards. Prepare five working calibration standards in humidified zero air at a concentration which will allow collection at the 2, 5, 10, 20, and 50 ppbv level for each component under the optimized concentration parameters.

9.2.2.3 Internal Standard Spiking Mixture. Prepare an internal spiking mixture containing bromochloromethane, chlorobenzene-d_5, and 1,4-difluorobenzene at 10 ppmv each in humidified zero air to be added to the sample or calibration standard. 500 µL of this mixture spiked into 500 mL of sample will result in a concentration of 10 ppbv. The internal standard is introduced into the trap during the collection time for all calibration, blank, and sample analyses using the apparatus shown in Figure 13 or by equivalent means. The volume of internal standard spiking mixture added for each analysis must be the same from run to run.

9.2.3 Standard Preparation by Dynamic Dilution Technique.

9.2.3.1 Standards may be prepared by dynamic dilution of the gaseous contents of a cylinder(s) containing the gas calibration stock standards with humidified zero air using mass flow controllers and a calibration manifold. The working standard may be delivered from the manifold to a clean, evacuated canister using a pump and mass flow controller.

9.2.3.2 Alternatively, the analytical system may be calibrated by sampling directly from the manifold if the flow rates are optimized to provide the desired amount of calibration standards. However, the use of the canister as a reservoir prior to introduction into the concentration system resembles the procedure normally used to collect samples and is preferred. Flow rates of the dilution air and cylinder standards (all expressed in the same units) are measured using a bubble meter or calibrated electronic flow measuring device, and the concentrations of target compounds in the manifold are then calculated using the dilution ratio and the original concentration of each compound.

$$\text{Manifold Conc.} = \frac{(\text{Original Conc.})\ (\text{Std. Gas Flowrate})}{(\text{Air Flowrate}) + (\text{Std. Gas Flowrate})}$$

9.2.3.3 Consider the example of 1 mL/min flow of 10 ppmv standard diluted with 1,000 mL/min of humid air provides a nominal 10 ppbv mixture, as calculated below:

$$\text{Manifold Conc.} = \frac{(10\ \text{ppm})(1\ \text{mL/min})(1000\ \text{ppb/1 ppm})}{(1000\ \text{mL/min}) + (1\ \text{mL/min})} = 10\ \text{ppb}$$

9.2.4 Standard Preparation by Static Dilution Bottle Technique

[Note: Standards may be prepared in canisters by spiking the canister with a mixture of components prepared in a static dilution bottle (12). This technique is used specifically for liquid standards.]

9.2.4.1 The volume of a clean 2-liter round-bottom flask, modified with a threaded glass neck to accept a Mininert septum cap, is determined by weighing the amount of water required to completely fill up the flask. Assuming a density for the water of 1 g/mL, the weight of the water in grams is taken as the volume of the flask in milliliters.

9.2.4.2 The flask is flushed with helium by attaching a tubing into the glass neck to deliver the helium. After a few minutes, the tubing is removed and the glass neck is immediately closed with a Mininert septum cap.

9.2.4.3 The flask is placed in a 60°C oven and allowed to equilibrate at that temperature for about 15 minutes. Predetermined aliquots of liquid standards are injected into the flask making sure to keep the flask temperature constant at 60°C.

9.2.4.4 The contents are allowed to equilibrate in the oven for at least 30 minutes. To avoid condensation, syringes must be preheated in the oven at the same temperature prior to withdrawal of aliquots to avoid condensation.

9.2.4.5 Sample aliquots may then be taken for introduction into the analytical system or for further dilution. An aliquot or aliquots totaling greater than 1 percent of the flask volume should be avoided.

9.2.4.6 Standards prepared by this method are stable for one week. The septum must be replaced with each freshly prepared standard.

9.2.4.7 The concentration of each component in the flask is calculated using the following equation:

$$\text{Concentration, mg/L} = \frac{(V_a)(d)}{V_f}$$

where:
V_a = Volume of liquid neat standard injected into the flask, µL.
d = Density of the liquid neat standard, mg/µL.
V_f = Volume of the flask, L.

9.2.4.8 To obtain concentrations in ppbv, the equation given in Section 9.2.5.7 can be used.

[Note: In the preparation of standards by this technique, the analyst should make sure that the volume of neat standard injected into the flask does not result in an overpressure due to the higher partial pressure produced by the standard compared to the vapor pressure in the flask. Precautions should also be taken to avoid a significant decrease in pressure inside the flask after withdrawal of aliquot(s).]

9.2.5 Standard Preparation Procedure in High Pressure Cylinders

[Note: Standards may be prepared in high pressure cylinders (13). A modified summary of the procedure is provided below.]

9.2.5.1 The standard compounds are obtained as gases or neat liquids (greater than 98 percent purity).

9.2.5.2 An aluminum cylinder is flushed with high-purity nitrogen gas and then evacuated to better than 25 in. Hg.

9.2.5.3 Predetermined amounts of each neat standard compound are measured using a microliter or gastight syringe and injected into the cylinder. The cylinder is equipped with a heated injection port and nitrogen flow to facilitate sample transfer.

9.2.5.4 The cylinder is pressurized to 1000 psig with zero nitrogen.

[Note: User should read all SOPs associated with generating standards in high pressure cylinders. Follow all safety requirements to minimize danger from high pressure cylinders.]

9.2.5.5 The contents of the cylinder are allowed to equilibrate (~24 hrs) prior to withdrawal of aliquots into the GC system.

9.2.5.6 If the neat standard is a gas, the cylinder concentration is determined using the following equation:

$$\text{Concentration, ppbv} = \frac{\text{Volume}_{\text{standard}}}{\text{Volume}_{\text{dilution gas}}} \times 10^9$$

[Note: Both values must be expressed in the same units.]

9.2.5.7 If the neat standard is a liquid, the gaseous concentration can be determined using the following equations:

$$V = \frac{nRT}{P}$$

and:

$$n = \frac{(mL)(d)}{MW}$$

where:

V = Gaseous volume of injected compound at EPA standard temperature (25°C) and pressure (760 mm Hg), L.
n = Moles.
R = Gas constant, 0.08206 L-atm/mole °K.
T = 298°K (standard temperature).
P = 1 standard pressure, 760 mm Hg (1 atm).
mL = Volume of liquid injected, mL.
d = Density of the neat standard, g/mL.
MW = Molecular weight of the neat standard expressed, g/g-mole.

The gaseous volume of the injected compound is divided by the cylinder volume at STP and then multiplied by 10^9 to obtain the component concentration in ppb units.

9.2.6 Standard Preparation by Water Methods.

[Note: Standards may be prepared by a water purge and trap method (14) and summarized as follows].

9.2.6.1 A previously cleaned and evacuated canister is pressurized to 760 mm Hg absolute (1 atm) with zero grade air.

9.2.6.2 The air gauge is removed from the canister and the sparging vessel is connected to the canister with the short length of 1/16 in. stainless steel tubing.

[Note: Extra effort should be made to minimize possible areas of dead volume to maximize transfer of analytes from the water to the canister.]

9.2.6.3 A measured amount of the stock standard solution and the internal standard solution is spiked into 5 mL of water.

9.2.6.4 This water is transferred into the sparge vessel and purged with nitrogen for 10 mins at 100 mL/min. The sparging vessel is maintained at 40°C.

9.2.6.5 At the end of 10 mins, the sparge vessel is removed and the air gauge is re-installed, to further pressurize the canister with pure nitrogen to 1500 mm Hg absolute pressure (approximately 29 psia).

9.2.6.6 The canister is allowed to equilibrate overnight before use.

9.2.6.7 A schematic of this approach is shown in Figure 14.

9.2.7 Preparation of Standards by Permeation Tubes.

9.2.7.1 Permeation tubes can be used to provide standard concentration of a trace gas or gases. The permeation of the gas can occur from inside a permeation tube containing the trace species of interest to an air stream outside. Permeation can also occur from outside a permeable membrane tube to an air stream passing through the tube (e.g., a tube of permeable material immersed in a liquid).

9.2.7.2 The permeation system is usually held at a constant temperature to generate a constant concentration of trace gas. Commercial suppliers provide systems for generation and dilution of over 250 compounds. Some commercial suppliers of permeation tube equipment are listed in Appendix D.

9.2.8 Storage of Standards.

9.2.8.1 Working standards prepared in canisters may be stored for thirty days in an atmosphere free of potential contaminants.

9.2.8.2 It is imperative that a storage logbook be kept to document storage time.

10. GC/MS Operating Conditions

10.1 Preconcentrator

The following are typical cryogenic and adsorbent preconcentrator analytical conditions which, however, depend on the specific combination of solid sorbent and must be selected carefully by the operator. The reader is referred to Tables 1 and 2 of Compendium Method TO-17 for guidance on selection of sorbents. An example of a system using a solid adsorbent preconcentrator with a cryofocusing trap is discussed in the literature (15). Oven temperature programming starts above ambient.

10.1.1 Sample Collection Conditions

<u>Cryogenic Trap</u>	<u>Adsorbent Trap</u>

Set point	-150°C	Set point	27°C
Sample volume	- up to 100 mL	Sample volume	- up to 1,000 mL
Carrier gas purge flow	- none	Carrier gas purge flow	- selectable

[Note: The analyst should optimize the flow rate, duration of sampling, and absolute sample volume to be used. Other preconcentration systems may be used provided performance standards (see Section 11) are realized.]

10.1.2 Desorption Conditions

Cryogenic Trap		Adsorbent Trap	
Desorb Temperature	120°C	Desorb Temperature	Variable
Desorb Flow Rate	~ 3 mL/min He	Desorb Flow Rate	~3 mL/min He
Desorb Time	<60 sec	Desorb Time	<60 sec

The adsorbent trap conditions depend on the specific solid adsorbents chosen (see manufacturers' specifications).

10.1.3 Trap Reconditioning Conditions.

Cryogenic Trap		Adsorbent Trap	
Initial bakeout	120°C (24 hrs)	Initial bakeout	
Variable (24 hrs)			
After each run	120°C (5 min)	After each run	Variable (5 min)

10.2 GC/MS System

10.2.1 Optimize GC conditions for compound separation and sensitivity. Baseline separation of benzene and carbon tetrachloride on a 100% methyl polysiloxane stationary phase is an indication of acceptable chromatographic performance.

10.2.2 The following are the recommended gas chromatographic analytical conditions when using a 50-meter by 0.3-mm I.D., 1 µm film thickness fused silica column with refocusing on the column.

Item	Condition	
Carrier Gas:	Helium	
Flow Rate:	Generally 1-3 mL/min as recommended by manufacturer	
Temperature Program:	Initial Temperature:	-50°C
	Initial Hold Time:	2 min
	Ramp Rate:	8° C/min
	Final Temperature:	200°C
	Final Hold Time:	Until all target compounds elute.

10.2.3 The following are the recommended mass spectrometer conditions:

Item	Condition

Electron Energy:	70 Volts (nominal)
Mass Range:	35-300 amu [the choice of 35 amu excludes the detection of some target compounds such as methanol and formaldehyde, and the quantitation of others such as ethylene oxide, ethyl carbamate, etc. (see Table 2). Lowering the mass range and using special programming features available on modern gas chromatographs will be necessary in these cases, but are not considered here.
Scan Time:	To give at least 10 scans per peak, not to exceed 1 second per scan].

A schematic for a typical GC/MS analytical system is illustrated in Figure 15.

10.3 Analytical Sequence

10.3.1 Introduction. The recommended GC/MS analytical sequence for samples during each 24-hour time period is as follows:

- Perform instrument performance check using bromofluorobenzene (BFB).
- Initiate multi-point calibration or daily calibration checks.
- Perform a laboratory method blank.
- Complete this sequence for analysis of $\leq$20 field samples.

10.4 Instrument Performance Check

10.4.1 Summary. It is necessary to establish that a given GC/MS meets tuning and standard mass spectral abundance criteria prior to initiating any data collection. The GC/MS system is set up according to the manufacturer's specifications, and the mass calibration and resolution of the GC/MS system are then verified by the analysis of the instrument performance check standard, bromofluorobenzene (BFB).

10.4.2 Frequency. Prior to the analyses of any samples, blanks, or calibration standards, the Laboratory must establish that the GC/MS system meets the mass spectral ion abundance criteria for the instrument performance check standard containing BFB. The instrument performance check solution must be analyzed initially and once per 24-hour time period of operation.

The 24-hour time period for GC/MS instrument performance check and standards calibration (initial calibration or daily calibration check criteria) begins at the injection of the BFB which the laboratory records as documentation of a compliance tune.

10.4.3 Procedure. The analysis of the instrument performance check standard is performed by trapping 50 ng of BFB under the optimized preconcentration parameters. The BFB is introduced from a cylinder into the GC/MS via a sample loop valve injection system similar to that shown in Figure 13.

The mass spectrum of BFB must be acquired in the following manner. Three scans (the peak apex scan and the scans immediately preceding and following the apex) are acquired and averaged. Background subtraction is conducted using a single scan prior to the elution of BFB.

10.4.4 Technical Acceptance Criteria. Prior to the analysis of any samples, blanks, or calibration standards, the analyst must establish that the GC/MS system meets the mass spectral ion abundance criteria for the instrument performance check standard as specified in Table 3.

10.4.5 Corrective Action. If the BFB acceptance criteria are not met, the MS must be retuned. It may be necessary to clean the ion source, or quadrupoles, or take other necessary actions to achieve the acceptance criteria.

10.4.6 Documentation. Results of the BFB tuning are to be recorded and maintained as part of the instrumentation log.

10.5 Initial Calibration

10.5.1 Summary. Prior to the analysis of samples and blanks but after the instrument performance check standard criteria have been met, each GC/MS system must be calibrated at five concentrations that span the monitoring range of interest in an initial calibration sequence to determine instrument sensitivity and the linearity of GC/MS response for the target compounds. For example, the range of interest may be 2 to 20 ppbv, in which case the five concentrations would be 1, 2, 5, 10 and 25 ppbv.

One of the calibration points from the initial calibration curve must be at the same concentration as the daily calibration standard (e.g., 10 ppbv).

10.5.2 Frequency. Each GC/MS system must be recalibrated following corrective action (e.g., ion source cleaning or repair, column replacement, etc.) which may change or affect the initial calibration criteria or if the daily calibration acceptance criteria have not been met.

If time remains in the 24-hour time period after meeting the acceptance criteria for the initial calibration, samples may be analyzed.

If time does not remain in the 24-hour period after meeting the acceptance criteria for the initial calibration, a new analytical sequence shall commence with the analysis of the instrument performance check standard followed by analysis of a daily calibration standard.

10.5.3 Procedure. Verify that the GC/MS system meets the instrument performance criteria in Section 10.4.

The GC must be operated using temperature and flow rate parameters equivalent to those in Section 10.2.2. Calibrate the preconcentration-GC/MS system by drawing the standard into the system. Use one of the standards preparation techniques described under Section 9.2 or equivalent.

A minimum of five concentration levels are needed to determine the instrument sensitivity and linearity. One of the calibration levels should be near the detection level for the compounds of interest. The calibration range should be chosen so that linear results are obtained as defined in Sections 10.5.1 and 10.5.5.

Quantitation ions for the target compounds are shown in Table 2. The primary ion should be used unless interferences are present, in which case a secondary ion is used.

10.5.4 Calculations.

[Note: In the following calculations, an internal standard approach is used to calculate response factors. The area response used is that of the primary quantitation ion unless otherwise stated.]

10.5.4.1 Relative Response Factor (RRF). Calculate the relative response factors for each target compound relative to the appropriate internal standard (i.e., standard with the nearest retention time) using the following equation:

$$\mathrm{RRF} = \frac{A_x C_{is}}{A_{is} C_x}$$

where: RRF = Relative response factor.
A_x = Area of the primary ion for the compound to be measured, counts.
A_{is} = Area of the primary ion for the internal standard, counts.
C_{is} = Concentration of internal standard spiking mixture, ppbv.
C_x = Concentration of the compound in the calibration standard, ppbv.

[Note: The equation above is valid under the condition that the volume of internal standard spiking mixture added in all field and QC analyses is the same from run to run, and that the volume of field and QC sample introduced into the trap is the same for each analysis. C_{is} and C_x must be in the same units.]

10.5.4.2 Mean Relative Response Factor. Calculate the mean RRF for each compound by averaging the values obtained at the five concentrations using the following equation:

$$\overline{\mathrm{RRF}} = \sum_{i=1}^{n} \frac{x_i}{n}$$

where: $\overline{\mathrm{RRF}}$ = Mean relative response factor.
x_i = RRF of the compound at concentration i.
n = Number of concentration values, in this case 5.

10.5.4.3 Percent Relative Standard Deviation (%RSD). Using the RRFs from the initial calibration, calculate the %RSD for all target compounds using the following equations:

$$\%\mathrm{RSD} = \frac{\mathrm{SD}_{\mathrm{RRF}}}{\overline{\mathrm{RRF}}} \times 100$$

and

$$\mathrm{SD}_{\mathrm{RRF}} = \sqrt{\sum_{i=1}^{N} \frac{(\mathrm{RRF}_i - \overline{\mathrm{RRF}})^2}{N - 1}}$$

where: $\mathrm{SD}_{\mathrm{RRF}}$ = Standard deviation of initial response factors (per compound).
RRF_i = Relative response factor at a concentration level i.
$\overline{\mathrm{RRF}}$ = Mean of initial relative response factors (per compound).

10.5.4.4 Relative Retention Times (RRT). Calculate the RRTs for each target compound over the initial calibration range using the following equation:

$$\mathrm{RRT} = \frac{\mathrm{RT}_c}{\mathrm{RT}_{is}}$$

where: RT_c = Retention time of the target compound, seconds
RT_{is} = Retention time of the internal standard, seconds.

10.5.4.5 Mean of the Relative Retention Times ($\overline{\mathrm{RRT}}$). Calculate the mean of the relative retention times ($\overline{\mathrm{RRT}}$) for each analyte target compound over the initial calibration range using the following equation:

$$\overline{RRT} = \sum_{i=1}^{n} \frac{RRT}{n}$$

where: $\overline{RRT}$ = Mean relative retention time for the target compound for each initial calibration standard.

RRT = Relative retention time for the target compound at each calibration level.

10.5.4.6 Tabulate Primary Ion Area Response (Y) for Internal Standard. Tabulate the area response (Y) of the primary ions (see Table 2) and the corresponding concentration for each compound and internal standard.

10.5.4.7 Mean Area Response ($\overline{Y}$) for Internal Standard. Calculate the mean area response ($\overline{Y}$) for each internal standard compound over the initial calibration range using the following equation:

$$\overline{Y} = \sum_{i=1}^{n} \frac{Y_i}{n}$$

where: $\overline{Y}$ = Mean area response.

Y = Area response for the primary quantitation ion for the internal standard for each initial calibration standard.

10.5.4.8 Mean Retention Times ($\overline{RT}$). Calculate the mean of the retention times ($\overline{RT}$) for each internal standard over the initial calibration range using the following equation:

$$\overline{RT} = \sum_{i=1}^{n} \frac{RT_i}{n}$$

where: $\overline{RT}$ = Mean retention time, seconds

RT = Retention time for the internal standard for each initial calibration standard, seconds.

10.5.5 Technical Acceptance Criteria for the Initial Calibration.

10.5.5.1 The calculated %RSD for the RRF for each compound in the calibration table must be less than 30% with at most two exceptions up to a limit of 40%.

[Note: This exception may not be acceptable for all projects. Many projects may have a specific target list of compounds which would require the lower limit for all compounds.]

10.5.5.2 The RRT for each target compound at each calibration level must be withiin 0.06 RRT units of the mean RRT for the compound.

10.5.5.3 The area response Y of at each calibration level must be within 40% of the mean area response $\overline{Y}$ over the initial calibration range for each internal standard.

10.5.5.4 The retention time shift for each of the internal standards at each calibration level must be within 20 s of the mean retention time over the initial calibration range for each internal standard.

10.5.6 Corrective Action.

10.5.6.1 Criteria. If the initial calibration technical acceptance criteria are not met, inspect the system for problems. It may be necessary to clean the ion source, change the column, or take other corrective actions to meet the initial calibration technical acceptance criteria.

10.5.6.2 Schedule. Initial calibration acceptance criteria *must* be met before any field samples, performance evaluation (PE) samples, or blanks are analyzed.

10.6 Daily Calibration

10.6.1 Summary. Prior to the analysis of samples and blanks but after tuning criteria have been met, the initial calibration of each GC/MS system must be routinely checked by analyzing a daily calibration standard to ensure that the instrument continues to remain under control. The daily calibration standard, which is the nominal 10 ppbv level calibration standard, should contain all the target compounds.

10.6.2 Frequency. A check of the calibration curve must be performed once every 24 hours on a GC/MS system that has met the tuning criteria. The daily calibration sequence starts with the injection of the BFB. If the BFB analysis meets the ion abundance criteria for BFB, then a daily calibration standard may be analyzed.

10.6.3 Procedure. The mid-level calibration standard (10 ppbv) is analyzed in a GC/MS system that has met the tuning and mass calibration criteria following the same procedure in Section 10.5.

10.6.4 Calculations. Perform the following calculations.

[Note: As indicated earlier, the area response of the primary quantitation ion is used unless otherwise stated.]

10.6.4.1 Relative Response Factor (RRF). Calculate a relative response factor (RRF) for each target compound using the equation in Section 10.5.4.1.

10.6.4.2 Percent Difference (%D). Calculate the percent difference in the RRF of the daily RRF (24-hour) compared to the mean RRF in the most recent initial calibration. Calculate the %D for each target compound using the following equation:

$$\%D = \frac{RRF_c - \overline{RRF_i}}{\overline{RRF_i}} \times 100$$

where: RRF_c = RRF of the compound in the continuing calibration standard.

$\overline{RRF_i}$ = Mean RRF of the compound in the most recent initial calibration.

10.6.5 Technical Acceptance Criteria. The daily calibration standard must be analyzed at the concentration level and frequency described in this Section 10.6 and on a GC/MS system meeting the BFB instrument performance check criteria (see Section 10.4).

The %D for each target compound in a daily calibration sequence must be within ±30 percent in order to proceed with the analysis of samples and blanks. A control chart showing %D values should be maintained.

10.6.6 Corrective Action. If the daily calibration technical acceptance criteria are not met, inspect the system for problems. It may be necessary to clean the ion source, change the column, or take other corrective actions to meet the daily calibration technical acceptance criteria.

Daily calibration acceptance criteria must be met before any field samples, performance evaluation (PE) samples, or blanks are analyzed. If the % D criteria are not met, it will be necessary to rerun the daily calibration sample.

10.7 Blank Analyses

10.7.1 Summary. To monitor for possible laboratory contamination, laboratory method blanks are analyzed at least once in a 24-hour analytical sequence. All steps in the analytical procedure are performed on the blank using all reagents, standards, equipment, apparatus, glassware, and solvents that would be used for a sample analysis.

A laboratory method blank (LMB) is an unused, certified canister that has not left the laboratory. The blank canister is pressurized with humidified, ultra-pure zero air and carried through the same analytical procedure as a field sample. The injected aliquot of the blank must contain the same amount of internal standards that are added to each sample.

10.7.2 Frequency. The laboratory method blank must be analyzed after the calibration standard(s) and before any samples are analyzed.

Whenever a high concentration sample is encountered (i.e., outside the calibration range), a blank analysis should be performed immediately after the sample is completed to check for carryover effects.

10.7.3 Procedure. Fill a cleaned and evacuated canister with humidified zero air (RH >20 percent, at 25°C). Pressurize the contents to 2 atm.

The blank sample should be analyzed using the same procedure outlined under Section 10.8.

10.7.4 Calculations. The blanks are analyzed similar to a field sample and the equations in Section 10.5.4 apply.

10.7.5 Technical Acceptance Criteria. A blank canister should be analyzed daily.

The area response for each internal standard (IS) in the blank must be within ±40 percent of the mean area response of the IS in the most recent valid calibration.

The retention time for each of the internal standards must be within ±0.33 minutes between the blank and the most recent valid calibration.

The blank should not contain any target analyte at a concentration greater than its quantitation level (three times the MDL as defined in Section 11.2) and should not contain additional compounds with elution characteristics and mass spectral features that would interfere with identification and measurement of a method analyte.

10.7.6 Corrective Action. If the blanks do not meet the technical acceptance criteria, the analyst should consider the analytical system to be out of control. It is the responsibility of the analyst to ensure that contaminants in solvents, reagents, glassware, and other sample storage and processing hardware that lead to discrete artifacts and/or elevated baselines in gas chromatograms be eliminated. If contamination is a problem, the source of the contamination must be investigated and appropriate corrective measures need to be taken and documented before further sample analysis proceeds.

If an analyte in the blank is found to be out of control (i.e., contaminated) and the analyte is also found in associated samples, those sample results should be "flagged" as possibly contaminated.

10.8 Sample Analysis

10.8.1 Summary. An aliquot of the air sample from a canister (e.g., 500 mL) is preconcentrated and analyzed by GC/MS under conditions stated in Sections 10.1 and 10.2. If using the multisorbent/dry purge approach, adjust the dry purge volume to reduce water effects in the analytical system to manageable levels.

[Note: The analyst should be aware that pressurized samples of high humidity samples will contain condensed water. As a result, the humidity of the sample released from the canister during analysis will vary

in humidity, being lower at the higher canister pressures and increasing in humidity as the canister pressures decreases. Storage integrity of water soluble compounds may also be affected.]

10.8.2 Frequency. If time remains in the 24-hour period in which an initial calibration is performed, samples may be analyzed without analysis of a daily calibration standard.

If time does not remain in the 24-hour period since the injection of the instrument performance check standard in which an initial calibration is performed, both the instrument performance check standard and the daily calibration standard should be analyzed before sample analysis may begin.

10.8.3 Procedure for Instrumental Analysis. Perform the following procedure for analysis.

10.8.3.1 All canister samples should be at temperature equilibrium with the laboratory.

10.8.3.2 Check and adjust the mass flow controllers to provide correct flow rates for the system.

10.8.3.3 Connect the sample canister to the inlet of the GC/MS analytical system, as shown in Figure 15 [Figure 16 shows an alternate two stage concentrator using multisorbent traps followed by a trap cooled by a closed cycle cooler (15)]. The desired sample flow is established through the six-port chromatographic valve and the preconcentrator to the downstream flow controller. The absolute volume of sample being pulled through the trap must be consistent from run to run.

10.8.3.4 Heat/cool the GC oven and cryogenic or adsorbent trap to their set points. Assuming a six-port value is being used, as soon as the trap reaches its lower set point, the six-port chromatographic valve is cycled to the trap position to begin sample collection. Utilize the sample collection time which has been optimized by the analyst.

10.8.3.5 Use the arrangement shown in Figure 13, (i.e., a gastight syringe or some alternate method) introduce an internal standard during the sample collection period. Add sufficient internal standard equivalent to 10 ppbv in the sample. For example, a 0.5 mL volume of a mixture of internal standard compounds, each at 10 ppmv concentration, added to a sample volume of 500 mL, will result in 10 ppbv of each internal standard in the sample.

10.8.3.6 After the sample and internal standards are preconcentrated on the trap, the GC sampling valve is cycled to the inject position and the trap is swept with helium and heated. Assuming a focusing trap is being used, the trapped analytes are thermally desorbed onto a focusing trap and then onto the head of the capillary column and are separated on the column using the GC oven temperature program. The canister valve is closed and the canister is disconnected from the mass flow controller and capped. The trap is maintained at elevated temperature until the beginning of the next analysis.

10.8.3.7 Upon sample injection onto the column, the GC/MS system is operated so that the MS scans the atomic mass range from 35 to 300 amu. At least ten scans per eluting chromatographic peak should be acquired. Scanning also allows identification of unknown compounds in the sample through searching of library spectra.

10.8.3.8 Each analytical run must be checked for saturation. The level at which an individual compound will saturate the detection system is a function of the overall system sensitivity and the mass spectral characteristics of that compound.

10.8.3.9 Secondary ion quantitation is allowed only when there are sample matrix interferences with the primary ion. If secondary ion quantitation is performed, document the reasons in the laboratory record book.

10.8.4 Calculations. The equation below is used for calculating concentrations.

$$C_x = \frac{A_x C_{is} DF}{A_{is} \overline{RRF}}$$

where: C_x = Compound concentration, ppbv.

A_x = Area of the characteristic ion for the compound to be measured, counts.
A_{is} = Area of the characteristic ion for the specific internal standard, counts.
C_{is} = Concentration of the internal standard spiking mixture, ppbv

.

$\overline{RRF}$ = Mean relative response factor from the initial calibration.

DF = Dilution factor calculated as described in section 2. If no dilution is performed, DF = 1.

[<u>Note</u>: The equation above is valid under the condition that the volume (~500 µL) of internal standard spiking mixture added in all field and QC analyses is the same from run to run, and that the volume (~500 mL) of field and QC sample introduced into the trap is the same for each analysis.]

10.8.5 Technical Acceptance Criteria.

[<u>Note</u>: If the most recent valid calibration is an initial calibration, internal standard area responses and RTs in the sample are evaluated against the corresponding internal standard area responses and RTs in the mid level standard (10 ppbv) of the initial calibration.]

10.8.5.1 The field sample must be analyzed on a GC/MS system meeting the BFB tuning, initial calibration, and continuing calibration technical acceptance criteria at the frequency described in Sections 10.4, 10.5 and 10.6.

10.8.5.2 The field samples must be analyzed along with a laboratory method blank that met the blank technical acceptance criteria.

10.8.5.3 All of the target analyte peaks should be within the initial calibration range.

10.8.5.4 The retention time for each internal standard must be within ±0.33 minutes of the retention time of the internal standard in the most recent valid calibration.

10.8.6 Corrective Action. If the on-column concentration of any compound in any sample exceeds the initial calibration range, an aliquot of the original sample must be diluted and reanalyzed. Guidance in performing dilutions and exceptions to this requirement are given below.

- Use the results of the original analysis to determine the approximate dilution factor required to get the largest analyte peak within the initial calibration range.
- The dilution factor chosen should keep the response of the largest analyte peak for a target compound in the upper half of the initial calibration range of the instrument.

[<u>Note</u>: Analysis involving dilution should be reported with a dilution factor and nature of the dilution gas.]

10.8.6.1 Internal standard responses and retention times must be evaluated during or immediately after data acquisition. If the retention time for any internal standard changes by more than 20 sec from the latest daily (24-hour) calibration standard (or mean retention time over the initial calibration range), the GC/MS system must be inspected for malfunctions, and corrections made as required.

10.8.6.2 If the area response for any internal standard changes by more than ±40 percent between the sample and the most recent valid calibration, the GC/MS system must be inspected for malfunction and corrections made as appropriate. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is necessary.

10.8.6.3 If, after reanalysis, the area responses or the RTs for all internal standards are inside the control limits, then the problem with the first analysis is considered to have been within the control of the Laboratory. Therefore, submit only data from the analysis with SICPs within the limits. This is considered the initial analysis and should be reported as such on all data deliverables.

11. Requirements for Demonstrating Method Acceptability for VOC Analysis from Canisters

11.1 Introduction

11.1.1 There are three performance criteria which must be met for a system to qualify under Compendium Method TO-15. These criteria are: the method detection limit of $\leq$0.5 ppbv, replicate precision within 25 percent, and audit accuracy within 30 percent for concentrations normally expected in contaminated ambient air (0.5 to 25 ppbv).

11.1.2 Either SIM or SCAN modes of operation can be used to achieve these criteria, and the choice of mode will depend on the number of target compounds, the decision of whether or not to determine tentatively identified compounds along with other VOCs on the target list, as well as on the analytical system characteristics.

11.1.3 Specific criteria for each Title III compound on the target compound list must be met by the analytical system. These criteria were established by examining summary data from EPA's Toxics Air Monitoring System Network and the Urban Air Toxics Monitoring Program network. Details for the determination of each of the criteria follow.

11.2 Method Detection Limit

11.2.1 The procedure chosen to define the method detection limit is that given in the *Code of Federal Regulations* (40 CFR 136 Appendix B).

11.2.2 The method detection limit is defined for each system by making seven replicate measurements of the compound of interest at a concentration near (within a factor of five) the expected detection limit, computing the standard deviation for the seven replicate concentrations, and multiplying this value by 3.14 (i.e., the Student's t value for 99 percent confidence for seven values). Employing this approach, the detection limits given in Table 4 were obtained for some of the VOCs of interest.

11.3 Replicate Precision

11.3.1 The measure of replicate precision used for this program is the absolute value of the difference between replicate measurements of the sample divided by the average value and expressed as a percentage as follows:

$$\text{percent difference} = \frac{|x_1 - x_2|}{\bar{x}} \times 100$$

where:

x_1 = First measurement value.
x_2 = Second measurement value.
$\bar{x}$ = Average of the two values.

11.3.2 There are several factors which may affect the precision of the measurement. The nature of the compound of interest itself such as molecular weight, water solubility, polarizability, etc., each have some effect on the precision, for a given sampling and analytical system. For example, styrene, which is classified as a polar VOC, generally shows slightly poorer precision than the bulk of nonpolar VOCs. A primary influence on precision is the concentration level of the compound of interest in the sample, i.e., the precision degrades as the concentration approaches the detection limit. A conservative measure was obtained from replicate analysis of "real world" canister samples from the TAMS and UATMP networks. These data are summarized in Table 5 and suggest that a replicate precision value of 25 percent can be achieved for each of the target compounds.

11.4 Audit Accuracy

11.4.1 A measure of analytical accuracy is the degree of agreement with audit standards. Audit accuracy is defined as the difference between the nominal concentration of the audit compound and the measured value divided by the audit value and expressed as a percentage, as illustrated in the following equation:

$$\text{Audit Accuracy, \%} = \frac{\text{Spiked Value} - \text{Observed Value}}{\text{Spiked Value}} \text{ x } 100$$

11.4.2 Audit accuracy results for TAMS and UATMP analyses are summarized in Table 6 and were used to form the basis for a selection of 30 percent as the performance criterion for audit accuracy.

12. References

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APPENDIX A.

LISTING OF SOME COMMERCIAL WATER MANAGEMENT SYSTEMS USED WITH AUTOGC SYSTEMS

Tekmar Dohrman Company
7143 East Kemper Road
Post Office Box 429576
Cincinnati, Ohio 45242-9576
(513) 247-7000
(513) 247-7050 (Fax)
(800) 543-4461
[Moisture control module]

Entech Laboratory Automation
950 Enchanted Way No. 101
Simi Valley, California 93065
(805) 527-5939
(805) 527-5687 (Fax)
[Microscale Purge and Trap]

Dynatherm Analytical Instruments
Post Office Box 159
Kelton, Pennsylvania 19346
(215) 869-8702
(215) 869-3885 (Fax)
[Thermal Desorption System]

XonTech Inc.
6862 Hayenhurst Avenue
Van Nuys, CA 91406
(818) 787-7380
(818) 787-4275 (Fax)
[Multi-adsorbent trap/dry purge]

Graseby
500 Technology Ct.
Smyrna, Georgia 30082
(770) 319-9999
(770) 319-0336 (Fax)
(800) 241-6898
[Controlled Desorption Trap]

Varian Chromatography System
2700 Mitchell Drive
Walnut Creek, California 94898
(510) 945-2196
(510) 945-2335 (FAX)
[Variable Temperature Adsorption Trap]

APPENDIX B.

COMMENT ON CANISTER CLEANING PROCEDURES

The canister cleaning procedures given in Section 8.4 require that canister pressure be reduced to <0.05mm Hg before the cleaning process is complete. Depending on the vacuum system design (diameter of connecting tubing, valve restrictions, etc.) and the placement of the vacuum gauge, the achievement of this value may take several hours. In any case, the pressure gauge should be placed near the canisters to determine pressure. The objective of requiring a low pressure evacuation during canister cleaning is to reduce contaminants. If canisters can be routinely certified (<0.2 ppbv for target compounds) while using a higher vacuum, then this criteria can be relaxed. However, the ultimate vacuum achieved during cleaning should always be <0.2mm Hg.

Canister cleaning as described in Section 8.4 and illustrated in Figure 10 requires components with special features. The vacuum gauge shown in Figure 10 must be capable of measuring 0.05mm Hg with less than a 20% error. The vacuum pump used for evacuating the canister must be noncontaminating while being capable of achieving the 0.05 mm Hg vacuum as monitored near the canisters. Thermoelectric vacuum gauges and turbomolecular drag pumps are typically being used for these two components.

An alternate to achieving the canister certification requirement of <0.2 ppbv for all target compounds is the criteria used in Compendium Method TO-12 that the total carbon count be <10ppbC. This check is less expensive and typically more exacting than the current certification requirement and can be used if proven to be equivalent to the original requirement. This equivalency must be established by comparing the total nonmethane organic carbon (TNMOC) expressed in ppbC to the requirement that individual target compounds be <0.2 ppbv for a series of analytical runs.

APPENDIX C.

LISTING OF COMMERCIAL MANUFACTURERS AND RE-SUPPLIERS OF SPECIALLY-PREPARED CANISTERS

BRC/Rasmussen
17010 NW Skyline Blvd.
Portland, Oregon 97321
(503) 621-1435

Meriter
1790 Potrero Drive
San Jose, CA 95124
(408) 265-6482

Restek Corporation
110 Benner Circle
Bellefonte, PA 16823-8812
(814) 353-1300
(800) 356-1688

Scientific Instrumentation Specialists
P.O. Box 8941
815 Courtney Street
Moscow, ID 83843
(208) 882-3860

Graseby
500 Technology Ct.
Smyrna, Georgia 30082
(404) 319-9999
(800) 241-6898

XonTech Inc.
6862 Hayenhurst Avenue
Van Nuys, CA 91406
(818) 787-7380

APPENDIX D.

LISTING OF COMMERCIAL SUPPLIERS OF PERMEATION TUBES AND SYSTEMS

Kin-Tek
504 Laurel St.
Lamarque, Texas 77568
(409) 938-3627
(800) 326-3627

Vici Metronics, Inc.
2991 Corvin Drive
Santa Clara, CA 95051
(408) 737-0550

Analytical Instrument Development, Inc.
Rt. 41 and Newark Rd.
Avondale, PA 19311
(215) 268-3181

Ecology Board, Inc.
9257 Independence Ave.
Chatsworth, CA 91311
(213) 882-6795

Tracor, Inc.
6500 Tracor Land
Austin, TX
(512) 926-2800

Metronics Associates, Inc.
3201 Porter Drive
Standford Industrial Park
Palo Alto, CA 94304
(415) 493-5632

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TABLE 1. VOLATILE ORGANIC COMPOUNDS ON THE TITLE III CLEAN AIR AMENDMENT LIST--MEMBERSHIP IN COMPENDIUM METHOD TO-14A LIST AND THE SOW-CLP LIST OF VOCs

Compound	CAS No.	BP (°C)	v.p. (mmHg)[1]	MW[1]	TO-14A	CLP-SOW
Methyl chloride (chloromethane); CH3Cl	74-87-3	-23.7	3.8 x 10	50.5	X	X
Carbonyl sulfide; COS	463-58-1	-50.0	3.7 x 10	60.1		
Vinyl chloride (chloroethene); C2H3Cl	75-01-4	-14.0	3.2 x 10	62.5	X	X
Diazomethane; CH2N2	334-88-3	-23.0	2.8 x 10	42.1		
Formaldehyde; CH2O	50-00-0	-19.5	2.7 x 10	30		
1,3-Butadiene; C4H6	106-99-0	-4.5	2.0 x 10	54		X
Methyl bromide (bromomethane); CH3Br	74-83-9	3.6	1.8 x 10	94.9	X	X
Phosgene; CCl2O	75-44-5	8.2	1.2 x 10	99		
Vinyl bromide (bromoethene); C2H3Br	593-60-2	15.8	1.1 x 10	107		
Ethylene oxide; C2H4O	75-21-8	10.7	1.1 x 10	44		
Ethyl chloride (chloroethane); C2H5Cl	75-00-3	12.5	1.0 x 10	64.5	X	X
Acetaldehyde (ethanal); C2H4O	75-07-0	21.0	952	44		
Vinylidene chloride (1,1-dichloroethylene); C2H2Cl2	75-35-4	31.7	500	97	X	X
Propylene oxide; C3H6O	75-56-9	34.2	445	58		
Methyl iodide (iodomethane); CH3I	74-88-4	42.4	400	141.9		
Methylene chloride; CH2Cl2	75-09-2	40.0	349	84.9	X	X
Methyl isocyanate; C2H3NO	624-83-9	59.6	348	57.1		
Allyl chloride (3-chloropropene); C3H5Cl	107-05-1	44.5	340	76.5	X	X
Carbon disulfide; CS2	75-15-0	46.5	260	76		
Methyl tert-butyl ether; C5H12O	1634-04-4	55.2	249	86		
Propionaldehyde; C2H5CHO	123-38-6	49.0	235	58.1		
Ethylidene dichloride (1,1-dichloroethane); C2H4Cl2	75-34-3	57.0	230	99	X	

TABLE 1. (continued)

Compound	CAS No.	BP (°C)	v.p. (mmHg)^1	MW^1	TO-14A	CLP-SOW
Chloroprene (2-chloro-1,3-butadiene); C4H5Cl	126-99-8	59.4	226	88.5		
Chloromethyl methyl ether; C2H5ClO	107-30-2	59.0	224	80.5		
Acrolein (2-propenal); C3H4O	107-02-8	52.5	220	56		X
1,2-Epoxybutane (1,2-butylene oxide); C4H8O	106-88-7	63.0	163	72		
Chloroform; CHCl3	67-66-3	61.2	160	119	X	X
Ethyleneimine (aziridine); C2H5N	151-56-4	56	160.0	43		
1,1-Dimethylhydrazine; C2H8N2	57-14-7	63	157.0	60.0		
Hexane; C6H14	110-54-3	69.0	120	86.2	X	
1,2-Propyleneimine (2-methylaziridine); C3H7N	75-55-8	66.0	112	57.1		
Acrylonitrile (2-propenenitrile); C3H3N	107-13-1	77.3	100	53	X	
Methyl chloroform (1,1,1-trichloroethane); C2H3Cl3	71-55-6	74.1	100	133.4	X	X
Methanol; CH4O	67-56-1	65.0	92.0	32		X
Carbon tetrachloride; CCl4	56-23-5	76.7	90.0	153.8	X	X
Vinyl acetate; C4H6O2	108-05-4	72.2	83.0	86		X
Methyl ethyl ketone (2-butanone); C4H8O	78-93-3	79.6	77.5	72		X
Benzene; C6H6	71-43-2	80.1	76.0	78	X	X
Acetonitrile (cyanomethane); C2H3N	75-05-8	82	74.0	41.0		X
Ethylene dichloride (1,2-dichloroethane); C2H4Cl2	107-06-2	83.5	61.5	99	X	X
Triethylamine; C6H15N	121-44-8	89.5	54.0	101.2		
Methylhydrazine; CH6N2	60-34-4	87. 8	49.6	46.1		
Propylene dichloride (1,2-dichloropropane); C3H6Cl2	78-87-5	97.0	42.0	113	X	X
2,2,4-Trimethyl pentane C8H18	540-84-l	99.2	40.6	114		
1,4-Dioxane (1,4-Diethylene oxide); C4H8O2	123-91-1	101	37.0	88		
Bis(chloromethyl) ether; C2H4Cl2O	542-88-1	104	30.0	115		
Ethyl acrylate; C5H8O2	140-88-5	100	29.3	100		
Methyl methacrylate; C5H8O2	80-62-6	101	28.0	100.1		

TABLE 1. (continued)

Compound	CAS No.	BP (°C)	v.p. (mmgHg)[1]	MW[1]	TO-14A	CLP-SOW
Methyl methacrylate; C5H8O2	80-62-101	101	28.0	100.1		
1,3-Dichloropropene; C3H4Cl2 (cis)	542-75-6	112	27.8	111	X	X
Toluene; C7H8	108-88-3	111	22.0	92	X	X
Trichloroethylene; C2HCl3	79-01-6	87.0	20.0	131.4	X	X
1,1,2-Trichloroethane; C2H3Cl3	79-00-5	114	19.0	133.4	X	X
Tetrachloroethylene; C2Cl4	127-18-4	121	14.0	165.8	X	X
Epichlorohydrin (1-chloro-2,3-epoxy propane); C3H5ClO	106-89-8	117	12.0	92.5		
Ethylene dibromide (1,2-dibromoethane); C2H4Br2	106-93-4	132	11.0	187.9	X	X
N-Nitroso-N-methylurea; C2H5N3O2	684-93-5	124	10.0	103		
2-Nitropropane; C3H7NO2	79-46-9	120	10.0	89		
Chlorobenzene; C6H5Cl	108-90-7	132	8.8	112.6	X	X
Ethylbenzene; C8H10	100-41-4	136	7.0	106	X	X
Xylenes (isomer & mixtures); C8H10	1330-20-7	142	6.7	106.2	X	X
Styrene; C8H8	100-42-5	145	6.6	104	X	X
p-Xylene; C8H10	106-42-3	138	6.5	106.2	X	X
m-Xylene; C8H10	108-38-3	139	6.0	106.2	X	X
Methyl isobutyl ketone (hexone); C6H12O	108-10-1	117	6.0	100.2		
Bromoform (tribromomethane); CHBr3	75-25-2	149	5.6	252.8		
l,l,2,2-Tetrachloroethane; C2H2Cl4	79-34-5	146	5.0	167.9	X	X
o-Xylene; C8H10	95-47-6	144	5.0	106.2	X	X
Dimethylcarbamyl chloride; C3H6ClNO	79-44-7	166	4.9	107.6		
N-Nitrosodimethylamine; C2H6N2O	62-75-9	152	3.7	74		
Beta-Propiolactone; C3H4O2	57-57-8	Decomposes at 162	3.4	72		
Cumene (isopropylbenzene); C9Hl2	98-82-8	153	3.2	120		

TABLE 1. (continued)

Compound	CAS No.	BP (°C)	v.p. (mmHg)[1]	MW[1]	TO-14A	CLP-SOW
Cumene (isopropylbenzene); C9H12	98-82-8	153	3.2	120		
Acrylic acid; C3H4O2	79-10-7	141	3.2	72		
N,N-Dimethylformamide; C3H7NO	68-12-2	153	2.7	73		
1,3-Propane sultone; C3H6O3S	1120-71-4	180/30mm	2.0	122.1		
Acetophenone; C8H8O	98-86-2	202	1.0	120		
Dimethyl sulfate; C2H6O4S	77-78-1	188	1.0	126.1		
Benzyl chloride (a-chlorotoluene); C7H7Cl	100-44-7	179	1.0	126.6	X	X
1,2-Dibromo-3-chloropropane; C3H5Br2Cl	96-12-8	196	0.80	236.4		
Bis(2-Chloroethyl)ether; C4H8Cl2O	111-44-4	178	0.71	143		
Chloroacetic acid; C2H3ClO2	79-11-8	189	0.69	94.5		
Aniline (aminobenzene); C6H7N	62-53-3	184	0.67	93		
1,4-Dichlorobenzene (p-); C6H4Cl2	106-46-7	173	0.60	147	X	X
Ethyl carbamate (urethane); C3H7NO2	51-79-6	183	0.54	89		
Acrylamide; C3H5NO	79-06-1	125/25 mm	0.53	71		
N,N-Dimethylaniline; C8H11N	121-69-7	192	0.50	121		
Hexachloroethane; C2Cl6	67-72-1	Sublimes at 186	0.40	236.7		
Hexachlorobutadiene; C4Cl6	87-68-3	215	0.40	260.8	X	X
Isophorone; C9H14O	78-59-1	215	0.38	138.2		
N-Nitrosomorpholine; C4H8N2O2	59-89-2	225	0.32	116.1		
Styrene oxide; C8H8O	96-09-3	194	0.30	120.2		
Diethyl sulfate; C4H10O4S	64-67-5	208	0.29	154		
Cresylic acid (cresol isomer mixture);C7H8O	1319-77-3	202	0.26	108		
o-Cresol; C7H8O	95-48-7	191	0.24	108		
Catechol (o-hydroxyphenol); C6H6O2	120-80-9	240	0.22	110		
Phenol; C6H6O	108-95-2	182	0.20	94		

TABLE 1. (continued)

Compound	CAS No.	BP (°C)	v.p. (mmHg)[1]	MW[1]	TO-14A	CLP-SOW
Catechol (o-hydroxyphenol); C6H6O2	120-80-9	240	0.22	110		
Phenol; C6H6O	108-95-2	182	0.20	94		
1,2,4-Trichlorobenzene; C6H3Cl3	120-82-1	213	0.18	181.5	X	X
nitrobenzene; C6H5NO2	98-95-3	211	0.15	123		

[1] Vapor pressure (v.p.), boiling point (BP) and molecularweight (MW) data from:
(a)D. L. Jones and J. bursey, "Simultaneous Control of PM-10 and Hazardous Air Pollutants II: Rationale for Selection of Hazardous Air Pollutants as Potential Particulate Matter," Report EPA-452/R-93/013, U. S. Environmental Protection Agency, Research Triangle Park, NC. October 1992;
(b)R. C. Weber, P. A. Parker, and M. Bowser. Vapor Pressure Distribution of Selected Organic Chemicals, Report EPA-600/2-81-021, U. S. Environmental Protection Agency, Cincinnati, OH, February 1981; and
(c)R. C. Weast, ed., "CRC Handbook of Chemistry and Physics," 59th edition, CRC Press, Boca Raton, 1979.

TABLE 2. CHARACTERISTIC MASSES (M/Z) USED FOR QUANTIFYING THE TITLE III CLEAN AIR ACT AMENDMENT COMPOUNDS

Compound	CAS No.	Primary Ion	Secondary Ion
Methyl chloride (chloromethane); CH3Cl	74-87-3	50	52
Carbonyl sulfide; COS	463-S8-1	60	62
Vinyl chloride (chloroethene); C2H3Cl	7S-01-4	62	64
Diazomethane; CH2N2	334-88-3	42	41
Formaldehyde; CH2O	50-00-0	29	30
1,3-Butadiene; C4H6	106-99-0	39	54
Methyl bromide (bromomethane); CH3Br	74-83-9	94	96
Phosgene; CCl2O	75-44-5	63	65
Vinyl bromide (bromoethene); C2H3Br	593-60-2	106	108
Ethylene oxide; C2H4O	75-21-8	29	44
Ethyl chloride (chloroethane); C2H5Cl	75-00-3	64	66
Acetaldehyde (ethanal); C2H4O	75-07-0	44	29, 43
Vinylidene chloride (1,1-dichloroethylene); C2H2Cl2	75-35-4	61	96
Propylene oxide; C3H6O	75-56-9	58	57
Methyl iodide (iodomethane); CH3I	74-88-4	142	127
Methylene chloride; CH2Cl2	75-09-2	49	84, 86
Methyl isocyanate; C2H3NO	624-83-9	57	56
Allyl chloride (3-chloropropene); C3H5Cl	107-05-1	76	41, 78
Carbon disulfide; CS2	75-15-0	76	44, 78
Methyl tert-butyl ether; C5H12O	1634-04-4	73	41, 53
Propionaldehyde; C2H5CHO	123-38-6	58	29, 57
Ethylidene dichloride (1,1-dichloroethane); C2H4Cl2	75-34-3	63	65, 27
Chloroprene (2-chloro-1,3-butadiene); C4H5Cl	126-99-8	88	53, 90
Chloromethyl methyl ether; C2H5ClO	107-30-2	45	29, 49
Acrolein (2-propenal); C3H4O	107-02-8	56	55
1,2-Epoxybutane (1,2-butylene oxide); C4H8O	106-88-7	42	41, 72
Chloroform; CHCl3	67-66-3	83	85, 47
Ethyleneimine (aziridine); C2H5N	151-56-4	42	43
1,1-Dimethylhydrazine; C2H8N2	57-14-7	60	45, 59
Hexane; C6H14	110-54-3	57	41, 43
1,2-Propyleneimine (2-methylazindine); C3H7N	75-55-8	56	57, 42
Acrylonitrile (2-propenenitrile); C3H3N	107-13-1	53	52
Methyl chloroform (1,1,1 trichloroethane); C2H3Cl3	71-55-6	97	99, 61
Methanol; CH4O	67-56-1	31	29
Carbon tetrachloride; CCl4	56-23-5	117	119
Vinyl acetate; C4H6O2	108-05-4	43	86
Methyl ethyl ketone (2-butanone); C4H8O	78-93-3	43	72

TABLE 2. (continued)

Compound	CAS No.	Primary Ion	Secondary Ion
Benzene; C6H6	71-43-2	78	77,50
Acetonitrile (cyanomethane); C2H3N	75-05-8	41	40
Ethylene dichloride (1,2-dichloroethane); C2H4Cl2	107-06-2	62	64, 27
Triethylamine; C6H15N	121-44-8	86	58, 101
Methylhydrazine; CH6N2	60-34-4	46	31, 45
Propylene dichloride (1,2-dichloropropane); C3H6Cl2	78-87-5	63	41, 62
2,2,4-Trimethyl pentane; C8H18	540-84-1	57	41, 56
1,4-Dioxane (1,4 Diethylene oxide); C4H8O2	123-91-1	88	58
Bis(chloromethyl) ether; C2H4Cl2O	542-88-1	79	49, 81
Ethyl acrylate; C5H8O2	140-88-5	55	73
Methyl methacrylate; C5H8O2	80-62-6	41	69, 100
1,3-Dichloropropene; C3H4Cl2 (cis)	542-75-6	75	39, 77
Toluene; C7H8	108-88-3	91	92
Trichloethylene; C2HCl3	79-01-6	130	132, 95
1,1,2-Trichloroethane; C2H3Cl3	79-00-5	97	83, 61
Tetrachloroethylene; C2Cl4	127-18-4	166	164, 131
Epichlorohydrin (l-chloro-2,3-epoxy propane); C3H5ClO	106-89-8	57	49, 62
Ethylene dibromide (1,2-dibromoethane); C2H4Br2	106-93-4	107	109
N-Nitrso-N-methylurea; C2H5N3O2	684-93-5	60	44, 103
2-Nitropropane; C3H7NO2	79-46-9	43	41
Chlorobenzene; C6H5Cl	108-90-7	112	77, 114
Ethylbenzene; C8H10	100-41-4	91	106
Xylenes (isomer & mixtures); C8H10	1330-20-7	91	106
Styrene; C8H8	100-42-5	104	78, 103
p-Xylene; C8H10	106-42-3	91	106
m-Xylene; C8H10	108-38-3	91	106
Methyl isobutyl ketone (hexone); C6H12O	108-10-1	43	58, 100
Bromoform (tribromomethane); CHBr3	75-25-2	173	171, 175
1,1,2,2-Tetrachloroethane; C2H2Cl4	79-34-5	83	85
o-Xylene; C8H10	95-47-6	91	106
Dimethylcarbamyl chloride; C3H6ClNO	79-44-7	72	107
N-Nitrosodimethylamine; C2H6N2O	62-75-9	74	42
Beta-Propiolactone; C3H4O2	57-57-8	42	43
Cumene (isopropylbenzene); C9H12	98-82-8	105	120
Acrylic acid; C3H4O2	79-10-7	72	45, 55
N,N-Dimethylformamide; C3H7NO	68-12-2	73	42, 44
1,3-Propane sultone; C3H6O3S	1120-71-4	58	65, 122

TABLE 2. (continued)

Compound	CAS No.	Primary Ion	Secondary Ion
Acetophenone; C8H8O	98-86-2	105	77,120
Dimethyl sulfate; C2H6O4S	77-78-1	95	66,96
Benzyl chloride (a-chlorotoluene); C7H7Cl	100-44-7	91	126
1,2-Dibromo-3-chloropropane; C3H5Br2Cl	96-12-8	57	155, 157
Bis(2-Chloroethyl)ether; C4H8Cl2O	111-44-4	93	63, 95
Chloroacetic acid; C2H3ClO2	79-11-8	50	45, 60
Aniline (aminobenzene); C6H7N	62-53-3	93	66
1,4-Dichlorobenzene (p-); C6H4Cl2	106-46-7	146	148, 111
Ethyl carbamate (urethane); C3H7NO2	51-79-6	31	44, 62
Acrylamide; C3H5NO	79-06-1	44	55, 71
N,N-Dimethylaniline; C8H11N	121-69-7	120	77, 121
Hexachloroethane; C2Cl6	67-72-1	201	199, 203
Hexachlorobutadiene; C4Cl6	87-68-3	225	227, 223
Isophorone; C9H14O	78-59-1	82	138
N-Nitrosomorpholine; C4H8N2O2	59-89-2	56	86, 116
Styrene oxide; C8H8O	96-09-3	91	120
Diethyl sulfate; C4H10O4S	64-67-5	45	59, 139
Cresylic acid (cresol isomer mixture); C7H8O	1319-77-3		
o-Cresol; C7H8O	95-48-7	108	107
Catechol (o-hydroxyphenol); C6H6O2	120-80-9	110	64
Phenol; C6H6O	108-95-2	94	66
1,2,4-Trichlorobenzene; C6H3Cl3	120-82-1	180	182, 184
Nitrobenzene; C6H5NO2	98-95-3	77	51, 123

TABLE 3. REQUIRED BFB KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria[1]
50	8.0 to 40.0 Percent of m/e 95
75	30.0 to 66.0 Percent of m/e 95
95	Base Peak, 100 Percent Relative Abundance
96	5.0 to 9.0 Percent of m/e 95 (See note)
173	Less than 2.0 Percent of m/e 174
174	50.0 to 120.0 Percent of m/e 95
175	4.0 to 9.0 Percent of m/e 174
176	93.0 to 101.0 Percent of m/e 174
177	5.0 to 9.0 Percent of m/e 176

[1] All ion abundances must be normalized to m/z 95, the nominal base peak, even though the ion abundance of m/z 174 may be up to 120 percent that of m/z 95.

TABLE 4. METHOD DETECTION LIMITS (MDL)[1]

TO-14A List	Lab #1, SCAN	Lab #2, SIM
Benzene	0.34	0.29
Benzyl Chloride	--	--
Carbon tetrachloride	0.42	0.15
Chlorobenzene	0.34	0.02
Chloroform	0.25	0.07
1,3-Dichlorobenzene	0.36	0.07
1,2-Dibromoethane	--	0.05
1,4-Dichlorobenzene	0.70	0.12
1,2-Dichlorobenzene	0.44	--
1,1-Dichloroethane	0.27	0.05
1,2-Dichloroethane	0.24	--
1,1-Dichloroethene	--	0.22
cis-1,2-Dichloroethene	--	0.06
Methylene chloride	1.38	0.84
1,2-Dichloropropane	0.21	--
cis-1,3-Dichloropropene	0.36	--
trans-1,3-Dichloropropene	0.22	--
Ethylbenzene	0.27	0.05
Chloroethane	0.19	--
Trichlorofluoromethane	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane		--
1,2-Dichloro-1,1,2,2-tetrafluoroethane	--	--
Dichlorodifluoromethane	--	--
Hexachlorobutadiene	--	--
Bromomethane	0.53	--
Chloromethane	0.40	--
Styrene	1.64	0.06
1,1,2,2-Tetrachloroethane	0.28	0.09
Tetrachloroethene	0.75	0.10
Toluene	0.99	0.20
1,2,4-Trichlorobenzene	--	--
1,1,1-Trichloroethane	0.62	0.21
1,1,2-Trichloroethane	0.50	--
Trichloroethene	0.45	0.07
1,2,4-Trimethylbenzene	--	--
1,3,5-Trimethylbenzene	--	--
Vinyl Chloride	0.33	0.48
m,p-Xylene	0.76	0.08
o-Xylene	0.57	0.28

[1] Method Detection Limits (MDLs) are defined as the product of the standard deviation of seven replicate analyses and the student's "t" test value for 99% confidence. For Lab #2, the MDLs represent an average over four studies. MDLs are for MS/SCAN for Lab #1 and for MS/SIM for Lab #2.

TABLE 5. SUMMARY OF EPA DATA ON REPLICATE PRECISION (RP) FROM EPA NETWORK OPERATIONS[1]

Monitoring Compound Identification	EPA's Urban Air Toxics Monitoring Program (UATMP)			EPA's Toxics Air Monitoring Stations (TAMS)		
	%RP	#	ppbv	%RP	#	ppbv
Dichlorodifluoromethane	--		--	13.9	47	0.9
Methylene chloride	16.3	07	4.3	19.4	47	0.6
1,2-Dichloroethane	36.2	31	1.6	--	--	--
1,1,1-Trichloroethane	14.1	44	1.0	10.6	47	2.0
Benzene	12.3	56	1.6	4.4	47	1.5
Trichloroethene	12.8	08	1.3	--	--	--
Toluene	14.7	76	3.1	3.4	47	3.1
Tetrachloroethene	36.2	12	0.8	--	--	--
Chlorobenzene	20.3	21	0.9	--	--	--
Ethylbenzene	14.6	32	0.7	5.4	47	0.5
m-Xylene	14.7	75	4.0	5.3	47	1.5
Styrene	22.8	59[2]	1.1	8.7	47	0.2[2]
o-Xylene	--		--	6.0	47	0.5
p-Xylene	--					
1,3-Dichlorobenzene	49.1	06	0.6	--	--	--
1,4-Dichlorobenzene	14.7	14	6.5	--	--	--

[1] Denotes the number of replicate or duplicate analysis used to generate the statistic. The replicate precision is defined as the mean ratio of absolute difference to the average value.

[2] Styrene and o-xylene coelute from the GC column used in UATMP. For the TAMS entries, both values were below detection limits for 18 of 47 replicates and were not included in the calculation.

TABLE 6. AUDIT ACCURACY (AA) VALUES[1] FOR SELECTED COMPENDIUM METHOD TO-14A COMPOUNDS

Selected Compounds From TO-14A List	FY-88 TAMS AA(%), N=30	FY-88 UATMP AA(%), N=3
Vinyl chloride	4.6	17.9
Bromomethane	--	6.4
Trichlorofluoromethane	6.4	--
Methylene chloride	8.6	31.4
Chloroform	--	4.2
1,2-Dichloroethane	6.8	11.4
1,1,1-Trichloroethane	18.6	11.3
Benzene	10.3	10.1
Carbon tetrachloride	12.4	9.4
1,2-Dichloropropane	--	6.2
Trichloroethene	8.8	5.2
Toluene	8.3	12.5
Tetrachloroethene	6.2	--
Chlorobenzene	10.5	11.7
Ethylbenzene	12.4	12.4
o-Xylene	16.2	21.2

[1] Audit accuracy is defined as the relative difference between the audit measurement result and its nominal value divided by the nominal value. N denotes the number of audits averaged to obtain the audit accuracy value. Information is not available for other TO-14A compounds because they were not present in the audit materials.

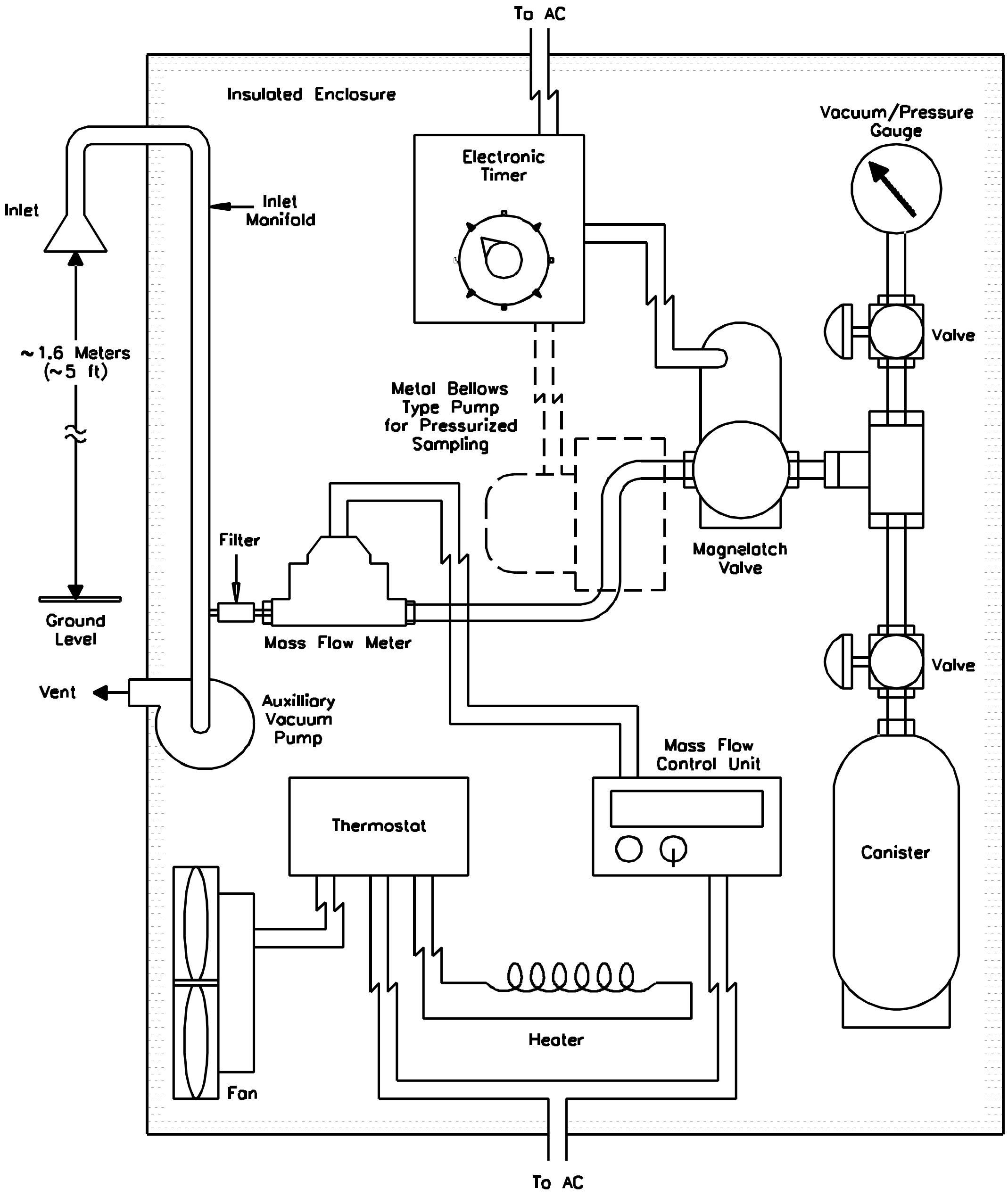
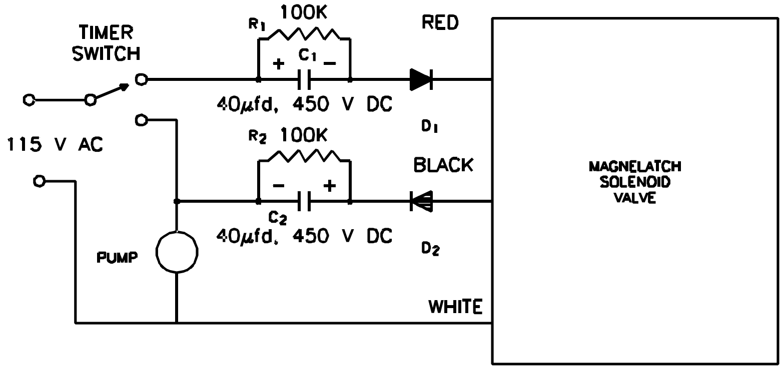


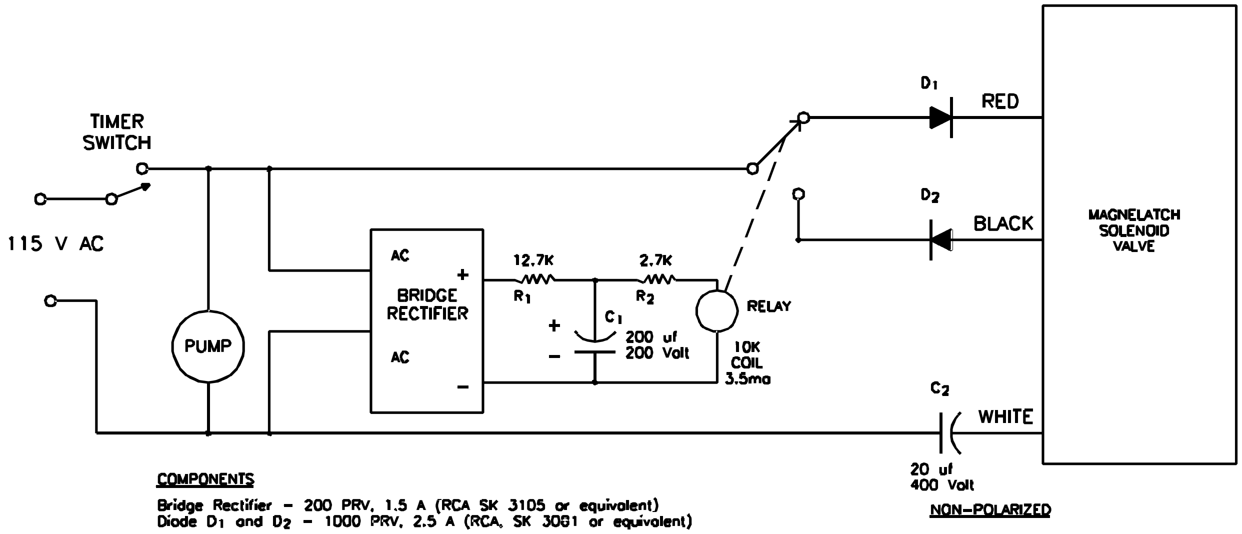
Figure 1. Sampler configuration for subatmospheric pressure or pressurized canister sampling.



COMPONENTS

Capacitor C_1 and C_2 - 40 uf, 450 VDC (Sprague Atom TVA 1712 or equivonent)
Resister R_1 and R_2 - 0.5 watt, 5% tolerance
Diode D_1 and D_2 - 1000 PRV, 2.5 A (RCA, SK 3081 or equivalent)

(a). Simple Circuit for Operating Magnelatch Valve



COMPONENTS

Bridge Rectifier - 200 PRV, 1.5 A (RCA SK 3105 or equivalent)
Diode D_1 and D_2 - 1000 PRV, 2.5 A (RCA, SK 3081 or equivalent)
Capacitor C_1 - 200 uf, 250 VDC (Sprague Atom TVA 1528 or equivalent)
Capacitor C_2 - 20 uf, 400 VDC Non-Polarized (Sprague Atom TVAN 1652 or equivalent)
Relay - 10,000 ohm coil, 3.5 ma (AMF Potter and Brumfield, KCP 5, or equivalent)
Resister R_1 and R_2 - 0.5 watt, 5% tolerance

(b). Improved Circuit Designed to Handle Power Interruptions

Figure 2. Electrical pulse circuits for driving Skinner magnelatch solenoid valve with mechanical timer.

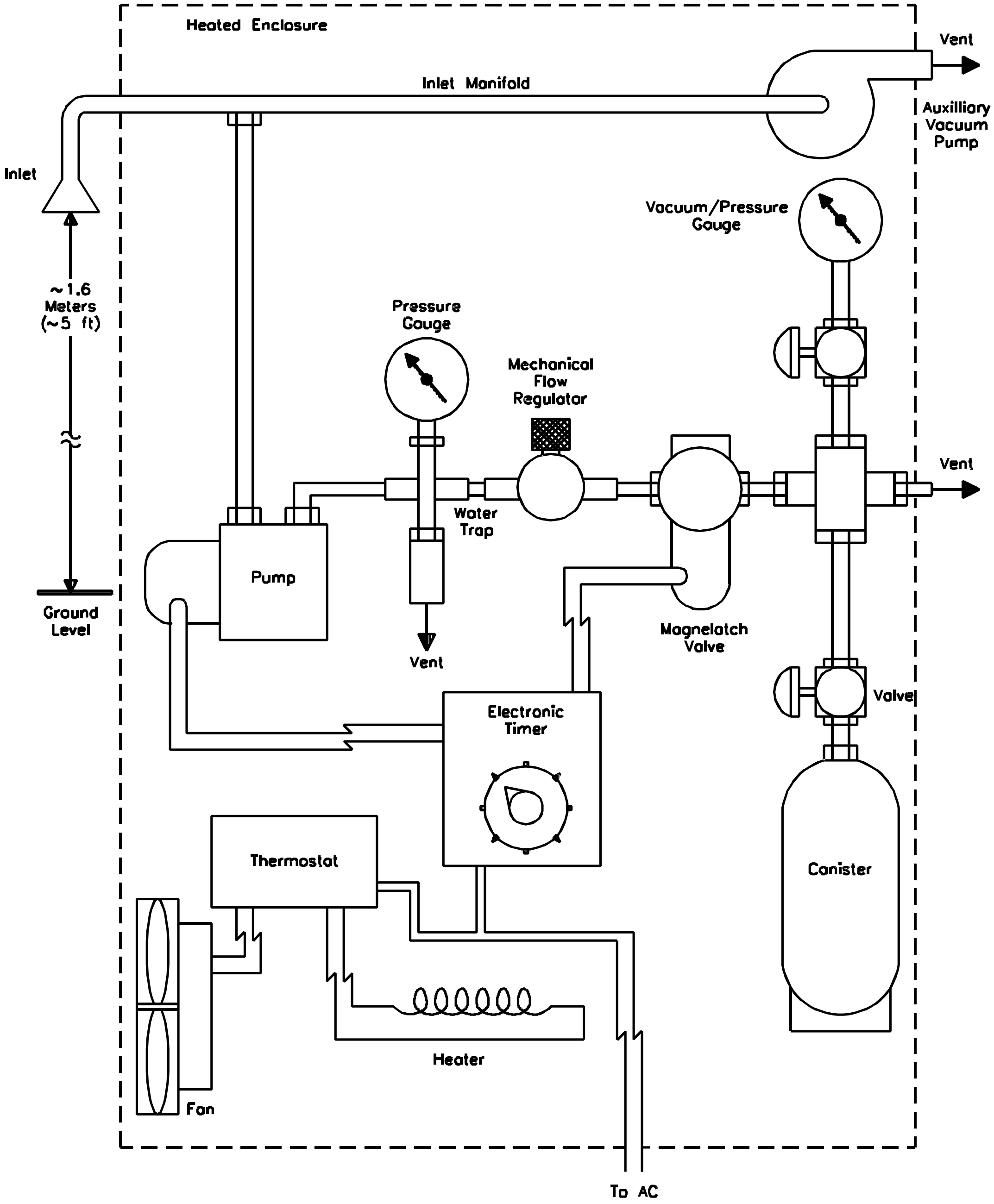


Figure 3. Alternative sampler configuration for pressurized canister sampling.

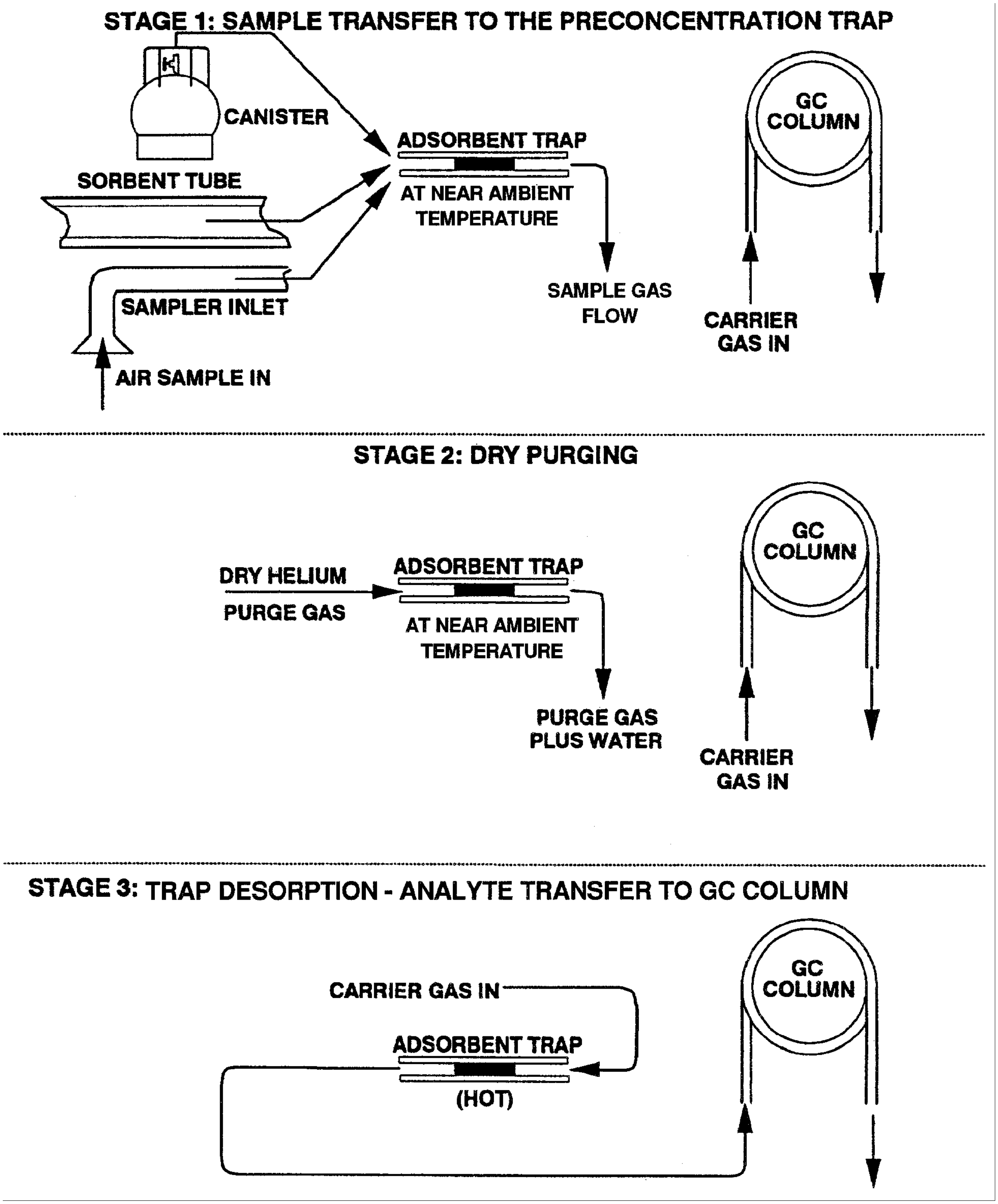


Figure 4. Illustration of three stages of dry purging of adsorbent trap.

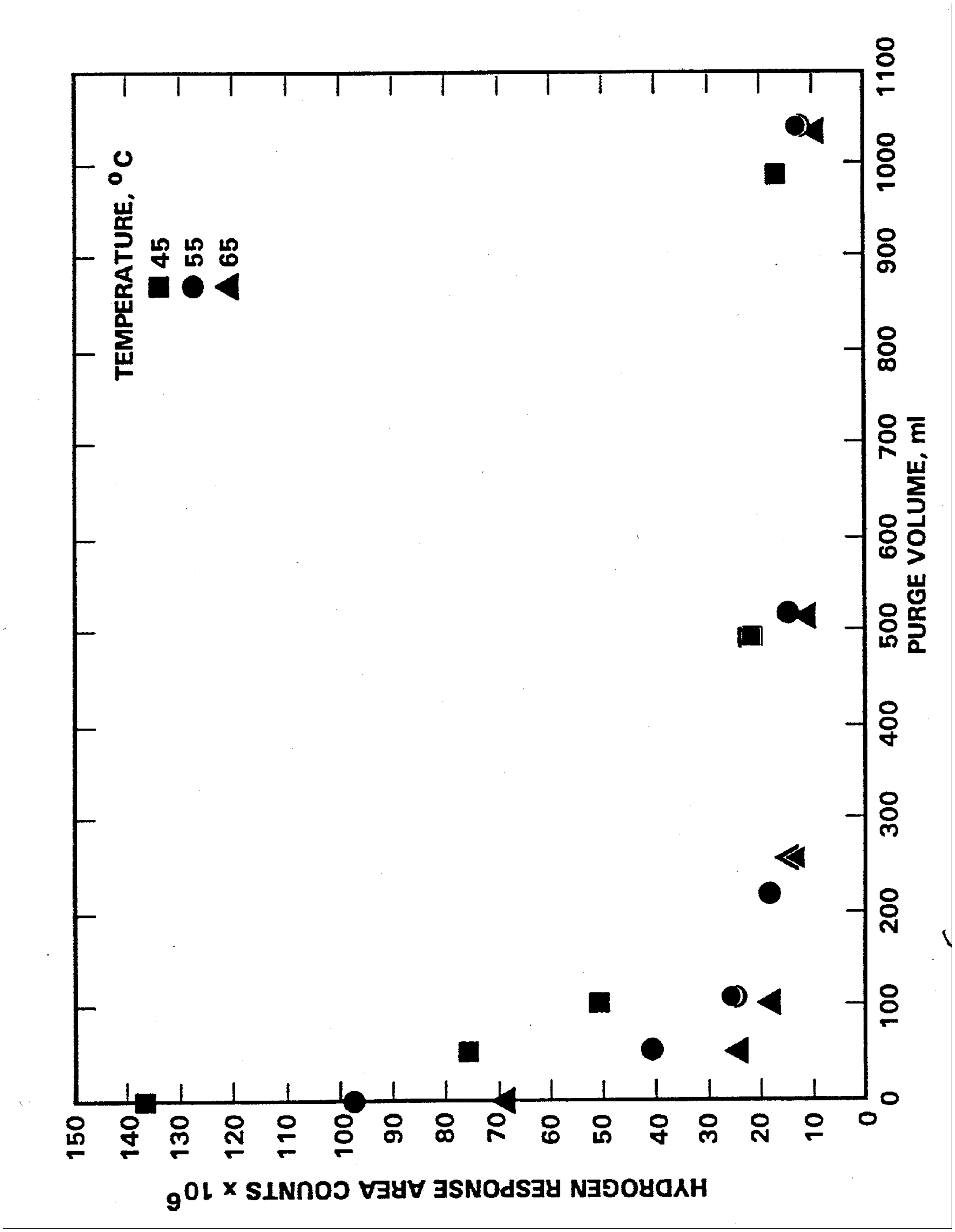


Figure 5. Residual water vapor on VOC concentrator vs. dry He purge volume.

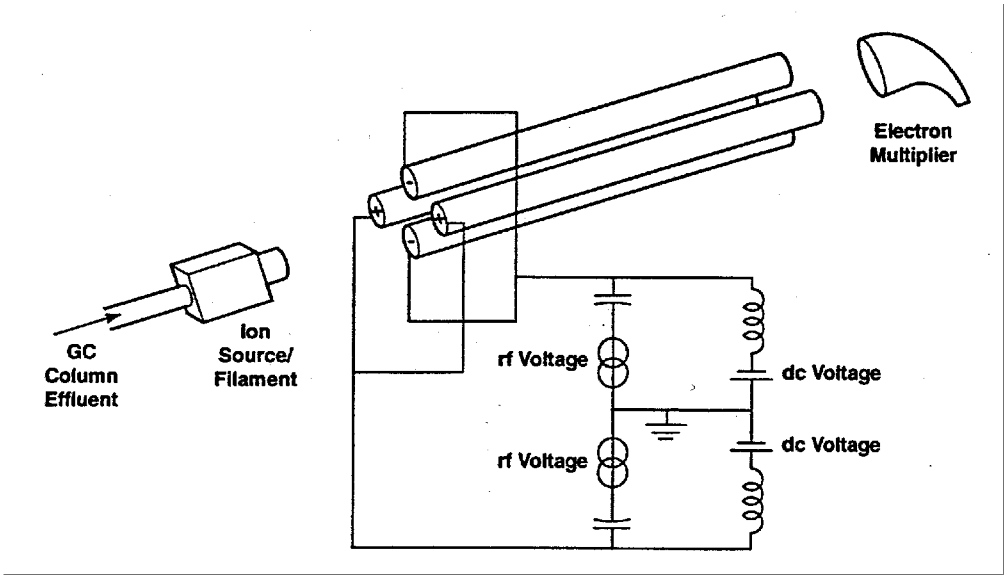


Figure 6. Simplified diagram of a quadrupole mass spectrometer.

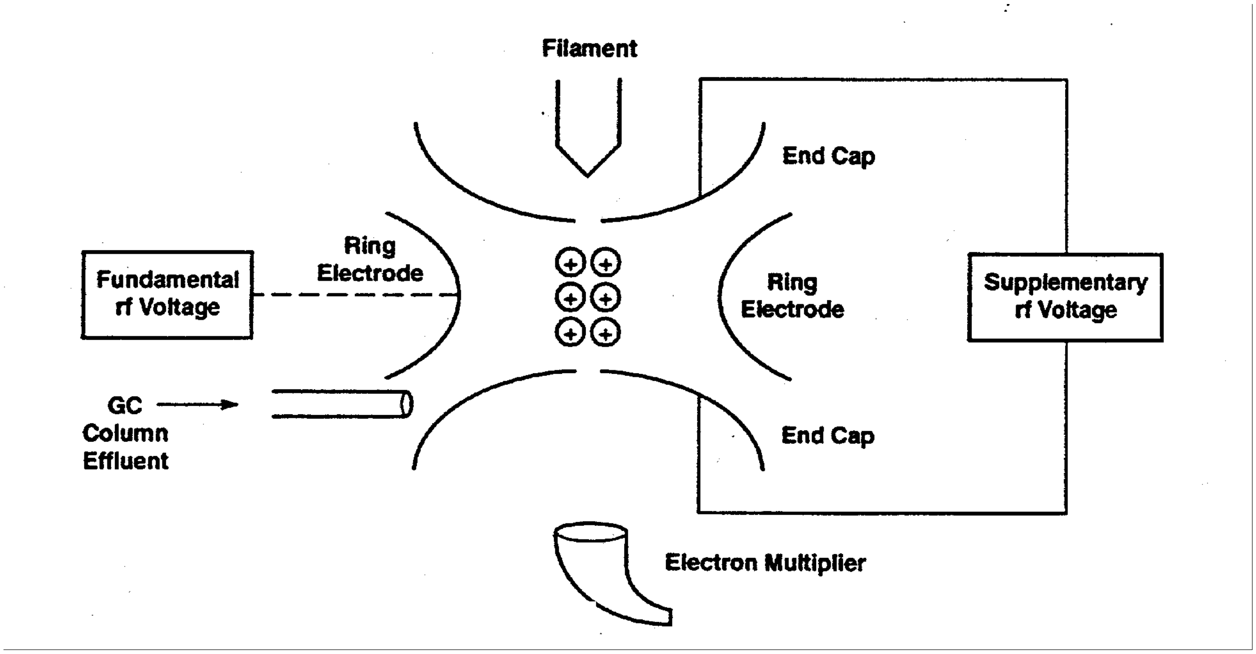


Figure 7. Simplified diagram of an ion trap mass spectrometer.

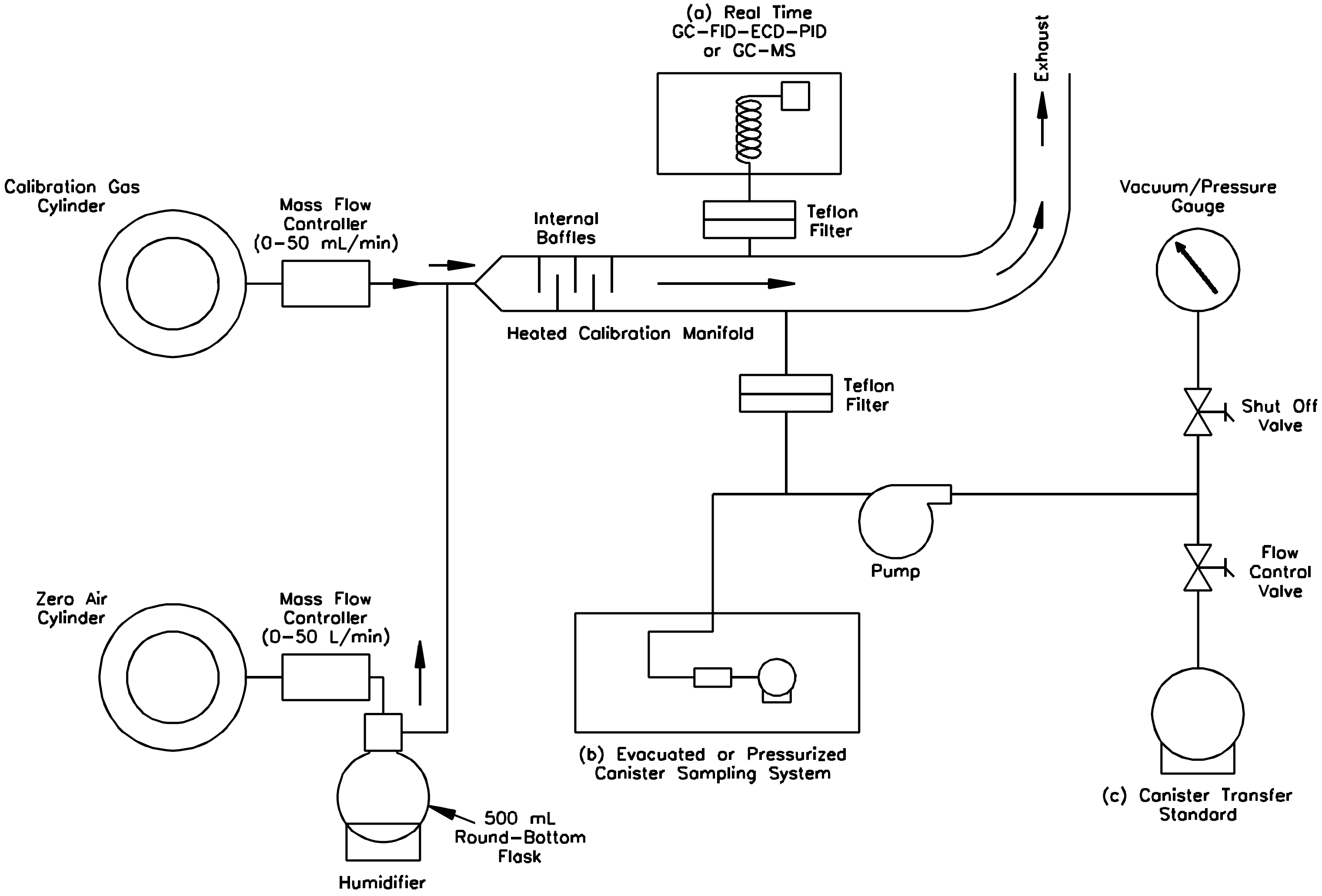


Figure 8. Schematic diagram of calibration system and manifold for
(a) analytical system calibration, (b) testing canister sampling system and (c) preparing canister transfer standards.

COMPENDIUM METHOD TO-15
CANISTER SAMPLING FIELD TEST DATA SHEET

A.GENERAL INFORMATION

SITE LOCATION:
SITE ADDRESS:
SAMPLING DATE:

SHIPPING DATE:
CANISTER SERIAL NO.:
SAMPLER ID:
OPERATOR:
CANISTER LEAK
CHECK DATE:

B. SAMPLING INFORMATION

	TEMPERATURE			
	INTERIOR	AMBIENT	MAXIMUM	MINIMUM
START				
STOP				

PRESSURE	
CANISTER PRESSURE	

	SAMPLING TIMES	
	LOCAL TIME	ELAPSED TIME METER READING
START		
STOP		

FLOW RATES		
MANIFOLD FLOW RATE	CANISTER FLOW RATE	FLOW CONTROLLER READOUT

SAMPLING SYSTEM CERTIFICATION DATE:
QUARTERLY RECERTIFICATION DATE:

C. LABORATORY INFORMATION

DATA RECEIVED:
RECEIVED BY:
INITIAL PRESSURE:
FINAL PRESSURE:
DILUTION FACTOR:
ANALYSIS
GC-FID-ECD DATE:
GC-MSD-SCAN DATE:
GC-MSD-SIM DATE:
RESULTS*:

GC-FID-ECD:
GC-MSD-SCAN:
GC-MSD-SIM:

SIGNATURE/TITLE

Figure 9. Canister sampling field test data sheet (FTDS).

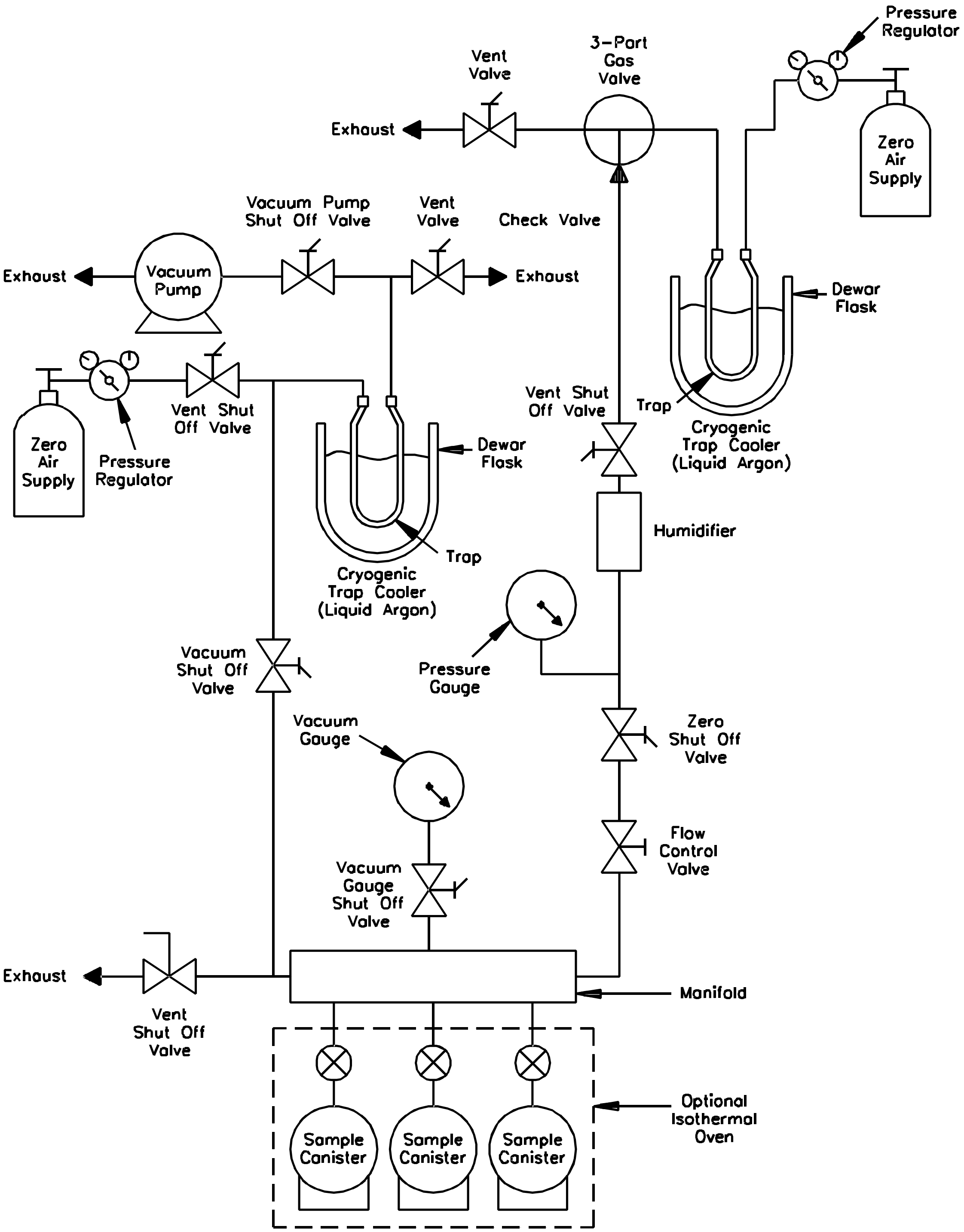


Figure 10. Canister cleaning system.

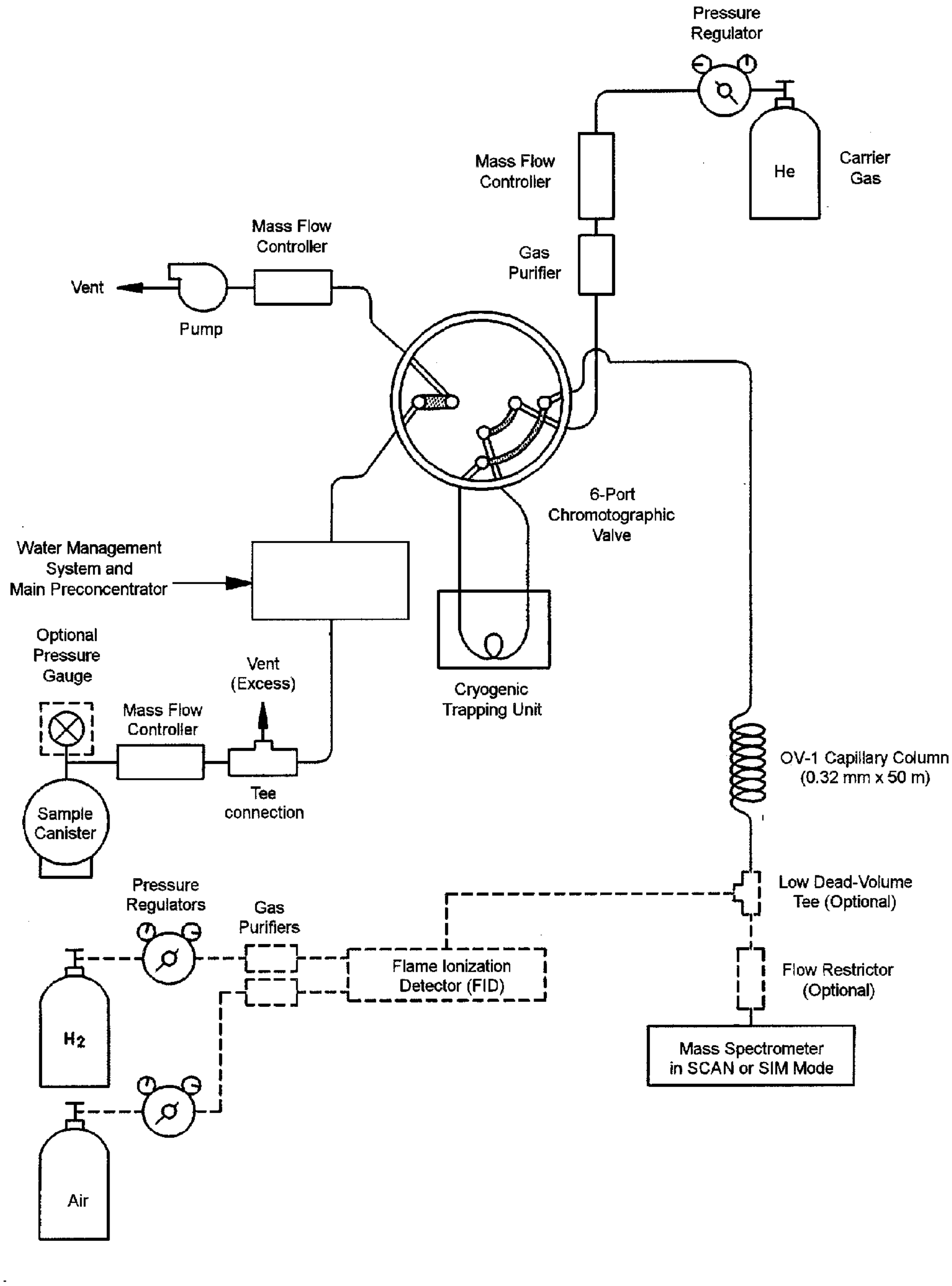
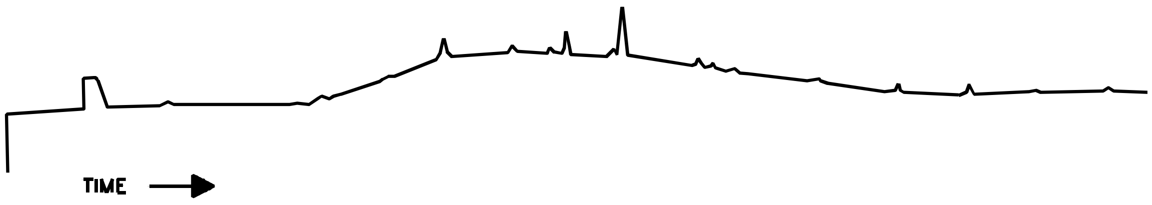
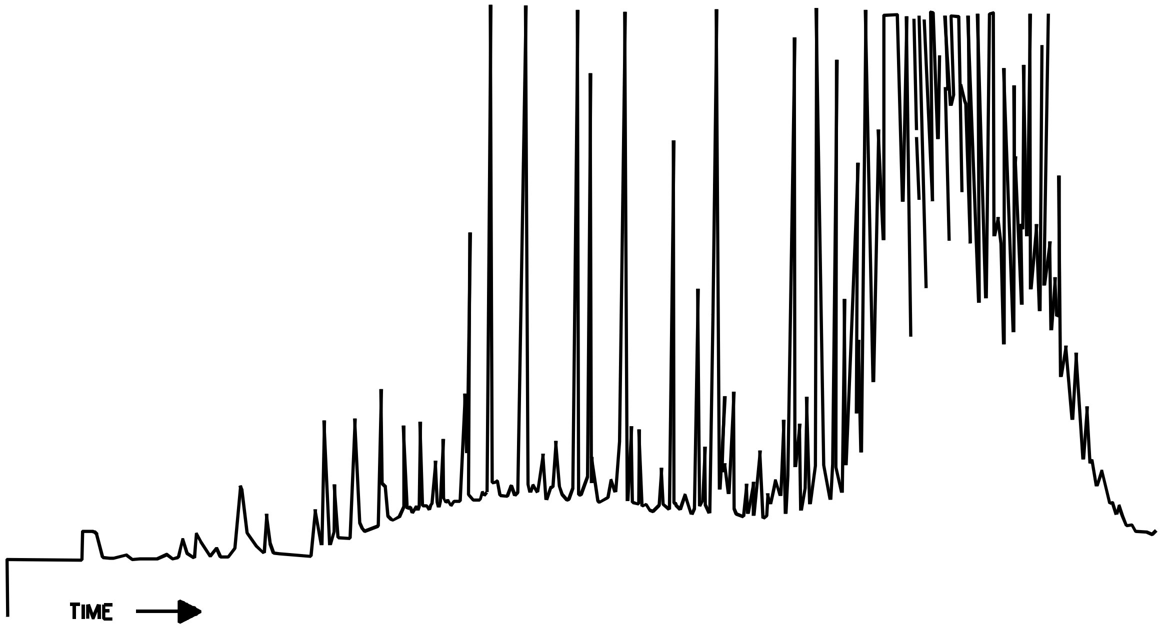


Figure 11. Canister analysis utilizing GC/MS/SCAN/SIM analytical system with optional flame ionization detector with 6-port chromatographic valve in the sample desorption mode.
[Alternative analytical system illustrated in Figure 16.]



(a). Certified Sampler



(b). Contaminated Sampler

Figure 12. Example of humid zero air test results for a clean sample canister (a) and a contaminated sample canister (b).

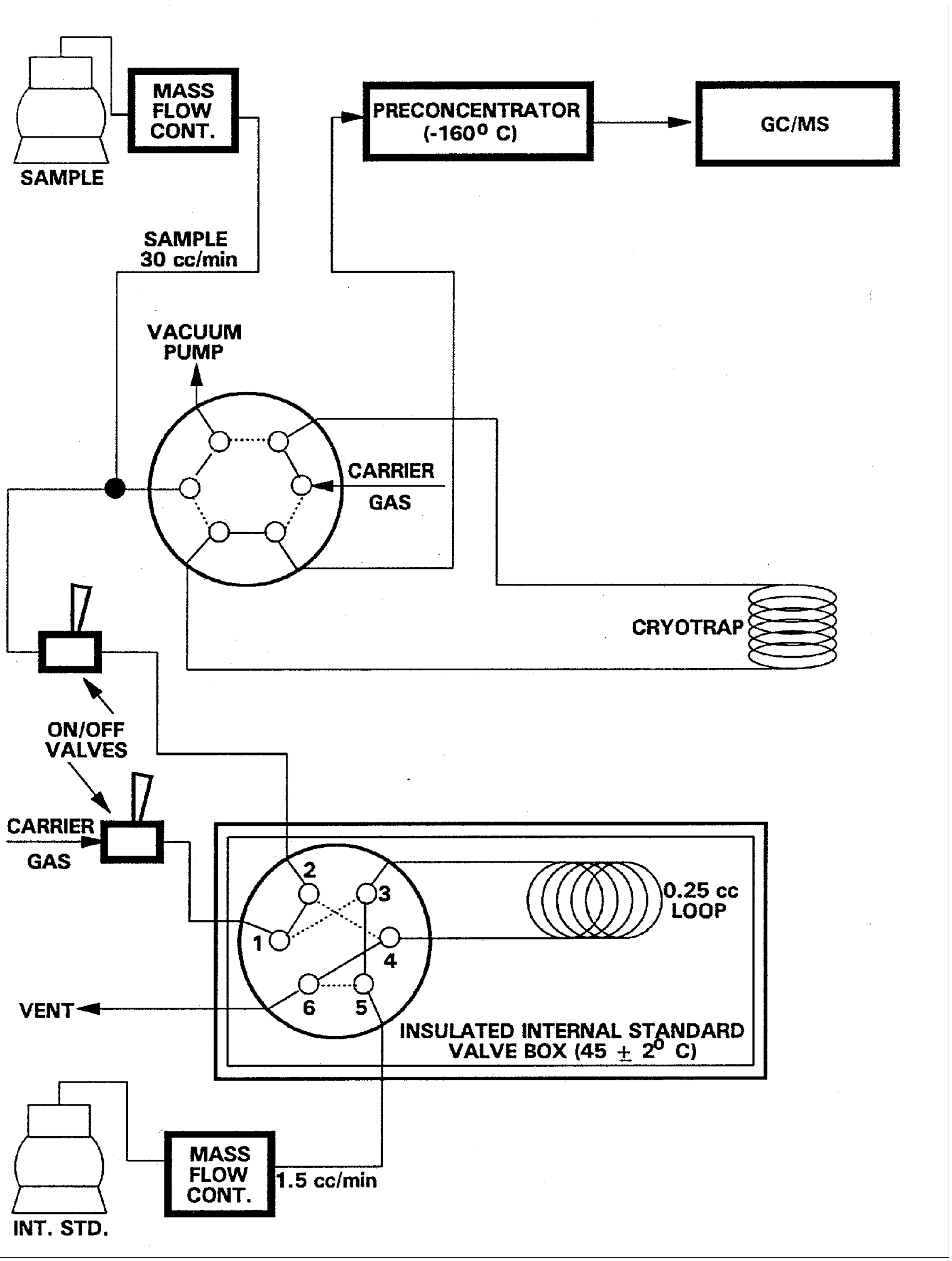


Figure 13. Diagram of design for internal standard addition.

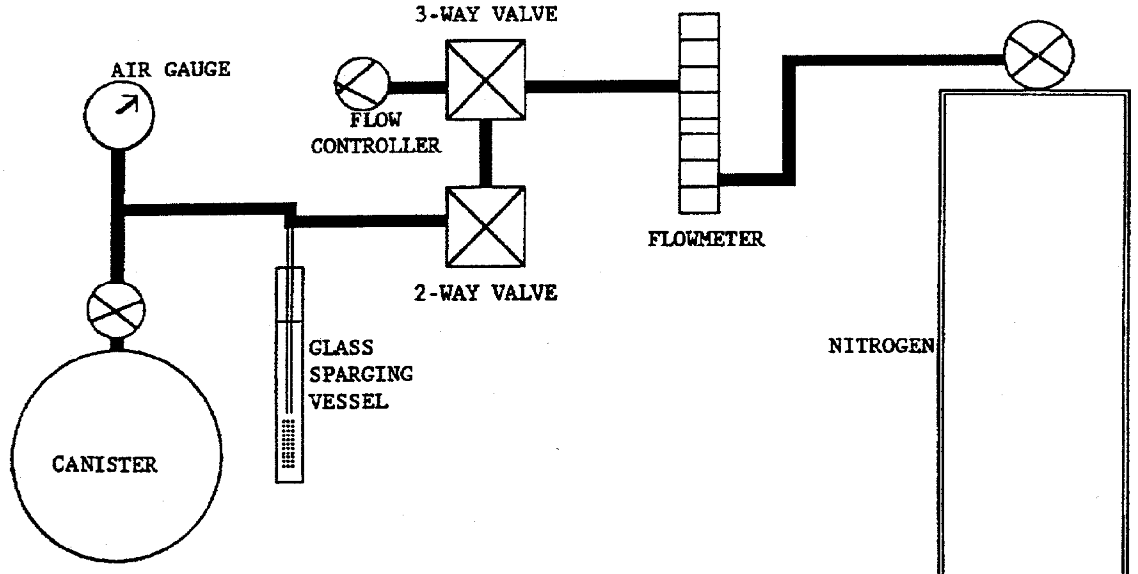


Figure 14. Water method of standard preparation in canisters.

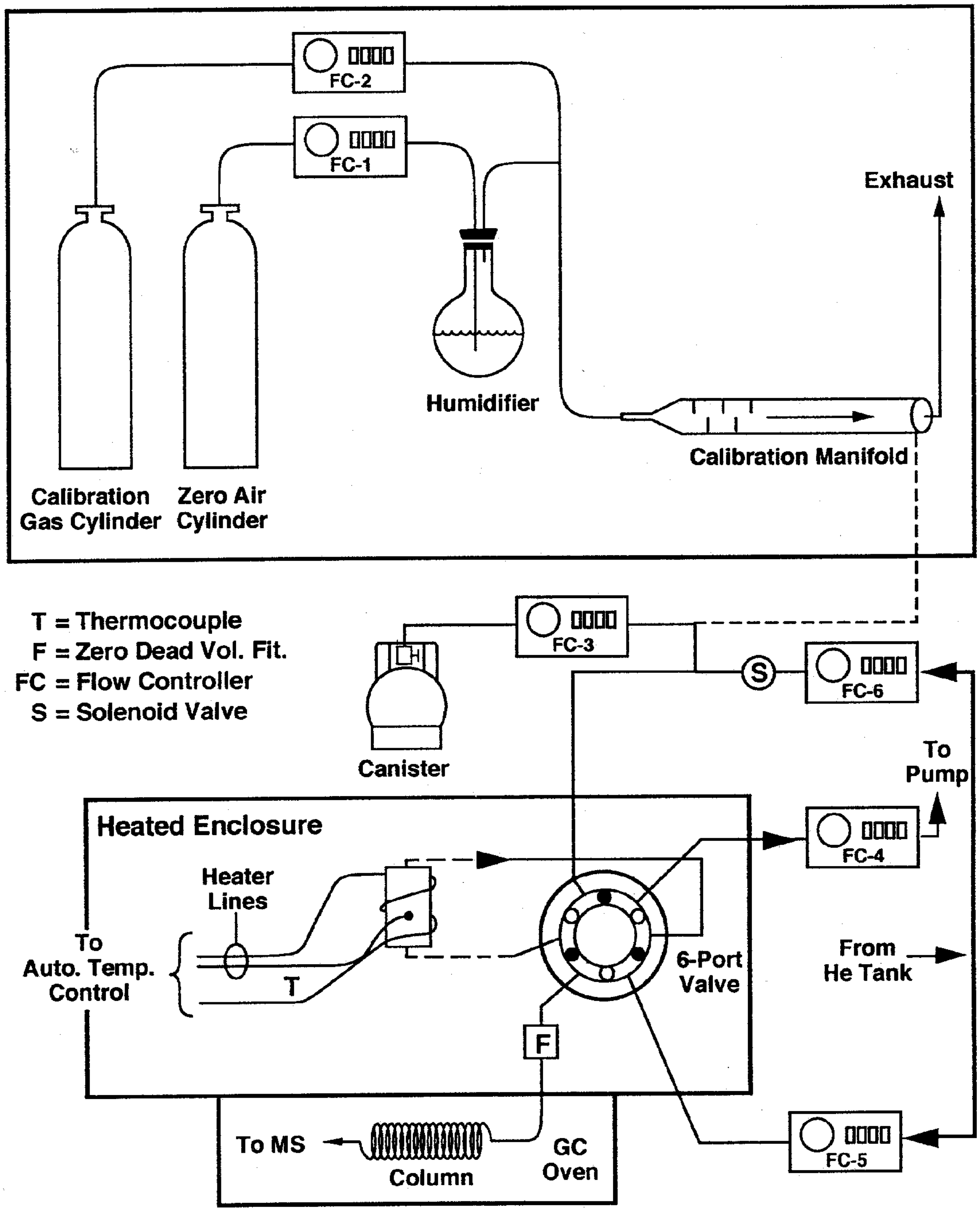


Figure 15. Diagram of the GC/MS analytical system.

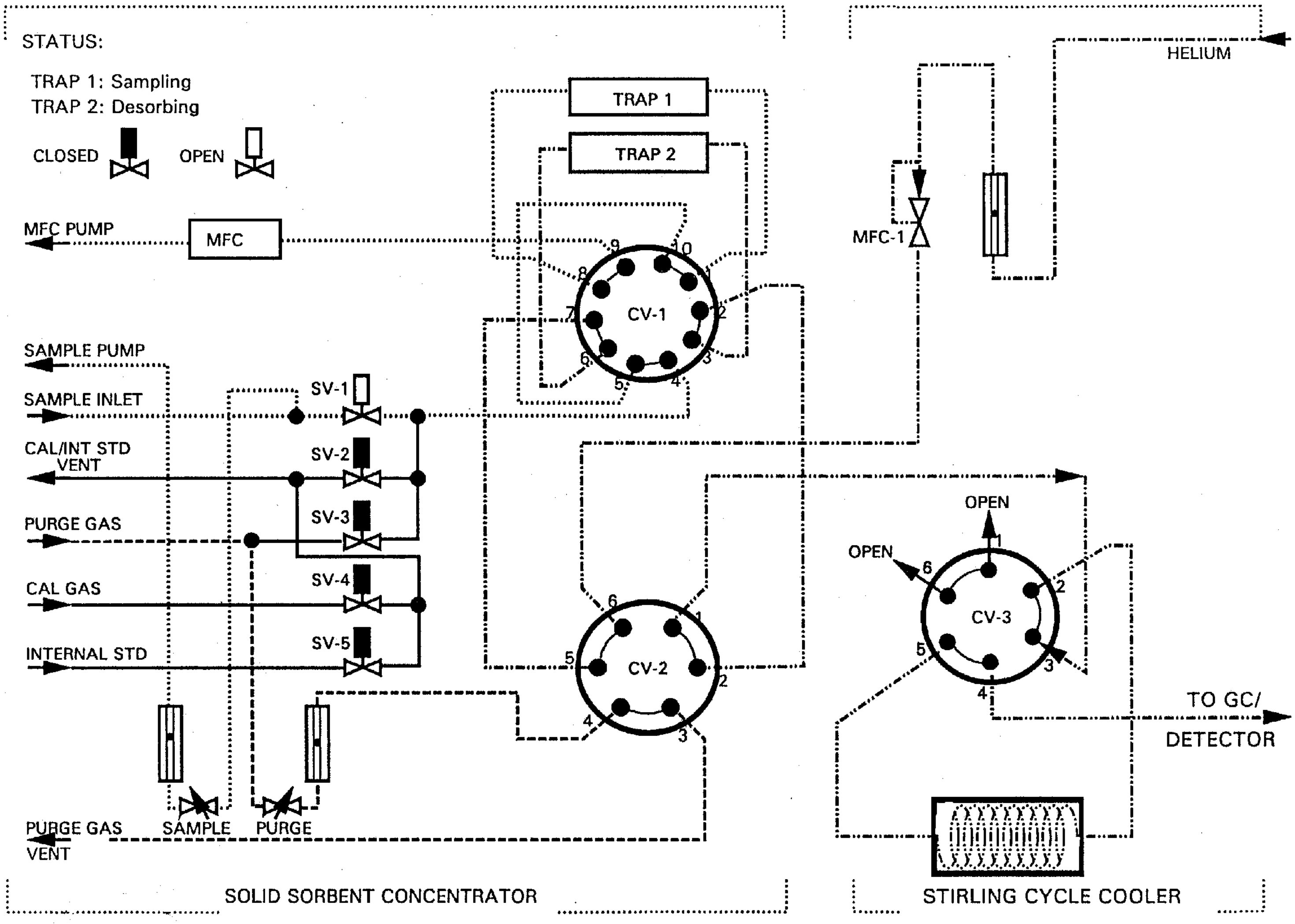


Figure 16. Sample flow diagram of a commercially available concentrator showing the combination of multisorbent tube and cooler (Trap 1 sampling; Trap 2 desorbing).

Appendix B

Analytical Report

Atmospheric Analysis & Consulting, Inc.

CLIENT : SCS Engineers
PROJECT NAME : Busy Bee
PROJECT NAME : 24219262.01
AAC PROJECT NO. : 191582
REPORT DATE : 09/26/2019

On September 20, 2019, Atmospheric Analysis & Consulting, Inc. received six (6) Six-Liter Summa Canisters for Volatile Organic Compounds and TICs analysis by EPA method TO-15. Upon receipt, each sample was assigned a unique Laboratory ID number as follows:

Client ID	Lab ID	Return Pressure (mmHga)
DOWN-2	191582-1633	603.9
DOWN-1	191582-1634	672.8
GH-2	191582-1635	671.4
GH-1	191582-1636	649.4
GH-3	191582-1637	623.8
UP	191582-1638	711.8

This analysis is accredited under the laboratory's ISO/IEC 17025:2005 accreditation issued by the ANSI-ASQ National Accreditation Board. Refer to certificate and scope of accreditation AT-1908. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of these samples.

The Technical Director or his/her designee, as verified by the following signature, has authorized release of the data contained in this hardcopy report.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 18 pages.

Laboratory Analysis Report

CLIENT : **SCS Engineers**
PROJECT NO : **191582**
MATRIX : **AIR**
UNITS : **PPB (v/v)**

DATE RECEIVED : **09/20/2019**
DATE REPORTED : **09/26/2019**

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	DOWN-2			Sample Reporting Limit (SRL) (MRLxDF's)	DOWN-1			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	191582-1633				191582-1634				
Date Sampled	09/18/2019				09/18/2019				
Date Analyzed	09/24/2019				09/24/2019				
Can Dilution Factor	1.70				1.52				
	Result	**Qualifier**	**Analysis DF**		**Result**	**Qualifier**	**Analysis DF**		
Chlorodifluoromethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Propene	<SRL	U	1.0	1.7	<SRL	U	1.0	1.5	1.0
Dichlorodifluoromethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Chloromethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Dichlorotetrafluoroethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Vinyl Chloride	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Methanol	9.84		1.0	8.5	<SRL	U	1.0	7.6	5.0
1,3-Butadiene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Bromomethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Chloroethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Dichlorofluoromethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Ethanol	<SRL	U	1.0	3.4	<SRL	U	1.0	3.0	2.0
Vinyl Bromide	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Acetone	<SRL	U	1.0	3.4	<SRL	U	1.0	3.0	2.0
Trichlorofluoromethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
2-Propanol (IPA)	<SRL	U	1.0	3.4	<SRL	U	1.0	3.0	2.0
Acrylonitrile	<SRL	U	1.0	1.7	<SRL	U	1.0	1.5	1.0
1,1-Dichloroethene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Methylene Chloride (DCM)	<SRL	U	1.0	1.7	<SRL	U	1.0	1.5	1.0
Allyl Chloride	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Carbon Disulfide	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Trichlorotrifluoroethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
trans-1,2-Dichloroethene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,1-Dichloroethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Methyl Tert Butyl Ether (MTBE)	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Vinyl Acetate	<SRL	U	1.0	1.7	<SRL	U	1.0	1.5	1.0
2-Butanone (MEK)	<SRL	U	1.0	1.7	<SRL	U	1.0	1.5	1.0
cis-1,2-Dichloroethene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Hexane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Chloroform	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Ethyl Acetate	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Tetrahydrofuran	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,2-Dichloroethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,1,1-Trichloroethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5

Laboratory Analysis Report

CLIENT	**: SCS Engineers**		**DATE RECEIVED**	**: 09/20/2019**
PROJECT NO	**: 191582**		**DATE REPORTED**	**: 09/26/2019**
MATRIX	**: AIR**			
UNITS	**: PPB (v/v)**			

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	DOWN-2			Sample Reporting Limit (SRL) (MRLxDF's)	DOWN-1			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	191582-1633				191582-1634				
Date Sampled	09/18/2019				09/18/2019				
Date Analyzed	09/24/2019				09/24/2019				
Can Dilution Factor	1.70				1.52				
	Result	Qualifier	Analysis DF		Result	Qualifier	Analysis DF		
Benzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Carbon Tetrachloride	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Cyclohexane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,2-Dichloropropane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Bromodichloromethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,4-Dioxane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Trichloroethene (TCE)	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
2,2,4-Trimethylpentane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Heptane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
cis-1,3-Dichloropropene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
4-Methyl-2-pentanone (MiBK)	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
trans-1,3-Dichloropropene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,1,2-Trichloroethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Toluene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
2-Hexanone (MBK)	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Dibromochloromethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,2-Dibromoethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Tetrachloroethene (PCE)	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Chlorobenzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Ethylbenzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
m & p-Xylenes	<SRL	U	1.0	1.7	<SRL	U	1.0	1.5	1.0
Bromoform	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Styrene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,1,2,2-Tetrachloroethane	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
o-Xylene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
4-Ethyltoluene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,3,5-Trimethylbenzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,2,4-Trimethylbenzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Benzyl Chloride (a-Chlorotoluene)	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,3-Dichlorobenzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,4-Dichlorobenzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,2-Dichlorobenzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
1,2,4-Trichlorobenzene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
Hexachlorobutadiene	<SRL	U	1.0	0.9	<SRL	U	1.0	0.8	0.5
BFB-Surrogate Std. % Recovery	92%				95%				70-130%

U - Compound was analyzed for, but was not detected at or above the SRL.

Sucha Parmar, Ph.D.
Technical Director

Laboratory Analysis Report

CLIENT	**: SCS Engineers**	**DATE RECEIVED**	**: 09/20/2019**
PROJECT NO	**: 191582**	**DATE REPORTED**	**: 09/26/2019**
MATRIX	**: AIR**		
UNITS	**: PPB (v/v)**		

TENTATIVELY IDENTIFIED COMPOUNDS

Client ID	**DOWN-2**	
AAC ID	**191582-1633**	
Date Sampled	**09/18/2019**	
Date Analyzed	**09/24/2019**	
Can Dilution Factor	**1.70**	
Compound	*PPB(V/V)*	*Spectra Identification Quality*
No Library Search Compounds Detected	ND	NA
BFB-Surrogate Std. % Recovery	92%	

TENTATIVELY IDENTIFIED COMPOUNDS

Client ID	**DOWN-1**	
AAC ID	**191582-1634**	
Date Sampled	**09/18/2019**	
Date Analyzed	**09/24/2019**	
Can Dilution Factor	**1.52**	
Compound	*PPB(V/V)*	*Spectra Identification Quality*
No Library Search Compounds Detected	ND	NA
BFB-Surrogate Std. % Recovery	95%	

Sucha Parmar, Ph.D.
Technical Director

Laboratory Analysis Report

CLIENT : **SCS Engineers**
PROJECT NO : **191582**
MATRIX : **AIR**
UNITS : **PPB (v/v)**

DATE RECEIVED : **09/20/2019**
DATE REPORTED : **09/26/2019**

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	GH-2			Sample Reporting Limit (SRL) (MRLxDF's)	GH-1			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	191582-1635				191582-1636				
Date Sampled	09/18/2019				09/18/2019				
Date Analyzed	09/24/2019				09/24/2019				
Can Dilution Factor	1.54				1.57				
	Result	**Qualifier**	**Analysis DF**		**Result**	**Qualifier**	**Analysis DF**		
Chlorodifluoromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Propene	<SRL	U	1.0	1.5	<SRL	U	1.0	1.6	1.0
Dichlorodifluoromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Chloromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Dichlorotetrafluoroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Vinyl Chloride	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Methanol	9.14		1.0	7.7	11.2		1.0	7.9	5.0
1,3-Butadiene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Bromomethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Chloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Dichlorofluoromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Ethanol	4.69		1.0	3.1	3.60		1.0	3.2	2.0
Vinyl Bromide	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Acetone	3.11		1.0	3.1	4.62		1.0	3.2	2.0
Trichlorofluoromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
2-Propanol (IPA)	<SRL	U	1.0	3.1	<SRL	U	1.0	3.2	2.0
Acrylonitrile	<SRL	U	1.0	1.5	<SRL	U	1.0	1.6	1.0
1,1-Dichloroethene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Methylene Chloride (DCM)	<SRL	U	1.0	1.5	<SRL	U	1.0	1.6	1.0
Allyl Chloride	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Carbon Disulfide	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Trichlorotrifluoroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
trans-1,2-Dichloroethene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,1-Dichloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Methyl Tert Butyl Ether (MTBE)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Vinyl Acetate	<SRL	U	1.0	1.5	<SRL	U	1.0	1.6	1.0
2-Butanone (MEK)	<SRL	U	1.0	1.5	<SRL	U	1.0	1.6	1.0
cis-1,2-Dichloroethene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Hexane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Chloroform	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Ethyl Acetate	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Tetrahydrofuran	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,2-Dichloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,1,1-Trichloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5

Laboratory Analysis Report

CLIENT : SCS Engineers
PROJECT NO : 191582
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 09/20/2019
DATE REPORTED : 09/26/2019

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	GH-2			Sample Reporting Limit (SRL) (MRLxDF's)	GH-1			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	191582-1635				191582-1636				
Date Sampled	09/18/2019				09/18/2019				
Date Analyzed	09/24/2019				09/24/2019				
Can Dilution Factor	1.54				1.57				
	Result	Qualifier	Analysis DF		Result	Qualifier	Analysis DF		
Benzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Carbon Tetrachloride	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Cyclohexane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,2-Dichloropropane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Bromodichloromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,4-Dioxane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Trichloroethene (TCE)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
2,2,4-Trimethylpentane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Heptane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
cis-1,3-Dichloropropene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
4-Methyl-2-pentanone (MiBK)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
trans-1,3-Dichloropropene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,1,2-Trichloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Toluene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
2-Hexanone (MBK)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Dibromochloromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,2-Dibromoethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Tetrachloroethene (PCE)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Chlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Ethylbenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
m & p-Xylenes	<SRL	U	1.0	1.5	<SRL	U	1.0	1.6	1.0
Bromoform	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Styrene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,1,2,2-Tetrachloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
o-Xylene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
4-Ethyltoluene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,3,5-Trimethylbenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,2,4-Trimethylbenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Benzyl Chloride (a-Chlorotoluene)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,3-Dichlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,4-Dichlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,2-Dichlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
1,2,4-Trichlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
Hexachlorobutadiene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.8	0.5
BFB-Surrogate Std. % Recovery	90%				88%				70-130%

U - Compound was analyzed for, but was not detected at or above the SRL.

Sucha Parmar, Ph.D.
Technical Director

Laboratory Analysis Report

CLIENT	**: SCS Engineers**	**DATE RECEIVED**	**: 09/20/2019**
PROJECT NO	**: 191582**	**DATE REPORTED**	**: 09/26/2019**
MATRIX	**: AIR**		
UNITS	**: PPB (v/v)**		

TENTATIVELY IDENTIFIED COMPOUNDS

Client ID	**GH-2**	
AAC ID	**191582-1635**	
Date Sampled	**09/18/2019**	
Date Analyzed	**09/24/2019**	
Can Dilution Factor	**1.54**	
Compound	***PPB(V/V)***	***Spectra Identification Quality***
No Library Search Compounds Detected	ND	NA
BFB-Surrogate Std. % Recovery	90%	

TENTATIVELY IDENTIFIED COMPOUNDS

Client ID	**GH-1**	
AAC ID	**191582-1636**	
Date Sampled	**09/18/2019**	
Date Analyzed	**09/24/2019**	
Can Dilution Factor	**1.57**	
Compound	***PPB(V/V)***	***Spectra Identification Quality***
.alpha.-Pinene	1.89	94
.beta.-Myrcene	8.93	93
Limonene	2.41	94
BFB-Surrogate Std. % Recovery	88%	

Sucha Parmar, Ph.D.
Technical Director

Laboratory Analysis Report

CLIENT	: **SCS Engineers**		**DATE RECEIVED**	: **09/20/2019**
PROJECT NO	: **191582**		**DATE REPORTED**	: **09/26/2019**
MATRIX	: **AIR**			
UNITS	: **PPB (v/v)**			

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	GH-3			Sample Reporting Limit (SRL) (MRLxDF's)	UP			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	191582-1637				191582-1638				
Date Sampled	09/18/2019				09/18/2019				
Date Analyzed	09/24/2019				09/24/2019				
Can Dilution Factor	1.64				1.44				
	Result	**Qualifier**	**Analysis DF**		**Result**	**Qualifier**	**Analysis DF**		
Chlorodifluoromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Propene	<SRL	U	1.0	1.6	<SRL	U	1.0	1.4	1.0
Dichlorodifluoromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Chloromethane	<SRL	U	1.0	0.8	0.74		1.0	0.7	0.5
Dichlorotetrafluoroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Vinyl Chloride	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Methanol	13.3		1.0	8.2	10.2		1.0	7.2	5.0
1,3-Butadiene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Bromomethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Chloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Dichlorofluoromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Ethanol	3.76		1.0	3.3	<SRL	U	1.0	2.9	2.0
Vinyl Bromide	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Acetone	5.12		1.0	3.3	8.64		1.0	2.9	2.0
Trichlorofluoromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
2-Propanol (IPA)	<SRL	U	1.0	3.3	<SRL	U	1.0	2.9	2.0
Acrylonitrile	<SRL	U	1.0	1.6	<SRL	U	1.0	1.4	1.0
1,1-Dichloroethene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Methylene Chloride (DCM)	<SRL	U	1.0	1.6	<SRL	U	1.0	1.4	1.0
Allyl Chloride	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Carbon Disulfide	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Trichlorotrifluoroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
trans-1,2-Dichloroethene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,1-Dichloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Methyl Tert Butyl Ether (MTBE)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Vinyl Acetate	<SRL	U	1.0	1.6	<SRL	U	1.0	1.4	1.0
2-Butanone (MEK)	<SRL	U	1.0	1.6	<SRL	U	1.0	1.4	1.0
cis-1,2-Dichloroethene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Hexane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Chloroform	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Ethyl Acetate	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Tetrahydrofuran	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,2-Dichloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,1,1-Trichloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5

Laboratory Analysis Report

CLIENT : **SCS Engineers**
PROJECT NO : **191582**
MATRIX : **AIR**
UNITS : **PPB (v/v)**

DATE RECEIVED : **09/20/2019**
DATE REPORTED : **09/26/2019**

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	GH-3			Sample Reporting Limit (SRL) (MRLxDF's)	UP			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	191582-1637				191582-1638				
Date Sampled	09/18/2019				09/18/2019				
Date Analyzed	09/24/2019				09/24/2019				
Can Dilution Factor	1.64				1.44				
	Result	**Qualifier**	**Analysis DF**		**Result**	**Qualifier**	**Analysis DF**		
Benzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Carbon Tetrachloride	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Cyclohexane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,2-Dichloropropane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Bromodichloromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,4-Dioxane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Trichloroethene (TCE)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
2,2,4-Trimethylpentane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Heptane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
cis-1,3-Dichloropropene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
4-Methyl-2-pentanone (MiBK)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
trans-1,3-Dichloropropene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,1,2-Trichloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Toluene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
2-Hexanone (MBK)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Dibromochloromethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,2-Dibromoethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Tetrachloroethene (PCE)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Chlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Ethylbenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
m & p-Xylenes	<SRL	U	1.0	1.6	<SRL	U	1.0	1.4	1.0
Bromoform	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Styrene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,1,2,2-Tetrachloroethane	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
o-Xylene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
4-Ethyltoluene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,3,5-Trimethylbenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,2,4-Trimethylbenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Benzyl Chloride (a-Chlorotoluene)	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,3-Dichlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,4-Dichlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,2-Dichlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
1,2,4-Trichlorobenzene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
Hexachlorobutadiene	<SRL	U	1.0	0.8	<SRL	U	1.0	0.7	0.5
BFB-Surrogate Std. % Recovery	90%				92%				70-130%

U - Compound was analyzed for, but was not detected at or above the SRL.

Sucha Parmar, Ph.D.
Technical Director

Laboratory Analysis Report

CLIENT	**: SCS Engineers**	**DATE RECEIVED**	**: 09/20/2019**
PROJECT NO	**: 191582**	**DATE REPORTED**	**: 09/26/2019**
MATRIX	**: AIR**		
UNITS	**: PPB (v/v)**		

TENTATIVELY IDENTIFIED COMPOUNDS

Client ID	**GH-3**	
AAC ID	**191582-1637**	
Date Sampled	**09/18/2019**	
Date Analyzed	**09/24/2019**	
Can Dilution Factor	**1.64**	
Compound	***PPB(V/V)***	***Spectra Identification Quality***
No Library Search Compounds Detected	ND	NA
BFB-Surrogate Std. % Recovery	90%	

TENTATIVELY IDENTIFIED COMPOUNDS

Client ID	**UP**	
AAC ID	**191582-1638**	
Date Sampled	**09/18/2019**	
Date Analyzed	**09/24/2019**	
Can Dilution Factor	**1.44**	
Compound	***PPB(V/V)***	***Spectra Identification Quality***
No Library Search Compounds Detected	ND	NA
BFB-Surrogate Std. % Recovery	92%	

Sucha Parmar, Ph.D.
Technical Director

ANALYSIS DATE : 09/24/2019
ANALYST : JJG
INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : PS082119-03

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Continuing Calibration Verification of the 09/20/2019 Calibration

Compounds	*Conc*	*Daily Conc*	*%REC**
4-BFB (surrogate standard)	10.00	10.10	101
Chlorodifluoromethane	10.80	10.41	96
Propene	11.00	11.15	101
Dichlorodifluoromethane	10.20	10.09	99
Chloromethane	10.60	11.21	106
Dichlorotetrafluoroethane	11.00	11.08	101
Vinyl Chloride	10.40	9.98	96
Methanol	22.50	25.05	111
1,3-Butadiene	10.90	11.96	110
Bromomethane	10.30	10.53	102
Chloroethane	10.10	12.04	119
Dichlorofluoromethane	10.80	11.06	102
Ethanol	11.00	10.75	98
Vinyl Bromide	10.70	11.10	104
Acetone	10.90	9.89	91
Trichlorofluoromethane	10.10	10.28	102
2-Propanol (IPA)	11.00	10.79	98
Acrylonitrile	11.50	11.37	99
1,1-Dichloroethene	10.70	11.24	105
Methylene Chloride (DCM)	10.60	10.88	103
Allyl Chloride	10.70	10.08	94
Carbon Disulfide	10.50	10.22	97
Trichlorotrifluoroethane	10.60	10.54	99
trans-1,2-Dichloroethene	10.30	10.18	99
1,1-Dichloroethane	10.50	10.28	98
Methyl Tert Butyl Ether (MTBE)	10.80	11.00	102
Vinyl Acetate	10.90	11.50	106
2-Butanone (MEK)	10.90	10.51	96
cis-1,2-Dichloroethene	10.90	11.08	102
Hexane	10.70	10.90	102
Chloroform	10.90	10.94	100
Ethyl Acetate	10.90	10.52	97
Tetrahydrofuran	10.20	10.18	100
1,2-Dichloroethane	10.80	10.97	102
1,1,1-Trichloroethane	10.80	10.85	100

ANALYSIS DATE : 09/24/2019
ANALYST : JJG

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : PS082119-03

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Continuing Calibration Verification of the 09/20/2019 Calibration

Compounds	*Conc*	*Daily Conc*	*%REC**
Benzene	10.90	10.60	97
Carbon Tetrachloride	10.60	10.68	101
Cyclohexane	10.90	11.15	102
1,2-Dichloropropane	10.80	10.75	100
Bromodichloromethane	10.90	10.93	100
1,4-Dioxane	10.90	10.14	93
Trichloroethene (TCE)	10.90	10.66	98
2,2,4-Trimethylpentane	10.70	10.69	100
Heptane	10.80	10.99	102
cis-1,3-Dichloropropene	10.60	10.46	99
4-Methyl-2-pentanone (MiBK)	10.60	10.54	99
trans-1,3-Dichloropropene	10.20	10.45	102
1,1,2-Trichloroethane	10.90	11.20	103
Toluene	11.00	10.65	97
2-Hexanone (MBK)	10.80	10.68	99
Dibromochloromethane	10.30	10.66	103
1,2-Dibromoethane	10.90	10.90	100
Tetrachloroethene (PCE)	10.90	10.79	99
Chlorobenzene	11.00	11.26	102
Ethylbenzene	10.90	11.15	102
m & p-Xylenes	21.00	20.94	100
Bromoform	10.50	10.42	99
Styrene	10.80	11.43	106
1,1,2,2-Tetrachloroethane	10.70	10.50	98
o-Xylene	10.70	10.85	101
4-Ethyltoluene	10.30	10.84	105
1,3,5-Trimethylbenzene	10.40	10.86	104
1,2,4-Trimethylbenzene	10.40	10.73	103
Benzyl Chloride (a-Chlorotoluene)	9.70	10.27	106
1,3-Dichlorobenzene	10.10	10.00	99
1,4-Dichlorobenzene	10.20	10.05	99
1,2-Dichlorobenzene	10.20	10.01	98
1,2,4-Trichlorobenzene	9.70	10.06	104
Hexachlorobutadiene	10.00	9.18	92

* - %REC should be 70-130%

Sucha Parmar, PhD
Technical Director

Quality Control/Quality Assurance Report

CLIENT ID	**: Laboratory Control Spike**	**DATE ANALYZED**	**: 09/24/2019**
AAC ID	**: LCS/LCSD**	**DATE REPORTED**	**: 09/24/2019**
MEDIA	**: Air**	**UNITS**	**: ppbv**

TO-15 Laboratory Control Spike Recovery

Compound	Sample Conc.	Spike Added	Spike Res	Dup Spike Res	Spike % Rec *	Spike Dup % Rec *	RPD** %
1,1-Dichloroethene	0.0	10.70	11.24	11.11	105	104	1.2
Methylene Chloride (DCM)	0.0	10.60	10.88	11.02	103	104	1.3
Benzene	0.0	10.90	10.60	10.92	97	100	3.0
Trichloroethene (TCE)	0.0	10.90	10.66	10.85	98	100	1.8
Toluene	0.0	11.00	10.65	11.32	97	103	6.1
Tetrachloroethene (PCE)	0.0	10.90	10.79	11.01	99	101	2.0
Chlorobenzene	0.0	11.00	11.26	11.04	102	100	2.0
Ethylbenzene	0.0	10.90	11.15	11.26	102	103	1.0
m & p-Xylenes	0.0	21.00	20.94	21.52	100	102	2.7
o-Xylene	0.0	10.70	10.85	10.76	101	101	0.8

* Must be 70-130%

** Must be < 25%

Sucha Parmar

Sucha Parmar, PhD
Technical Director

Method Blank Analysis Report

MATRIX : **AIR** **ANALYSIS DATE** : **09/24/2019**
UNITS : **ppbv** **REPORT DATE** : **09/24/2019**

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	**Method Blank**	**RL**
AAC ID	**MB 092419**	
Chlorodifluoromethane	<RL	0.5
Propene	<RL	1.0
Dichlorodifluoromethane	<RL	0.5
Chloromethane	<RL	0.5
Dichlorotetrafluoroethane	<RL	0.5
Vinyl Chloride	<RL	0.5
Methanol	<RL	5.0
1,3-Butadiene	<RL	0.5
Bromomethane	<RL	0.5
Chloroethane	<RL	0.5
Dichlorofluoromethane	<RL	0.5
Ethanol	<RL	2.0
Vinyl Bromide	<RL	0.5
Acetone	<RL	2.0
Trichlorofluoromethane	<RL	0.5
2-Propanol (IPA)	<RL	2.0
Acrylonitrile	<RL	1.0
1,1-Dichloroethene	<RL	0.5
Methylene Chloride (DCM)	<RL	1.0
Allyl Chloride	<RL	0.5
Carbon Disulfide	<RL	0.5
Trichlorotrifluoroethane	<RL	0.5
trans-1,2-Dichloroethene	<RL	0.5
1,1-Dichloroethane	<RL	0.5
Methyl Tert Butyl Ether (MTBE)	<RL	0.5
Vinyl Acetate	<RL	1.0
2-Butanone (MEK)	<RL	1.0
cis-1,2-Dichloroethene	<RL	0.5
Hexane	<RL	0.5
Chloroform	<RL	0.5
Ethyl Acetate	<RL	0.5
Tetrahydrofuran	<RL	0.5
1,2-Dichloroethane	<RL	0.5
1,1,1-Trichloroethane	<RL	0.5
Benzene	<RL	0.5
Carbon Tetrachloride	<RL	0.5
Cyclohexane	<RL	0.5
1,2-Dichloropropane	<RL	0.5
Bromodichloromethane	<RL	0.5
1,4-Dioxane	<RL	0.5
Trichloroethene (TCE)	<RL	0.5
2,2,4-Trimethylpentane	<RL	0.5
Heptane	<RL	0.5

Method Blank Analysis Report

MATRIX : **AIR** **ANALYSIS DATE** : **09/24/2019**
UNITS : **ppbv** **REPORT DATE** : **09/24/2019**

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	**Method Blank**	**RL**
AAC ID	**MB 092419**	
cis-1,3-Dichloropropene	<RL	0.5
4-Methyl-2-pentanone (MiBK)	<RL	0.5
trans-1,3-Dichloropropene	<RL	0.5
1,1,2-Trichloroethane	<RL	0.5
Toluene	<RL	0.5
2-Hexanone (MBK)	<RL	0.5
Dibromochloromethane	<RL	0.5
1,2-Dibromoethane	<RL	0.5
Tetrachloroethene (PCE)	<RL	0.5
Chlorobenzene	<RL	0.5
Ethylbenzene	<RL	0.5
m & p-Xylenes	<RL	1.0
Bromoform	<RL	0.5
Styrene	<RL	0.5
1,1,2,2-Tetrachloroethane	<RL	0.5
o-Xylene	<RL	0.5
4-Ethyltoluene	<RL	0.5
1,3,5-Trimethylbenzene	<RL	0.5
1,2,4-Trimethylbenzene	<RL	0.5
Benzyl Chloride (a-Chlorotoluene)	<RL	0.5
1,3-Dichlorobenzene	<RL	0.5
1,4-Dichlorobenzene	<RL	0.5
1,2-Dichlorobenzene	<RL	0.5
1,2,4-Trichlorobenzene	<RL	0.5
Hexachlorobutadiene	<RL	0.5
System Monitoring Compounds		
BFB-Surrogate Std. % Recovery	91%	--

RL - Reporting Limit

Sucha Parmar, PhD
Technical Director

Quality Control/Quality Assurance Report

AAC ID	**: 191582-1633**	**DATE ANALYZED**	**: 09/24/2019**
MATRIX	**: Air**	**DATE REPORTED**	**: 09/24/2019**
		UNITS	**: ppbv**

TO-15 Duplicate Analysis

Compound	Sample Conc	Duplicate Conc	% RPD
Chlorodifluoromethane	<SRL	<SRL	0.0
Propene	<SRL	<SRL	0.0
Dichlorodifluoromethane	<SRL	<SRL	0.0
Chloromethane	<SRL	<SRL	0.0
Dichlorotetrafluoroethane	<SRL	<SRL	0.0
Vinyl Chloride	<SRL	<SRL	0.0
Methanol	9.84	10.00	1.6
1,3-Butadiene	<SRL	<SRL	0.0
Bromomethane	<SRL	<SRL	0.0
Chloroethane	<SRL	<SRL	0.0
Dichlorofluoromethane	<SRL	<SRL	0.0
Ethanol	<SRL	<SRL	0.0
Vinyl Bromide	<SRL	<SRL	0.0
Acetone	<SRL	<SRL	0.0
Trichlorofluoromethane	<SRL	<SRL	0.0
2-Propanol (IPA)	<SRL	<SRL	0.0
Acrylonitrile	<SRL	<SRL	0.0
1,1-Dichloroethene	<SRL	<SRL	0.0
Methylene Chloride (DCM)	<SRL	<SRL	0.0
Allyl Chloride	<SRL	<SRL	0.0
Carbon Disulfide	<SRL	<SRL	0.0
Trichlorotrifluoroethane	<SRL	<SRL	0.0
trans-1,2-Dichloroethene	<SRL	<SRL	0.0
1,1-Dichloroethane	<SRL	<SRL	0.0
Methyl Tert Butyl Ether (MTBE)	<SRL	<SRL	0.0
Vinyl Acetate	<SRL	<SRL	0.0
2-Butanone (MEK)	<SRL	<SRL	0.0
cis-1,2-Dichloroethene	<SRL	<SRL	0.0
Hexane	<SRL	<SRL	0.0
Chloroform	<SRL	<SRL	0.0
Ethyl Acetate	<SRL	<SRL	0.0
Tetrahydrofuran	<SRL	<SRL	0.0
1,2-Dichloroethane	<SRL	<SRL	0.0
1,1,1-Trichloroethane	<SRL	<SRL	0.0
Benzene	<SRL	<SRL	0.0
Carbon Tetrachloride	<SRL	<SRL	0.0

Quality Control/Quality Assurance Report

AAC ID : 191582-1633
MATRIX : Air
DATE ANALYZED : 09/24/2019
DATE REPORTED : 09/24/2019
UNITS : ppbv

TO-15 Duplicate Analysis

Compound	Sample Conc	Duplicate Conc	% RPD
Cyclohexane	<SRL	<SRL	0.0
1,2-Dichloropropane	<SRL	<SRL	0.0
Bromodichloromethane	<SRL	<SRL	0.0
1,4-Dioxane	<SRL	<SRL	0.0
Trichloroethene (TCE)	<SRL	<SRL	0.0
2,2,4-Trimethylpentane	<SRL	<SRL	0.0
Heptane	<SRL	<SRL	0.0
cis-1,3-Dichloropropene	<SRL	<SRL	0.0
4-Methyl-2-pentanone (MiBK)	<SRL	<SRL	0.0
trans-1,3-Dichloropropene	<SRL	<SRL	0.0
1,1,2-Trichloroethane	<SRL	<SRL	0.0
Toluene	<SRL	<SRL	0.0
2-Hexanone (MBK)	<SRL	<SRL	0.0
Dibromochloromethane	<SRL	<SRL	0.0
1,2-Dibromoethane	<SRL	<SRL	0.0
Tetrachloroethene (PCE)	<SRL	<SRL	0.0
Chlorobenzene	<SRL	<SRL	0.0
Ethylbenzene	<SRL	<SRL	0.0
m & p-Xylenes	<SRL	<SRL	0.0
Bromoform	<SRL	<SRL	0.0
Styrene	<SRL	<SRL	0.0
1,1,2,2-Tetrachloroethane	<SRL	<SRL	0.0
o-Xylene	<SRL	<SRL	0.0
4-Ethyltoluene	<SRL	<SRL	0.0
1,3,5-Trimethylbenzene	<SRL	<SRL	0.0
1,2,4-Trimethylbenzene	<SRL	<SRL	0.0
Benzyl Chloride (a-Chlorotoluene)	<SRL	<SRL	0.0
1,3-Dichlorobenzene	<SRL	<SRL	0.0
1,4-Dichlorobenzene	<SRL	<SRL	0.0
1,2-Dichlorobenzene	<SRL	<SRL	0.0
1,2,4-Trichlorobenzene	<SRL	<SRL	0.0
Hexachlorobutadiene	<SRL	<SRL	0.0
System Monitoring Compounds			
BFB-Surrogate Std. % Recovery	92%	90%	3.1

SRL - Sample Reporting Limit

Sucha Parmar, PhD
Technical Director

ATMOSPHERIC ANALYSIS & CONSULTING, INC.
1534 Eastman Avenue, Suite A
Ventura, California 93003
Phone (805) 650-1642 Fax (805) 650-1644
E-mail: info@aaclab.com

AAC Project No. 191582

Page ____ of ____

CHAIN OF CUSTODY/ ANALYSIS REQUEST FORM

Client Name: SCS Engineers

Project Name: Busy Bee

Project Mgr (Print Name): Paul Schafer

Project Number: 24219262.01

Sampler's Name (Print Name): Eva Luu

Sampler's Signature: Ou m

AAC Sample No.	Date Sampled	Time Sampled	Sample Type	Client Sample ID/Description	Type/No. of Containers	EPA TO-15 scan VOCs + TICs					
1633	9/18	1302	air	Down-2 (can # 832)	air 1	X					
1634	↓	1310	↓	Down-1 (can # 849)	air 1	X					
1635		1322		GH-2 (can # 846)	air 1	X					
1636		1330		~~GH-2~~ GH-1 (can # 844)	air 1	X					
1637		1349		GH-3 (can # 828)	air 1	X					
1638		1358		UP (can # 835)	air 1	X					

Send report: pschafer@scsengineers.com

Attn: Paul Schafer

Phone#: 619.823.5333

Fax#

Send invoice to:

Attn: ____________

P.O. # ____________

Turnaround Time

24-Hr ____ 48-Hr ____

5 Day ____ Normal X

Other (Specify) ____________

Special Instructions/remarks:

Relinquished by (Signature): Ou m	Print Name: Eva Luu	Date/Time 9/18/ 1536	Received by (signature):	Print Name
Relinquished by (Signature):	Print Name:	Date/Time 9/20/19 12:36	Received by (signature):	Print Name Elie Grosj

"UP" missing cap

6x cans

UPS

O
S&E
www.odorscience.com

Odor Science & Engineering, Inc.
105 Filley Street, Bloomfield, CT 06002
(860) 243-9380 Fax: (860) 243-9431

October 3, 2019

Paul Schafer
SCS Engineers
5963 LaPlace Court
Suite 207
Carlsbad, CA 92008

PSchafer@scsengineers.com

RE: Odor Panel Analysis – October 1st, 2019
OS&E Project No. 2158-M-00
SCS Project Name: Busy Bee

Dear Paul:

This letter presents the results of the recent odor panel analyses conducted by Odor Science & Engineering, Inc. (OS&E) for SCS Engineers. A total of nine (9) odor emission samples were collected on September 30th, 2019 by on-site personnel. The odor samples were collected into Tedlar gas sampling bags provided by OS&E and shipped via overnight air to OS&E's Olfactory Laboratory in Bloomfield, CT for sensory analysis the next day. The samples arrived intact with a chain of custody requesting sensory analysis.

Upon arrival the samples were analyzed by dynamic dilution olfactometry using a trained and screened odor panel of 8 members. The odor panelists were chosen from OS&E's pool of panelists from the Greater Hartford area who actively participate in ongoing olfactory research and represent an average to above average sensitivity when compared to a large population. The samples were quantified in terms of dilution-to-threshold (D/T) ratio and odor intensity in accordance with ASTM Methods E-679-04 and E-544-10, respectively. The odor panelists were also asked to describe the odor character of the samples at varying dilution levels. The odor panel methodology is further described in Attachment A.

The results of the odor panel tests are presented in the attached Table 1.

We appreciate the opportunity to be of continued service to SCS Engineers. Please feel free to call Martha O'Brien or me if you have any questions concerning these results.

Sincerely,
ODOR SCIENCE & ENGINEERING, INC.

Gary K. Grumley

Gary K. Grumley
Associate Scientist

Table 1. Results of dynamic dilution olfactometry analysis – October 1st, 2019
SCS Engineers – Sampling Site: Busy Bee
OS&E Project No. 2158-M-00

			Odor Conc. D/T(1)	Stevens' Law Constants(2)		Odor Character(3)
Date	Sample ID	Time		a	b	
09/30/19	SOURCE	13:36	298	.64	.94	Skunk, "pot", weed, marijuana
09/30/19	UP	14:23	9	--	--	Stale, vegetation, plastic, rubber tires, exhaust, salty
09/30/19	R1-XW	14:12	9	--	--	Stale, sour vegetation, plastic, cardboard, rubber, cleaning chemical, bleachy, salty
09/30/19	R2-DW	14:02	11	--	--	Stale, plastic, sour vegetation, swampy, moldy basement, mildew, cardboard, exhaust, salty
09/30/19	R3-DW	15:40	12	--	--	Stale, sour vegetation, plastic, swampy, cardboard, rubber, cleaning chemical
09/30/19	TR-DW	15:12	13	--	--	Stale, sour vegetation, plastic, swampy, lead pencil, mildew, moldy, exhaust
09/30/19	VET-DW	14:37	15	--	--	Chemical, putty, stale, vegetation, plastic, tree bark, skunk, rubber tires
09/30/19	RES-DW	14:53	15	--	--	Stale, sour vegetation, swampy, rotten eggs, rubber, plastic, cardboard, cleaning chemical
09/30/19	EL-DW	15:02	11	--	--	Stale, sour vegetation, swampy, plastic, cardboard, rubber, exhaust

1. D/T = dilutions-to-threshold
2. Stevens' Law correlates odor concentration (C) and odor intensity (I): $I = aC^b$. The constants a and b were determined by regression analysis based on the intensity ratings of the odor panel at varying dilution levels. I = 0-8 (based on the n-butanol intensity scale), C = odor concentration (D/T) typical of ambient odor levels.
3. Summary of all odor character descriptors used by the odor panelists at varying dilution levels.

-- Sample D/T too low for dose response calculations

ATTACHMENT A
Odor Science & Engineering, Inc.
Odor Panel Methodology

Measurement of Odor Levels by Dynamic Dilution Olfactometry

Odor concentration is defined as the dilution of an odor sample with odor-free air, at which only a specified percent of an odor panel, typically 50%, will detect the odor. This point represents odor threshold and is expressed in terms of "dilutions-to-threshold" (D/T).

Odor concentration was determined by means of OS&E's forced choice dynamic dilution olfactometer. The members of the panel who have been screened for their olfactory sensitivity and their ability to match odor intensities, have participated in on-going olfactory research at OS&E for a number of years.

In olfactometry, known dilutions of the odor sample were prepared by mixing a stream of odor-free air with a stream of the odor sample. The odor-free air is generated in-situ by passing the air from a compressor pump through a bed of activated charcoal and a potassium permanganate medium for purification. A portion of the odor free air is diverted into two sniff ports for direct presentation to a panelist who compares them with the diluted odor sample.

Another portion of the odor-free air is mixed in a known ratio with the odor from the sample bag and is then introduced into the third sniff port. A panelist is thus presented with three identical sniff ports, two of which provide a stream of odor-free air and the third one a known dilution of the odor sample. Unaware of which is which, the panelist is asked to identify the sniff port which is different from the other two, i.e., which contains the odor. The flow rate at all three nose cups is maintained at 3 liters per minute.

The analysis starts at high odor dilutions. Odor concentration in each subsequent evaluation is increased by a factor of 2. Initially a panelist is unlikely to correctly identify the sniff port which contains an odor. As the concentration increases, the likelihood of error is reduced and at one point the response at every subsequently higher concentration becomes consistently correct. The lowest odor concentration at which this consistency is first noticed, represents the **detection odor threshold** for that panelist.

As the odor concentration is increased further in the subsequent steps, the panelist becomes aware of the odor character, i.e. becomes able to differentiate the analyzed odor from other odors. The lowest odor concentration at which odor differentiation first becomes possible, represent the **recognition odor threshold** for the panelist. Essentially all of OS&E's work is done with recognition odor threshold. By definition the threshold odor is equal to 1 D/T (i.e. the volume of odorous air after dilution divided by the volume before dilution equals one).

The panelists typically arrive at threshold values at different concentrations. To interpret the data statistically, the geometric mean of the individual panelist's thresholds is calculated.

The olfactometer and the odor presentation procedure meet the recommendations of ASTM Standard Practice for Determination of Odor and Taste Thresholds by a Forced-Choice Ascending Concentration Series of Limits (ASTM E679-04). The analysis was carried out in the OS&E Olfactory Laboratory in Bloomfield, Connecticut.

Odor Intensity

Odor intensity is determined using reference sample method with n-butanol as the reference compound (ASTM Method E-544-10). The n-butanol odor intensity scale is based on n-butanol vapor as odorant at eight concentrations. The concentration increases by a factor of two at each intensity step, starting with approximately 15 ppm at step 1.

Odors of widely different types can be compared on that scale just like the intensities of the lights of different colors can be compared to the intensity of standard, e.g. white light. Odor character and hedonic tone are ignored in that comparison. Odor intensities are routinely measured as part of the dynamic dilution olfactometry measurements. The n-butanol vapor samples are presented to the panelists in closed jars containing the standard solutions of n-butanol in distilled water. The vapor pressure above the butanol solutions corresponds to the steps on the n-butanol scale. To observe the odor intensity, a panelist opens the jar and sniffs the air above the liquid. The panelist then closes the jar so that the equilibrium vapor pressure of butanol can be re-established before the next panelist uses the jar. The odor in the jar is compared with unknown odor present at the olfactometer sniff port.

The relationship between odor concentration and intensity can be expressed as a psychophysical power function also known as Steven's law (Dose-Response Function). The function is of the form:

$$I = aC^b$$

where:

I = odor intensity on the butanol scale
C = the odor level in dilution-to-threshold ratio (D/T)
a,b = constants specific for each odor

The major significance of the dose-response function in odor control work is that it determines the rate at which odor intensity decreases as the odor concentration is reduced (either by atmospheric dispersion or by an odor control device).

Odor emissions are used as input to an odor dispersion model, which predicts odor impacts downwind under a variety of meteorological conditions. Whether or not an odor is judged objectionable depends primarily in its intensity. The dose-response constants are used to convert predicted ambient odor concentration to intensity levels. OS&E experience has shown that odors are almost universally considered objectionable when their intensity is 3 or higher on the 8-point n-butanol scale. In general, the lower the intensity, the lower the probability of complaints.

Odor Character Description

Odor character refers to our ability to recognize the similarity of odors. It allows us to distinguish odors of different substances on the basis of experience. We use three types of descriptors, general such as “sweet”, “pungent”, “acrid”, etc. or specific references to its source such as “orange”, “skunk”, “paint”, “sewage”, etc., or to a specific chemical, e.g. “methyl mercaptan”, “butyric acid”, or “cyclohexane”. In the course of the dynamic dilution olfactometry measurements, the odor panelists are asked to describe the character of the odors they detect.

Appendix C

Field Data Record Forms and COC

SCS Engineers
Field Sampling Form

DOWN-2

~~DOWN 500~~

Date:	9/18	Sample Location:	~~500 DOWN~~
		Latitude:	34° 37.157 N
		Longitude	120° 13.435W

Method:	SUMMA	Can. ID:	832	Sample ID:	~~DOWN~~ DOWN-2
Start Time:	1302			Stop Time:	1302
Start Po:	-30			Stop Pf:	-5

Method:	Odor	Bag. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: PID: 0.1 ppm (essentially BG)
wind: slight winds towards ESE

SCS Engineers
Field Sampling Form

Date:	9/18	Sample Location:	Down-1
		Latitude:	34° 37.169
		Longitude	120° 13.498

Method:	SUMMA	Can. ID:	849	Sample ID:	Down-1
Start Time:	1310			Stop Time:	
Start Po:	-30			Stop Pf:	-2

Method:	Odor	Bag. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: PID 0.1 ppm

winds: signif. from W

@ S1 (from odor sampling 9/12)

SCS Engineers
Field Sampling Form

Date:	9/18	Sample Location:	GH-2
		Latitude:	34° 37.177
		Longitude	120° 13.550

Method:	SUMMA	Can. ID:	846	Sample ID:	GH-2
Start Time:	1322			Stop Time:	
Start Po:	-30			Stop Pf:	0

Method:	Odor	Bag. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: PID @ plant: 0.2 ppm // sticking in bud: 0.6 ppm
@ walking in aisle: 0.1 ppm
winds: to E

grapehead plants
location @ odor GH2

SCS Engineers
Field Sampling Form

Date:	9/18	Sample Location:	GH-1
		Latitude:	34° 37.179
		Longitude	120° 13.540

Method:	SUMMA	Can. ID:	044	Sample ID:	GH-1
Start Time:	1330			Stop Time:	
Start Po:	-30			Stop Pf:	-1

Method:	Odor	Bag. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: PID: hit 56 ppm before sampling
during sampling ~6.6 ppm - 28 ppm
winds: to E
lemony plants

SCS Engineers
Field Sampling Form

Date:	9/18	Sample Location:	GH3
		Latitude:	34° 37.181
		Longitude	120° 13.593

Method:	SUMMA	Can. ID:	828	Sample ID:	GH-3
Start Time:	1349			Stop Time:	
Start Po:	-30			Stop Pf:	-2

Method:	Odor	Bag. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: PID - 0.5 ppm ~~ambie~~ walking
0.9 ppm sampling
wind: ESE

plant: hells bells

SCS Engineers
Field Sampling Form

Date:	9/18	Sample Location:	UP
		Latitude:	34° 37.231
		Longitude	120° 13.672

Method:	SUMMA	Can. ID:	835	Sample ID:	UP
Start Time:	1358			Stop Time:	
Start Po:	-30			Stop Pf:	0

Method:	Odor	Bag. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: PID @ BG 0.3
in GRASS: 0.6 ppm
wind: Slight to SE

@ odor UP location

ATMOSPHERIC ANALYSIS & CONSULTING, INC.
1534 Eastman Avenue, Suite A
Ventura, California 93003
Phone (805) 650-1642 Fax (805) 650-1644
E-mail: info@aaclab.com

AAC Project No. ____________

Page ____ of ____

CHAIN OF CUSTODY/ ANALYSIS REQUEST FORM

Client Name: SCS Engineers
Project Name: Busy Bee
Project Mgr (Print Name): Paul Schafer
Project Number: 24219262.01
Sampler's Name (Print Name): Eva Luu
Sampler's Signature:

Send report: pschafer@scsengineers.com
Attn: Paul Schafer
Phone#: 619.823.5333
Fax#
Send invoice to:
Attn: ____________
P.O. # ____________

Turnaround Time
24-Hr ____ 48-Hr ____
5 Day ____ Normal X
Other (Specify) ____________

Special Instructions/remarks:

AAC Sample No.	Date Sampled	Time Sampled	Sample Type	Client Sample ID/Description	Type/No. of Containers	EPA TO-15 scan VOCs + TICs					
	9/18	1302	air	Down-2 (can # 832)	air / 1	X					
	↓	1310	↓	Down-1 (can # 849)	air / 1	X					
	↓	1322	↓	GH-2 (can # 846)	air / 1	X					
	↓	1330	↓	~~GH-2~~ GH-1 (can # 844)	air / 1	X					
	↓	1349	↓	GH-3 (can # 828)	air / 1	X					
	↓	1358	↓	UP (can # 835)	air / 1	X					

Analysis Requested

Relinquished by (Signature):	Print Name: Eva Luu	Date/Time 9/18 / 1536	Received by (signature):	Print Name
Relinquished by (Signature):	Print Name:	Date/Time	Received by (signature):	Print Name

SCS Engineers
Field Sampling Form

Date:	9/30	Sample Location:	Upwind
		Latitude:	34° 37.333
		Longitude	120° 13.846

Method:	SUMMA	Can. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Po:				Stop Pf:	

Method:	Odor	Bag. ID:	/	Sample ID:	up
Start Time:	1423			Stop Time:	
Start Flow				Stop Flow	10 Lpm
				% Filled	

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: Winds strong from SW

SCS Engineers
Field Sampling Form

Date:	9/30	Sample Location:	Source
		Latitude:	34°37.182 N
		Longitude	120° 13.574 W

Method:	SUMMA	Can. ID:		~~Sample ID:~~	
Start Time:				Stop Time:	
Start Pd:				Stop Pf:	

Method:	Odor	Bag. ID:	/	Sample ID:	Source
Start Time:	1336			Stop Time:	1337
Start Flow	10LPM			Stop Flow	10LPM
				% Filled	60

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments:

SCS Engineers
Field Sampling Form

Date: 9/30

Sample Location: Res1 · crosswind
Latitude: 34° 37.450
Longitude 120° 13.526

Method: SUMMA
Can. ID:
Start Time:
Start Po:

Sample ID:
Stop Time:
Stop Pf:

Method: Odor
Bag. ID:
Start Time: 1412
Start Flow

Sample ID: R1-XW
Stop Time:
Stop Flow 1LPM
% Filled 60

Method: Odor
Bag ID.
Start Time:
Start Flow

Sample ID:
Stop Time:
Stop Flow
% Filled

Method:
Bag ID.
Start Time:
Start Flow

Sample ID:
Stop Time:
Stop Flow
% Filled

Comments:

SCS Engineers
Field Sampling Form

Date: 9/30

Sample Location: Residence 2 : Down Wind
Latitude: 34°37.424
Longitude 120° 13.232

Method: SUMMA
Start Time:
Start Po:
Can. ID:
Sample ID:
Stop Time:
Stop Pf:

Method: Odor
Start Time: 1402
Start Flow
Bag. ID:
Sample ID: R2-DW
Stop Time:
Stop Flow 10LPM
% Filled 60

Method: Odor
Start Time:
Start Flow
Bag ID.
Sample ID:
Stop Time:
Stop Flow
% Filled

Method:
Start Time:
Start Flow
Bag ID.
Sample ID:
Stop Time:
Stop Flow
% Filled

Comments:

SCS Engineers
Field Sampling Form

Date:	9/30	Sample Location:	Residential 3
		Latitude:	34 37 217
		Longitude	120 13 148

Method:	SUMMA	Can. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Po:				Stop Pf:	

Method:	Odor	Bag. ID:		Sample ID:	~~R3~~ R3-DW
Start Time:	1540			Stop Time:	
Start Flow				Stop Flow	10 LPM
				% Filled	60

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: Strong ✓

SCS Engineers
Field Sampling Form

Date: 9/30

Sample Location: Veterinary Clinic
Latitude: 34°37.323
Longitude 120° 13.018

Method: SUMMA
Can. ID:
Start Time:
Start Po:
Sample ID:
Stop Time:
Stop Pf:

Method: Odor
Bag. ID:
Start Time: 1437
Start Flow
Sample ID: Vet-DW
Stop Time:
Stop Flow
% Filled

Method: Odor
Bag ID.
Start Time:
Start Flow
Sample ID:
Stop Time:
Stop Flow
% Filled

Method:
Bag ID.
Start Time:
Start Flow
Sample ID:
Stop Time:
Stop Flow
% Filled

Comments: Still / Slight winds from W

SCS Engineers
Field Sampling Form

Date: 9/30

Sample Location: Brick Red Barn Tasting Room
Latitude: 34 37.398
Longitude 120 12.700

Method: SUMMA
Start Time:
Start Po:
Can. ID:

Sample ID:
Stop Time:
Stop Pf:

Method: Odor
Start Time: ~~12~~ 1512
Start Flow
Bag. ID:

Sample ID: TR-DW
Stop Time:
Stop Flow
% Filled 60

Method: Odor
Start Time:
Start Flow
Bag ID.

Sample ID:
Stop Time:
Stop Flow
% Filled

Method:
Start Time:
Start Flow
Bag ID.

Sample ID:
Stop Time:
Stop Flow
% Filled

Comments: Slight from W

SCS Engineers
Field Sampling Form

Date:	9/30	Sample Location:	Residential Area
		Latitude:	34 37.064
		Longitude	120 12.610

Method:	SUMMA	Can. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Po:				Stop Pf:	

Method:	Odor	Bag. ID:	/	Sample ID:	Res – DW
Start Time:	1453			Stop Time:	
Start Flow				Stop Flow	10LPM
				% Filled	60

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments:

SCS Engineers
Field Sampling Form

Date: 9/30

Sample Location: Elementary School
Latitude: 34°37.257
Longitude 120 12.490

Method:	SUMMA	Can. ID:		Sample ID:	
Start Time:				Stop Time:	
Start Po:				Stop Pf:	

Method:	Odor	Bag. ID:		Sample ID:	EL - DW
Start Time:	1502			Stop Time:	
Start Flow				Stop Flow	10 lpm
				% Filled	80

Method:	Odor	Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Method:		Bag ID.		Sample ID:	
Start Time:				Stop Time:	
Start Flow				Stop Flow	
				% Filled	

Comments: Strong winds from West