



**ADVANCED DATA ANALYSIS FOR THE
CENTRAL CALIFORNIA OZONE STUDY (CCOS)**

TASK 2

**Comparisons of Proportions of Species Derived from
Ambient and Emission Inventory Data**

TASK 3

**Volatile Organic Compound Source Apportionment
Using Chemical Mass Balance Receptor Modeling**

Final Report

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1. INTRODUCTION

A consortium of investigators within the University of California System and the Desert Research Institute performed initial analyses of the CCOS measurements to validate key features of the database that will be used to drive air quality simulations. These analyses included evaluation of mobile source emissions using remote sensing data, comparisons of the proportions of species derived from ambient and emission inventory data, VOC source apportionment using Chemical Mass Balance (CMB) receptor modeling, evaluation of photolysis parameters, and statistical analysis of species that may be used to infer VOC or NO_x limitation with respect to formation of ozone. Additional analyses include: comparison of rates of ozone change obtained from data analysis to predictions of photochemical air quality models, use of Principal Component Analysis to study underlying mechanisms of ozone days and formulate explanations for observed trends and patterns, and exploration of statistical analysis methods for evaluating and ranking observation based methods according to their ability to capture ozone mechanisms. This report summarizes the results of DRI's analysis of ambient ratios and application of the CMB receptor model to the CCOS ambient speciated VOC data. DRI's evaluation of photolysis parameters were reported separately (Stockwell et al., 2003).

1.1 Background

The Central California Ozone Study (CCOS) was conducted in summer 2000 to acquire a comprehensive database to support the development, evaluation, and application of an air quality simulation model for northern and central California. The CCOS field measurement program was conducted during a four-month period from 06/01/00 to 10/02/00. During this study period, a network of upper-air and surface meteorological and air quality monitoring stations supplemented the existing routine monitoring network. Additional measurements were made during meteorological scenarios that were conducive to high ambient ozone concentrations. These periods of intensive measurements were known as intensive operational periods, or IOPs. IOP measurements were made on 07/23 - 07/24 (IOP #1), 07/30 - 08/02 (IOP #2), 08/14 (IOP #3), 09/14 (IOP #4), and 09/17 - 09/21 (IOP #5). In addition, additional boundary condition flights were made during 09/30 - 10/2. Summary of Field Operations - CCOS Volume III (Fujita et al., 2001), documents the meteorological and air quality conditions during the summer 2000 ozone season and during individual IOPs, describes the daily forecasting and making-decision protocols for launching IOPs, and documents the parameters that were measured, locations, measurement methods, times, and levels of data capture

The emission inventory is a key component of any air pollution control program. It includes types of emission sources, quantities of emissions, the temporal and spatial characteristics of emissions, and the process and emission control devices that are used at sources. Uncertainties in the estimation of emissions have historically been one of the major limitations to producing reliable air quality model results. Model sensitivity studies conducted in the early 1990s showed greatly improved model performance (i.e., closer agreement between observed and predicted ozone levels) when the "official" on-road motor vehicle VOC emissions were increased by substantial margins (Wagner and Wheeler, 1993; Chico et al., 1993; Harley et al., 1993). These results were also supported by contemporary on-road tunnel measurements, apportionments of ambient volatile organic compounds (VOC) and reconciliation of ambient and

emission inventory data, which all indicated that on-road VOC and CO emissions have been historically underestimated relative to emissions of nitrogen oxides (NO_x) (e.g., Ingalls, 1989; Pierson et al., 1990; Fujita et al., 1992). Modifications that were incorporated over the past decade into successive versions of the mobile source emission factor models, MOBILE (developed by the U.S. Environmental Protection Agency) and EMFAC (developed by the California Air Resources Board), have substantially increased all emissions (for a common base year). During the same time, ambient CO, VOC, and ratios of VOC to nitrogen oxides (NO_x) have declined significantly. While advances have been made in emission inventory methodology and will continue to be made in the future, the evidence that emission inventories in urban areas were underestimated in past inventories underscores the need for on-going verification of emission inventories.

The methods that have been applied in evaluating mobile source emission inventories fall into two general approaches: “top-down” and bottom up”. The “top-down” approach evaluates the emissions inventory by reconciling ambient air quality and other data to corresponding estimates derived from emission inventory estimates. These approaches include: 1) spatial and temporal comparisons of ambient and emission inventory pollutant ratios (e.g., CO/NO_x and NMOC/NO_x) (Fujita et al., 1992; Fujita et al., 1994; Korc et al., 1993; Korc et al., 1995; Haste et al., 1999; Stoeckenius and Jimenez, 2000); 2) speciation profiles for volatile organic compounds (Fujita et al., 2003); 3) comparisons of long-term trends in ambient pollutant concentrations and concentration ratios with corresponding emission inventory trends (Fujita et al., 2003); 4) source apportionment by receptor modeling (Mayrsohn and Crabtree, 1976; Mayrsohn et al., 1977; Harley 1992; Lewis et al., 1993; Scheff and Wadden, 1993; Fujita et al., 1994; Lin and Milford, 1994; Kenski et al., 1995; Fujita et al., 1995b; Chung et al., 1996; Scheff et al., 1996; Fujita et al. 1997a; Fujita et al., 1997c; Fujita, 2001; Seila et al., 2001; Fujita et al., 1999b; Fujita and Campbell, 2003b; Fujita et al. 2002; Fujita et al., 2003a); and 5) fuel-based emissions inventory (Singer and Harley, 1996; Harley et al., 1997; Singer and Harley, 2000; Pokharel et al., 2002). The top-down evaluations can be used to independently assess the uncertainties associated with the motor vehicle and total emission inventories and to identify potential areas for improvement. These analyses also aid in evaluating the performance of air quality modeling that are used by state and local air pollution agencies to develop State Implementation Plans (SIP) and demonstrate future attainment of air quality standards. These evaluations can serve as the basis for developing alternate emission inventories to evaluate the sensitivity of modeling results to emission inventory uncertainties.

The “bottom-up” approach evaluates specific emissions or activity factors and associated correction factors that are used in mobile source emission models. These approaches include tunnel measurements (Ingalls et al., 1989; Gertler et al., 1997), remote sensing (Stedman, 1989; Bishop et al., 1989; Bishop and Stedman, 1989; Bishop and Stedman, 1990; Stephens and Cadle, 1991; Stedman and Bishop, 1990; Stedman et al., 1991; Lawson et al., 1990; Lawson et al., 1996), and evaluations of Inspection and Maintenance and random roadside testing programs (Lawson 1993; Lawson 1994). These evaluation approaches do not involve ambient monitoring data and are not the subject of this document. Although a fuel-based emission inventory is considered a top-down approach, this method as commonly applied involves remote sensing data and will not be covered here. The bottom up evaluations of the mobile source inventory should not be confused with bottom-up development of the mobile source emission models. The later involves regular laboratory testing of in-use vehicles to derive basic emission rates by model

year and technology group and additional tests to develop various correction factors (e.g., temperature, speed, I&M benefit, deterioration etc.) that are applied to the basic emission factors. Bottom up evaluations are independent checks of the accuracy and representativeness of the various emission and correction factors that are used to drive the mobile emissions models.

This report describes the results of initial reconciliation of CCOS ambient measurements with emissions inventories of carbon monoxide (CO), volatile organic compounds (VOC) and nitrogen oxides (NO_x). The methods used in this evaluation include comparison of ambient and emission inventory pollutant ratios and application of the CMB receptor model to the CCOS ambient speciated VOC data. They are used to ascertain whether the total regional inventories of pollutant emissions are reasonable.

1.2 Methods and Approach

Receptor models infer contributions from different source types using multivariate measurements taken at one or more receptor locations. Source models estimate receptor concentrations from source emissions and meteorological measurements. Receptor models use ambient concentrations and the abundances of chemical components in source emissions to quantify source contributions. Source and receptor models are complementary and each has strengths and weaknesses that compensate for the other. Chemical Mass Balance (CMB) is well established for VOC apportionment was applied to the CCOS speciated VOC data to estimate source contributions at PAMS and CCOS supplemental monitoring sites (Section 3). The review by Watson et al. (2001) examines how the CMB receptor model has been applied to quantify ambient Volatile Organic Compound (VOC) source contributions to ambient concentrations of organic gases. It explains how CMB source contribution estimates have been used to evaluate and improve VOC emissions inventories used in ozone models. We also compare the source attributions from the CMB analysis to those derived from the multivariate method, Positive Matrix Factorization (PMF) (Section 4). Prior to the receptor analysis, various descriptive analyses of the CCOS VOC database were performed (Section 2). The examination of the spatial and temporal distribution of atmospheric constituent and relative abundance of certain chemical species is a useful prelude to receptor modeling. When coupled with a conceptual understanding of the emission sources, meteorology and chemical transformation mechanisms, this receptor oriented analysis provides qualitative and semi-quantitative evidence of relationships between source emissions and receptor mixing ratios.

Comparisons of the ambient pollutant ratios with corresponding ratios derived from emission inventory estimates have been widely used to determine consistency between emission inventory estimates and ambient measurements. VOC/NO_x ratios have been the main focus of past ambient versus inventory reconciliations because they affect the rate and efficiency of ozone formation. The consistency between ambient concentrations and emission inventory data are examined by comparing early morning (typically 0600-0900) ambient CO/NO_x and VOC/NO_x ratios to corresponding ratios derived from emission inventory data. An early morning sampling period is used because it corresponds to the peak in commuter traffic, generally stable atmospheric conditions and lower mixing depths, and the time when photochemical reactions are reduced. Ambient measurements during this period are more likely to reflect on-road motor vehicle emissions because of their higher contribution to total emissions during the morning commute period and more uniform spatial distribution. In contrast, stationary sources are too

widely dispersed to consistently affect the monitoring site with their emissions. Furthermore, emissions during the night and early morning from tall stacks (e.g., NO_x emissions from power plants) are emitted into the elevated stable layer and generally do not mix down until later in the morning after the elevated inversion has eroded.

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2. RECONCILIATION OF AMBIENT AND EMISSION INVENTORY POLLUTANT RATIOS

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This section summarized the ambient CO/NO_x and NMOC/NO_x ratios that were obtained during the summer 2000 Central California Ozone Study (CCOS) and provides an initial reconciliation of the ambient ratios with corresponding ratios derived from appropriate county-level emission inventory data. The technical basis, assumptions and limitations of this approach as a tool for evaluating the reasonableness of the emission inventory data is discussed.

2.1. Introduction and Background

Comparisons of the ambient pollutant ratios with corresponding ratios derived from emission inventory estimates have been widely used to determine consistency between emission inventory estimates and ambient measurements. The reconciliation of ambient and emission inventory pollutant ratios has been used in the Southern California Air Quality Study (Fujita et al., 1992), the San Joaquin Valley Air Quality Study (Fujita et al., 1994), the Lake Michigan Ozone Study (Korc et al., 1993), Coastal Oxidant Assessment for Southeast Texas (Korc et al., 1995), NARSTO-Northeast (Haste et al., 1998) and MARAMA (Stoeckenius and Jimenez, 2000). The previous ambient/inventory reconciliation studies that have been conducted in the United States during the past decade were summarized in CRC Project E-64 (Pollack et al., 2004) (Table 2-1). Comparison of the reconciliations of ambient and emission inventory NMHC/NO_x ratios for the 1987 Southern California Air Quality Study (Fujita et al. 1992) and the 1997 Southern California Ozone Study (Yarwood et al., 2003) show better agreement in recent years (Table 2-2). Most of these studies concluded that the inventory VOC/NO_x ratios were lower than the ambient ratios by factors ranging from 1.2 to 6. Studies that also examined CO/NO_x ratios concluded that the inventory CO/NO_x ratios were lower than the ambient ratios by a factor ranging from 1.5 to 2.7. Although the discrepancies in VOC/NO_x ratios can be due either to an underestimation in VOC emissions and/or overestimation of NO_x emissions in the inventory, results of tunnel measurements, receptor modeling and photochemical modeling sensitivity studies pointed to greater uncertainty with the VOC inventory and with the on-road mobile source VOC inventory in particular.

Although the reconciliation approaches do not evaluate the accuracy of the absolute magnitudes of emissions, they are useful in evaluating the ability of mobile emissions models to reproduce the observed composition of the mobile source pollutant mixture. In addition to reconciliation of the ambient and emission inventory pollutant ratios, the temporal and spatial patterns (diurnal, day-of-week, seasonal) in pollutant concentrations and ratios may be reconciled with corresponding patterns of emissions. This approach provides a direct comparison of the inventory estimates for an area around a given ambient monitoring site with data from that site. Comparisons with ambient data can be conducted at a wide variety of locations where suitable ambient data are available and thus provide a broad perspective on the overall accuracy

of the inventory estimates. The results of emissions versus ambient reconciliation should be interpreted in the context of long-term trends in emission inventory estimates and ambient air quality and other corroborating analyses such as tunnel and roadway measurements, receptor analysis, air quality modeling studies.

2.2. Methods

2.2.1. Technical Basis and Assumptions of Approach

The consistency between ambient concentrations and emission inventory data are examined by comparing early morning (typically 0600-0900) ambient CO/NO_x and VOC/NO_x ratios to corresponding ratios derived from emission inventory data. An early morning sampling period is used because it corresponds to the peak in commuter traffic, generally stable atmospheric conditions and lower mixing depths, and the time when photochemical reactions are reduced. Ambient measurements during this period are more likely to reflect on-road motor vehicle emissions because of their higher contribution to total emissions during the morning commute period and more uniform spatial distribution. In contrast, stationary sources are too widely dispersed to consistently affect the monitoring site with their emissions. Furthermore, emissions during the night and early morning from tall stacks (e.g., NO_x emissions from power plants) are emitted into the elevated stable layer and generally do not mix down until later in the morning after the elevated inversion has eroded.

In the context of evaluating mobile source emission estimates, it must be recognized that species ratios in the ambient data represent a mixture of source categories and are not limited to just on-road mobile sources. Thus, discrepancies between ambient and inventory ratios cannot be definitively tied to inaccuracies in the MOBILE or EMFAC portion of the inventory. Selecting monitoring sites in locations that are dominated by on-road mobile sources minimizes this ambiguity. The dominant influence of mobile sources may be confirmed by examining correlations of CO and VOC with NO_x during the 0600-0900 sampling period for multiple sites. Multiple sites are needed for this analysis because correlations between pollutants may be explained by the effect of meteorological condition on the dispersion and dilution of pollutant emissions. In the absence of significant carry over of emission from the prior day and distances between sampling sites that are greater than horizontal transport during the night and early morning, the pollutant ratios measured at the sampling sites are independent of the pollutant ratio at any other sampling site and therefore represent primarily local emissions. Similarity in the CO/NO_x and VOC/NO_x ratios among the sites would indicate that the CO, VOC and NO_x emissions at each of the sites are likely due to a single source type that is common to each site. Additionally, the ambient VOC speciation for this time period can be compared to the speciation of vehicle exhaust, preferably from local measurements made in a highway tunnel or along a high-traffic roadway (with background subtraction).

Since diesel emissions are characterized by significantly lower HC/NO_x and CO/NO_x ratios than are found in gasoline engine emissions, comparisons of mobile emissions with ambient data can be strongly influenced by the degree to which diesel emissions contributed to the ambient measurements. In a recent study in California's South Coast Air Basin, we examined the spatial gradients and temporal (both diurnal and day-of-the-week) variations in the mixing ratios and source attributions of VOC and NO_x along and near major highways and surface

streets, at urban air monitoring stations, and at regional background sites (Fujita et al. 2003). VOC/NO_x ratios were lower on freeways because NO mixing ratios were substantially higher on freeways than other areas due to greater proportion of diesel traffic. The large spikes in NO levels that were measured on freeways were accompanied by higher levels of black carbon and semi-volatile hydrocarbons. Although diesel exhaust is not the sole source of black carbon and semi-volatile hydrocarbons, it is the predominant source during hot, stabilized driving conditions on freeways. NO levels were 1-2 orders of magnitude higher on freeways than on surface streets or at the urban air monitoring stations and other regional background sites. In contrast CO and VOC levels were about a factor of 2-3 higher on freeways than at other sampling locations. NO levels were substantially lower at a freeway with prohibited truck traffic than at other freeways with a mixed fleet of gasoline- and diesel-powered vehicles. However, CO and VOC levels were comparable to other freeway samples with a mixed fleet of gasoline- and diesel-powered vehicles indicating that gasoline-powered vehicles are the main source of CO and VOC. VOC/NO_x ratios on freeways ranged from 0.5 to 2 depending upon the mix of gasoline and diesel traffic. The light-duty gasoline-powered vehicle fleet, as represented by the samples collected at a freeway with prohibited truck traffic, had an average VOC/NO_x ratio of about 3.5, which was similar to the VOC/NO_x ratios measured at regional background and local air monitoring stations. Contributions of HDD activity to emissions are substantially lower on weekends (especially Sunday) and care must be taken to insure that the inventory ratios that are used for comparison reflect these weekday variations in relative contributions.

2.2.2. Ambient Data

The ambient pollutant ratios are derived from data that are routinely collected by local air pollution monitoring networks and at CCOS supplemental monitoring sites. Speciated VOCs are measured in areas classified as serious, severe, or extreme for ozone nonattainment at photochemical assessment monitoring stations (PAMS). Each station measures ozone, oxides of nitrogen, surface meteorological data and speciated hydrocarbons. Additionally, each area must monitor upper air meteorology at one representative site and carbonyl compounds in the source area. The program was phased in over a five-year schedule, beginning in 1994. PAMS networks are based on selection of an array of site locations relative to ozone precursor source areas and predominant wind directions associated with high ozone events. Specific monitoring objectives are to characterize precursor emission sources within the area (Type 2), transport of ozone and its precursors into (Type 1) and out of the area (Type 3 and 4), and the photochemical processes related to ozone nonattainment, as well as developing an initial urban toxic pollutant database. A maximum of five PAMS sites are required in affected nonattainment areas, depending on the population of the Metropolitan Statistical Area/Consolidated Metropolitan Statistical Area (MSA/CMSA) or nonattainment area, whichever is larger.

Volatile Organic Compounds

The CCOS ambient speciated VOC data were obtained during intensive operational periods at existing Photochemical Assessment Monitoring Stations (PAMS) and supplemental CCOS monitoring sites. Most of the VOC data from CCOS supplemental monitoring sites were collected using methods consistent with the PAMS program. Automated gas chromatographs with mass spectrometry (GC/MS) were used at the three CCOS research sites (Sunol, Granite Bay and Parlier) in order to obtain greater temporal resolution.

PAMS monitoring is conducted annually in California during the peak ozone season (July, August and September). Eleven PAMS sites were in operation during summer 2000 (four in Sacramento County, four in Fresno County, and three in Kern County). Under the California Alternative Plan, four 3-hour samples (0000-0300, 0600-0900, 1300-1600, and 1700-2000, PDT) are collected every third day during the monitoring period at all PAMS sites for speciated hydrocarbons and at Type 2 sites only for carbonyl compounds. These sampling periods are the same as the CCOS supplemental VOC sampling periods. In addition to the regularly scheduled measurements, samples are collected on a forecast basis during up to five high-ozone episodes of at least two consecutive days. Episodic measurements consist of four samples per day (0600-0900, 0900-1200, 1300-1600, and 1700-2000, PDT) for speciated hydrocarbons at all PAMS sites and for carbonyl compounds at Type 2 sites. Because of the limited number canisters, a relaxation of the regularly scheduled PAMS sampling was necessary to accommodate multi-day IOPs of three or more consecutive days. Instead of the sampling schedule in the California Alternative Plan, the U.S. Environmental Protection Agency approved a request by the ARB to modify the normal PAMS sampling schedule in order to accommodate more episodic sampling in coordination with the CCOS IOPs. The implementation of PAMS by the local APCDs in central California during summer 2000 is outlined in Table 2-3. This sampling plan retained only the 6-9 a.m (PDT) sample, every third day, to preserve the analysis of long-term trend. Up to 24 canister samples were collected at PAMS sites in Central California during a maximum of three consecutive IOP days during any one-week period. Table 2-3 shows the allocation of the 24 samples among the eleven PAMS sites in the CCOS domain.

The CCOS field measurement program consisted of four categories of supplemental measurement sites with increasing levels of chemical speciation and time resolution – Type 0, 1, and 2 “supplemental” (S) sites and “research” (R) sites. S0 sites were intended to fill in key areas of the modeling domain where ozone and nitrogen oxides were not measured. S1 sites were intended to establish boundary and initial conditions for input into air quality models. These sites were located at the upwind boundaries of the modeling domain, in the urban center (initial conditions) and at downwind locations (boundary conditions). With the exception of NO_y measurements, S1 sites were equivalent to Photochemical Assessment Monitoring Stations (PAMS) sites. S2 sites were located at the interbasin transport and intrabasin gradient sites, and near the downwind edge of the urban center where ozone formation may either be VOC or NO_x limited depending upon time of day and pattern of pollutant transport. S2 sites also provide data for initial conditions and operation evaluations and some diagnostic evaluation of model outputs. Research sites (R) were intended to measure a representative urban mix of pollutants and had the same site requirements as S2 sites. Research sites were intended to provide the maximum extent of high-quality, time-resolved chemical and other aerometric data for rigorous diagnostic evaluation of air quality model simulations and emission inventory estimates. VOC speciation was obtained at research sites hourly rather than four 3-hour samples at S1 and S2 sites. Table 2-4 lists the CCOS supplemental VOC monitoring sites by type and the organizations that were responsible for sample collection and analysis.

Speciated hydrocarbons and carbonyl compounds are measured in the PAMS program by EPA methods TO-14 and TO-11, respectively (EPA, 1991). Table 2-5 contains the minimum list of targeted hydrocarbon species. For carbonyl compounds, state and local agencies are currently required to report only formaldehyde, acetaldehyde and acetone. Total nonmethane hydrocarbon (NMHC) concentrations are also measured by analysis of the canister samples by

preconcentration direct injection flame ionization detection (PDFID). NMHC concentrations were monitored continuously on an hourly basis at all Sacramento and San Joaquin Valley PAMS sites by either automated-Preconcentration Direct Injection Flame Ionization Detection (PDFID) (e.g., Xontech 850) or TEI 55C. Modifications of the TEI55C (Ventura option) provide improved limit of detection (from 150 ppbC to 75 ppbC).

VOC Measurements at CCOS Supplemental Type S1 and S2 sites were obtained using methods consistent with EPA Method TO-14 and TO-11. Stainless steel SUMMA™-polished canisters of 6-L capacity were employed for volatile hydrocarbon (C2-C12) collection. Prior to sampling, the canisters are to be cleaned by repeated evacuation and pressurization with humidified zero air, and certified as described in the EPA document "Technical Assistance Document for Sampling and Analysis of Ozone Precursors" (October 1991, EPA/600-8-91/215).

A continuous Gas Chromatograph/Mass Spectrometer (GC/MS) system was used at the three CCOS research sites for sample collection and analysis of VOC. This system consisted of an Entech real-time integrator with an Entech 7100 preconcentrator and a Varian 3800 gas chromatograph with a flame ionization detector (FID) and column switching valve interfaced to a Varian Saturn 2000 ion trap mass spectrometer. The samples were collected with 1-hour resolution during intensive operational periods (IOP) and 3-hour resolution during the remaining days of the two-month study period or non-intensive operational periods (non-IOP) (Zielinska, 2003). The continuous GC/MS systems were calibrated for 126 organic compounds including hydrocarbons from C2 to C12, oxygenated hydrocarbons, and halogenated compounds. C2 and C3 hydrocarbons were quantified using a FID detector and the remaining compounds were identified and quantified by MS (Ion Trap) detector

In order to properly reconcile ambient and emission inventory data, common definitions and units must be used for ambient concentrations, source profiles, and emissions rates. However, the quantification of total VOC and various subtotals are, as a practical matter, operational definitions that depend on the sensitivity and selectivity of the sampling and analytical methods that are employed. Furthermore, several terms are used inconsistently but interchangeably to describe different fractions of atmospheric organic material. The following terms are defined as they are used throughout this report:

- Volatile organic compounds (VOC): All gaseous organic compounds that are present in the ambient air could be considered VOCs irrespective of their photochemical reactivity or ability of measurement methods to quantify their concentrations. However, methane, ethane, acetone, and some others nonreactive species are excluded in EPA's formal definition of VOC. In practice, VOC is used interchangeably with reactive organic gases (ROG).
- Hydrocarbons: Organic compounds that consist only of carbon and hydrogen atoms. Subclasses of hydrocarbons include alkanes, alkenes, alkynes, and aromatic hydrocarbons. Paraffins and olefins are synonymous with alkanes and alkenes, respectively. All of the 55 target PAMS compounds are hydrocarbons. They typically comprise about 70 to 80 percent of total VOC in urban areas. This fraction is less in afternoon samples relative to morning samples and in downwind locations due to

photochemical reactions that convert hydrocarbons to oxidized species such as carbonyl compounds and organic acids.

- Nonmethane hydrocarbons (NMHC, also termed “light” hydrocarbons): C₂ through C₁₁ (light) hydrocarbons collected in stainless steel canisters and measured by gas chromatography with flame ionization detection (GC-FID) by EPA method TO-14A (U.S. EPA, 1999a). Known halocarbons and oxygenated compounds (e.g., aldehydes, ketones, ethers and alcohols) are excluded from NMHC.
- Carbonyls: Aldehydes and ketones, the most common being formaldehyde, acetaldehyde, and acetone. Carbonyls are operationally defined as C₁ through C₇ oxygenated compounds measured by collection on acidified 2,4-dinitrophenylhydrazine (DNPH)-impregnated C₁₈ or silica gel cartridges and analyzed by high performance liquid chromatography with UV detection (HPLC/UV) by EPA Method TO-11A (1999b). PAMS data normally include only formaldehyde and acetaldehyde.
- Non-methane organic compounds (NMOC): Sum of quantifiable peaks by EPA method TO-14A, including unidentified but excluding halocarbons, or by continuous instruments with flame ionization detection. Measured NMOC will be lower for laboratories employing water management. NMOC also refers to the sum of NMHC plus carbonyl compounds by TO-11A.
- Reactive organic gases (ROG): Organic gases with potential to react (<30 day half-life) with the hydroxyl radical and other chemicals, resulting in ozone and secondary organic aerosol. The most reactive chemicals are not necessarily the largest contributors to undesirable end-products, however, as this depends on the magnitude of their emissions as well as on their reactivity. ROG is commonly used in connection with emission inventory data.
- Total organic gases (TOG): Organic gases with and without high hydroxyl reactivity. TOG typically includes ROG plus methane and halocarbons. TOG is commonly used in connection with emission inventory data.

Oxides of Nitrogen

Nitric oxide (NO) and nitrogen dioxide (NO₂) are commonly measured in air monitoring programs by the chemiluminescence nitric oxide-ozone method. This method is based on the gas-phase chemical reaction of NO with ozone. In this method ambient air is mixed with a high concentration of ozone so that any NO in the air sample will react and thereby produce light. The light intensity is measured with a photomultiplier and converted into an electronic signal that is proportional to the NO concentration. To measure NO_x concentrations, the sum of NO and NO₂ (nitrogen dioxide), the air sample is first reduced to NO, either by a heated catalyst (molybdenum or gold in the presence of CO) or chemically using FeSO₄, adding to the NO already present in the sample, then into the reaction chamber for measurement as described above. The (NO₂) concentration is derived by subtracting the NO concentration measurement from the NO_x concentration measurements. Standard sensitivity instruments have detection limits of about 0.5 to 3 ppb (60 sec averaging times) and are suitable for air quality monitoring in urban and suburban areas. Thermo Environmental Instruments, Inc. (TEI) Model 42C and

Monitor Labs 8440 and 8840 are examples of this type of instrument. Trace level instruments, such as the TEI Model 42C-TL have detection limits of about 50 ppt (120 sec averaging times) and are better suited in rural and background sites, and onboard instrumented aircrafts.

The reduction of NO₂ to NO by the chemiluminescence nitric oxide-ozone method is not specific and a number of other nitrogen-containing species (e.g., HNO₃, PAN, N₂O₅, HONO, and NO₃) are reduced to NO, which interferes with the measurement of NO₂. Therefore the thermal catalytic method is used to measure NO, and then NO plus other nitrogen oxides as a group. If the group is not well defined, it is referred commonly as NO_x. Therefore, NO₂ and NO_x reported by chemiluminescence instruments must be considered upper limits. The magnitude of the interference depends on factors such as inlet and line losses and environmental factors that affect the formation and ambient levels of other oxidized nitrogenous species. HNO₃ is most prone to line losses and usually does not contribute to the interference. Placing the converter as close to the sample inlet as possible minimizes these losses. Chemiluminescence analyzers that are configured in this manner are commonly known as NO_y analyzers. The relative magnitude of the interference is relatively small in urban areas where NO sources are large, but can be substantial in downwind suburban areas and in rural areas. Because photochemical reactions of NO_x are reasonably rapid, the effect of atmospheric transformations is an important consideration in selecting times and locations that are appropriate for reconciling ambient measurements with emission estimates.

Carbon Monoxide

Ambient carbon monoxide (CO) is an excellent indicator of mobile source emissions, especially light-duty gasoline vehicles, and has historically tracked improvements in vehicle emission control systems. Because CO is a directly emitted pollutant, its measurement is usually limited to a few hot-spot areas within urban centers. CO is commonly measured at air monitoring stations by continuous nondispersive infrared analyzers. A variety of commercial CO instruments are certified by the U.S. Environmental Protection Agency as reference or equivalent methods (Method EQSA-0486-060). The instruments that are used for routine air monitoring have lower detection limits of about 0.4 ppm or better and zero stability to within 0.3 ppm. Data are commonly reported to ARS to the nearest ppm. However, with significant reductions in ambient levels of CO in most urban areas, more agencies are reporting CO to the nearest 100 ppb. The number of sites where CO is monitored has decreased over time as various areas come into compliance with the ambient CO standard.

2.2.3. Calculation of ratios from ambient data

Annually averaged values of CO, NO_x, TNMOC, and the ratios of CO/NO_x and TNMOC/NO_x for all sites within the CCOS domain that reported sufficient data between 1990 and 2000 were calculated. In addition, basin-wide averages were calculated for the Sacramento Valley (SV), San Joaquin Valley (SJV), and San Francisco Bay Area (SFBA) air basins. VOC data was only available from 1994 to 2000 for the SJV and the Sacramento-Del Paso site.

For the purposes of the reconciliation analysis, NMOC is the quantity used to calculate the ambient VOC/NO_x ratios. NMOC is defined here as the sum of quantifiable peaks by EPA

method TO-14A, including unidentified VOCs but excluding halocarbons, or by continuous instruments with flame ionization detection. It is the same NMOC parameter (#43102) used in the PAMS database. This parameter excludes formaldehyde and other carbonyl compounds measured by Method TO-11. The following specifics of how the procedures outlined in Section 5.2 were applied are noted here:

- In order to meet the criteria for high-traffic urban sites, only Type 2 PAMS sites were used in calculating average NMOC/NO_x ratios for comparison to the emissions inventory.
- The total NMOC as reported in the CARB speciated NMOC data tables is used in this analysis, except for the Sacramento sites in year 2000 when additional VOC data collected at the Del Paso and Airport Road sites by for the CCOS project was used to supplement the data set. The additional samples were analyzed by DRI and Biospheric Research Corp (BRC) using similar methods that have proven consistent in prior intercomparisons.
- Some outlier data points, where the reported NMOC was well in excess of all other data for a site and did correspond to unusually high NO_x or CO, were also excluded (this did not occur at any of the Type 2 sites studied).
- Hourly measurements where total NO_x was less than 20 ppb were excluded.
- In this analysis only data from the months July – September were included. Hourly CO and NO_x data from 6-10 PDT were used to calculate average concentrations to correspond to the 3 hour morning NMOC measurements made from 6-8 or, in some cases, 7-9 PDT.
- Separate weekday and weekend emission inventories were not available for this initial investigation. Only the summer weekday emissions are compared to observations.
- Where VOC data was unavailable or inadequate, the mean ratio of CO to NMOC was used to estimate the VOC/NO_x ratios from basin averaged CO measurements. For the SJV the average 5-7AM CO concentrations were found to be 2.2 ± 0.1 times the average NMOC concentration for the period 1995 to 2000. In the Sacramento Valley the ratio was 2.9 ± 0.4 . No CO or VOC data from the SFBA was available for the same period.
- Since the only site in the Sacramento Valley that reported NMOC data consistently from 1995 to 2000 was the Del Paso Blvd site, and this site exhibited poor data recovery for several of those years, the year 2000 Sacramento data was supplemented with VOC data collected at Del Paso and the Natoma/Airport Rd. sites during the CCOS field program. For earlier years, estimated basin wide values using CO data are also presented.

The resulting averages and ratios are shown in Table 2-6 and Figure 2-1. The VOC ratios appear to decline due to decreasing VOC concentrations at several sites, but all changes are comparable to the error of the means. NO_x concentrations are generally constant throughout. The VOC concentration and ratios estimated from CO/NMOC ratios appear to be consistent

with the measured values. Uncertainty for the estimated values is difficult to quantify, but should be <10% for the SJV and <20% for Sacramento.

2.2.4. Calculation of ratios from emission inventories

ROG and NO_x emissions inventory data (base year 2004) for the 3 air basins were retrieved from the CARB online Almanac at <http://www.arb.ca.gov/ei/emsmain/reportform.htm>. The “grown and controlled” sources and “all sources except natural” were selected when retrieving the data. The ambient ratios are compared to basinwide emissions for this initial reconciliation. More detailed comparisons can be made based on a spatially and temporally resolved modeling emissions inventory. The corresponding emission inventory ratios can be calculated for the grid cell containing the sampling site as well as a larger nine-cell area. In the later case, average ambient ratios can be computed by wind direction sector for comparison with emissions ratios for grids falling within the sector.

Total ROG and NO_x emissions were calculated by summing the on-road mobile source categories for each basin. To place the ambient and emission inventory data on a common basis, the inventory data are converted from a mass basis to a molar basis (46 g/mole for NO_x and 13.85 g/carbon atom for NMOC). The conversion for NMOC is based upon the carbon to hydrogen ratio of 1:1.85 which is assumed in the computation of hydrocarbon emissions from motor vehicle exhaust (CARB, 1978). The resulting averages and ratios for 5 year periods from 1990 to 2005 are shown in Table 2-7 and Figure 2-2 for the 3 major air basins in the CCOS domain. The emission inventories show continually decreasing emissions of ROG and NO_x and a consequent reduction in the ROG/NO_x ratio throughout the past decade. This is due to relatively larger reductions in ROG than NO_x. The largest decrease occurs in the San Joaquin Valley and the highest ratios are in the Sacramento Valley.

2.3. Results

Using the VOC/NO_x values in Table 2-6 for the years 1990, 1995, and 2000 we have calculated the ratio of the mean measured values to those derived from the emissions inventory. The observed VOC/NO_x ratios are up to twice as large as the EI values for on-road gasoline vehicles, and 2 to 4 times larger for all mobile sources. The values estimated from CO measurements for 1990 are similar in magnitude to the later years where VOC data was available. For both the San Joaquin Valley and Sacramento counties the underestimation of the EI appears to be decreasing with time.

In general, there are several reasons why ratios of NMHC/NO_x in the inventory may differ from ratios in the ambient data. NMOC emissions may be over (under) estimated in the inventory. Similarly, NO_x emissions may be under (over) estimated in the inventory. Other independent evaluation approaches such as tunnel measurements, fuel-based emission inventory and comparisons of ambient VOC and NO_x levels with air quality model predictions have all indicated in past studies that underprediction of VOC was more likely than an underestimation of NO_x emissions. Deterioration rates for automotive emission controls of VOC tend to increase at a greater rate than do NO_x emissions, which contribute to higher uncertainty in the VOC emissions for this source. Chassis dynamometer test, tunnel measurements and fuel-based inventories all indicated that NO_x emissions from heavy-duty diesel trucks were historically underestimated.

Emissions of NMOC or NO_x may not be properly allocated spatially across different sources or properly allocated temporally to different times of the day. This is more likely if the ambient ratios are compared to an inventory ratio of the total emissions for the region rather than a specific modeling grid cell containing the monitoring site. The lack of temporal resolution of the emission inventory could be addressed by including more ambient sites in order to better characterize the spatial variability in the ambient pollutant ratios. Significant perturbation from average daily emissions can also result in discrepancies between ambient and emission inventory pollutant ratios. This may be particularly important in the case of diesel truck activity, which can strongly influence NO_x levels and exhibits distinctive diurnal and day-of-week variations.

The definition of what range of NMOCs are included in the inventory definition of “NMOC” may not correspond well with the range of NMOCs captured by the ambient NMOC measurement. Previous studies have used mobile source speciation profiles to break down the VOC calculated by MOBILE into its individual component species and then include in the comparison only the range of species represented in the ambient data (typically the sum of the 55 PAMS target species or the NMOC reported from the GC/FID or GC/MS analysis). Since the objective of the proposed study is to validate the MOBILE 6 model and not necessarily the speciation profiles used to perform the validation, care must be taken to use the most appropriate speciation profiles and to estimate the potential uncertainties introduced into the analysis as a result of this extra step.

Ambient NMOC or NO_x concentrations may be lower than they would otherwise be due to chemical reactions between time of emissions and when material is observed at the monitoring site. The rate of reaction will in general be different for different chemical species, different pollutant mixtures, and different meteorological conditions. Air parcels sampled at the monitoring site may represent a different source mixture than is contained in the area-wide average emission inventory. This is particularly important for NO_x emissions from elevated sources such as power plant smoke stacks since the extent to which smoke stack plumes mix to the ground at the monitoring site is highly variable. Errors may occur in the ambient measurements due to concentrations below instrumentation detection limits, NMOC species misidentification, calibration errors, etc.

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Table 2-1. Summary of selected inventory reconciliation studies.

Study	Reference	Location	Date	Ambient Data	Inventory Data	Ratio of Ratios: (Ambient HC/NOx) / (Inventory HC/NOx)	Additional Results
TXAQS 2000	Stoeckenius et al. (2002)	Houston, TX	2000	PAMS, TXAQS (locations and wind directions with max on-road mobile source impacts)	Gridded, fully speciated, temporally allocated version of Houston SIP modeling inventory (MOBILE6)	HC/NOx: 2.4 to 3.7 CO/NOx: 0.7 – 1.7	Both HC/NOx and CO/NOx ratio of ratios higher at other (less mobile source dominated) locations and wind directions
MARAMA	Stoeckenius and Jimenez (2000)	Mid-Atlantic	1997	PAMS: McMillan Res., Washington DC; Essex, Baltimore MD	New gridded, speciated, MOBILE 5b based inventory (no excess NOx adjustment)	Washington: 1.2 to 1.6 Baltimore: 1.5 to 3.7	Relative abundance of aromatics slightly higher in inventory relative to ambient
CA-PAMS	Haste-Funk and Chinkin (1999)	Central and Southern California	1996	PAMS: Fresno, Sacramento	ARB county-level inventory for 1996	HC/NOx: 1.5 to 4.0 CO/NOx: 1.5 to 2	Ambient paraffins slightly higher than in inventory; olefins and aromatics lower
NARSTO-NE	Haste et al. (1998)	Northeastern U.S.	1995	PAMS and NARSTO-NE: Bronx, NY (New York City), Lake Clifton, MD (Baltimore, MD), Lynn, MA (near Boston).	OTAG 1990 grown to 1995 using 1995 OTAG modeling inventory (MOBILE 5)	1.5 to 3.5	Ambient NMHC composition similar to composite of mobile and area inventory composition
LADCO	LADCO, 1998	Lake Michigan, New York City, Washington, DC	1995	PAMS (Jardine-Chicago; IITRI-Gary, IN; UWM-North-Milwaukee; Northbrook, IL)	OTAG 1995 modeling inventory with local adjustments (MOBILE 5)	1 ± .25	
COAST	Korc et al. (1995)	Southeast TX	1993	PAMS-Houston (Clinton Dr., Galleria)	COAST inventory from TNRCC (MOBILE4.1)	2 to 6	
SCAQS	Fujita et al. (1992)	South Coast (Los Angeles)	1987	SCAQS	SCAQS (EMFAC7E)	CO/NOx: 1.1 to 2.7 NMOG/NOx: 1.8 to 3.2	

Table 2-2. Reconciliation of ambient and emission inventory derived NMHC/NOx ratios from the 1987 Southern California Air Quality Study and the 1997 Southern California Ozone Study.

Locations	SCAQ5 Summer 1987 ¹			SCOS97-NARSTO August 4-7 1997			1999-2000
	07-08 Observed NMHC/NOx	07-09 Inventory NMHC/NOx	07-10 Observed/ Predicted	PAMS 06-09 Observed NMHC/NOx	CAMx/MM5 ² 06-09 CB4/E2K1 NMHC/NOx	06-09 Observed/ Predicted	PAMS 06-09 Observed NMHC/NOx
Anaheim	8.2	4.7	1.7				
Azusa	7.5	5.3	1.4	4.6	4.0	1.2	4.4
Burbank	8.7	4.6	1.9				
Los Angeles	8.8	4.9	1.8	4.3	3.7	1.2	3.8
Claremont	8.0	5.2	1.5				
Hawthorne	8.9	3.4	2.6				
Long Beach	7.9	3.3	2.4				
Rubidoux	7.8	2.3	3.4				
Pico Rivera				2.9	4.1	0.7	3.7
Upland				3.9	3.0	1.3	4.0
Mean	8.2	4.2	2.1	3.9	3.7	1.1	4.0
Std Err	0.2	0.4	0.2	0.4	0.2	0.1	0.2
Mean ³				4.3	3.6	1.2	4.1
Std Err ³				0.2	0.3	0.0	0.2

1. Data from Fujita et al., 1992

2. Data from Yarwood et al., 2003

3. Excluding Pico Rivera

Table 2-3. PAMS sites in the CCOS area.

Site	Type of Site	Sampling Schedule for 2000 (CCOS)					
		HC ^a	Carb ^b	00	06	13	17
Sacramento							
Elk Grove-Bruceville	PAMS - 1	x		1	1	0	0
Sacramento-Airport Rd.	PAMS - 2	x	x	0	1	0	1
Sacramento-Del Paso	PAMS - 2A	x	x	1	1	0	1
Folsom-50 Natoma Street	PAMS - 3	x		0	1	0	1
Fresno							
Madera	PAMS - 3/1	x		0	0	0	0
Clovis Villa	PAMS - 2	x	x	1	1	0	1
Fresno-1st Street	PAMS - 2	x	x	1	1	0	1
Parlier	PAMS - 3	x		0	1	0	0
Bakersfield							
Bakersfield-Golden State	PAMS - 2	x	x	1	1	0	1
Arvin	PAMS - 3/1	x		1	1	0	1
Shafter	PAMS - 1	x		1	1	0	0
				7	10	0	7

Type 1 - Upwind background.

Type 2 - Maximum precursor emissions (typically located immediately downwind of the central business district).

Type 3 - Maximum ozone concentration.

Type 4 - Extreme downwind transported ozone area that may contribute to overwhelming transport in other areas.

a - Canisters collected every third day (one 3-hr sample beginning at 0600 PDT) plus CCOS IOPs as indicated.

b - DNPH cartridges collected every third day (one 3-hr sample beginning at 0600 PDT) plus CCOS IOPs as indicated.

Table 2-4. CCOS supplemental surface VOC monitoring sites and measurements

Site	Site	Operations and Sample Collection				Chemical Analysis		
		Canister ⁽¹⁾	DNPH ⁽¹⁾	Tenax ⁽¹⁾	Automated GC/MS ⁽²⁾	Canister	DNPH	Tenax
Sutter Buttes	S1	ARB	ARB			DRI	AtmAA	
White Cloud	S1	DRI	DRI			DRI	AtmAA	
Bruceville	PAMS, S1'	SMAQMD				ARB		
Granite Bay	R	DRI ⁽³⁾	DRI ⁽³⁾	DRI	DRI	DRI ⁽³⁾	AtmAA ⁽³⁾	DRI
Bodega Bay	S1	T&B	T&B			BRC	AtmAA	
Bethel Island	S2	BAAQMD	BAAQMD			DRI	AtmAA	
San Leandro	S1'	BAAQMD	BAAQMD			DRI	AtmAA	
San Jose 4th Street	S1'	BAAQMD	BAAQMD			BAAQMD ⁽⁴⁾	AtmAA ⁽⁴⁾	
Sunol	R	DRI ⁽³⁾	DRI ⁽³⁾	DRI	DRI	DRI ⁽³⁾	AtmAA ⁽³⁾	DRI
Patterson Pass	S2	UC Berkeley	UC Berkeley			DRI	AtmAA	
Pacheco Pass	S2	T&B	T&B			BRC	AtmAA	
Turlock	S1	T&B	T&B			BRC	AtmAA	
San Andreas	S1	ARB	ARB			BRC	AtmAA	
Trimmer	S2	ARB	ARB			DRI	AtmAA	
Parlier	R	DRI ⁽³⁾	DRI ⁽³⁾	DRI ⁽³⁾	DRI ⁽³⁾	DRI ⁽³⁾	AtmAA ⁽³⁾	DRI
Parlier	PAMS, R'	SJUAPCD				ARB		
Angiola	S1+	SJUAPCD	SJUAPCD			BRC	AtmAA	
Arvin	PAMS, S2'	ARB				ARB		
Piedras Blancas	S1	SLOAPCD	SLOAPCD			BRC	AtmAA	

(1) Four samples per day on 15 IOP days (0000-0300, 0600-0900, 1300-1600, 1700-2000, PDT).

(2) Daily auto-GC/MS from 7/2/00 to 9/2/00 (23 hourly on IOP days and seven 3-hr on non IOP days).

(3) Two samples per day on 4 IOP days (0600-0900, 1300-1600, PDT). Second IOP day of first four episodes

(4) Analyze samples collected during ozone episodes in the Bay Area.

Table 2-5. PAMS target species.

	Mnemonics ¹	Names	Formula	AIRS		Lifetime			Mnemonics ¹	Names	Formula	AIRS		Lifetime	
				Code	MW	hours	Code					MW	hours		
1	ETHENE	ethene	C2H4	43203	28.05	6.52		29	PEN23M	2,3-dimethylpentane	C7H16	43291	100.20	11.41	
2	ACETYL	acetylene	C2H2	43206	26.04	61.73		30	HEXA3M	3-methylhexane	C7H16	43249	100.20	7.80	
3	ETHANE	ethane	C2H6	43202	30.07	207.30		31	PA224M	2,2,4-trimethylpentane	C8H18	43250	114.23	15.10	
4	PROPE	Propene	C3H6	43205	42.08	2.11		32	N_HEPT	n-heptane	C7H16	43232	100.20	7.77	
5	N_PROP	n-propane	C3H8	43204	44.10	48.31		33	MECYHX	methylcyclohexane	C7H14	43261	98.19	5.34	
6	I_BUTA	isobutane	C4H10	43214	58.12	23.74		34	PA234M	2,3,4-trimethylpentane	C8H18	43252	114.23	7.94	
7	LBUT1E	1-butene	C4H8	43280	56.11	1.77		35	TOLUE	toluene	C7H8	43202	92.14	9.32	
8	N_BUTA	n-butane	C4H10	43212	58.12	21.87		36	HEP2ME	2-methylheptane	C8H18	43260	114.23	6.80	
9	T2BUTE	t-2-Butene	C4H8	43216	56.11	0.87		37	HEP3ME	3-methylheptane	C8H18	43253	114.23	6.49	
10	C2BUTE	c-2-butene	C4H8	43217	56.11	0.99		38	N_OCT	n-octane	C8H18	43233	114.22	6.40	
11	IPENTA	isopentane	C5H12	43221	72.15	14.25		39	ETBZ	ethylbenzene	C8H10	45203	106.16	7.82	
12	PENTE1	1-pentene	C5H10	43224	70.13	1.77		40	MP_XYL	mp-xylene	C8H10	45109	106.16	4.71	
13	N_PENT	n-pentane	C5H12	43220	72.15	14.10		41	STYR	styrene	C8H8	45220	104.14	0.96	
14	I_PREN	isoprene	C5H8	43243	68.11	0.55		42	O_XYL	o-xylene	C8H10	45204	106.17	4.06	
15	T2PENE	t-2-Pentene	C5H10	43226	70.13	0.83		43	N_NON	n-nonane	C9H20	43235	128.26	5.45	
16	C2PENE	c-2-pentene	C5H10	43227	70.13	0.85		44	IPRBZ	isopropylbenzene	C9H12	45210	120.20	8.55	
17	BU22DM	2,2-dimethylbutane	C6H14	43244	86.17	23.95		45	N_PRBZ	n-propylbenzene	C9H12	45209	120.20	9.26	
18	CPENTA	cyclopentane	C5H10	43242	70.13	10.77		46	M_ETOL	m-ethyltoluene	C9H12	45212	120.20	2.89	
19	BU23DM	2,3-dimethylbutane	C6H14	43284	86.17	8.96		47	P_ETOL	p-ethyltoluene	C9H12	45213	120.20	4.59	
20	PENA2M	2-methylpentane	C6H14	43285	86.17	9.92		48	BZ135M	1,3,5-trimethylbenzene	C9H12	45207	120.20	0.97	
21	PENA3M	3-methylpentane	C6H14	43230	86.17	9.75		49	O_ETOL	o-ethyltoluene	C9H12	45211	120.20	4.52	
22	P1E2ME	2-methyl-1-pentene	C6H12	43246	84.16	1.77		50	BZ124M	1,2,4-trimethylbenzene	C9H12	45208	120.20	1.71	
23	N_HEX	n-hexane	C6H14	43231	86.17	9.90		51	N_DEC	n-decane	C10H22	43238	142.29	4.79	
24	MCYPNA	Methylcyclopentane	C6H12	43262	84.16	6.31		52	BZ123M	1,2,3-trimethylbenzene	C9H12	45225	120.20	1.70	
25	PEN24M	2,4-dimethylpentane	C7H16	43247	100.20	10.89		53	DETBZ1	m-diethylbenzene	C10H14	45218	134.22	3.90	
26	BENZE	benzene	C6H6	45201	78.11	45.17		54	DETBZ2	p-diethylbenzene	C10H14	45219	134.22	3.90	
27	CYHEXA	cyclohexane	C6H12	43248	84.16	7.42		55	N_UNDE	n-undecane	C11H24	43954	156.30	4.20	
28	HEXA2M	2-methylhexane	C7H16	43263	98.19	8.18									

Table 2-6. Summer emissions inventory VOC and NOx compared to measured ambient pollutant concentrations in 4 counties. The ratio of ROG/NOx from the emissions inventory to TNMOC/NOx from ambient data is also shown. Ambient data are average of values for 5-7AM, June-September, 1990 to 2000. Values in *italics* are estimated using the 1995-2000 average CO/NMOC ratio where VOC measurements were not available. Uncertainties are the standard deviation of the daily values.

	ROG (tons/day)			NOx (tons/day)			ROG/NOx			EI/ambient ratio		
	1990	1995	2000	1990	1995	2000	1990	1995	2000	1990	1995	2000
SACRAMENTO												
on-road diesel	1.8	1.4	1.3	37.7	32.3	30.2	0.16	0.15	0.14	45.2	33.6	34.4
on-road gas	80.0	57.6	36.3	62.5	52.5	35.5	4.27	3.65	3.42	1.7	1.4	1.4
total on-road	81.8	59.0	37.6	100.2	84.8	65.7	2.72	2.32	1.91	2.6	2.2	2.5
total mobile	101.9	78.6	55.7	134.3	113.4	94.5	2.53	2.31	1.97	2.8	2.2	2.4
total mobile, stationary, and area	141.8	112.6	84.5	142.7	119.9	100.2	3.31	3.13	2.81	2.2	1.6	1.7
mean ambient 6-9am VOC/NOx	157.2	206 ± 17	178 ± 17	22.0	52 ± 17	50 ± 11	7.1	5.0 ± 0.9	4.8 ± 0.4			
FRESNO												
on-road diesel	1.8	1.4	1.2	30.3	27.5	24.5	0.20	0.17	0.16	45.8	37.1	30.6
on-road gas	48.7	39.5	26.7	35.3	32.8	25.1	4.60	4.01	3.54	2.0	1.6	1.4
total on-road	50.5	40.9	27.9	65.6	60.4	49.6	2.57	2.26	1.87	3.6	2.8	2.7
total mobile	67.0	57.4	43.4	112.8	100.8	86.8	1.98	1.90	1.67	4.6	3.4	3.0
total mobile, stationary, and area	125.5	110.2	91.9	167.5	146.5	115.1	2.50	2.51	2.66	3.6	2.6	1.9
mean ambient 6-9am VOC/NOx	346.3	317 ± 15	270 ± 17	38.0	51 ± 2	55 ± 3	9.1	6.4 ± 0.2	5.0 ± 0.1			
KERN												
on-road diesel	2.0	1.5	1.3	32.5	26.9	26.4	0.20	0.19	0.17		39.3	35.2
on-road gas	48.6	35.7	23.6	41.5	36.7	27.4	3.90	3.24	2.88		2.3	2.1
total on-road	50.6	37.2	25.0	74.0	63.6	53.8	2.28	1.95	1.55		3.7	3.9
total mobile	74.4	55.3	43.2	127.8	107.7	97.0	1.94	1.71	1.48		4.3	4.0
total mobile, stationary, and area	220.8	131.5	115.2	309.8	232.7	187.3	2.38	1.88	2.05		3.9	2.9
mean ambient 6-9am VOC/NOx		547 ± 43	365 ± 24		79 ± 6	64 ± 6		7.3 ± 0.4	6.0 ± 0.5			
ALAMEDA												
on-road diesel	2.1	1.6	1.5	46.6	37.4	37.6	0.15	0.14	0.14			25.7
on-road gas	83.7	60.1	40.4	68.2	54.8	39.3	4.09	3.65	3.42			1.0
total on-road	85.8	61.7	41.9	114.8	92.2	76.9	2.49	2.23	1.82			1.9
total mobile	109.7	83.9	61.3	153.2	127.8	112.0	2.39	2.19	1.83			1.9
total mobile, stationary, and area	163.6	129.6	102.6	166.9	139.4	121.8	3.27	3.10	2.81			1.2
mean ambient 6-9am VOC/NOx			115 ± 17			51 ± 13			3.5 ± 0.9			

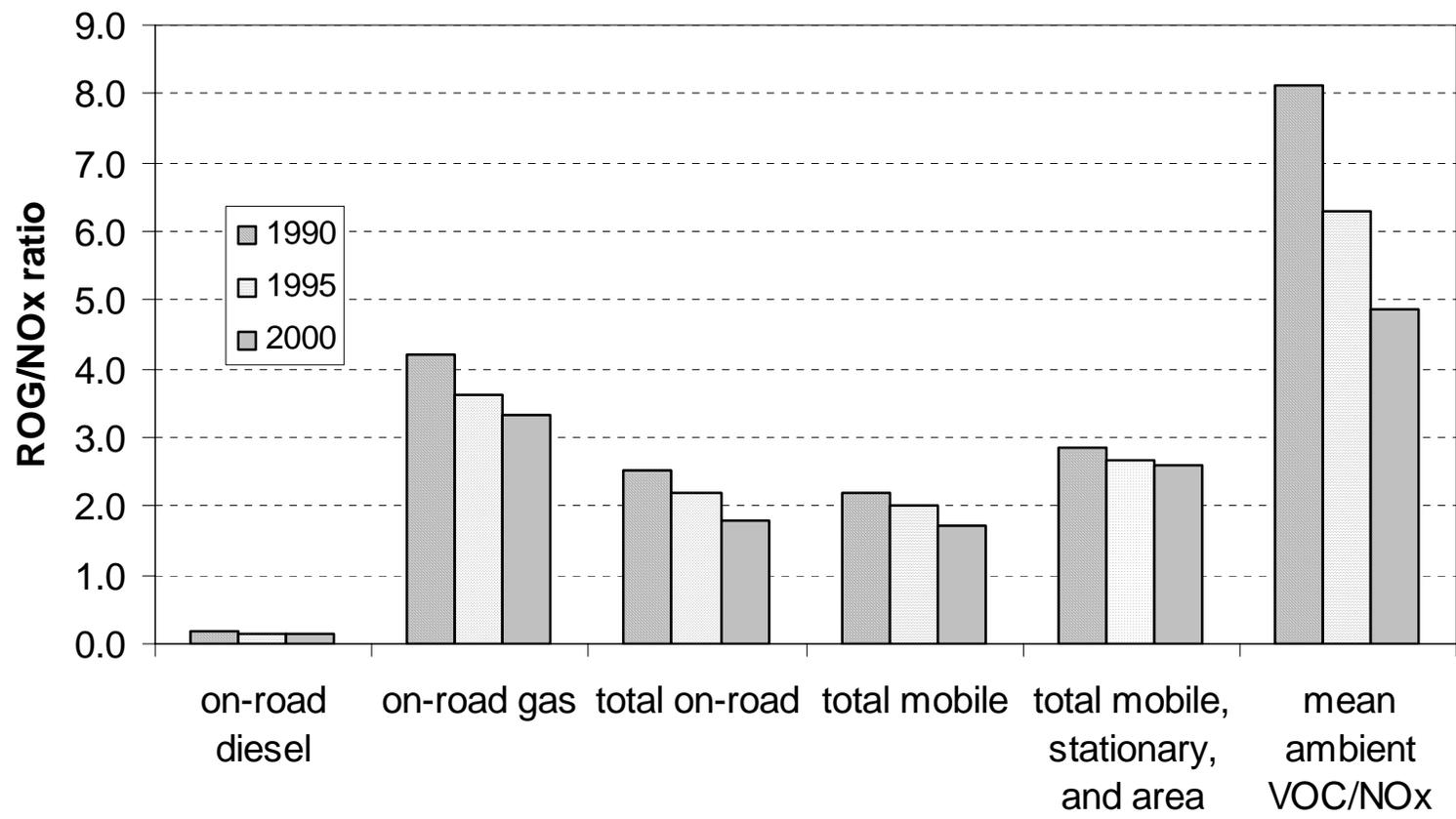


Figure 2-1. Average of 1990 to 2000 ROG/NOx ratios from summer mobile source emissions inventory data for 4 counties and mean ambient measurements at urban (type 2) sites.

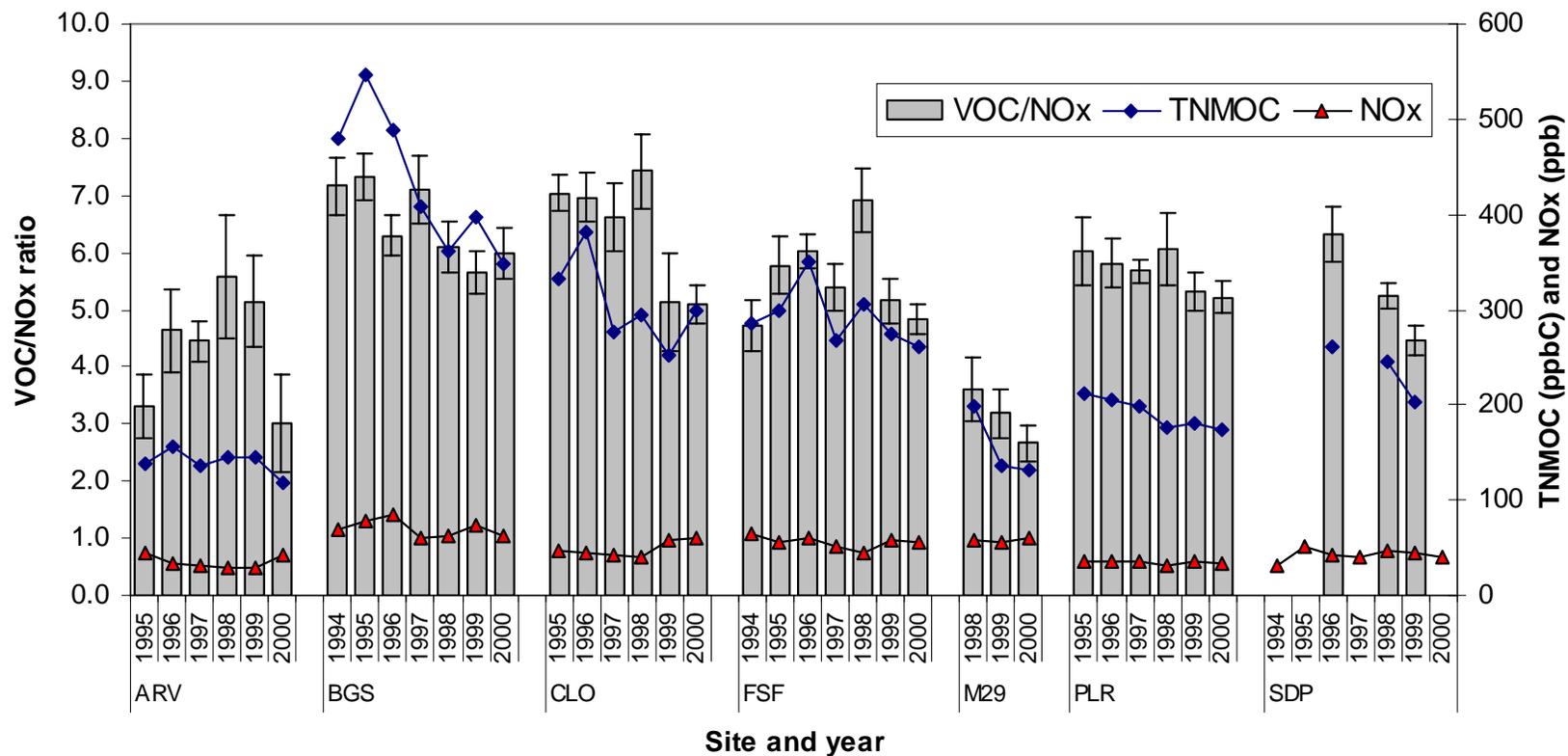


Figure 2-2. VOC/NO_x ratio by site and year for monitoring sites in the SJV and Sacramento air basins. Values are annual averages of the 6-9AM PDT measurements for the months of July-September. Error bars indicate the standard error of the mean ratio. Average VOC (TNMOC) and NO_x are also shown.

3 CENTRAL CALIFORNIA OZONE STUDY: SOURCE APPORTIONMENT OF AMBIENT VOLATILE ORGANIC COMPOUNDS BY CHEMICAL MASS BALANCE (CMB) RECEPTOR MODELING

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3.1 Introduction

The Central California Ozone Study (CCOS) was conducted in summer 2000 to acquire a comprehensive database to support the development, evaluation, and application of an air quality simulation model for northern and central California. Receptor modeling analysis was performed with the Chemical Mass Balance (CMB) model on speciated hydrocarbon data from the automated semi-continuous gas chromatograph equipped with a mass spectrometer (GC/MS) at the three CCOS research sites (Granite Bay, Parlier and Sunol), 12 supplemental CCOS VOC monitoring sites, and 11 Photochemical Assessment Monitoring Stations (PAMS) in the study area. This section presents the results of the application of the CMB receptor model to the CCOS ambient database for speciated volatile organic compounds.

In this study, CMB Version 8 was applied to 376 hydrocarbon samples for the research sites, 650 samples from other CCOS supplemental VOC sampling sites and PAMS sites covering the period from June 1, 2000 to September 21, 2000. In addition to the profiles that were used in previous source apportionment studies in central California and South Coast Air Basin (Fujita et al., 1995; Fujita et al., 1994), we also examined the applicability of more recent speciated hydrocarbon source profiles that were developed as part of the Gas/Diesel PM Split Study (Fujita et al., 2005), CRPAQS source characterization study (Fitz et al., 2003), and the weekend ozone study in Los Angeles (Fujita et al., 2003). A subset of the ambient speciated hydrocarbon data was used to evaluate the variations in the apportionments with application of alternative source composition profiles and to select the optimum sets of source profiles and fitting species. The CMB model was applied to all valid hourly GC/MS VOC data collected during CCOS Intensive Operational Periods (IOPs) and 3-hour integrated data during non-IOPs and VOC data from CCOS supplemental and PAMS monitoring sites.

3.2 Experimental Methods

The CCOS field measurement program was conducted during a four-month period from 06/01/00 to 10/02/00. During this study period, a network of meteorological and air quality monitoring stations supplemented the existing routine monitoring network. Additional measurements were made during meteorological scenarios that were conducive to high ambient ozone concentrations. These periods of intensive measurements were known as intensive operational periods, or IOPs. IOP measurements were made on 07/23 - 07/24 (IOP #1), 07/30 - 08/02 (IOP #2), 08/14 (IOP #3), 09/14 (IOP #4), and 09/17 - 09/21 (IOP #5). Summary of Field Operations - CCOS Volume III (Fujita et al., 2001), documents the meteorological and air quality conditions during the summer 2000 ozone season and during individual IOPs, describes

the daily forecasting and making-decision protocols for launching IOPs, and documents the parameters that were measured, locations, measurement methods, times, and levels of data capture. The non intensive operational period (non IOP) measurements were made on 07/02 – 07/03, 07/13 – 07/19, 07/25 – 07/29, 08/03 – 08/04, 08/07 – 08/08, 08/11 – 08/13, 08/31, 09/01, 09/09 -09/10 and 09/22.

3.2.1 Collection and analysis of CCOS ambient samples for speciated volatile organic compounds

The CCOS ambient speciated VOC data were obtained during intensive operational periods at existing Photochemical Assessment Monitoring Stations (PAMS) and supplemental CCOS monitoring sites. PAMS monitoring is conducted annually in California during the peak ozone season (July, August and September). Eleven PAMS sites were in operation during summer 2000 (four in Sacramento County, four in Fresno County, and three in Kern County). Because of the limited number of canisters, a relaxation of the regularly scheduled PAMS sampling was necessary to accommodate multi-day IOPs of three or more consecutive days. The U.S. Environmental Protection Agency approved a request by the ARB to modify the normal PAMS sampling schedule in order to accommodate more episodic sampling in coordination with the CCOS IOPs. The implementation of PAMS by the local APCDs in central California during summer 2000 is outlined in Table 3.2-1. This sampling plan retained only the 6-9 a.m (PDT) sample, every third day, to preserve the analysis of long-term trend. Up to 24 canister samples were collected at PAMS sites in Central California during a maximum of three consecutive IOP days during any one-week period. Table 3.2-1 shows the allocation of the 24 samples among the eleven PAMS sites in the CCOS domain. Type 2 PAMS sites measure maximum precursor emissions and are located downwind of the central business district and Type 3 sites represent areas of maximum ozone levels. Type 1 and 4 sites are located at upwind background and downwind transport areas, respectively.

The CCOS field measurement program consisted of four categories of supplemental measurement sites with increasing levels of chemical speciation and time resolution – Type 0, 1, and 2 “supplemental” (S) sites and “research” (R) sites. S0 sites were intended to fill in key areas of the modeling domain where ozone and nitrogen oxides were not measured. S1 sites were intended to establish boundary and initial conditions for input into air quality models. These sites were located at the upwind boundaries of the modeling domain, in the urban center (initial conditions) and at downwind locations (boundary conditions). With the exception of NOy measurements, S1 sites were equivalent to PAMS sites. S2 sites were located at the interbasin transport and intrabasin gradient sites, and near the downwind edge of the urban center where ozone formation may either be VOC or NOx limited depending upon time of day and pattern of pollutant transport. S2 sites also provide data for initial conditions and operation evaluations and some diagnostic evaluation of model outputs. Research sites (R) were intended to measure a representative urban mix of pollutants and had the same site requirements as S2 sites. Research sites were intended to provide the maximum extent of high-quality, time-resolved chemical and other aerometric data for rigorous diagnostic evaluation of air quality model simulations and emission inventory estimates. VOC speciation was obtained at research sites hourly rather than four 3-hour samples at S1 and S2 sites. Table 3.2-2 lists the CCOS supplemental VOC monitoring sites by type and the organizations that were responsible for sample collection and analysis.

Most of the VOC data from CCOS supplemental monitoring sites were collected using methods consistent with the PAMS program (Zielinska et al., 2003a). Speciated hydrocarbons and carbonyl compounds are measured in the PAMS program by EPA methods TO-14 (EPA, 1999a) and TO-11, respectively (EPA, 1999b). Table 3.2-3 contains the list of targeted hydrocarbon species and their rate lifetimes for reaction with hydroxyl radical. For carbonyl compounds, state and local agencies are currently required to report only formaldehyde, acetaldehyde and acetone. Automated gas chromatographs with mass spectrometry (GC/MS) were used at the three CCOS research sites (Sunol, Granite Bay and Parlier) in order to obtain greater temporal resolution (Zielinska et al., 2003b).

The GC/MS data were originally submitted on 6/12/02. Problems revealed during initial evaluations of this dataset were traced to variations in calibrations due to instability of the standard mixture in the transfer standard as well as potential biases that may have been caused by the operational protocol of the instrument (Fujita et al., 2005). Examination of the calibration data confirmed that calibration shifts did occur and that corrections to the originally submitted data base were necessary. The corrections were performed by multiplying the measured values by the ratios of the reference calibration mixture concentrations versus the observed mixture concentrations in the transfer standard. This approach was used to derive species-specific correction factors for each sample. Based on the observed concentration of the calibration checks, the measured values were subsequently corrected and the data were resubmitted on 2/4/03. Scatter plots for the three sites showed the correlations between the canister and GC/MS data improved after the correction process. Box plots for all three sites showed that the distribution between the canister data and the GC/MS data improved after correction (Fujita et al., 2005).

3.2.2 Source Apportionment Method and Procedures

The Chemical Mass Balance (CMB) receptor model consists of a least-squares solution to a set of linear equations that expresses each receptor concentration of a chemical species as a linear sum of products of source profile species and source contributions. The source profile species (the fractional amount of each species in the VOC emissions from a given source type) and the receptor concentrations, each with uncertainty estimates, serve as input data to the CMB model. The output consists of the contributions of each source type to both total and individual ambient VOC concentrations. The model calculates values for contributions from each source and the uncertainties of those values. Input data uncertainties are used both to weight the relative importance of the input data to the model solution and to estimate uncertainties of the source contributions. The review by Watson et al. (2001) examines how the Chemical Mass Balance (CMB) receptor model has been applied to quantify ambient VOC source contributions to ambient concentrations of organic gases. It explains how CMB source contribution estimates have been used to evaluate and improve VOC emissions inventories used in ozone models. CMB software applies the effective variance solution (Watson et al., 1984), which gives greater influence in the solution to chemical species that are measured more precisely in both source and receptor samples, and calculates uncertainties for source contributions from both the source and receptor uncertainties. The software also incorporates collinearity measures (Henry, 1982, 1992) to assess the effects of source profile similarity on source contribution estimates and their standard errors.

Source contribution estimates (SCE) are the main output of the CMB model. The sum of these concentrations approximates the total mass concentrations. Negative SCE are not physically meaningful, but can occur when a source profile is collinear with another profile or when the source contribution is close to zero. Collinearity is usually identified in the similarity/uncertainty cluster display. When the SCE is less than its standard error, the source contribution is undetectable. Two or three times the standard error may be taken as the upper limit of the SCE in this case. There is about a 66% probability that the true source contribution is within one standard error and about a 95% probability that the true concentration is within two standard errors of the SCE. The reduced chi square (χ^2), R^2 , and percent mass are goodness of fit measures for the least-squares calculation. The χ^2 is the weighted sum of squares of the differences between calculated and measured fitting species concentrations. The weighting is inversely proportional to the squares of the precision in the source profiles and ambient data for each species. Ideally, there would be no difference between calculated and measured species concentrations and χ^2 would be zero. A value of less than one indicates a very good fit to the data, while values between 1 and 2 are acceptable. χ^2 values greater than 4 indicate that one or more of the fitting species concentrations are not well-explained by the source contribution estimates. R^2 is determined by the linear regression of the measured versus model-calculated values for the fitting species. R^2 ranges from 0 to 1. The closer the value is to 1.0, the better the SCEs explain the measured concentrations. When R^2 is less than 0.8, the SCEs do not explain the observations very well with the given source profiles. Percent mass is the percent ratio of the sum of model-calculated SCEs to the measured mass concentration. This ratio should equal 100%, though values ranging from 80 to 120% are acceptable.

A prerequisite for using receptor models is that the relative proportions of chemical species change little between source and receptor. Most ambient NMHCs are oxidized in the lowest 2 km of the troposphere with tropospheric lifetimes ranging from hours to several months. For the CMB calculations, only species with lifetimes in the atmosphere greater than that of toluene (~9 hours during the summer) were used as fitting species for morning samples from urban source areas (e.g, PAMS Type 2). An exception to this is isoprene. It is included as a fitting species despite its high reactivity because it serves as a marker for biogenic emissions. The predicted source contribution for this source is an upper estimated of the true contribution. Among the PAMS target species, 36 hydrocarbons satisfy the reactivity criteria defined above and are candidates for use as fitting species (shown in Table 3.2-3). The table shows more restricted lists that were used for afternoon samples from PAMS Type 2 sites and for all samples in upwind or downwind locations. The more reactive species are included in the CMB analysis as “floating species”. They do not affect the CMB fit but their relative abundances are predicted from the CMB solution of the less reactive species. Consequently, the predicted values exceed the measured values and the magnitude of this difference increases with increasing reactivity of the species. While the use of a more restrictive list of relatively nonreactive fitting species might result in a reasonably good fit, as indicated by the R^2 and χ^2 values, the ability of CMB to resolve the contributions of gasoline exhaust, liquid gasoline and diesel exhaust is often degraded.

The choice of which set of fitting species to use for the CCOS VOC samples was not obvious since so many of the CCOS VOC sampling sites were located in far downwind and interbasin transport locations. In such locations, the extent of photochemical aging of the VOC

samples does not correspond to the typical diurnal pattern found at urban sites. Rather than time of sampling collection, we used the ratios of the sum of xylenes to benzene as an indicator of the photochemical age of each VOC sample. The samples were divided into three groups based upon the following two criteria: 1) xylene/benzene ratios greater than 1.5 and 2) benzene concentrations greater than $0.5 \mu\text{g}/\text{m}^3$. Samples in batch 1 met both criteria and the full fitting species list was used in the CMB. Samples in batch 2 met the the second but not the first criteria. The fitting species list for urban photochemically aged samples (i.e., Type 2, afternoon) was used in the CMB. Samples in group 3 failed both criteria and fitting species list for background samples was used for these samples.

3.2.3 Source Composition Profiles

In urban locations, motor vehicle exhaust and evaporative emissions of gasoline are the major sources of hydrocarbon emissions. Composites of dynamometer measurements of vehicles of varying age and mileage are commonly used to represent fleet-averaged exhaust profiles. For these profiles to represent the actual fleet-average exhaust near ambient monitoring sites the fuels in the dynamometer tests should resemble the fuels used in the study region and the mix of test vehicles should reflect the relative influence of non-catalyst vehicles or high emitters and catalyst-equipped normal emitters. This section describes the compilation, derivation, and evaluation of the source composition profiles that were considered and applied in the CMB analysis. Table 3.2-4 lists the mnemonic of the profiles that were considered in this study with short descriptions.

The source composition profiles are expressed as weight percentages and are normalized to the sum of the 55 Photochemical Assessment Monitoring Station (PAMS) target NMHC compounds. We use this sum because there is better consistency among laboratories for this quantity than for total NMHC. The PAMS species typically account for 70%–80% of the total ambient hydrocarbons at most urban locations. Compounds other than the identified 55 PAMS species are retained in the database individually and as a subtotal named “OTHER.” Compounds reported as “unknown” are grouped into a category named “UNID.” The source profile data reported in units of ppbC or ppbv are converted to $\mu\text{g}/\text{m}^3$ before the weight percentages are calculated using species-specific conversion factors. One-sigma uncertainties were derived from variations among multiple measurements for a particular source type or a nominal analytical uncertainty of 15%. The assigned uncertainties are the larger of the two values.

The CMB applications and validation protocol was adapted by Fujita and Campbell (2003) for application to PAMS and similar VOC data through a grant from the United States Environmental Protection Agency’s Science to Achieve Results (STAR) program. The guidance includes a library of available source VOC composition profiles that were newly developed for studies conducted by DRI, references from the literature, and from the California Air Resources Boards Modeling Emissions Data System (MEDS). More recent composition profiles from the Weekend Ozone Study (Fujita et al., 2003), the DOE Gasoline/Diesel PM Split Study and CRC E55/E59 Speciation Study. Vehicle testing for the Gasoline/Diesel PM Split Study consisted of 59 light-duty vehicles (including 2 diesel vehicles) and 34 heavy-duty diesel vehicles. VOC speciation was added to the light-duty passenger vehicle testing as part of the CRPAQS source characterization project (Fitz, 2003). The composite gasoline exhaust profiles that we derived from this testing program include the vehicle tests listed in Table 3.2-5. Emissions from meat

cooking and wood combustion were also characterized by DRI as part of the CRPAQS source characterization project. Meat cooking included: Smoked chicken (CHKNsmoke), charcoal charbroiled chicken (CHKNchar01), propane/lava rock charbroiled chicken (CHKNpr01), charcoal charbroiled hamburger (CARhamb01), stir fry (STIRfry01) and smoked chicken (CHKNsmoke). Diesel exhaust profiles were developed from the CRC E55/E59 speciation study. The source profiles were obtained for a 1985 International Diesel Tractor Truck, 1994 Freightliner Diesel Tractor Truck and 1995 Freightliner Diesel Tractor Truck using a Heavy Heavy-Duty Diesel Truck (HHDDT) schedule (consisting of four modes, namely: Transient, Cruise, long Idle (1800 seconds duration) and long Creep.

Alternative source composition profiles were applied in the CMB model to a subset of ambient samples to test the sensitivity of the source contribution estimates and model performance to alternative profiles and to address uncertainties in model output. The primary focus of these sensitivity runs to evaluate the most recent source composition profiles from the Weekend Ozone Study (Fujita et al., 2003), the DOE Gasoline/Diesel PM Split Study and CRC E55/E59 Speciation Study. Table 3.2-4 lists a description of the source profiles compiled for the CCOS source apportionment. The following list identifies the specific profiles that were used in the default set of source composition profiles. The actual profiles are listed in Table 3.2-6. Table 3.2-7 lists the composition profiles that were evaluated prior to selecting the following default profiles.

Gasoline Exhaust. Light-duty vehicle exhaust (average on-road profile from the Pasadena Freeway with background subtraction. (WEOzLDV1)..

Diesel Exhaust. Heavy-duty diesel exhaust from the Ft. McHenry Tunnel (Tu_MchHD); "corrected" profile from the Lincoln Tunnel (Exh_Lin1) (Sagebiel et al., 1996). The data for the Fort McHenry tunnels were analyzed to extract the light duty and heavy duty components. For the Fort McHenry tunnels the roadway grade was uphill (+3.3%) and downhill (-1.8%), the emission factors for CO was 55.5/47.4 g/L, NMHC was 4.88/5.03 g/L and 7.77/5.55 g/L for NOx.

Gasoline Liquid. Composite liquid consist of two grades (regular and premium) for five brands (ARCO, Union 76, Shell, Chevron and Mobil) 68 % regular and 32% premium from the weekend ozone study in Los Angeles 2000(WE003 Gas00LRPC);

Gasoline Vapor. Composite gasoline headspace vapor 68% Reg/32% Prem from the weekend ozone study in Los Angeles 2000 (WE006 Gas00VRPC);

Commercial Natural Gas. (CNG, PAM015) from Los Angeles, Mayrsohn et al 1976;

Liquified Petroleum Gas. (LPG, PAM018) Liquefied Petroleum Gas from Los Angeles, Mayrsohn et al 1976.

Consumers Products. (CA1799, CP_comp1) draft consumers product: combined small categories EPA composite.

Surface Coatings. Surface coatings (PAM012, COATcomp) composite of coatings 2-11, weighted by total U.S. sales. Surface coating profiles for solvent based industrial maintenance

coatings, solvent based medium gloss/high gloss. Solvent based primers and sealers, quick dry primers and enamels and thinning solvent. With abundance of styrene and n-decane.

Isoprene. isoprene emissions is used as a single component biogenic profile.

A series of alternative vehicle exhaust profiles were compiled from the gas/diesel PM split study: WARM01C, COLD01C, WEOzLDV1, WARM01E, COLD01E, COWAloem (Table 3.2-7). The alternative vehicle exhaust profiles were applied to morning and afternoon VOC samples from San Leandro, an urban location in the San Francisco Bay Area. Figure 3.2-1 shows the effect of alternative gasoline powered vehicle exhaust profiles on the average source contributions for a set of combined ambient samples from San Leandro. Each of the ambient samples was apportioned with six alternative gasoline vehicle exhaust profiles (WEOzLDV1, COLD01E, COLDhiem, COLD01C, WARM01C and WARMhiem). The variations in average source contributions are shown in Figure 3.2-1 for each of the six gasoline exhaust profile. These sensitivity analyses show that WEOzLDV1 gave the best fit among the alternative gasoline vehicle exhaust profile and Gas00VRP and Gas00LRP fit best for gasoline vapor and liquid gasoline, respectively.

It is interesting to note that all of the other profiles except WEOzLDV1 yield contributions for liquid gasoline. Previous studies showed that source attributions between tailpipe and evaporative emissions from receptor modeling can vary greatly depending on the particular profile chosen for tailpipe emissions (Harley et al., 1992, Fujita et al., 1994, Pierson et al., 1999). This is because tailpipe emissions are a mixture of hydrocarbons produced during combustion along with unburned gasoline resulting from incomplete combustion. In the CMB calculation, liquid gasoline represents the additional unburned gasoline (due to misfiring and other engine malfunctions) that is not included in the exhaust profile, plus evaporative emissions from gasoline spillage, hot soaks, and some portion of resting losses (leaks, permeation). The profile for gasoline headspace vapor is taken to represent fuel tank vapor losses (e.g., migration of fuel vapor from the canister). WEOzLDV1 was derived from samples collected on the portion of State Highway 110 (Pasadena Freeway), which prohibits heavy-duty trucks. Therefore, the background subtracted profile represents vehicle exhaust from predominantly light-duty gasoline vehicles. Additionally, unlike dynamometer exhaust profiles, this on-road profile includes running evaporative losses

3.3 Results

3.3.1 Spatial Variations in Average Source Contributions

This section presents the source apportionment results for the three CCOS research sites with DRI automated GC/MS, other CCOS supplemental and PAMS VOC monitoring sites in the study area. The three CCOS research sites, Granite Bay, Parlier and Sunol, were located downwind of Sacramento, Fresno and the San Francisco Bay Area, respectively. CCOS S1 supplemental monitoring sites were located at the upwind boundaries of the modeling domain, in the urban center (initial conditions) and at downwind locations (boundary conditions). The upwind background sites included a coastal site north of San Francisco at Bodega Bay and Piedras Blancas, which is located along the south central coast north of Morro Bay. Sutter Buttes

and Turlock provide characterization of ambient air transported into the upper Sacramento Valley and into the northern San Joaquin Valley, respectively, as a function of the nature of the flow bifurcation downwind of the San Francisco Bay Area. Measurements were also made in the foothill communities near Grass Valley at White Cloud and at San Andreas. Type S1 measurements were made at the CRPAQS Anchor site at Angiola and at two urban locations in the Bay Area at the existing San Jose and San Leandro monitoring sites. CCOS S2 sites were located along the three main passes connecting the Bay Area and the Central Valley (Bethel Island, Patterson Pass, and Pacheco Pass). S2 measurements are also made downwind of Fresno at the Mouth of the Kings River near Trimmer and downwind of Bakersfield at Arvin. The PAMS sites are listed in Table 3.2-1 along with their site characteristics. The VOC samples from most of the CCOS supplemental sites are expected to be highly aged because of their location. This necessitated use of a more limited set of unreactive fitting species for the CMB calculations that limited the extent to which sources could be apportioned.

The average source contribution estimates are presented for the three CCOS research sites, Granite Bay, Parlier, and Sunol for hourly averages for IOP days in Tables 3.3-1a, 3.3-1b and 3.3-1c, respectively, and for averages of the three-hour samples during non-IOP days in Table 3.3-2. The uncertainties in absolute source contributions (in $\mu\text{g}/\text{m}^3$) are root mean squares of the individual one-sigma error propagations from CMB. The relative contributions (in percent) are normalized to sum of contributions including non-negative, unexplained contributions and their uncertainties are one standard deviations of the individual contributions. Model performance was fair to poor with R^2 values generally in the range between 0.8 and 0.9 for all three sites and most χ^2 values between 1.0 and 3.0 for Granite Bay, 2.0 to 6.0 for Parlier and 2.0 to 4.0 for Sunol. The fraction of ambient PAM species apportioned to sources generally ranged from 90 to 100 percent. Gasoline exhaust was apportioned without colinearity for 60, 85 and 78 percent of the samples at Granite Bay, Parlier and Sunol, respectively. Similarly, coatings were apportioned for most samples. Liquid gasoline was not apportioned or was found to be collinear with gasoline exhaust for about two-thirds of the samples at Granite Bay and Parlier and about 85 percent of the samples at Sunol. Diesel exhaust was apportioned for only 7, 39 and 21 percent of the samples at Granite Bay, Parlier and Sunol, respectively. The poor fit for diesel exhaust is primarily due to removal of the higher molecular alkanes from the fit.

Gasoline vehicles are the dominant source during the morning commute period (0600-0900), comprising 68.5%, 63.5% and 68.7.6% of the PAMS compounds at Granite Bay, Parlier and Sunol, respectively. The contributions of biogenic emissions are negligible at Parlier, but were substantial at Sunol and Granite Bay with average contribution during daylight hours (0800-2000) of 12.8% and 18.3%, respectively, and peak contributions at Granite Bay during the afternoon ranging from 20 to 30%. Because isoprene is reactive, biogenic contributions are lower limit estimates and the actual contributions are higher. LPG and CNG accounted for most of the remaining contributions, with Parlier showing the largest average combined LPG and CNG contribution of 21.7%. This combined category represents a combination of gas leaks, petroleum operations and/or aged emissions with enrichment of propane and ethane, which are stable photochemically. Contributions of solvent emissions due to surface coatings or use of consumer products are minor with contributions of 6.5%, 4.4% and 7.2% at Granite Bay, Parlier and Sunol, respectively.

The three-hour average source contribution estimates are presented for the CCOS supplemental and PAMS VOC sampling sites in Table 3.3-3. Results are shown for the two coastal background sites in Tables 3.3-3a, for the downwind sites in Table 3.3-b, for transport locations in Table 3.3-3c, and for urban sites in Table 3.3-3d. Bodega Bay had VOC levels that are characteristic of a background site with total sum of PAMS species less than $10 \mu\text{g}/\text{m}^3$, while Piedras Blancas was apparently influenced by some local source of VOC with relatively high concentrations of propane. The transport locations (e.g., Patterson Pass, Pacheco Pass, Bethel Island, Angiola, and Sutter Buttes), all gave total predicted source contributions exceeding measured total PAMS species concentrations. This is characteristic of downwind locations because the CMB source apportionment is based upon use of relatively nonreactive species, which results in overprediction of reactive species. These sites also have higher contributions of CNG and LPG. In addition to gas leaks, these sources could also represent aged emissions that are enriched in nonreactive hydrocarbons such as ethane and propane. Motor vehicle exhaust and evaporative emissions generally account for about 60-80 percent of the the total sum of PAMS species in urban locations such as San Leandro, Sacramento Airport Rd and Del Paso, Madera and Fresno Clovis. The relative apportionments of gasoline and diesel exhaust have higher uncertainty for afternoon samples because fewer fitting species are used in the CMB calculation. The more reactive species that are removed from the fit include higher molecular weight hydrocarbons (e.g., n-nonane, n-decane and n-undecane) that are needed to properly apportion diesel from gasoline exhaust. While the contributions of solvent emissions are measurable, they are generally minor. Contributions of biogenic were highly variable with Sutter Buttes and Pacheco Pass showing high contributions, while the other transport sites show negligible to minor contributions.

3.3.2 Diurnal and Day of the Week Variations in Source Contribution Estimates

A major advantage of automated gas chromatographs is that it can be operated continuously thereby providing time resolution that would be impractical to obtain with canister-based sampling. The CMB calculations made for hourly auto-GC data greatly enhances the understanding of the temporal variability in source contributions. While motor vehicle exhaust contributions generally peak during morning and afternoon commute periods on weekday, the average contributions are significantly lower during weekend mornings. These patterns provide confidence in the proper apportionment of vehicle emissions. The diurnal variations observed at Granite Bay for the absolute and fractional contributions show that biogenic emissions are major contributors to total VOC, especially considering that the lifetime of isoprene is about 35 minutes.

3.3.3 Wind Directional Dependence of Source Contributions

Figures 3.3-1a,b,c show the average source contributions in $\mu\text{g}/\text{m}^3$ of total PAMS target compounds by wind sector (centered on N, NE, E, SE, S, SW, W, NW) and time of the day (00-06, 06-12, 12-18, and 18-24, PDT) for the research sites Granite Bay, Parlier and Sunol, respectively. At Granite Bay during the 18-24 PDT period when the highest concentrations of NMHC occurs, motor vehicle exhaust and evaporative emissions contributions are predominantly from the west and southwest in the direction of Sacramento. Most of the source contributions at Parlier for motor vehicle exhaust are from the northeast and southeast wind

quadrants during the time period 00-06 PDT and northwest during the time period 12-18 PDT. Gasoline vapor has a wind dependence similar to liquid petroleum gas, which suggest that these two sources are likely from a common origin. Contributions of gasoline vehicle exhaust at Sunol are predominantly from southwest (San Jose) during the time period 17-24 PDT. The dominant source of hydrocarbon at the three research sites is gasoline-powered vehicles. This source contribution is fairly uniform from all directions. All other source contributions are small in comparison and also show no particular wind dependence. Biogenic emissions are greatest during the afternoon and relatively uniform from all direction.

3.4 Conclusions and Summary

The VOC samples from most of the CCOS supplemental sites were highly aged because of their location. This necessitated use of a more limited set of unreactive fitting species for the CMB calculations that limited the extent to which sources could be apportioned. Model performance was fair to poor and substantial collinearity occurred between gasoline exhaust and evaporative emissions and diesel exhaust. The poor fit for diesel exhaust is primarily due to the necessity to remove higher molecular alkanes from the fit. Gasoline exhaust is the dominant source during the morning commute period (0600-0900), comprising 60 to 80 percent of the PAMS compounds at urban and near-urban downwind locations. The contributions of biogenic emissions are negligible at Parlier, but were substantial at Sunol and Granite Bay with average contribution during daylight hours (0800-2000) of 12.8% and 18.3%, respectively, and peak contributions at Granite Bay during the afternoon ranging from 20 to 30% of total PAMS compounds. Because isoprene is reactive, biogenic contributions are lower limit estimates and the actual contributions are higher. LPG and CNG accounted for most of the remaining contributions, with Parlier showing the largest average combined LPG and CNG contribution of 21.7%. This combined category represents a combination of gas leaks, petroleum operations and/or aged emissions with enrichment of propane and ethane, which are stable photochemically. Contributions of solvent emissions due to surface coatings or use of consumer products are minor with contributions of 6.5%, 4.4% and 7.2% at Granite Bay, Parlier and Sunol, respectively.

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Table 3.2-1. PAMS sites in the CCOS area.

Site	Type of Site	Sampling Schedule for 2000 (CCOS)					
		HC ^a	Carb ^b	00	06	13	17
Sacramento							
Elk Grove-Bruceville	PAMS - 1	x		1	1	0	0
Sacramento-Airport Rd.	PAMS - 2	x	x	0	1	0	1
Sacramento-Del Paso	PAMS - 2A	x	x	1	1	0	1
Folsom-50 Natoma Street	PAMS - 3	x		0	1	0	1
Fresno							
Madera	PAMS - 3/1	x		0	0	0	0
Clovis Villa	PAMS - 2	x	x	1	1	0	1
Fresno-1st Street	PAMS - 2	x	x	1	1	0	1
Parlier	PAMS - 3	x		0	1	0	0
Bakersfield							
Bakersfield-Golden State	PAMS - 2	x	x	1	1	0	1
Arvin	PAMS - 3/1	x		1	1	0	1
Shafter	PAMS - 1	x		1	1	0	0
				7	10	0	7

Type 1 - Upwind background.

Type 2 - Maximum precursor emissions (typically located immediately downwind of the central business district).

Type 3 - Maximum ozone concentration.

Type 4 - Extreme downwind transported ozone area that may contribute to overwhelming transport in other areas.

a - Canisters collected every third day (one 3-hr sample beginning at 0600 PDT) plus CCOS IOPs as indicated.

b - DNPH cartridges collected every third day (one 3-hr sample beginning at 0600 PDT) plus CCOS IOPs as indicated.

Table 3.2-2. CCOS supplemental surface VOC monitoring sites and measurements.

Site	Site	Operations and Sample Collection				Chemical Analysis		
		Canister ⁽¹⁾	DNPH ⁽¹⁾	Tenax ⁽¹⁾	Automated GC/MS ⁽²⁾	Canister	DNPH	Tenax
Sutter Buttes	S1	ARB	ARB			DRI	AtmAA	
White Cloud	S1	DRI	DRI			DRI	AtmAA	
Bruceville	PAMS, S1'	SMAQMD				ARB		
Granite Bay	R	DRI ⁽³⁾	DRI ⁽³⁾	DRI	DRI	DRI ⁽³⁾	AtmAA ⁽³⁾	DRI
Bodega Bay	S1	T&B	T&B			BRC	AtmAA	
Bethel Island	S2	BAAQMD	BAAQMD			DRI	AtmAA	
San Leandro	S1'	BAAQMD	BAAQMD			DRI	AtmAA	
San Jose 4th Street	S1'	BAAQMD	BAAQMD			BAAQMD ⁽⁴⁾	AtmAA ⁽⁴⁾	
Sunol	R	DRI ⁽³⁾	DRI ⁽³⁾	DRI	DRI	DRI ⁽³⁾	AtmAA ⁽³⁾	DRI
Patterson Pass	S2	UC Berkeley	UC Berkeley			DRI	AtmAA	
Pacheco Pass	S2	T&B	T&B			BRC	AtmAA	
Turlock	S1	T&B	T&B			BRC	AtmAA	
San Andreas	S1	ARB	ARB			BRC	AtmAA	
Trimmer	S2	ARB	ARB			DRI	AtmAA	
Parlier	R	DRI ⁽³⁾	DRI ⁽³⁾	DRI ⁽³⁾	DRI ⁽³⁾	DRI ⁽³⁾	AtmAA ⁽³⁾	DRI
Parlier	PAMS, R'	SJUAPCD				ARB		
Angiola	S1+	SJUAPCD	SJUAPCD			BRC	AtmAA	
Arvin	PAMS, S2'	ARB				ARB		
Piedras Blancas	S1	SLOAPCD	SLOAPCD			BRC	AtmAA	

(1) Four samples per day on 15 IOP days (0000-0300, 0600-0900, 1300-1600, 1700-2000, PDT).

(2) Daily auto-GC/MS from 7/2/00 to 9/2/00 (23 hourly on IOP days and seven 3-hr on non IOP days).

(3) Two samples per day on 4 IOP days (0600-0900, 1300-1600, PDT). Second IOP day of first four episodes

(4) Analyze samples collected during ozone episodes in the Bay Area.

Table 3.2-3. PAMS target hydrocarbon species, their lifetimes for reaction with OH radical and recommendation for use as fitting species in CMB receptor modeling.

Mnemonics	Names	Formula	AIRS Code	MW	Group	k_{OH} at 298 K	Lifetime hours	CMB Fitting Species		
								Type 2 AM	Type 2 PM	Types 1,3, & 4
ethene	ethene	C2H4	43203	28.05	O	8.52	6.52	*		
acetyl	acetylene	C2H2	43206	26.04	Y	0.90	61.73	*	*	*
ethane	ethane	C2H6	43202	30.07	P	0.27	207.30	*	*	*
prope	Propene	C3H6	43205	42.08	O	26.30	2.11			
n_prop	n-propane	C3H8	43204	44.10	P	1.15	48.31	*	*	*
i_buta	isobutane	C4H10	43214	58.12	P	2.34	23.74	*	*	*
lbut1e	1-butene	C4H8	43280	56.11	O	31.40	1.77			
n_buta	n-butane	C4H10	43212	58.12	P	2.54	21.87	*	*	*
t2bute	t-2-Butene	C4H8	43216	56.11	O	64.00	0.87			
c2bute	c-2-butene	C4H8	43217	56.11	O	56.40	0.99			
ipenta	isopentane	C5H12	43221	72.15	P	3.90	14.25		*	*
pentel	1-pentene	C5H10	43224	70.13	O	31.40	1.77			
n_pent	n-pentane	C5H12	43220	72.15	P	3.94	14.10	*	*	*
i_pren	isoprene	C5H8	43243	68.11	O	101.00	0.55	+	+	+
t2pene	t-2-Pentene	C5H10	43226	70.13	O	67.00	0.83			
c2pene	c-2-pentene	C5H10	43227	70.13	O	65.00	0.85			
bu22dm	2,2-dimethylbutane	C6H14	43244	86.17	P	2.32	23.95	*	*	*
cpenta	cyclopentane	C5H10	43242	70.13	P	5.16	10.77	*	*	
bu23dm	2,3-dimethylbutane	C6H14	43284	86.17	P	6.20	8.96	*		
pena2m	2-methylpentane	C6H14	43285	86.17	P	5.60	9.92	*	*	
pena3m	3-methylpentane	C6H14	43230	86.17	P	5.70	9.75	*	*	
ple2me	2-methyl-1-pentene	C6H12	43246	84.16	O	31.40	1.77			
n_hex	n-hexane	C6H14	43231	86.17	P	5.61	9.90	*	*	
mcypna	Methylcyclopentane	C6H12	43262	84.16	P	8.81	6.31	*		
pen24m	2,4-dimethylpentane	C7H16	43247	100.20	P	5.10	10.89	*	*	
benze	benzene	C6H6	45201	78.11	A	1.23	45.17	*	*	*
cyhexa	cyclohexane	C6H12	43248	84.16	P	7.49	7.42	*		
hexa2m	2-methylhexane	C7H16	43263	98.19	P	6.79	8.18	*		
pen23m	2,3-dimethylpentane	C7H16	43291	100.20	P	4.87	11.41	*	*	
hexa3m	3-methylhexane	C7H16	43249	100.20	P	7.16	7.80	*	*	
pa224m	2,2,4-trimethylpentane	C8H18	43250	114.23	P	3.68	15.10	*	*	*
n_hept	n-heptane	C7H16	43232	100.20	P	7.15	7.77	*		
mecyhx	methylcyclohexane	C7H14	43261	98.19	P	10.40	5.34	*		
pa234m	2,3,4-trimethylpentane	C8H18	43252	114.23	P	7.00	7.94	*		
tolue	toluene	C7H8	43202	92.14	A	5.96	9.32	*	*	
hep2me	2-methylheptane	C8H18	43260	114.23	P	8.18	6.80	*	*	
hep3me	3-methylheptane	C8H18	43253	114.23	P	8.56	6.49	*		
n_oct	n-octane	C8H18	43233	114.22	P	8.68	6.40	*		
etbz	ethylbenzene	C8H10	45203	106.16	A	7.10	7.82	*		
mp_xyl	mp-xylene	C8H10	45109	106.16	A	18.95	4.71			
styr	styrene	C8H8	45220	104.14	A	58.00	0.96			
o_xyl	o-xylene	C8H10	45204	106.17	A	13.70	4.06			
n_non	n-nonane	C9H20	43235	128.26	P	10.20	5.45	*		
iprbz	isopropylbenzene	C9H12	45210	120.20	A	6.50	8.55	*		
n_prbz	n-propylbenzene	C9H12	45209	120.20	A	6.00	9.26	*		
m_etol	m-ethyltoluene	C9H12	45212	120.20	A	19.20	2.89			
p_etol	p-ethyltoluene	C9H12	45213	120.20	A	12.10	4.59			
bz135m	1,3,5-trimethylbenzene	C9H12	45207	120.20	A	57.50	0.97			
o_etol	o-ethyltoluene	C9H12	45211	120.20	A	12.30	4.52			
bz124m	1,2,4-trimethylbenzene	C9H12	45208	120.20	A	32.50	1.71			
n_dec	n-decane	C10H22	43238	142.29	P	11.60	4.79	*		
bz123m	1,2,3-trimethylbenzene	C9H12	45225	120.20	A	32.70	1.70			
detbz1	m-diethylbenzene	C10H14	45218	134.22	A	14.20	3.90			
detbz2	p-diethylbenzene	C10H14	45219	134.22	A	14.20	3.90			
n_unde	n-undecane	C11H24	43954	156.30	P	13.20	4.20	*		

A = aromatic, AL = Aldehyde, O = alkene (olefin), P = paraffin, Y = alkyne, K = ketone, E = ether, X = haogenated, OH = alcohol

Note: Rate constants k at 298 K for the reaction of OH radicals with VOCs. Unit: $10^{12} \times \text{k cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$

+ Included because single species source. Will underestimate true contribution due to reactivity.

Table 3.2-4. Source profiles compiled and evaluated for CCOS source apportionment.

	Mnemonics	Description	Data Source
Default Profiles			
1	WEOzLDV1	Light Duty Vehicle exhaust (avg. Pasadene Fwy) (ozone study LA fall 2000).	Weekend Ozone study LA, Fujita et al. 2003
2	TUMchHDe	Heavy duty diesel exhaust from the Ft. Mc Henry Tunnel (Baltimore).	Fujita et al.1992
3	Gas00LRPC	Composite liquid gasoline 68% reg/32% prem.	Weekend Ozone study LA, Fujita et al. 2003
4	Gas00VRPC	Composite gasoline headspace 68% reg/32% prem.	Weekend Ozone study LA, Fujita et al. 2003
6	CNG	Commercial Natural Gas from Los Angeles.	Mayrsohn et al 1976
5	LPG	Liquified Petroleum Gas.	Mayrsohn et al 1976
7	CPcomp_1	Draft consumers product; combined small categories EPA composite (Households).	Weekend Ozone study LA, Fujita et al. 2003
8	COATcomp	Surface Coating.	Weekend Ozone study LA, Fujita et al. 2003
9	Biogenic	Isoprene emissions.	
Evaluated Profiles			
10	COLD01E	Cold start (calc. by average conc.) of the Modified Unified Driving Cycle (MUDC).	Gas Diesel PM split study
11	COLD01C	Cold start (calc. by average weight fraction) of the Modified Unified Driving Cycle.	Gas Diesel PM split study
12	WEOzHDD1	Heavy Duty Vehicle gasoline exhaust (ozone study LA fall 2000) Tuscarora Tunnel, Light duty emissions.	Weekend Ozone study LA, Fujita et al. 2003
13	LGMTB11%	Liquified Petroleum Gas-MTBE 11%-Commercial grade MTBE/EtHO	Weekend Ozone study LA, Fujita et al. 2003
14	CBG_HSox	Gasoline vapor-hot soak-MTBE/EtOH program LDV.	Weekend Ozone study LA, Fujita et al. 2003
15	COLDhiem	Cold start high emission (calc. by average weight fraction) of the MUDC (Riverside).	Gas Diesel PM split study
16	COLDhiemE	Cold start high emission (calc. by average conc.) of the MUDC (Riverside).	Gas Diesel PM split study
17	COLDloem	Cold start low emission (calc. by average weight fraction) of the MUDC (Riverside).	Gas Diesel PM split study
18	COLDloemE	Cold start low emission (calc.by average conc.) of the MUDC.	Gas Diesel PM split study
19	COLDincr1	Incremental cold start (calc. by average conc.).	Gas Diesel PM split study
20	WARM01C	Warm start (calc. by average weight fraction) of the MUDC.	Gas Diesel PM split study
21	WARMhiemE	Warm start high emission (calc. by average conc.) of the MUDC.	Gas Diesel PM split study
22	WARM01E	Warm start (calc. by average weight fraction) of the MUDC.	Gas Diesel PM split study
23	WARMloemE	Warm start low emission (calc. by weight fraction).	Gas Diesel PM split study
24	COWAloemE	Cold start and warm start low emission (calc. by average conc.).	Gas Diesel PM split study
25	85TRUCKcr	Heavy duty diesel International 1985 Truck exhaust (cruise mode).	CRC E55-E59 speciation study
26	85TRUCKtr	Heavy duty diesel International 1985 Truck exhaust (transient mode).	CRC E55-E59 speciation study
27	94TRUCKcr	Heavy duty diesel Freightliner 1994 Truck exhaust (cruise mode).	CRC E55-E59 speciation study
28	94TRUCKcrE	Heavy duty diesel Freightliner 1994 Truck exhaust (cruise mode)(calc.av.conc.).	CRC E55-E59 speciation study
29	94TRUCKtr	Heavy duty diesel Freightliner 1994 Truck exhaust (transient mode).	CRC E55-E59 speciation study
30	94TRUCKtrE	Heavy duty diesel Freightliner 1994 Truck exhaust (transient mode)(calc.av.conc.).	CRC E55-E59 speciation study
31	94TRUCKE	Heavy duty diesel 1994 Truck exhaust (transient and cruise mode)(calc.av.conc.).	CRC E55-E59 speciation study
32	95TRUCKcr	Heavy duty diesel Freightliner 1995 Truck exhaust(cruise mode)(calc.av.weight frac).	CRC E55-E59 speciation study
33	95TRUCKtr	Heavy duty diesel Freightliner 1995 Truck exhaust(trans. mode)(calc.av.weight frac.).	CRC E55-E59 speciation study
34	CARhamb01	Charbroiled hamburger (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
35	CHKNchar0	Charbroiled chicken (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
36	CHKNSmoke	Smoked chicken (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
37	CHKNpr01	Propane cooked chicken (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
38	STIRfry01	Stir fry (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
39	ALMOcomb0	Burning emission from composite of almond (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
40	CEDcomb01	Burning emission from composite of cedar (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
41	OAKcomb01	Burning emission from composite of oak (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
42	EUCAcomb0	Burning emission from composite of eucalyptus (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
43	WHEATcomb	Burning emission from composite of wheat (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
44	RICEcomb0	Burning emission from composite of rice (calc. by weight fraction).	CRPAQS (Fitz et al. 2003)
45	GENdies01	Off road Diesel generator (Generator Airman 45 Kva).	Gas Diesel PM split study
46	TRACdies0	Off road Diesel Tractor (Backhoe Case 580 L Extendahoe).	Gas Diesel PM split study
47	LIFTdies0	Off road Diesel (Manlift JLG 60HA).	Gas Diesel PM split study
48	REFIN01	Refinery.	
49	FrstFire	Wildfire.	

Table 3.2-5. Cold start vehicle tests included in Gasoline/Diesel PM Split Study VOC composite profiles.

mid	Vehicle type	Model Year	Make	Model
1_1c-6-5-01	SEDAN	1995	TOYOTA	CAMRY
	TRUCK	1996	DODGE	DAKOTA SPORT
	SUV	1995	GMC	YUKON
	SUV	1997	JEEP	CHEROKEE LAREDO
g2c1-c-6-6-01	SUV	1995	FORD	EXPLORER
	SEDAN	1995	TOYOTA	CAMRY
	SEDAN	1995	FORD	CONTOUR
g2c2-c-6-6-01	MINIVAN	1995	PONTIAC	TRANS SPORT
g3c-6-7-01	TRUCK	1999	FORD	RANGER XLT
	SEDAN	1996	GEO	PRIZM
	SEDAN	1995	TOYOTA	CAMRY
	SEDAN	1995	NISSAN	MAXIMA
g4c-6-8-01xt	SUV	1991	JEEP	CHEROKEE LAREDO
	SEDAN	1992	BMW	3 SERIES
	MINIVAN	1992	TOYOTA	PREVIA
	SEDAN	1991	MAZDA	MX 6
g5-v17c-6-9-01	MINIVAN	1995	FORD	WINDSTAR
g5-v18c-6-9-01	SEDAN	1993	GEO	PRIZM
g5-v20c-6-9-01	SUV	1992	FORD	EXPLORER
g522c-6-11-01	SEDAN	1994	NISSAN	SENTRA
g5v23c-6-11-01	MINIVAN	1995	DODGE	CARAVAN
g5v24c-6-11-01	SEDAN	1994	TOYOTA	CAMRY
g6v26c-6-12-01	SEDAN	1991	TOYOTA	COROLLA
g6v28c-6-12-01	SEDAN	1992	HONDA	ACCORD
g6v31c-6-13-01	SEDAN	1991	BUICK	LESABRE
g6v32c-6-13-01	SEDAN	1992	HONDA	ACCORD
g6v33c-6-14-01	SUV	1995	FORD	EXPLORER
g7v34c-6-14-01	TRUCK	1988	FORD	RANGER
g7v36c-6-15-01	TRUCK	1986	CHEVROLET	S-10
g7v37c-6-15-01	SEDAN	1989	PLYMOUTH	RELIANT
g7v38ac(d)30	SEDAN	1987	OLDS	CUTLASS
g7v39c-6-15-01	SEDAN	1989	ACURA	LEGEND
g8v40c-6-16-01	TRUCK	1985	TOYOTA	TACOMA
g8v45c	SEDAN	1983	TOYOTA	CELICA
g9v46c(dil)30	SEDAN	1979	MERCEDES	450 SL
g9v47c(dil)30	SEDAN	1979	MERCEDES	450 SL
g10v53c(d)30	TRUCK	1988	MAZDA	B2200 PU
g10v57c(d)30	SEDAN	1990	VW	JETTA

Table 3.2-6. Default set of source profiles used in CCOS VOC CMB.

Species	WEOzLDV1	TuMchHDc	Gas00LRPC	Gas00VRPC	LPG	CNG
ETHANE	0.059 ± 0.006	0.0119 ± 0.0012	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0411 ± 0.0062	0.6919 ± 0.1038
ETHENE	0.070 ± 0.007	0.0992 ± 0.0099	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
ACETYL	0.055 ± 0.005	0.0180 ± 0.0018	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
LBUT1E	0.006 ± 0.001	0.0297 ± 0.0030	0.0008 ± 0.0003	0.0078 ± 0.0027	0.0000 ± 0.0010	0.0000 ± 0.0010
PROPE	0.036 ± 0.004	0.0402 ± 0.0040	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0511 ± 0.0077	0.0000 ± 0.0010
N_PROP	0.018 ± 0.002	0.0223 ± 0.0022	0.0000 ± 0.0002	0.0000 ± 0.0002	0.9058 ± 0.1359	0.2123 ± 0.0319
I_BUTA	0.007 ± 0.001	0.0028 ± 0.0010	0.0024 ± 0.0004	0.0288 ± 0.0046	0.0020 ± 0.0010	0.0209 ± 0.0033
N_BUTA	0.018 ± 0.002	0.0064 ± 0.0010	0.0152 ± 0.0016	0.1300 ± 0.0132	0.0000 ± 0.0010	0.0310 ± 0.0048
T2BUTE	0.002 ± 0.000	0.0024 ± 0.0010	0.0014 ± 0.0006	0.0101 ± 0.0042	0.0000 ± 0.0010	0.0000 ± 0.0010
C2BUTE	0.003 ± 0.000	0.0030 ± 0.0010	0.0015 ± 0.0006	0.0110 ± 0.0047	0.0000 ± 0.0010	0.0000 ± 0.0010
IPENTA	0.095 ± 0.009	0.0132 ± 0.0013	0.1252 ± 0.0125	0.4138 ± 0.0414	0.0000 ± 0.0010	0.0069 ± 0.0015
PENTE1	0.001 ± 0.000	0.0089 ± 0.0010	0.0022 ± 0.0007	0.0067 ± 0.0019	0.0000 ± 0.0010	0.0000 ± 0.0010
N_PENT	0.030 ± 0.003	0.0153 ± 0.0015	0.0472 ± 0.0080	0.1160 ± 0.0157	0.0000 ± 0.0010	0.0069 ± 0.0015
I_PREN	0.003 ± 0.000	0.0000 ± 0.0010	0.0001 ± 0.0001	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
T2PENE	0.003 ± 0.000	0.0036 ± 0.0010	0.0060 ± 0.0014	0.0144 ± 0.0030	0.0000 ± 0.0010	0.0000 ± 0.0010
C2PENE	0.002 ± 0.000	0.0029 ± 0.0010	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
BU22DM	0.010 ± 0.001	0.0264 ± 0.0026	0.0125 ± 0.0076	0.0198 ± 0.0121	0.0000 ± 0.0010	0.0000 ± 0.0010
CPENTA	0.004 ± 0.000	0.0032 ± 0.0010	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
BU23DM	0.014 ± 0.001	0.0032 ± 0.0010	0.0161 ± 0.0073	0.0183 ± 0.0083	0.0000 ± 0.0010	0.0000 ± 0.0010
PENA2M	0.035 ± 0.003	0.0198 ± 0.0020	0.0612 ± 0.0062	0.0643 ± 0.0085	0.0000 ± 0.0010	0.0030 ± 0.0011
PENA3M	0.021 ± 0.002	0.0092 ± 0.0010	0.0376 ± 0.0042	0.0354 ± 0.0051	0.0000 ± 0.0010	0.0010 ± 0.0010
PIE2ME	0.001 ± 0.000	0.0023 ± 0.0010	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
N_HEX	0.015 ± 0.002	0.0097 ± 0.0010	0.0285 ± 0.0029	0.0215 ± 0.0022	0.0000 ± 0.0010	0.0040 ± 0.0012
MCYPNA	0.021 ± 0.002	0.0063 ± 0.0010	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0100 ± 0.0018
PEN24M	0.012 ± 0.001	0.0036 ± 0.0010	0.0217 ± 0.0055	0.0107 ± 0.0027	0.0000 ± 0.0010	0.0000 ± 0.0010
BENZE	0.033 ± 0.003	0.0321 ± 0.0032	0.0115 ± 0.0016	0.0055 ± 0.0006	0.0000 ± 0.0010	0.0000 ± 0.0010
CYHEXA	0.009 ± 0.001	0.0024 ± 0.0010	0.0147 ± 0.0056	0.0072 ± 0.0026	0.0000 ± 0.0010	0.0000 ± 0.0010
HEXA2M	0.016 ± 0.002	0.0000 ± 0.0010	0.0287 ± 0.0031	0.0097 ± 0.0014	0.0000 ± 0.0010	0.0000 ± 0.0010
PEN23M	0.019 ± 0.002	0.0091 ± 0.0010	0.0355 ± 0.0122	0.0124 ± 0.0043	0.0000 ± 0.0010	0.0000 ± 0.0010
HEXA3M	0.018 ± 0.002	0.0232 ± 0.0023	0.0304 ± 0.0031	0.0095 ± 0.0013	0.0000 ± 0.0010	0.0020 ± 0.0010
PA224M	0.031 ± 0.003	0.0148 ± 0.0015	0.0291 ± 0.0182	0.0074 ± 0.0046	0.0000 ± 0.0010	0.0030 ± 0.0011
N_HEPT	0.013 ± 0.001	0.0058 ± 0.0010	0.0199 ± 0.0020	0.0047 ± 0.0006	0.0000 ± 0.0010	0.0020 ± 0.0010
MECYHX	0.011 ± 0.001	0.0044 ± 0.0010	0.0173 ± 0.0030	0.0041 ± 0.0006	0.0000 ± 0.0010	0.0010 ± 0.0010
PA234M	0.012 ± 0.001	0.0032 ± 0.0010	0.0173 ± 0.0093	0.0024 ± 0.0013	0.0000 ± 0.0010	0.0000 ± 0.0010
TOLUE	0.084 ± 0.008	0.0453 ± 0.0045	0.1163 ± 0.0132	0.0171 ± 0.0018	0.0000 ± 0.0010	0.0000 ± 0.0010
HEP2ME	0.007 ± 0.001	0.0000 ± 0.0010	0.0127 ± 0.0013	0.0014 ± 0.0002	0.0000 ± 0.0010	0.0040 ± 0.0012
HEP3ME	0.006 ± 0.001	0.0044 ± 0.0010	0.0125 ± 0.0013	0.0013 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
N_OCT	0.004 ± 0.000	0.0031 ± 0.0010	0.0090 ± 0.0018	0.0007 ± 0.0001	0.0000 ± 0.0010	0.0000 ± 0.0010
ETBZ	0.016 ± 0.002	0.0286 ± 0.0029	0.0234 ± 0.0024	0.0012 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
MP_XYL	0.066 ± 0.007	0.1105 ± 0.0111	0.0909 ± 0.0069	0.0041 ± 0.0004	0.0000 ± 0.0010	0.0000 ± 0.0010
STYR	0.005 ± 0.001	0.0186 ± 0.0019	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
O_XYL	0.023 ± 0.002	0.0376 ± 0.0038	0.0344 ± 0.0034	0.0012 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
N_NON	0.004 ± 0.000	0.0113 ± 0.0011	0.0066 ± 0.0009	0.0002 ± 0.0000	0.0000 ± 0.0010	0.0000 ± 0.0010
IPRBZ	0.002 ± 0.000	0.0033 ± 0.0010	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
N_PRBZ	0.004 ± 0.000	0.0106 ± 0.0011	0.0007 ± 0.0004	0.0000 ± 0.0000	0.0000 ± 0.0010	0.0000 ± 0.0010
M_ETOL	0.017 ± 0.002	0.0417 ± 0.0042	0.0251 ± 0.0025	0.0004 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
P_ETOL	0.008 ± 0.001	0.0141 ± 0.0014	0.0113 ± 0.0012	0.0002 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
BZ135M	0.009 ± 0.001	0.0210 ± 0.0021	0.0133 ± 0.0014	0.0002 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0010
O_ETOL	0.005 ± 0.001	0.0201 ± 0.0020	0.0057 ± 0.0021	0.0001 ± 0.0000	0.0000 ± 0.0010	0.0000 ± 0.0010
BZ124M	0.024 ± 0.002	0.0750 ± 0.0075	0.0410 ± 0.0041	0.0005 ± 0.0001	0.0000 ± 0.0010	0.0000 ± 0.0010
N_DEC	0.002 ± 0.000	0.0263 ± 0.0026	0.0004 ± 0.0002	0.0000 ± 0.0000	0.0000 ± 0.0010	0.0000 ± 0.0010
BZ123M	0.006 ± 0.001	0.0168 ± 0.0017	0.0099 ± 0.0011	0.0001 ± 0.0000	0.0000 ± 0.0010	0.0000 ± 0.0010
DETBZ1	0.001 ± 0.000	0.0000 ± 0.0010	0.0014 ± 0.0006	0.0000 ± 0.0000	0.0000 ± 0.0010	0.0000 ± 0.0010
DETBZ2	0.005 ± 0.001	0.0000 ± 0.0010	0.0001 ± 0.0002	0.0000 ± 0.0000	0.0000 ± 0.0010	0.0000 ± 0.0010
N_UNDE	0.001 ± 0.000	0.0535 ± 0.0054	0.0017 ± 0.0002	0.0000 ± 0.0000	0.0000 ± 0.0010	0.0000 ± 0.0010

Table 3.2-6 (continued). Default set of source profiles used in CCOS VOC CMB.

Species	CPcomp_1	COATcomp	Biogenic
ETHANE	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
ETHENE	0.0022 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0020
ACETYL	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
LBUT1E	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
PROPE	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
N_PROP	0.1318 ± 0.0133	0.0000 ± 0.0044	0.0000 ± 0.0010
I_BUTA	0.4204 ± 0.0421	0.0000 ± 0.0044	0.0000 ± 0.0010
N_BUTA	0.0781 ± 0.0081	0.0000 ± 0.0044	0.0000 ± 0.0010
T2BUTE	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
C2BUTE	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
IPENTA	0.0000 ± 0.0020	0.0000 ± 0.0010	0.0000 ± 0.0010
PENTE1	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
N_PENT	0.0005 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
I_PREN	0.0000 ± 0.0020	0.0000 ± 0.0044	1.0000 ± 0.1000
T2PENE	0.0000 ± 0.0020	0.0000 ± 0.0010	0.0000 ± 0.0010
C2PENE	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
BU22DM	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
CPENTA	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
BU23DM	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
PENA2M	0.0005 ± 0.0020	0.0001 ± 0.0010	0.0000 ± 0.0010
PENA3M	0.0000 ± 0.0020	0.0001 ± 0.0010	0.0000 ± 0.0010
P1E2ME	0.0000 ± 0.0020	0.0000 ± 0.0010	0.0000 ± 0.0010
N_HEX	0.0467 ± 0.0051	0.0000 ± 0.0044	0.0000 ± 0.0010
MCYPNA	0.0000 ± 0.0020	0.0004 ± 0.0010	0.0000 ± 0.0010
PEN24M	0.0000 ± 0.0020	0.0002 ± 0.0010	0.0000 ± 0.0010
BENZE	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
CYHEXA	0.0006 ± 0.0020	0.0015 ± 0.0023	0.0000 ± 0.0010
HEXA2M	0.0013 ± 0.0020	0.0028 ± 0.0122	0.0000 ± 0.0010
PEN23M	0.0000 ± 0.0020	0.0012 ± 0.0021	0.0000 ± 0.0010
HEXA3M	0.0000 ± 0.0020	0.0034 ± 0.0045	0.0000 ± 0.0010
PA224M	0.0000 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
N_HEPT	0.0319 ± 0.0038	0.0157 ± 0.0482	0.0000 ± 0.0010
MECYHX	0.0018 ± 0.0020	0.0261 ± 0.0912	0.0000 ± 0.0010
PA234M	0.0000 ± 0.0020	0.0005 ± 0.0010	0.0000 ± 0.0010
TOLUE	0.1917 ± 0.0193	0.0691 ± 0.0686	0.0000 ± 0.0010
HEP2ME	0.0004 ± 0.0020	0.0136 ± 0.0234	0.0000 ± 0.0010
HEP3ME	0.0003 ± 0.0020	0.0096 ± 0.0162	0.0000 ± 0.0010
N_OCT	0.0007 ± 0.0020	0.0344 ± 0.0530	0.0000 ± 0.0010
ETBZ	0.0033 ± 0.0020	0.0382 ± 0.0285	0.0000 ± 0.0010
MP_XYL	0.0187 ± 0.0027	0.1540 ± 0.1058	0.0000 ± 0.0010
STYR	0.0006 ± 0.0020	0.0001 ± 0.0010	0.0000 ± 0.0010
O_XYL	0.0142 ± 0.0025	0.0718 ± 0.0436	0.0000 ± 0.0010
N_NON	0.0588 ± 0.0062	0.0454 ± 0.0230	0.0000 ± 0.0010
IPRBZ	0.0000 ± 0.0020	0.0063 ± 0.0057	0.0000 ± 0.0010
N_PRBZ	0.0087 ± 0.0022	0.0147 ± 0.0146	0.0000 ± 0.0010
M_ETOL	0.0001 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
P_ETOL	0.0001 ± 0.0020	0.0451 ± 0.0166	0.0000 ± 0.0010
BZ135M	0.0000 ± 0.0020	0.0414 ± 0.0264	0.0000 ± 0.0010
O_ETOL	0.0033 ± 0.0020	0.0000 ± 0.0044	0.0000 ± 0.0010
BZ124M	0.0003 ± 0.0020	0.1113 ± 0.0431	0.0000 ± 0.0010
N_DEC	0.0008 ± 0.0020	0.1812 ± 0.0601	0.0000 ± 0.0010
BZ123M	0.0001 ± 0.0020	0.0000 ± 0.0010	0.0000 ± 0.0010
DETBZ1	0.0000 ± 0.0020	0.0039 ± 0.0042	0.0000 ± 0.0010
DETBZ2	0.0000 ± 0.0020	0.0000 ± 0.0010	0.0000 ± 0.0010
N_UNDE	0.0008 ± 0.0020	0.1081 ± 0.0814	0.0000 ± 0.0010

Table 3.2-7. Source profiles evaluated for sensitivity analysis in CCOS VOC CMB.

Species	WEOzHDD1	85TRUCKcr	85TRUCKtr	94TRUCKcr	94TRUCKcrE	94TRUCKtr	94TRUCKtrE
ETHANE	0.000 ± 0.000	0.0046 ± 0.0004	0.0055 ± 0.0006	0.0112 ± 0.0015	0.0113 ± 0.0028	0.0134 ± 0.0023	0.0136 ± 0.0033
ETHENE	0.137 ± 0.014	0.3084 ± 0.0240	0.3043 ± 0.0296	0.2985 ± 0.0532	0.2953 ± 0.0243	0.4165 ± 0.0324	0.4184 ± 0.0697
ACETYL	0.049 ± 0.005	0.0326 ± 0.0025	0.0362 ± 0.0028	0.0675 ± 0.0107	0.0669 ± 0.0055	0.0944 ± 0.0074	0.0946 ± 0.0139
LBUTIE	0.001 ± 0.000	0.0485 ± 0.0055	0.0395 ± 0.0031	0.0313 ± 0.0097	0.0308 ± 0.0062	0.0314 ± 0.0037	0.0318 ± 0.0067
PROPE	0.029 ± 0.003	0.1400 ± 0.0109	0.1266 ± 0.0099	0.0917 ± 0.0227	0.0904 ± 0.0126	0.1092 ± 0.0085	0.1092 ± 0.0151
N_PROP	0.047 ± 0.005	0.0019 ± 0.0004	0.0017 ± 0.0002	0.0093 ± 0.0013	0.0093 ± 0.0008	0.0069 ± 0.0007	0.0070 ± 0.0014
I_BUTA	0.019 ± 0.002	0.0009 ± 0.0002	0.0008 ± 0.0001	0.0085 ± 0.0007	0.0085 ± 0.0012	0.0039 ± 0.0030	0.0042 ± 0.0026
N_BUTA	0.018 ± 0.002	0.0012 ± 0.0001	0.0008 ± 0.0011	0.0075 ± 0.0013	0.0074 ± 0.0006	0.0052 ± 0.0006	0.0052 ± 0.0011
T2BUTE	0.000 ± 0.000	0.0055 ± 0.0008	0.0043 ± 0.0004	0.0047 ± 0.0013	0.0046 ± 0.0007	0.0048 ± 0.0004	0.0048 ± 0.0007
C2BUTE	0.002 ± 0.000	0.0037 ± 0.0003	0.0027 ± 0.0002	0.0039 ± 0.0011	0.0038 ± 0.0007	0.0037 ± 0.0004	0.0038 ± 0.0007
IPENTA	0.048 ± 0.005	0.0016 ± 0.0008	0.0016 ± 0.0017	0.0034 ± 0.0049	0.0037 ± 0.0053	0.0089 ± 0.0033	0.0087 ± 0.0013
PENTE1	0.002 ± 0.000	0.0277 ± 0.0022	0.0196 ± 0.0016	0.0130 ± 0.0037	0.0128 ± 0.0022	0.0130 ± 0.0010	0.0130 ± 0.0019
N_PENT	0.029 ± 0.003	0.0007 ± 0.0001	0.0024 ± 0.0034	0.0054 ± 0.0005	0.0054 ± 0.0004	0.0040 ± 0.0005	0.0040 ± 0.0008
I_PREN	0.004 ± 0.000	0.0006 ± 0.0001	0.0052 ± 0.0007	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000
T2PENE	0.002 ± 0.000	0.0036 ± 0.0003	0.0028 ± 0.0003	0.0029 ± 0.0010	0.0028 ± 0.0007	0.0022 ± 0.0002	0.0022 ± 0.0003
C2PENE	0.000 ± 0.000	0.0021 ± 0.0002	0.0014 ± 0.0001	0.0021 ± 0.0004	0.0021 ± 0.0002	0.0017 ± 0.0002	0.0017 ± 0.0001
BU22DM	0.007 ± 0.001	0.0001 ± 0.0001	0.0001 ± 0.0000	0.0014 ± 0.0003	0.0014 ± 0.0001	0.0010 ± 0.0003	0.0011 ± 0.0003
CPENTA	0.001 ± 0.000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0001 ± 0.0000	0.0001 ± 0.0000	0.0001 ± 0.0000	0.0001 ± 0.0000
BU23DM	0.004 ± 0.000	0.0001 ± 0.0000	0.0002 ± 0.0000	0.0016 ± 0.0003	0.0015 ± 0.0001	0.0011 ± 0.0001	0.0011 ± 0.0001
PENA2M	0.016 ± 0.002	0.0007 ± 0.0001	0.0010 ± 0.0001	0.0054 ± 0.0004	0.0054 ± 0.0008	0.0043 ± 0.0008	0.0044 ± 0.0011
PENA3M	0.008 ± 0.001	0.0014 ± 0.0003	0.0014 ± 0.0003	0.0040 ± 0.0003	0.0039 ± 0.0003	0.0026 ± 0.0008	0.0026 ± 0.0009
PIE2ME	0.000 ± 0.000	0.0182 ± 0.0014	0.0125 ± 0.0010	0.0069 ± 0.0031	0.0068 ± 0.0023	0.0066 ± 0.0005	0.0066 ± 0.0007
N_HEX	0.000 ± 0.000	0.0005 ± 0.0001	0.0007 ± 0.0002	0.0072 ± 0.0006	0.0072 ± 0.0013	0.0044 ± 0.0003	0.0044 ± 0.0006
MCYPNA	0.006 ± 0.001	0.0002 ± 0.0000	0.0003 ± 0.0001	0.0022 ± 0.0002	0.0022 ± 0.0005	0.0015 ± 0.0002	0.0015 ± 0.0003
PEN24M	0.005 ± 0.001	0.0001 ± 0.0010	0.0001 ± 0.0000	0.0012 ± 0.0001	0.0012 ± 0.0001	0.0010 ± 0.0003	0.0010 ± 0.0004
BENZE	0.015 ± 0.002	0.0261 ± 0.0009	0.0269 ± 0.0021	0.0367 ± 0.0074	0.0363 ± 0.0035	0.0422 ± 0.0033	0.0424 ± 0.0075
CYHEXA	0.007 ± 0.001	0.0018 ± 0.0014	0.0012 ± 0.0001	0.0034 ± 0.0009	0.0034 ± 0.0005	0.0028 ± 0.0002	0.0028 ± 0.0004
HEXA2M	0.008 ± 0.001	0.0003 ± 0.0014	0.0003 ± 0.0000	0.0012 ± 0.0010	0.0011 ± 0.0008	0.0015 ± 0.0004	0.0016 ± 0.0005
PEN23M	0.006 ± 0.001	0.0003 ± 0.0011	0.0003 ± 0.0000	0.0016 ± 0.0001	0.0016 ± 0.0002	0.0009 ± 0.0012	0.0010 ± 0.0010
HEXA3M	0.011 ± 0.001	0.0003 ± 0.0004	0.0003 ± 0.0000	0.0025 ± 0.0002	0.0025 ± 0.0002	0.0022 ± 0.0003	0.0022 ± 0.0005
PA224M	0.018 ± 0.002	0.0003 ± 0.0016	0.0002 ± 0.0001	0.0029 ± 0.0004	0.0029 ± 0.0002	0.0023 ± 0.0008	0.0022 ± 0.0003
N_HEPT	0.010 ± 0.001	0.0005 ± 0.0013	0.0006 ± 0.0000	0.0057 ± 0.0007	0.0057 ± 0.0005	0.0038 ± 0.0004	0.0037 ± 0.0003
MECYHX	0.013 ± 0.001	0.0010 ± 0.0015	0.0012 ± 0.0003	0.0044 ± 0.0009	0.0043 ± 0.0005	0.0031 ± 0.0002	0.0031 ± 0.0005
PA234M	0.004 ± 0.000	0.0008 ± 0.0014	0.0001 ± 0.0001	0.0007 ± 0.0007	0.0007 ± 0.0007	0.0003 ± 0.0004	0.0003 ± 0.0003
TOLUE	0.091 ± 0.009	0.0104 ± 0.0066	0.0104 ± 0.0019	0.0168 ± 0.0013	0.0168 ± 0.0016	0.0251 ± 0.0020	0.0252 ± 0.0037
HEP2ME	0.012 ± 0.001	0.0008 ± 0.0011	0.0008 ± 0.0002	0.0035 ± 0.0006	0.0035 ± 0.0003	0.0027 ± 0.0002	0.0027 ± 0.0005
HEP3ME	0.010 ± 0.001	0.0008 ± 0.0005	0.0007 ± 0.0001	0.0021 ± 0.0005	0.0021 ± 0.0003	0.0013 ± 0.0002	0.0013 ± 0.0003
N_OCT	0.015 ± 0.002	0.0020 ± 0.0039	0.0017 ± 0.0003	0.0080 ± 0.0010	0.0081 ± 0.0020	0.0045 ± 0.0005	0.0045 ± 0.0004
ETBZ	0.018 ± 0.002	0.0020 ± 0.0029	0.0019 ± 0.0003	0.0026 ± 0.0002	0.0026 ± 0.0003	0.0025 ± 0.0003	0.0025 ± 0.0006
MP_XYL	0.067 ± 0.007	0.0045 ± 0.0044	0.0041 ± 0.0004	0.0060 ± 0.0005	0.0060 ± 0.0005	0.0052 ± 0.0010	0.0053 ± 0.0014
STYR	0.061 ± 0.006	0.0064 ± 0.0045	0.0064 ± 0.0005	0.0044 ± 0.0003	0.0044 ± 0.0004	0.0058 ± 0.0012	0.0060 ± 0.0016
O_XYL	0.022 ± 0.002	0.0018 ± 0.0025	0.0017 ± 0.0002	0.0021 ± 0.0003	0.0021 ± 0.0002	0.0018 ± 0.0003	0.0018 ± 0.0005
N_NON	0.021 ± 0.002	0.0053 ± 0.0029	0.0056 ± 0.0006	0.0202 ± 0.0015	0.0201 ± 0.0017	0.0123 ± 0.0010	0.0123 ± 0.0012
IPRBZ	0.002 ± 0.000	0.0004 ± 0.0011	0.0004 ± 0.0000	0.0007 ± 0.0001	0.0007 ± 0.0001	0.0006 ± 0.0000	0.0006 ± 0.0001
N_PRBZ	0.004 ± 0.000	0.0011 ± 0.0020	0.0010 ± 0.0001	0.0011 ± 0.0002	0.0011 ± 0.0001	0.0010 ± 0.0001	0.0009 ± 0.0001
M_ETOL	0.019 ± 0.002	0.0015 ± 0.0022	0.0014 ± 0.0001	0.0015 ± 0.0002	0.0015 ± 0.0001	0.0011 ± 0.0001	0.0011 ± 0.0002
P_ETOL	0.008 ± 0.001	0.0015 ± 0.0026	0.0014 ± 0.0002	0.0013 ± 0.0002	0.0013 ± 0.0001	0.0011 ± 0.0001	0.0011 ± 0.0002
BZ135M	0.015 ± 0.002	0.0019 ± 0.0021	0.0018 ± 0.0001	0.0018 ± 0.0004	0.0018 ± 0.0002	0.0013 ± 0.0001	0.0013 ± 0.0002
O_ETOL	0.010 ± 0.001	0.0018 ± 0.0019	0.0016 ± 0.0001	0.0018 ± 0.0003	0.0018 ± 0.0002	0.0014 ± 0.0001	0.0014 ± 0.0002
BZ124M	0.041 ± 0.004	0.0017 ± 0.0026	0.0016 ± 0.0001	0.0018 ± 0.0001	0.0018 ± 0.0002	0.0016 ± 0.0001	0.0016 ± 0.0001
N_DEC	0.016 ± 0.002	0.0121 ± 0.0037	0.0133 ± 0.0012	0.0254 ± 0.0034	0.0252 ± 0.0021	0.0169 ± 0.0013	0.0168 ± 0.0015
BZ123M	0.019 ± 0.002	0.0027 ± 0.0028	0.0026 ± 0.0002	0.0030 ± 0.0004	0.0029 ± 0.0002	0.0022 ± 0.0002	0.0022 ± 0.0004
DETBZ1	0.000 ± 0.000	0.0014 ± 0.0003	0.0013 ± 0.0001	0.0010 ± 0.0001	0.0010 ± 0.0001	0.0007 ± 0.0002	0.0007 ± 0.0002
DETBZ2	0.000 ± 0.000	0.0073 ± 0.0042	0.0067 ± 0.0005	0.0050 ± 0.0006	0.0050 ± 0.0004	0.0035 ± 0.0003	0.0035 ± 0.0004
N_UNDE	0.021 ± 0.002	0.2963 ± 0.0154	0.3310 ± 0.0342	0.2399 ± 0.1228	0.2471 ± 0.1512	0.1067 ± 0.0407	0.1032 ± 0.0163

Table 3.2-7 (continued). Source profiles evaluated for sensitivity analysis in CCOS VOC CMB.

Species	94TRUCKE	95TRUCKcr	95TRUCKtr	CARhamb01	CHKNchar0	CHKNsmoke	CHKNpr01
ETHANE	0.0125 ± 0.0021	0.0088 ± 0.0029	0.0090 ± 0.0010	0.0520 ± 0.0030	0.0648 ± 0.0032	0.0702 ± 0.0033	0.0214 ± 0.0025
ETHENE	0.3609 ± 0.0596	0.2369 ± 0.0186	0.2419 ± 0.0730	0.1339 ± 0.0042	0.0956 ± 0.0037	0.0878 ± 0.0035	0.0688 ± 0.0033
ACETYL	0.0817 ± 0.0130	0.0832 ± 0.0065	0.0656 ± 0.0059	0.0293 ± 0.0026	0.0233 ± 0.0025	0.1256 ± 0.0039	0.0392 ± 0.0028
LBUTIE	0.0313 ± 0.0039	0.0221 ± 0.0017	0.0355 ± 0.0028	0.0391 ± 0.0028	0.0285 ± 0.0026	0.0084 ± 0.0022	0.0056 ± 0.0021
PROPE	0.1005 ± 0.0124	0.0790 ± 0.0062	0.1138 ± 0.0089	0.0801 ± 0.0035	0.0616 ± 0.0032	0.0381 ± 0.0028	0.0364 ± 0.0028
N_PROP	0.0081 ± 0.0008	0.0096 ± 0.0092	0.0037 ± 0.0003	0.0764 ± 0.0034	0.0359 ± 0.0028	0.0507 ± 0.0030	0.6247 ± 0.0082
I_BUTA	0.0062 ± 0.0016	0.0029 ± 0.0002	0.0019 ± 0.0012	0.0100 ± 0.0022	0.0062 ± 0.0022	0.0185 ± 0.0024	0.0144 ± 0.0023
N_BUTA	0.0062 ± 0.0007	0.0020 ± 0.0005	0.0007 ± 0.0010	0.0372 ± 0.0028	0.0352 ± 0.0027	0.0446 ± 0.0029	0.0339 ± 0.0027
T2BUTE	0.0047 ± 0.0005	0.0028 ± 0.0002	0.0039 ± 0.0003	0.0054 ± 0.0021	0.0052 ± 0.0021	0.0042 ± 0.0021	0.0019 ± 0.0021
C2BUTE	0.0038 ± 0.0004	0.0021 ± 0.0002	0.0027 ± 0.0003	0.0041 ± 0.0021	0.0039 ± 0.0021	0.0034 ± 0.0021	0.0016 ± 0.0020
IPENTA	0.0064 ± 0.0023	0.0000 ± 0.0000	0.0022 ± 0.0015	0.0191 ± 0.0024	0.0261 ± 0.0026	0.0318 ± 0.0027	0.0295 ± 0.0026
PENTE1	0.0129 ± 0.0013	0.0114 ± 0.0009	0.0162 ± 0.0013	0.0328 ± 0.0027	0.0245 ± 0.0025	0.0032 ± 0.0021	0.0029 ± 0.0021
N_PENT	0.0047 ± 0.0005	0.0013 ± 0.0001	0.0011 ± 0.0003	0.0225 ± 0.0025	0.0326 ± 0.0027	0.0143 ± 0.0023	0.0122 ± 0.0023
I_PREN	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0017 ± 0.0021	0.0021 ± 0.0021	0.0017 ± 0.0020	0.0025 ± 0.0021	0.0006 ± 0.0020
T2PENE	0.0025 ± 0.0003	0.0018 ± 0.0001	0.0028 ± 0.0003	0.0041 ± 0.0021	0.0041 ± 0.0021	0.0034 ± 0.0021	0.0019 ± 0.0021
C2PENE	0.0019 ± 0.0001	0.0012 ± 0.0001	0.0016 ± 0.0002	0.0021 ± 0.0021	0.0021 ± 0.0021	0.0014 ± 0.0020	0.0008 ± 0.0020
BU22DM	0.0012 ± 0.0002	0.0004 ± 0.0002	0.0003 ± 0.0000	0.0035 ± 0.0021	0.0025 ± 0.0021	0.0015 ± 0.0020	0.0010 ± 0.0020
CPENTA	0.0001 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0013 ± 0.0020	0.0016 ± 0.0020	0.0016 ± 0.0020	0.0012 ± 0.0020
BU23DM	0.0013 ± 0.0001	0.0002 ± 0.0002	0.0003 ± 0.0001	0.0009 ± 0.0020	0.0015 ± 0.0020	0.0016 ± 0.0020	0.0013 ± 0.0020
PENA2M	0.0049 ± 0.0006	0.0011 ± 0.0002	0.0010 ± 0.0002	0.0054 ± 0.0021	0.0057 ± 0.0021	0.0089 ± 0.0022	0.0054 ± 0.0021
PENA3M	0.0032 ± 0.0005	0.0007 ± 0.0005	0.0008 ± 0.0009	0.0030 ± 0.0021	0.0030 ± 0.0021	0.0057 ± 0.0021	0.0040 ± 0.0021
PIE2ME	0.0067 ± 0.0008	0.0061 ± 0.0005	0.0093 ± 0.0010	0.0002 ± 0.0020	0.0002 ± 0.0020	0.0004 ± 0.0020	0.0001 ± 0.0020
N_HEX	0.0057 ± 0.0008	0.0016 ± 0.0001	0.0016 ± 0.0003	0.0365 ± 0.0028	0.0317 ± 0.0027	0.0521 ± 0.0030	0.0124 ± 0.0023
MCYPNA	0.0018 ± 0.0002	0.0006 ± 0.0001	0.0006 ± 0.0002	0.0069 ± 0.0022	0.0056 ± 0.0021	0.0132 ± 0.0023	0.0045 ± 0.0021
PEN24M	0.0011 ± 0.0002	0.0002 ± 0.0002	0.0002 ± 0.0001	0.0009 ± 0.0020	0.0012 ± 0.0020	0.0011 ± 0.0020	0.0007 ± 0.0020
BENZE	0.0396 ± 0.0050	0.0503 ± 0.0039	0.0383 ± 0.0030	0.0615 ± 0.0032	0.0772 ± 0.0034	0.0399 ± 0.0028	0.0075 ± 0.0022
CYHEXA	0.0031 ± 0.0003	0.0013 ± 0.0002	0.0014 ± 0.0002	0.0039 ± 0.0021	0.0049 ± 0.0021	0.0019 ± 0.0021	0.0016 ± 0.0020
HEXA2M	0.0014 ± 0.0004	0.0006 ± 0.0001	0.0004 ± 0.0003	0.0021 ± 0.0021	0.0021 ± 0.0021	0.0021 ± 0.0021	0.0012 ± 0.0020
PEN23M	0.0013 ± 0.0005	0.0004 ± 0.0000	0.0004 ± 0.0000	0.0013 ± 0.0020	0.0015 ± 0.0020	0.0020 ± 0.0021	0.0012 ± 0.0020
HEXA3M	0.0023 ± 0.0002	0.0005 ± 0.0001	0.0007 ± 0.0001	0.0038 ± 0.0021	0.0036 ± 0.0021	0.0032 ± 0.0021	0.0048 ± 0.0021
PA224M	0.0025 ± 0.0002	0.0004 ± 0.0001	0.0007 ± 0.0002	0.0016 ± 0.0020	0.0037 ± 0.0021	0.0035 ± 0.0021	0.0014 ± 0.0020
N_HEPT	0.0046 ± 0.0004	0.0015 ± 0.0003	0.0014 ± 0.0004	0.0235 ± 0.0025	0.0249 ± 0.0026	0.0042 ± 0.0021	0.0051 ± 0.0021
MECYHX	0.0037 ± 0.0003	0.0015 ± 0.0001	0.0017 ± 0.0004	0.0067 ± 0.0022	0.0075 ± 0.0022	0.0050 ± 0.0021	0.0071 ± 0.0022
PA234M	0.0005 ± 0.0003	0.0000 ± 0.0000	0.0003 ± 0.0002	0.0009 ± 0.0020	0.0020 ± 0.0021	0.0012 ± 0.0020	0.0006 ± 0.0020
TOLUE	0.0213 ± 0.0037	0.0117 ± 0.0029	0.0116 ± 0.0022	0.0351 ± 0.0027	0.0434 ± 0.0029	0.0295 ± 0.0026	0.0126 ± 0.0023
HEP2ME	0.0031 ± 0.0003	0.0012 ± 0.0001	0.0013 ± 0.0003	0.0013 ± 0.0020	0.0014 ± 0.0020	0.0013 ± 0.0020	0.0013 ± 0.0020
HEP3ME	0.0017 ± 0.0002	0.0008 ± 0.0001	0.0011 ± 0.0002	0.0008 ± 0.0020	0.0007 ± 0.0020	0.0008 ± 0.0020	0.0008 ± 0.0020
N_OCT	0.0062 ± 0.0010	0.0028 ± 0.0005	0.0026 ± 0.0004	0.0173 ± 0.0024	0.0194 ± 0.0024	0.0016 ± 0.0020	0.0017 ± 0.0020
ETBZ	0.0025 ± 0.0003	0.0019 ± 0.0002	0.0021 ± 0.0006	0.0069 ± 0.0022	0.0073 ± 0.0022	0.0037 ± 0.0021	0.0012 ± 0.0020
MP_XYL	0.0056 ± 0.0007	0.0044 ± 0.0004	0.0046 ± 0.0008	0.0059 ± 0.0021	0.0090 ± 0.0022	0.0106 ± 0.0023	0.0040 ± 0.0021
STYR	0.0052 ± 0.0010	0.0056 ± 0.0012	0.0069 ± 0.0005	0.0184 ± 0.0024	0.0127 ± 0.0023	0.0038 ± 0.0021	0.0049 ± 0.0021
O_XYL	0.0020 ± 0.0002	0.0020 ± 0.0002	0.0021 ± 0.0004	0.0059 ± 0.0021	0.0093 ± 0.0022	0.0084 ± 0.0022	0.0016 ± 0.0020
N_NON	0.0159 ± 0.0019	0.0093 ± 0.0007	0.0082 ± 0.0009	0.0308 ± 0.0027	0.0389 ± 0.0028	0.0369 ± 0.0028	0.0007 ± 0.0020
IPRBZ	0.0006 ± 0.0001	0.0005 ± 0.0000	0.0007 ± 0.0001	0.0048 ± 0.0021	0.0069 ± 0.0022	0.0073 ± 0.0022	0.0002 ± 0.0020
N_PRBZ	0.0010 ± 0.0001	0.0012 ± 0.0001	0.0013 ± 0.0001	0.0053 ± 0.0021	0.0069 ± 0.0022	0.0033 ± 0.0021	0.0007 ± 0.0020
M_ETOL	0.0013 ± 0.0001	0.0015 ± 0.0001	0.0017 ± 0.0001	0.0019 ± 0.0021	0.0041 ± 0.0021	0.0032 ± 0.0021	0.0017 ± 0.0020
P_ETOL	0.0012 ± 0.0001	0.0014 ± 0.0001	0.0015 ± 0.0001	0.0027 ± 0.0021	0.0044 ± 0.0021	0.0049 ± 0.0021	0.0010 ± 0.0020
BZ135M	0.0015 ± 0.0001	0.0019 ± 0.0002	0.0021 ± 0.0002	0.0142 ± 0.0023	0.0205 ± 0.0025	0.0247 ± 0.0025	0.0008 ± 0.0020
O_ETOL	0.0016 ± 0.0001	0.0018 ± 0.0001	0.0019 ± 0.0001	0.0028 ± 0.0021	0.0043 ± 0.0021	0.0024 ± 0.0021	0.0006 ± 0.0020
BZ124M	0.0017 ± 0.0001	0.0016 ± 0.0002	0.0020 ± 0.0004	0.0214 ± 0.0025	0.0318 ± 0.0027	0.0353 ± 0.0027	0.0051 ± 0.0021
N_DEC	0.0207 ± 0.0020	0.0157 ± 0.0012	0.0150 ± 0.0021	0.0817 ± 0.0035	0.1115 ± 0.0039	0.1314 ± 0.0041	0.0013 ± 0.0020
BZ123M	0.0025 ± 0.0002	0.0026 ± 0.0002	0.0028 ± 0.0002	0.0052 ± 0.0021	0.0073 ± 0.0022	0.0089 ± 0.0022	0.0010 ± 0.0020
DETBZ1	0.0008 ± 0.0001	0.0015 ± 0.0001	0.0014 ± 0.0002	0.0010 ± 0.0020	0.0014 ± 0.0020	0.0023 ± 0.0021	0.0002 ± 0.0020
DETBZ2	0.0042 ± 0.0004	0.0070 ± 0.0006	0.0073 ± 0.0006	0.0056 ± 0.0021	0.0070 ± 0.0022	0.0052 ± 0.0021	0.0011 ± 0.0020
N_UNDE	0.1704 ± 0.0545	0.3915 ± 0.0307	0.3584 ± 0.0425	0.0170 ± 0.0024	0.0205 ± 0.0025	0.0180 ± 0.0024	0.0007 ± 0.0020

Table 3.2-7 (continued). Source profiles evaluated for sensitivity analysis in CCOS VOC CMB.

Species	STIRfry01	GENdies01	TRACdies0	LIFTdies0	COLD01C	COLD01E	COLDhiem
ETHANE	0.0341 ± 0.0027	0.0255 ± 0.0026	0.0218 ± 0.0025	0.0395 ± 0.0028	0.0249 ± 0.0086	0.0280 ± 0.0081	0.0266 ± 0.0048
ETHENE	0.0234 ± 0.0025	0.2994 ± 0.0058	0.3285 ± 0.0061	0.2497 ± 0.0054	0.1212 ± 0.0489	0.1256 ± 0.0491	0.1188 ± 0.0667
ACETYL	0.0301 ± 0.0027	0.0676 ± 0.0033	0.0811 ± 0.0035	0.0629 ± 0.0032	0.0547 ± 0.0404	0.0557 ± 0.0217	0.0824 ± 0.0096
LBUTIE	0.0041 ± 0.0021	0.0397 ± 0.0028	0.0699 ± 0.0033	0.0730 ± 0.0034	0.0472 ± 0.0176	0.0457 ± 0.0126	0.0426 ± 0.0184
PROPE	0.0183 ± 0.0024	0.1003 ± 0.0038	0.1175 ± 0.0040	0.0810 ± 0.0035	0.0601 ± 0.0271	0.0567 ± 0.0199	0.0520 ± 0.0243
N_PROP	0.1015 ± 0.0038	0.0209 ± 0.0025	0.0234 ± 0.0025	0.0474 ± 0.0029	0.0020 ± 0.0009	0.0020 ± 0.0006	0.0018 ± 0.0003
I_BUTA	0.0313 ± 0.0027	0.0047 ± 0.0021	0.0039 ± 0.0021	0.0160 ± 0.0024	0.0016 ± 0.0007	0.0016 ± 0.0004	0.0016 ± 0.0007
N_BUTA	0.0712 ± 0.0033	0.0041 ± 0.0021	0.0057 ± 0.0021	0.0248 ± 0.0025	0.0075 ± 0.0039	0.0081 ± 0.0022	0.0094 ± 0.0061
T2BUTE	0.0033 ± 0.0021	0.0061 ± 0.0022	0.0097 ± 0.0022	0.0156 ± 0.0024	0.0050 ± 0.0016	0.0044 ± 0.0012	0.0041 ± 0.0018
C2BUTE	0.0030 ± 0.0021	0.0039 ± 0.0021	0.0070 ± 0.0022	0.0123 ± 0.0023	0.0037 ± 0.0013	0.0031 ± 0.0008	0.0030 ± 0.0013
IPENTA	0.1059 ± 0.0038	0.0328 ± 0.0027	0.0105 ± 0.0023	0.0172 ± 0.0024	0.1261 ± 0.1189	0.1493 ± 0.0592	0.1705 ± 0.1234
PENTE1	0.0024 ± 0.0021	0.0173 ± 0.0024	0.0225 ± 0.0025	0.0136 ± 0.0023	0.0024 ± 0.0028	0.0019 ± 0.0006	0.0019 ± 0.0008
N_PENT	0.0647 ± 0.0032	0.0102 ± 0.0022	0.0040 ± 0.0021	0.0066 ± 0.0022	0.0195 ± 0.0059	0.0198 ± 0.0055	0.0165 ± 0.0048
I_PREN	0.0008 ± 0.0020	0.0104 ± 0.0023	0.0093 ± 0.0022	0.0062 ± 0.0022	0.0027 ± 0.0016	0.0027 ± 0.0010	0.0027 ± 0.0013
T2PENE	0.0045 ± 0.0021	0.0034 ± 0.0021	0.0038 ± 0.0021	0.0015 ± 0.0020	0.0029 ± 0.0010	0.0027 ± 0.0007	0.0030 ± 0.0018
C2PENE	0.0022 ± 0.0021	0.0018 ± 0.0020	0.0020 ± 0.0021	0.0017 ± 0.0020	0.0016 ± 0.0006	0.0015 ± 0.0004	0.0016 ± 0.0010
BU22DM	0.0039 ± 0.0021	0.0017 ± 0.0020	0.0009 ± 0.0020	0.0019 ± 0.0021	0.0103 ± 0.0063	0.0089 ± 0.0023	0.0068 ± 0.0052
CPENTA	0.0047 ± 0.0021	0.0002 ± 0.0020	0.0002 ± 0.0020	0.0000 ± 0.0020	0.0035 ± 0.0018	0.0031 ± 0.0008	0.0029 ± 0.0017
BU23DM	0.0085 ± 0.0022	0.0014 ± 0.0020	0.0012 ± 0.0020	0.0002 ± 0.0020	0.0123 ± 0.0049	0.0117 ± 0.0029	0.0122 ± 0.0057
PENA2M	0.0293 ± 0.0026	0.0075 ± 0.0022	0.0040 ± 0.0021	0.0065 ± 0.0022	0.0291 ± 0.0104	0.0327 ± 0.0091	0.0260 ± 0.0109
PENA3M	0.0210 ± 0.0025	0.0037 ± 0.0021	0.0024 ± 0.0021	0.0027 ± 0.0021	0.0335 ± 0.0151	0.0308 ± 0.0075	0.0269 ± 0.0125
PIE2ME	0.0008 ± 0.0020	0.0022 ± 0.0021	0.0012 ± 0.0020	0.0017 ± 0.0020	0.0057 ± 0.0070	0.0080 ± 0.0034	0.0064 ± 0.0075
N_HEX	0.1063 ± 0.0038	0.0221 ± 0.0025	0.0116 ± 0.0023	0.0058 ± 0.0021	0.0166 ± 0.0062	0.0159 ± 0.0041	0.0122 ± 0.0045
MCYPNA	0.0344 ± 0.0027	0.0040 ± 0.0021	0.0021 ± 0.0021	0.0020 ± 0.0021	0.0171 ± 0.0052	0.0173 ± 0.0044	0.0170 ± 0.0068
PEN24M	0.0071 ± 0.0022	0.0013 ± 0.0020	0.0008 ± 0.0020	0.0003 ± 0.0020	0.0136 ± 0.0070	0.0143 ± 0.0039	0.0199 ± 0.0165
BENZE	0.0091 ± 0.0022	0.0319 ± 0.0027	0.0431 ± 0.0029	0.0283 ± 0.0026	0.0530 ± 0.0155	0.0552 ± 0.0159	0.0500 ± 0.0124
CYHEXA	0.0055 ± 0.0021	0.0106 ± 0.0023	0.0072 ± 0.0022	0.0111 ± 0.0023	0.0097 ± 0.0041	0.0092 ± 0.0024	0.0070 ± 0.0049
HEXA2M	0.0100 ± 0.0022	0.0017 ± 0.0020	0.0011 ± 0.0020	0.0017 ± 0.0020	0.0148 ± 0.0056	0.0141 ± 0.0034	0.0125 ± 0.0062
PEN23M	0.0130 ± 0.0023	0.0019 ± 0.0021	0.0011 ± 0.0020	0.0016 ± 0.0020	0.0173 ± 0.0099	0.0195 ± 0.0055	0.0268 ± 0.0211
HEXA3M	0.0146 ± 0.0023	0.0021 ± 0.0021	0.0013 ± 0.0020	0.0018 ± 0.0021	0.0160 ± 0.0058	0.0155 ± 0.0037	0.0139 ± 0.0047
PA224M	0.0176 ± 0.0024	0.0012 ± 0.0020	0.0008 ± 0.0020	0.0008 ± 0.0020	0.0134 ± 0.0079	0.0130 ± 0.0034	0.0150 ± 0.0102
N_HEPT	0.0112 ± 0.0023	0.0031 ± 0.0021	0.0024 ± 0.0021	0.0011 ± 0.0020	0.0084 ± 0.0031	0.0083 ± 0.0020	0.0070 ± 0.0026
MECYHX	0.0113 ± 0.0023	0.0045 ± 0.0021	0.0035 ± 0.0021	0.0032 ± 0.0021	0.0094 ± 0.0037	0.0094 ± 0.0023	0.0080 ± 0.0049
PA234M	0.0057 ± 0.0021	0.0005 ± 0.0020	0.0000 ± 0.0020	0.0000 ± 0.0020	0.0080 ± 0.0053	0.0074 ± 0.0019	0.0087 ± 0.0070
TOLUE	0.0417 ± 0.0029	0.0238 ± 0.0025	0.0132 ± 0.0023	0.0142 ± 0.0023	0.0603 ± 0.0223	0.0538 ± 0.0127	0.0486 ± 0.0227
HEP2ME	0.0045 ± 0.0021	0.0027 ± 0.0021	0.0025 ± 0.0021	0.0023 ± 0.0021	0.0060 ± 0.0022	0.0056 ± 0.0013	0.0050 ± 0.0014
HEP3ME	0.0039 ± 0.0021	0.0016 ± 0.0020	0.0016 ± 0.0020	0.0012 ± 0.0020	0.0057 ± 0.0020	0.0053 ± 0.0013	0.0047 ± 0.0013
N_OCT	0.0043 ± 0.0021	0.0054 ± 0.0021	0.0044 ± 0.0021	0.0047 ± 0.0021	0.0042 ± 0.0077	0.0038 ± 0.0009	0.0033 ± 0.0504
ETBZ	0.0067 ± 0.0022	0.0060 ± 0.0021	0.0024 ± 0.0021	0.0030 ± 0.0021	0.0137 ± 0.0053	0.0123 ± 0.0031	0.0136 ± 0.0084
MP_XYL	0.0270 ± 0.0026	0.0202 ± 0.0025	0.0061 ± 0.0022	0.0094 ± 0.0022	0.0437 ± 0.0151	0.0391 ± 0.0093	0.0327 ± 0.0089
STYR	0.0052 ± 0.0021	0.0067 ± 0.0022	0.0059 ± 0.0021	0.0054 ± 0.0021	0.0087 ± 0.0064	0.0078 ± 0.0024	0.0100 ± 0.0096
O_XYL	0.0108 ± 0.0023	0.0092 ± 0.0022	0.0028 ± 0.0021	0.0037 ± 0.0021	0.0165 ± 0.0055	0.0146 ± 0.0035	0.0138 ± 0.0046
N_NON	0.0047 ± 0.0021	0.0127 ± 0.0023	0.0104 ± 0.0022	0.0091 ± 0.0022	0.0027 ± 0.0012	0.0024 ± 0.0006	0.0019 ± 0.0005
IPRBZ	0.0012 ± 0.0020	0.0009 ± 0.0020	0.0006 ± 0.0020	0.0005 ± 0.0020	0.0007 ± 0.0003	0.0006 ± 0.0002	0.0006 ± 0.0003
N_PRBZ	0.0033 ± 0.0021	0.0036 ± 0.0021	0.0016 ± 0.0020	0.0009 ± 0.0020	0.0030 ± 0.0010	0.0025 ± 0.0006	0.0024 ± 0.0007
M_ETOL	0.0103 ± 0.0022	0.0098 ± 0.0022	0.0045 ± 0.0021	0.0047 ± 0.0021	0.0202 ± 0.0089	0.0163 ± 0.0038	0.0159 ± 0.0067
P_ETOL	0.0059 ± 0.0021	0.0057 ± 0.0021	0.0021 ± 0.0021	0.0023 ± 0.0021	0.0052 ± 0.0015	0.0047 ± 0.0012	0.0042 ± 0.0006
BZ135M	0.0053 ± 0.0021	0.0045 ± 0.0021	0.0024 ± 0.0021	0.0026 ± 0.0021	0.0072 ± 0.0026	0.0061 ± 0.0015	0.0055 ± 0.0015
O_ETOL	0.0029 ± 0.0021	0.0053 ± 0.0021	0.0032 ± 0.0021	0.0030 ± 0.0021	0.0061 ± 0.0021	0.0051 ± 0.0013	0.0049 ± 0.0011
BZ124M	0.0211 ± 0.0025	0.0035 ± 0.0021	0.0018 ± 0.0020	0.0014 ± 0.0020	0.0046 ± 0.0018	0.0036 ± 0.0009	0.0033 ± 0.0007
N_DEC	0.0085 ± 0.0022	0.0249 ± 0.0026	0.0234 ± 0.0025	0.0163 ± 0.0024	0.0016 ± 0.0011	0.0014 ± 0.0004	0.0012 ± 0.0006
BZ123M	0.0053 ± 0.0021	0.0056 ± 0.0021	0.0037 ± 0.0021	0.0032 ± 0.0021	0.0052 ± 0.0020	0.0042 ± 0.0011	0.0037 ± 0.0007
DETBZ1	0.0014 ± 0.0020	0.0026 ± 0.0021	0.0018 ± 0.0021	0.0046 ± 0.0021	0.0013 ± 0.0006	0.0010 ± 0.0003	0.0009 ± 0.0005
DETBZ2	0.0054 ± 0.0021	0.0101 ± 0.0022	0.0080 ± 0.0022	0.0027 ± 0.0021	0.0079 ± 0.0033	0.0064 ± 0.0016	0.0057 ± 0.0027
N_UNDE	0.0059 ± 0.0021	0.0507 ± 0.0030	0.0478 ± 0.0030	0.0328 ± 0.0027	0.0011 ± 0.0027	0.0007 ± 0.0002	0.0005 ± 0.0093

Table 3.2-7 (continued). Source profiles evaluated for sensitivity analysis in CCOS VOC CMB

Species	COLDhiemE	COLDloem	COLDloemE	COLDloemsub	COLDincrE	WARM01C	WARMhiemE
ETHANE	0.0270 ± 0.0138	0.0266 ± 0.0090	0.0288 ± 0.0057	0.0269 ± 0.0090	0.0083 ± 0.0037	0.0407 ± 0.0221	0.0170 ± 0.0159
ETHENE	0.1445 ± 0.1018	0.1015 ± 0.0312	0.1099 ± 0.0215	0.0935 ± 0.0187	0.0723 ± 0.0381	0.0763 ± 0.0685	0.1610 ± 0.1394
ACETYL	0.0839 ± 0.0445	0.0348 ± 0.0109	0.0324 ± 0.0046	0.0304 ± 0.0077	0.0290 ± 0.0104	0.0160 ± 0.0326	0.1029 ± 0.0916
LBUTIE	0.0400 ± 0.0211	0.0515 ± 0.0140	0.0504 ± 0.0077	0.0508 ± 0.0126	0.0201 ± 0.0044	0.0459 ± 0.0156	0.0480 ± 0.0447
PROPE	0.0597 ± 0.0398	0.0544 ± 0.0132	0.0543 ± 0.0091	0.0507 ± 0.0105	0.0347 ± 0.0161	0.0480 ± 0.0291	0.0817 ± 0.0697
N_PROP	0.0019 ± 0.0010	0.0024 ± 0.0010	0.0021 ± 0.0003	0.0025 ± 0.0010	0.0006 ± 0.0003	0.0064 ± 0.0066	0.0010 ± 0.0008
I_BUTA	0.0013 ± 0.0006	0.0018 ± 0.0006	0.0018 ± 0.0003	0.0019 ± 0.0007	0.0006 ± 0.0002	0.0030 ± 0.0019	0.0013 ± 0.0012
N_BUTA	0.0073 ± 0.0033	0.0080 ± 0.0037	0.0088 ± 0.0019	0.0087 ± 0.0042	0.0034 ± 0.0015	0.0106 ± 0.0056	0.0040 ± 0.0040
T2BUTE	0.0038 ± 0.0019	0.0051 ± 0.0012	0.0049 ± 0.0008	0.0049 ± 0.0012	0.0026 ± 0.0009	0.0046 ± 0.0014	0.0040 ± 0.0036
C2BUTE	0.0027 ± 0.0014	0.0036 ± 0.0009	0.0035 ± 0.0005	0.0035 ± 0.0008	0.0019 ± 0.0007	0.0032 ± 0.0010	0.0029 ± 0.0026
IPENTA	0.2006 ± 0.1207	0.0932 ± 0.0485	0.1069 ± 0.0274	0.0904 ± 0.0217	0.1672 ± 0.1296	0.1100 ± 0.0570	0.1681 ± 0.1675
PENTE1	0.0020 ± 0.0011	0.0021 ± 0.0006	0.0019 ± 0.0003	0.0020 ± 0.0006	0.0011 ± 0.0003	0.0020 ± 0.0034	0.0022 ± 0.0008
N_PENT	0.0170 ± 0.0087	0.0208 ± 0.0059	0.0222 ± 0.0041	0.0214 ± 0.0062	0.0132 ± 0.0073	0.0226 ± 0.0073	0.0186 ± 0.0182
I_PREN	0.0032 ± 0.0022	0.0029 ± 0.0018	0.0023 ± 0.0004	0.0029 ± 0.0020	0.0019 ± 0.0009	0.0018 ± 0.0017	0.0033 ± 0.0031
T2PENE	0.0026 ± 0.0012	0.0029 ± 0.0008	0.0027 ± 0.0004	0.0028 ± 0.0008	0.0019 ± 0.0007	0.0020 ± 0.0008	0.0019 ± 0.0016
C2PENE	0.0015 ± 0.0007	0.0016 ± 0.0005	0.0015 ± 0.0002	0.0015 ± 0.0005	0.0010 ± 0.0004	0.0011 ± 0.0004	0.0010 ± 0.0009
BU22DM	0.0066 ± 0.0035	0.0117 ± 0.0052	0.0109 ± 0.0017	0.0128 ± 0.0057	0.0049 ± 0.0013	0.0147 ± 0.0069	0.0101 ± 0.0100
CPENTA	0.0021 ± 0.0010	0.0041 ± 0.0015	0.0038 ± 0.0006	0.0046 ± 0.0013	0.0018 ± 0.0004	0.0040 ± 0.0017	0.0015 ± 0.0015
BU23DM	0.0096 ± 0.0040	0.0135 ± 0.0040	0.0134 ± 0.0023	0.0148 ± 0.0038	0.0064 ± 0.0021	0.0141 ± 0.0045	0.0056 ± 0.0054
PENA2M	0.0270 ± 0.0138	0.0336 ± 0.0101	0.0373 ± 0.0078	0.0357 ± 0.0120	0.0182 ± 0.0092	0.0337 ± 0.0104	0.0279 ± 0.0274
PENA3M	0.0221 ± 0.0095	0.0387 ± 0.0114	0.0380 ± 0.0062	0.0428 ± 0.0090	0.0185 ± 0.0055	0.0386 ± 0.0135	0.0146 ± 0.0143
PIE2ME	0.0086 ± 0.0059	0.0047 ± 0.0074	0.0075 ± 0.0035	0.0037 ± 0.0078	0.0061 ± 0.0048	0.0039 ± 0.0073	0.0119 ± 0.0117
N_HEX	0.0116 ± 0.0055	0.0189 ± 0.0050	0.0195 ± 0.0037	0.0198 ± 0.0051	0.0110 ± 0.0050	0.0263 ± 0.0321	0.0110 ± 0.0108
MCYPNA	0.0144 ± 0.0062	0.0193 ± 0.0039	0.0198 ± 0.0033	0.0205 ± 0.0033	0.0108 ± 0.0043	0.0178 ± 0.0048	0.0100 ± 0.0098
PEN24M	0.0145 ± 0.0066	0.0137 ± 0.0047	0.0141 ± 0.0025	0.0149 ± 0.0045	0.0079 ± 0.0034	0.0134 ± 0.0074	0.0054 ± 0.0052
BENZE	0.0498 ± 0.0271	0.0570 ± 0.0116	0.0595 ± 0.0105	0.0558 ± 0.0106	0.0224 ± 0.0088	0.0855 ± 0.0329	0.0429 ± 0.0389
CYHEXA	0.0065 ± 0.0032	0.0112 ± 0.0034	0.0114 ± 0.0021	0.0117 ± 0.0038	0.0067 ± 0.0028	0.0098 ± 0.0031	0.0081 ± 0.0079
HEXA2M	0.0095 ± 0.0045	0.0181 ± 0.0032	0.0179 ± 0.0027	0.0193 ± 0.0030	0.0086 ± 0.0029	0.0173 ± 0.0056	0.0086 ± 0.0085
PEN23M	0.0200 ± 0.0092	0.0185 ± 0.0078	0.0192 ± 0.0036	0.0201 ± 0.0073	0.0091 ± 0.0033	0.0164 ± 0.0097	0.0070 ± 0.0068
HEXA3M	0.0115 ± 0.0049	0.0193 ± 0.0036	0.0188 ± 0.0028	0.0208 ± 0.0028	0.0090 ± 0.0028	0.0188 ± 0.0054	0.0082 ± 0.0080
PA224M	0.0118 ± 0.0051	0.0143 ± 0.0050	0.0140 ± 0.0024	0.0149 ± 0.0056	0.0082 ± 0.0034	0.0152 ± 0.0096	0.0038 ± 0.0037
N_HEPT	0.0061 ± 0.0028	0.0103 ± 0.0020	0.0100 ± 0.0015	0.0107 ± 0.0019	0.0048 ± 0.0018	0.0105 ± 0.0033	0.0053 ± 0.0052
MECYHX	0.0068 ± 0.0031	0.0116 ± 0.0028	0.0116 ± 0.0018	0.0121 ± 0.0032	0.0058 ± 0.0018	0.0094 ± 0.0036	0.0056 ± 0.0055
PA234M	0.0064 ± 0.0028	0.0090 ± 0.0034	0.0082 ± 0.0012	0.0098 ± 0.0037	0.0043 ± 0.0014	0.0096 ± 0.0064	0.0016 ± 0.0016
TOLUE	0.0401 ± 0.0173	0.0730 ± 0.0199	0.0651 ± 0.0081	0.0725 ± 0.0192	0.0325 ± 0.0093	0.0744 ± 0.0296	0.0549 ± 0.0535
HEP2ME	0.0042 ± 0.0018	0.0072 ± 0.0015	0.0067 ± 0.0009	0.0071 ± 0.0013	0.0036 ± 0.0013	0.0081 ± 0.0031	0.0028 ± 0.0027
HEP3ME	0.0042 ± 0.0019	0.0068 ± 0.0014	0.0063 ± 0.0008	0.0069 ± 0.0013	0.0034 ± 0.0014	0.0077 ± 0.0026	0.0033 ± 0.0032
N_OCT	0.0029 ± 0.0013	0.0049 ± 0.0060	0.0045 ± 0.0006	0.0051 ± 0.0615	0.0027 ± 0.0012	0.0056 ± 0.0021	0.0024 ± 0.0023
ETBZ	0.0110 ± 0.0049	0.0153 ± 0.0048	0.0134 ± 0.0016	0.0150 ± 0.0046	0.0095 ± 0.0030	0.0137 ± 0.0050	0.0117 ± 0.0115
MP_XYL	0.0291 ± 0.0130	0.0527 ± 0.0129	0.0474 ± 0.0058	0.0529 ± 0.0139	0.0256 ± 0.0080	0.0486 ± 0.0183	0.0395 ± 0.0388
STYR	0.0078 ± 0.0040	0.0080 ± 0.0042	0.0079 ± 0.0018	0.0095 ± 0.0047	0.0047 ± 0.0016	0.0082 ± 0.0051	0.0084 ± 0.0079
O_XYL	0.0118 ± 0.0051	0.0190 ± 0.0050	0.0169 ± 0.0020	0.0191 ± 0.0052	0.0106 ± 0.0034	0.0170 ± 0.0059	0.0144 ± 0.0142
N_NON	0.0018 ± 0.0008	0.0030 ± 0.0011	0.0028 ± 0.0004	0.0032 ± 0.0013	0.0019 ± 0.0009	0.0034 ± 0.0013	0.0015 ± 0.0013
IPRBZ	0.0005 ± 0.0003	0.0008 ± 0.0003	0.0007 ± 0.0001	0.0008 ± 0.0003	0.0006 ± 0.0002	0.0007 ± 0.0002	0.0006 ± 0.0006
N_PRBZ	0.0022 ± 0.0011	0.0031 ± 0.0011	0.0027 ± 0.0003	0.0031 ± 0.0012	0.0025 ± 0.0011	0.0025 ± 0.0008	0.0027 ± 0.0026
M_ETOL	0.0129 ± 0.0055	0.0230 ± 0.0090	0.0191 ± 0.0021	0.0233 ± 0.0089	0.0139 ± 0.0044	0.0202 ± 0.0084	0.0131 ± 0.0127
P_ETOL	0.0041 ± 0.0020	0.0055 ± 0.0015	0.0051 ± 0.0008	0.0053 ± 0.0018	0.0044 ± 0.0021	0.0043 ± 0.0013	0.0062 ± 0.0060
BZ135M	0.0049 ± 0.0022	0.0079 ± 0.0026	0.0070 ± 0.0009	0.0079 ± 0.0029	0.0053 ± 0.0021	0.0069 ± 0.0026	0.0067 ± 0.0065
O_ETOL	0.0045 ± 0.0020	0.0064 ± 0.0022	0.0057 ± 0.0007	0.0065 ± 0.0024	0.0046 ± 0.0019	0.0052 ± 0.0018	0.0058 ± 0.0056
BZ124M	0.0029 ± 0.0013	0.0048 ± 0.0018	0.0041 ± 0.0005	0.0048 ± 0.0020	0.0036 ± 0.0016	0.0039 ± 0.0016	0.0040 ± 0.0038
N_DEC	0.0012 ± 0.0006	0.0017 ± 0.0007	0.0016 ± 0.0002	0.0017 ± 0.0008	0.0012 ± 0.0006	0.0020 ± 0.0011	0.0010 ± 0.0007
BZ123M	0.0035 ± 0.0016	0.0055 ± 0.0020	0.0048 ± 0.0006	0.0055 ± 0.0023	0.0041 ± 0.0017	0.0045 ± 0.0017	0.0049 ± 0.0047
DETBZ1	0.0008 ± 0.0004	0.0014 ± 0.0006	0.0012 ± 0.0002	0.0014 ± 0.0007	0.0011 ± 0.0005	0.0012 ± 0.0005	0.0009 ± 0.0009
DETBZ2	0.0051 ± 0.0024	0.0085 ± 0.0035	0.0074 ± 0.0010	0.0084 ± 0.0036	0.0061 ± 0.0025	0.0074 ± 0.0030	0.0065 ± 0.0061
N_UNDE	0.0005 ± 0.0003	0.0009 ± 0.0115	0.0008 ± 0.0002	0.0008 ± 0.0108	0.0006 ± 0.0004	0.0014 ± 0.0024	0.0009 ± 0.0001

Table 3.2-7 (continued). Source profiles evaluated for sensitivity analysis in CCOS VOC CMB.

Species	WARM01E	WARMloemE	COWAloemE	ALMOcomb0	CEDcomb01	OAKcomb01	EUCAcomb0
ETHANE	0.0298 ± 0.0065	0.0275 ± 0.0063	0.2820 ± 0.0905	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001
ETHENE	0.1482 ± 0.0447	0.1261 ± 0.0414	1.2250 ± 0.4488	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001
ACETYL	0.0307 ± 0.0156	0.0166 ± 0.0089	0.2166 ± 0.0870	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001
LBUTIE	0.0467 ± 0.0116	0.0401 ± 0.0104	0.4369 ± 0.1416	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001
PROPE	0.0675 ± 0.0194	0.0563 ± 0.0173	0.5630 ± 0.1981	0.0488 ± 0.0030	0.1618 ± 0.0121	0.0749 ± 0.0034	0.0229 ± 0.0025
N_PROP	0.0022 ± 0.0005	0.0021 ± 0.0004	0.0211 ± 0.0066	0.0813 ± 0.0035	0.0946 ± 0.0064	0.1718 ± 0.0046	0.0792 ± 0.0035
I_BUTA	0.0020 ± 0.0005	0.0018 ± 0.0005	0.0182 ± 0.0063	0.0197 ± 0.0024	0.0122 ± 0.0006	0.0169 ± 0.0024	0.0292 ± 0.0026
N_BUTA	0.0078 ± 0.0019	0.0073 ± 0.0019	0.0781 ± 0.0256	0.0619 ± 0.0032	0.0301 ± 0.0015	0.0474 ± 0.0030	0.0755 ± 0.0034
T2BUTE	0.0053 ± 0.0014	0.0048 ± 0.0014	0.0484 ± 0.0166	0.0133 ± 0.0023	0.0298 ± 0.0021	0.0177 ± 0.0024	0.0097 ± 0.0022
C2BUTE	0.0038 ± 0.0010	0.0034 ± 0.0010	0.0346 ± 0.0119	0.0077 ± 0.0022	0.0114 ± 0.0008	0.0076 ± 0.0022	0.0056 ± 0.0021
IPENTA	0.1464 ± 0.0484	0.1233 ± 0.0443	1.1960 ± 0.4591	0.0920 ± 0.0036	0.0253 ± 0.0009	0.0648 ± 0.0032	0.1209 ± 0.0040
PENTE1	0.0019 ± 0.0005	0.0016 ± 0.0005	0.0168 ± 0.0056	0.0091 ± 0.0022	0.0065 ± 0.0003	0.0163 ± 0.0024	0.0164 ± 0.0024
N_PENT	0.0226 ± 0.0054	0.0200 ± 0.0051	0.2094 ± 0.0684	0.0264 ± 0.0026	0.0121 ± 0.0005	0.0184 ± 0.0024	0.0279 ± 0.0026
I_PREN	0.0029 ± 0.0011	0.0025 ± 0.0011	0.0244 ± 0.0101	0.0075 ± 0.0022	0.0249 ± 0.0019	0.0098 ± 0.0022	0.0037 ± 0.0021
T2PENE	0.0022 ± 0.0005	0.0019 ± 0.0005	0.0219 ± 0.0070	0.0128 ± 0.0023	0.0090 ± 0.0005	0.0116 ± 0.0023	0.0132 ± 0.0023
C2PENE	0.0012 ± 0.0003	0.0011 ± 0.0003	0.0119 ± 0.0039	0.0072 ± 0.0022	0.0054 ± 0.0003	0.0071 ± 0.0022	0.0075 ± 0.0022
BU22DM	0.0117 ± 0.0029	0.0103 ± 0.0027	0.1059 ± 0.0349	0.0031 ± 0.0021	0.0047 ± 0.0003	0.0026 ± 0.0021	0.0052 ± 0.0021
CPENTA	0.0032 ± 0.0010	0.0030 ± 0.0010	0.0326 ± 0.0114	0.0049 ± 0.0021	0.0015 ± 0.0001	0.0047 ± 0.0021	0.0051 ± 0.0021
BU23DM	0.0118 ± 0.0031	0.0110 ± 0.0030	0.1190 ± 0.0394	0.0071 ± 0.0022	0.0018 ± 0.0000	0.0046 ± 0.0021	0.0072 ± 0.0022
PENA2M	0.0305 ± 0.0071	0.0266 ± 0.0064	0.3024 ± 0.0967	0.0243 ± 0.0025	0.0087 ± 0.0003	0.0139 ± 0.0023	0.0267 ± 0.0026
PENA3M	0.0305 ± 0.0076	0.0284 ± 0.0075	0.3171 ± 0.1029	0.0188 ± 0.0024	0.0110 ± 0.0007	0.0152 ± 0.0024	0.0239 ± 0.0025
PIE2ME	0.0077 ± 0.0027	0.0061 ± 0.0023	0.0661 ± 0.0263	0.0000 ± 0.0020	0.0058 ± 0.0000	0.0286 ± 0.0026	0.0013 ± 0.0020
N_HEX	0.0172 ± 0.0040	0.0157 ± 0.0039	0.1707 ± 0.0551	0.0125 ± 0.0023	0.0047 ± 0.0002	0.0152 ± 0.0024	0.0146 ± 0.0023
MCYPNA	0.0148 ± 0.0033	0.0134 ± 0.0032	0.1553 ± 0.0488	0.0181 ± 0.0024	0.0053 ± 0.0010	0.0112 ± 0.0023	0.0186 ± 0.0024
PEN24M	0.0115 ± 0.0028	0.0108 ± 0.0027	0.1190 ± 0.0384	0.0072 ± 0.0022	0.0050 ± 0.0004	0.0054 ± 0.0021	0.0066 ± 0.0022
BENZE	0.0693 ± 0.0182	0.0634 ± 0.0177	0.6293 ± 0.2149	0.0705 ± 0.0033	0.1858 ± 0.0136	0.1083 ± 0.0039	0.0551 ± 0.0031
CYHEXA	0.0094 ± 0.0024	0.0083 ± 0.0022	0.0935 ± 0.0306	0.0040 ± 0.0021	0.0135 ± 0.0007	0.0020 ± 0.0021	0.0032 ± 0.0021
HEXA2M	0.0126 ± 0.0027	0.0114 ± 0.0025	0.1356 ± 0.0419	0.0107 ± 0.0023	0.0046 ± 0.0003	0.0069 ± 0.0022	0.0132 ± 0.0023
PEN23M	0.0128 ± 0.0026	0.0119 ± 0.0025	0.1425 ± 0.0440	0.0086 ± 0.0022	0.0034 ± 0.0007	0.0041 ± 0.0021	0.0093 ± 0.0022
HEXA3M	0.0134 ± 0.0028	0.0123 ± 0.0027	0.1442 ± 0.0443	0.0129 ± 0.0023	0.0075 ± 0.0003	0.0089 ± 0.0022	0.0148 ± 0.0023
PA224M	0.0116 ± 0.0031	0.0111 ± 0.0031	0.1211 ± 0.0402	0.0127 ± 0.0023	0.0027 ± 0.0001	0.0059 ± 0.0021	0.0123 ± 0.0023
N_HEPT	0.0076 ± 0.0016	0.0069 ± 0.0015	0.0793 ± 0.0246	0.0100 ± 0.0022	0.0085 ± 0.0002	0.0092 ± 0.0022	0.0115 ± 0.0023
MECYHX	0.0074 ± 0.0016	0.0066 ± 0.0015	0.0821 ± 0.0252	0.0082 ± 0.0022	0.0043 ± 0.0001	0.0062 ± 0.0022	0.0110 ± 0.0023
PA234M	0.0063 ± 0.0017	0.0060 ± 0.0016	0.0678 ± 0.0221	0.0062 ± 0.0022	0.0027 ± 0.0001	0.0035 ± 0.0021	0.0060 ± 0.0022
TOLUE	0.0521 ± 0.0124	0.0446 ± 0.0107	0.5144 ± 0.1608	0.0943 ± 0.0037	0.1123 ± 0.0070	0.0856 ± 0.0035	0.0981 ± 0.0037
HEP2ME	0.0052 ± 0.0012	0.0049 ± 0.0011	0.0547 ± 0.0171	0.0054 ± 0.0021	0.0015 ± 0.0001	0.0029 ± 0.0021	0.0036 ± 0.0021
HEP3ME	0.0052 ± 0.0012	0.0048 ± 0.0011	0.0530 ± 0.0166	0.0057 ± 0.0021	0.0018 ± 0.0001	0.0031 ± 0.0021	0.0044 ± 0.0021
N_OCT	0.0042 ± 0.0011	0.0038 ± 0.0010	0.0407 ± 0.0134	0.0053 ± 0.0021	0.0043 ± 0.0001	0.0041 ± 0.0021	0.0022 ± 0.0021
ETBZ	0.0105 ± 0.0026	0.0089 ± 0.0022	0.1039 ± 0.0326	0.0192 ± 0.0024	0.0171 ± 0.0010	0.0149 ± 0.0023	0.0203 ± 0.0025
MP_XYL	0.0341 ± 0.0084	0.0287 ± 0.0070	0.3481 ± 0.1082	0.0725 ± 0.0034	0.0516 ± 0.0026	0.0496 ± 0.0030	0.0732 ± 0.0034
STYR	0.0115 ± 0.0047	0.0103 ± 0.0046	0.0966 ± 0.0421	0.0087 ± 0.0022	0.0229 ± 0.0017	0.0114 ± 0.0023	0.0085 ± 0.0022
O_XYL	0.0132 ± 0.0033	0.0112 ± 0.0029	0.1312 ± 0.0414	0.0326 ± 0.0027	0.0152 ± 0.0008	0.0205 ± 0.0025	0.0320 ± 0.0027
N_NON	0.0024 ± 0.0006	0.0022 ± 0.0006	0.0242 ± 0.0079	0.0048 ± 0.0021	0.0023 ± 0.0001	0.0039 ± 0.0021	0.0019 ± 0.0021
IPRBZ	0.0006 ± 0.0002	0.0005 ± 0.0002	0.0058 ± 0.0019	0.0016 ± 0.0020	0.0014 ± 0.0001	0.0010 ± 0.0020	0.0015 ± 0.0020
N_PRBZ	0.0023 ± 0.0006	0.0020 ± 0.0005	0.0221 ± 0.0072	0.0061 ± 0.0022	0.0019 ± 0.0001	0.0029 ± 0.0021	0.0046 ± 0.0021
M_ETOL	0.0150 ± 0.0037	0.0132 ± 0.0034	0.1517 ± 0.0482	0.0216 ± 0.0025	0.0114 ± 0.0006	0.0131 ± 0.0023	0.0200 ± 0.0025
P_ETOL	0.0046 ± 0.0013	0.0038 ± 0.0011	0.0424 ± 0.0140	0.0089 ± 0.0022	0.0072 ± 0.0004	0.0055 ± 0.0021	0.0085 ± 0.0022
BZ135M	0.0060 ± 0.0015	0.0051 ± 0.0013	0.0573 ± 0.0183	0.0105 ± 0.0023	0.0040 ± 0.0002	0.0067 ± 0.0022	0.0074 ± 0.0022
O_ETOL	0.0052 ± 0.0014	0.0044 ± 0.0012	0.0485 ± 0.0159	0.0074 ± 0.0022	0.0035 ± 0.0002	0.0048 ± 0.0021	0.0061 ± 0.0022
BZ124M	0.0040 ± 0.0011	0.0034 ± 0.0010	0.0368 ± 0.0124	0.0354 ± 0.0028	0.0160 ± 0.0008	0.0203 ± 0.0025	0.0276 ± 0.0026
N_DEC	0.0013 ± 0.0003	0.0012 ± 0.0003	0.0131 ± 0.0042	0.0037 ± 0.0021	0.0020 ± 0.0001	0.0073 ± 0.0022	0.0003 ± 0.0020
BZ123M	0.0044 ± 0.0012	0.0037 ± 0.0010	0.0409 ± 0.0134	0.0107 ± 0.0023	0.0116 ± 0.0007	0.0074 ± 0.0022	0.0092 ± 0.0022
DETBZ1	0.0010 ± 0.0003	0.0009 ± 0.0003	0.0102 ± 0.0033	0.0026 ± 0.0021	0.0006 ± 0.0000	0.0021 ± 0.0021	0.0031 ± 0.0021
DETBZ2	0.0061 ± 0.0015	0.0052 ± 0.0013	0.0592 ± 0.0189	0.0126 ± 0.0023	0.0045 ± 0.0005	0.0061 ± 0.0022	0.0095 ± 0.0022
N_UNDE	0.0007 ± 0.0002	0.0006 ± 0.0001	0.0067 ± 0.0021	0.0034 ± 0.0021	0.0024 ± 0.0001	0.0061 ± 0.0022	0.0005 ± 0.0020

Table 3.2-7 (continued). Source profiles evaluated for sensitivity analysis in CCOS VOC CMB

Species	WHEATcomb	RICEcomb0
ETHANE	0.0000 ± 0.0001	0.0000 ± 0.0001
ETHENE	0.0000 ± 0.0001	0.0000 ± 0.0001
ACETYL	0.0000 ± 0.0001	0.0000 ± 0.0001
LBUT1E	0.0000 ± 0.0001	0.0000 ± 0.0001
PROPE	0.1696 ± 0.0046	0.0623 ± 0.0032
N_PROP	0.1428 ± 0.0043	0.1013 ± 0.0038
I_BUTA	0.0243 ± 0.0025	0.0313 ± 0.0027
N_BUTA	0.0570 ± 0.0031	0.0799 ± 0.0035
T2BUTE	0.0291 ± 0.0026	0.0131 ± 0.0023
C2BUTE	0.0126 ± 0.0023	0.0075 ± 0.0022
IPENTA	0.0384 ± 0.0028	0.0683 ± 0.0033
PENTE1	0.0089 ± 0.0022	0.0188 ± 0.0024
N_PENT	0.0139 ± 0.0023	0.0199 ± 0.0025
I_PREN	0.0163 ± 0.0024	0.0112 ± 0.0023
T2PENE	0.0095 ± 0.0022	0.0087 ± 0.0022
C2PENE	0.0054 ± 0.0021	0.0049 ± 0.0021
BU22DM	0.0047 ± 0.0021	0.0022 ± 0.0021
CPENTA	0.0011 ± 0.0020	0.0031 ± 0.0021
BU23DM	0.0018 ± 0.0020	0.0032 ± 0.0021
PENA2M	0.0104 ± 0.0023	0.0110 ± 0.0023
PENA3M	0.0032 ± 0.0021	0.0119 ± 0.0023
P1E2ME	0.0000 ± 0.0020	0.0008 ± 0.0020
N_HEX	0.0079 ± 0.0022	0.0105 ± 0.0023
MCYPNA	0.0049 ± 0.0021	0.0072 ± 0.0022
PEN24M	0.0039 ± 0.0021	0.0022 ± 0.0021
BENZE	0.1723 ± 0.0046	0.2524 ± 0.0054
CYHEXA	0.0023 ± 0.0021	0.0019 ± 0.0021
HEXA2M	0.0023 ± 0.0021	0.0042 ± 0.0021
PEN23M	0.0023 ± 0.0021	0.0028 ± 0.0021
HEXA3M	0.0047 ± 0.0021	0.0054 ± 0.0021
PA224M	0.0046 ± 0.0021	0.0048 ± 0.0021
N_HEPT	0.0066 ± 0.0022	0.0079 ± 0.0022
MECYHX	0.0023 ± 0.0021	0.0045 ± 0.0021
PA234M	0.0025 ± 0.0021	0.0020 ± 0.0021
TOLUE	0.0984 ± 0.0037	0.0883 ± 0.0036
HEP2ME	0.0013 ± 0.0020	0.0017 ± 0.0020
HEP3ME	0.0032 ± 0.0021	0.0016 ± 0.0020
N_OCT	0.0034 ± 0.0021	0.0035 ± 0.0021
ETBZ	0.0138 ± 0.0023	0.0110 ± 0.0023
MP_XYL	0.0352 ± 0.0027	0.0369 ± 0.0028
STYR	0.0143 ± 0.0023	0.0126 ± 0.0023
O_XYL	0.0171 ± 0.0024	0.0141 ± 0.0023
N_NON	0.0029 ± 0.0021	0.0046 ± 0.0021
IPRBZ	0.0007 ± 0.0020	0.0009 ± 0.0020
N_PRBZ	0.0020 ± 0.0021	0.0026 ± 0.0021
M_ETOL	0.0063 ± 0.0022	0.0084 ± 0.0022
P_ETOL	0.0037 ± 0.0021	0.0041 ± 0.0021
BZ135M	0.0028 ± 0.0021	0.0045 ± 0.0021
O_ETOL	0.0027 ± 0.0021	0.0024 ± 0.0021
BZ124M	0.0124 ± 0.0023	0.0120 ± 0.0023
N_DEC	0.0043 ± 0.0021	0.0095 ± 0.0022
BZ123M	0.0033 ± 0.0021	0.0050 ± 0.0021
DETBZ1	0.0007 ± 0.0020	0.0019 ± 0.0021
DETBZ2	0.0024 ± 0.0021	0.0037 ± 0.0021
N_UNDE	0.0037 ± 0.0021	0.0064 ± 0.0022

Table 3.3-1a. Hourly average source contributions to sum of PAMS VOCs for auto-GC/MS data at Granite Bay during CCOS IOPs.

Hour (PDT)	# in Avg	PAMS (ug/m ³)	R ²	χ ²	% PAMS Explained	Gasoline Exhaust	Liquid Gasoline	Gasoline Vapor	Diesel Exhaust	Consumer Products	Coatings	CNG	LPG	Biogenic	Biomass Burning
<u>Absolute Contributions (ug/m³)</u>															
0	7	27.8±9.3	0.87	3.22	97.3±2.6	11.8±0.2	7.6±0.2	1.4±0.1	0.0±0.0	1.1±0.1	0.7±0.0	0.7±0.0	1.1±0.1	2.3±0.2	0.0±0.0
1	8	18.6±5.8	0.81	3.16	92.9±4.4	7.0±0.5	3.9±0.5	0.9±0.3	0.5±0.6	0.8±0.0	0.5±0.2	0.9±0.1	1.1±0.1	1.8±0.2	0.0±0.0
2	8	19.4±6.8	0.82	3.08	93.8±4.0	7.5±0.5	3.9±0.5	1.1±0.3	0.3±0.8	0.9±0.0	0.8±0.1	0.8±0.0	1.2±0.2	1.7±0.2	0.0±0.0
5	8	19.6±7.8	0.84	2.97	92.6±4.2	6.0±0.5	5.4±0.5	1.2±0.2	0.5±0.7	1.1±0.0	0.6±0.2	1.1±0.1	1.3±0.2	0.9±0.1	0.0±0.0
6	9	23.5±8.1	0.86	3.29	93.9±5.8	9.6±0.2	5.1±0.2	1.7±0.3	0.7±0.8	0.8±0.0	0.5±0.2	0.8±0.0	1.5±0.2	1.4±0.1	0.0±0.0
7	8	25.4±10.8	0.88	2.66	94.9±5.7	12.0±0.6	3.1±0.6	1.4±0.3	0.6±0.8	1.5±0.1	0.4±0.2	0.5±0.1	1.6±0.2	2.9±0.3	0.0±0.0
8	8	22.1±7.6	0.89	2.00	95.1±3.1	9.4±0.6	3.1±0.6	1.3±0.2	0.0±0.6	0.8±0.0	0.6±0.1	0.7±0.0	1.0±0.1	4.0±0.3	0.0±0.0
9	8	17.1±6.2	0.89	1.61	97.1±4.4	7.1±0.5	2.3±0.5	0.9±0.2	0.1±0.8	0.9±0.0	0.5±0.1	0.9±0.0	0.9±0.1	2.9±0.2	0.0±0.0
10	8	18.0±5.8	0.91	1.64	100.1±4.7	8.2±0.5	3.0±0.5	1.3±0.3	0.3±0.7	0.9±0.0	0.4±0.2	0.9±0.1	0.9±0.1	2.0±0.1	0.0±0.0
11	9	16.3±7.0	0.88	1.98	98.4±6.9	7.8±0.7	1.5±0.7	1.5±0.1	0.2±0.9	0.9±0.0	0.4±0.1	0.8±0.1	0.8±0.2	1.9±0.2	0.0±0.0
12	8	17.6±5.2	0.88	1.89	99.8±6.4	8.2±0.8	1.6±0.8	1.9±0.1	0.3±0.9	0.7±0.0	0.7±0.1	0.9±0.0	0.9±0.1	2.4±0.1	0.0±0.0
13	9	19.9±7.5	0.86	2.49	96.8±7.4	8.8±0.8	2.1±0.8	2.3±0.3	0.4±0.8	1.1±0.0	0.6±0.1	0.9±0.0	0.7±0.2	2.4±0.1	0.0±0.0
14	10	16.4±6.2	0.88	1.57	98.5±6.9	7.0±0.6	1.1±0.6	1.8±0.1	0.3±0.7	0.9±0.1	0.7±0.1	1.0±0.0	0.7±0.2	2.7±0.2	0.0±0.1
15	10	14.5±3.8	0.87	1.58	98.4±6.8	5.8±0.6	1.0±0.6	1.4±0.2	0.5±0.8	0.9±0.0	0.5±0.1	1.0±0.0	0.5±0.1	2.6±0.2	0.0±0.0
16	10	14.7±4.3	0.86	1.65	97.3±7.0	5.2±0.6	0.9±0.6	1.3±0.2	0.6±0.7	0.9±0.1	0.4±0.2	1.1±0.0	0.3±0.1	3.5±0.3	0.0±0.1
17	9	16.3±3.2	0.85	1.85	95.8±7.6	5.9±0.7	0.9±0.7	1.7±0.3	0.5±0.8	0.6±0.0	0.4±0.0	1.1±0.0	0.3±0.0	4.2±0.3	0.0±0.2
18	8	24.3±9.0	0.87	2.06	95.5±5.8	9.0±0.6	1.6±0.6	1.6±0.2	0.3±0.7	0.7±0.0	0.5±0.1	0.9±0.1	0.2±0.1	8.3±0.7	0.0±0.1
19	9	25.5±7.9	0.88	2.09	95.7±4.9	7.6±0.5	4.8±0.5	1.6±0.2	0.4±0.6	0.9±0.0	0.5±0.2	0.9±0.0	0.6±0.2	7.3±0.9	0.0±0.0
20	7	39.9±24.6	0.88	3.17	99.0±3.9	13.5±0.7	16.6±0.7	2.9±0.6	0.6±1.0	0.5±0.1	0.6±0.1	0.8±0.2	0.8±0.2	3.5±0.3	0.0±0.0
21	6	49.9±20.3	0.85	5.02	99.3±3.6	18.4±0.9	17.1±0.9	2.8±0.5	0.7±1.0	1.1±0.2	0.7±0.1	0.7±0.2	1.3±0.2	6.3±0.8	0.0±0.0
22	6	38.9±21.7	0.85	4.52	97.9±3.1	14.3±0.5	13.7±0.5	2.3±0.6	0.4±0.7	0.8±0.1	0.5±0.1	0.7±0.1	0.9±0.1	4.4±0.5	0.0±0.0
23	8	28.2±9.9	0.87	3.46	97.0±3.3	11.8±0.2	7.6±0.2	2.1±0.2	0.5±1.0	0.9±0.0	0.7±0.1	0.6±0.0	1.0±0.1	2.1±0.2	0.0±0.0
<u>Percent Contributions</u>															
0	7	27.8±9.3	0.87	3.22	97.3±2.6	41.6±9.3	27.2±9.3	5.3±2.2	0.0±0.0	5.3±6.7	2.7±1.1	3.3±2.8	4.1±3.2	7.7±5.0	0.0±0.0
1	8	18.6±5.8	0.81	3.16	92.9±4.4	37.7±11.9	20.7±11.9	4.2±4.5	2.8±5.3	5.3±7.2	2.9±2.0	5.2±3.1	5.8±4.0	8.3±5.9	0.0±0.0
2	8	19.4±6.8	0.82	3.08	93.8±4.0	38.9±10.8	20.4±10.8	5.0±4.3	1.5±3.2	5.7±7.5	4.0±2.9	4.7±2.5	5.8±4.0	7.8±6.8	0.0±0.0
5	8	19.6±7.8	0.84	2.97	92.6±4.2	31.2±13.4	25.9±13.4	6.1±4.2	2.4±4.9	6.5±4.2	3.2±2.6	6.9±3.9	6.2±3.0	4.2±2.7	0.0±0.0
6	9	23.5±8.1	0.86	3.29	93.9±5.8	40.6±7.8	22.0±7.8	6.8±3.5	3.4±4.6	4.0±3.8	2.3±1.4	4.2±2.7	5.5±3.8	5.1±3.2	0.0±0.0
7	8	25.4±10.8	0.88	2.66	94.9±5.7	46.9±12.1	16.0±12.1	4.0±4.8	2.5±3.7	5.3±4.2	1.5±1.1	2.9±2.6	5.5±4.2	10.2±5.2	0.0±0.0
8	8	22.1±7.6	0.89	2.00	95.1±3.1	42.9±10.6	15.2±10.6	5.1±4.6	0.2±0.4	4.1±2.1	2.4±1.0	3.9±3.8	4.9±3.3	16.4±8.1	0.0±0.0
9	8	17.1±6.2	0.89	1.61	97.1±4.4	41.0±8.9	15.1±8.9	4.5±4.2	0.8±2.1	5.5±2.6	2.8±1.0	5.9±3.5	4.9±3.6	16.6±7.7	0.0±0.0
10	8	18.0±5.8	0.91	1.64	100.1±4.7	44.8±11.0	18.8±11.0	6.4±6.8	1.3±2.6	4.7±1.9	2.7±1.8	5.8±2.8	4.4±3.2	11.3±5.1	0.0±0.0
11	9	16.3±7.0	0.88	1.98	98.4±6.9	47.7±11.3	9.9±11.3	8.5±4.9	1.0±1.6	6.5±4.1	2.8±1.3	6.2±3.4	4.3±3.5	11.5±4.6	0.0±0.0
12	8	17.6±5.2	0.88	1.89	99.8±6.4	45.8±12.2	8.6±12.2	11.1±5.7	1.3±1.9	4.8±3.8	3.8±2.6	6.0±3.1	4.7±3.7	13.8±5.5	0.0±0.0
13	9	19.9±7.5	0.86	2.49	96.8±7.4	44.1±13.0	8.2±13.0	11.5±8.3	2.4±3.7	6.5±3.3	2.8±2.2	5.6±3.0	3.1±3.1	12.8±5.3	0.0±0.0
14	10	16.4±6.2	0.88	1.57	98.5±6.9	41.7±15.3	8.9±15.3	10.2±6.0	1.5±3.6	5.1±3.9	4.3±4.3	6.9±3.5	3.6±3.2	16.2±6.5	0.0±0.1
15	10	14.5±3.8	0.87	1.58	98.4±6.8	39.9±14.9	9.4±14.9	8.7±7.2	2.9±4.6	6.2±2.9	3.2±2.4	7.4±2.9	3.3±2.7	17.4±6.5	0.0±0.0
16	10	14.7±4.3	0.86	1.65	97.3±7.0	37.1±11.9	7.9±11.9	8.2±6.7	3.8±6.3	5.5±4.0	2.7±2.1	7.8±2.1	2.1±1.7	22.2±9.9	0.1±0.2
17	9	16.3±3.2	0.85	1.85	95.8±7.6	36.2±12.7	7.1±12.7	9.4±8.6	2.6±4.1	3.7±2.5	2.6±1.0	7.0±1.9	2.1±1.2	25.0±12.2	0.1±0.4
18	8	24.3±9.0	0.87	2.06	95.5±5.8	36.9±15.8	8.5±15.8	5.6±5.4	1.4±2.9	3.3±1.6	2.1±1.1	4.5±2.7	1.2±1.4	31.9±16.8	0.0±0.0
19	9	25.5±7.9	0.88	2.09	95.7±4.9	31.9±12.8	19.1±12.8	5.5±3.7	1.6±3.3	3.9±3.3	2.2±1.6	3.9±1.5	2.6±3.2	25.0±19.0	0.0±0.0
20	7	39.9±24.6	0.88	3.17	99.0±3.9	35.0±54.2	37.1±54.2	7.5±16.2	1.2±4.9	2.0±7.2	2.2±5.1	3.2±7.3	2.0±4.0	8.8±20.9	0.0±0.0
21	6	49.9±20.3	0.85	5.02	99.3±3.6	39.3±17.3	34.1±17.3	5.0±3.8	1.1±2.8	2.8±3.3	1.6±1.1	2.4±3.8	2.3±1.8	10.6±8.5	0.0±0.0
22	6	38.9±21.7	0.85	4.52	97.9±3.1	40.8±14.1	32.8±14.1	4.3±4.5	1.4±3.3	2.8±2.9	1.6±1.4	2.7±3.8	2.4±2.3	9.2±5.6	0.0±0.0
23	8	28.2±9.9	0.87	3.46	97.0±3.3	42.4±12.2	25.9±12.2	7.3±3.6	1.4±2.6	4.2±3.9	2.7±2.2	2.9±3.1	3.7±2.3	6.5±5.3	0.0±0.0

Table 3.3-1b. Hourly average source contributions to sum of PAMS VOCs for auto-GC/MS data at Parlier during CCOS IOPs.

Hour (PDT)	# in Avg	PAMS (ug/m ³)	R ²	χ ²	% PAMS Explained	Gasoline Exhaust	Liquid Gasoline	Gasoline Vapor	Diesel Exhaust	Consumer Products	Coatings	CNG	LPG	Biogenic	Biomass Burning
<u>Absolute Contributions (ug/m³)</u>															
0	5	51.3±17.5	0.83	5.80	89.3±11.7	16.9±1.2	5.8±1.2	5.0±0.4	1.5±1.3	2.0±0.2	0.5±0.1	5.1±1.1	5.9±0.9	0.2±0.1	2.2±0.6
1	7	51.8±32.6	0.87	4.28	93.4±10.8	16.8±1.0	9.9±1.0	5.8±0.6	0.2±0.9	2.8±0.2	0.7±0.1	3.8±1.0	6.6±1.5	0.3±0.1	0.9±0.5
2	5	61.6±14.1	0.86	5.91	91.4±14.3	24.7±1.2	6.2±1.2	5.4±0.2	0.3±1.2	2.8±0.2	0.6±0.3	1.8±0.6	11.6±1.3	0.3±0.1	1.6±0.6
5	6	68.7±32.4	0.84	6.45	90.9±14.0	27.3±1.3	5.9±1.3	7.4±0.6	1.7±1.1	2.7±0.2	0.3±0.3	4.5±1.7	13.1±2.2	0.3±0.1	0.2±0.4
6	6	88.1±42.9	0.86	5.50	88.6±9.6	41.8±1.3	6.2±1.3	7.4±1.0	0.9±1.4	2.7±0.2	0.7±0.3	4.3±1.2	14.4±2.1	0.4±0.0	0.1±0.4
7	8	91.0±34.3	0.87	5.16	92.2±12.0	42.6±1.0	2.4±1.0	7.1±0.9	2.0±1.4	2.4±0.2	0.5±0.3	9.9±2.5	16.0±2.0	0.2±0.0	1.1±0.6
8	10	59.6±27.9	0.85	5.51	91.4±10.9	24.9±0.9	4.6±0.9	3.8±0.6	2.3±1.0	2.3±0.1	0.3±0.2	4.5±0.7	10.2±1.7	0.2±0.0	1.0±0.6
9	10	37.9±13.7	0.82	5.21	89.7±11.3	15.8±0.0	0.0±0.0	3.2±0.4	1.7±1.0	2.5±0.2	0.3±0.2	3.7±0.4	5.3±0.7	0.3±0.0	0.6±0.3
10	9	34.9±10.6	0.81	5.57	96.4±12.2	15.8±0.6	0.1±0.6	1.9±0.3	2.0±1.1	1.9±0.2	0.5±0.3	3.5±0.3	5.6±0.6	0.3±0.1	1.2±0.3
11	10	36.2±15.8	0.84	5.24	94.9±8.8	14.4±0.8	0.5±0.8	3.2±0.4	2.7±1.0	2.5±0.2	0.3±0.3	3.6±0.4	5.1±0.3	0.3±0.1	0.7±0.3
12	7	26.7±10.7	0.87	2.99	93.7±11.7	8.6±0.9	1.1±0.9	1.6±0.3	2.4±1.0	1.9±0.2	0.4±0.2	3.0±0.3	3.7±0.2	0.4±0.1	1.2±0.4
13	9	21.0±8.2	0.89	1.98	95.8±7.4	7.9±0.5	0.4±0.5	2.0±0.2	1.3±0.8	1.2±0.1	0.3±0.2	2.9±0.2	2.8±0.3	0.4±0.1	0.6±0.2
14	9	22.8±11.3	0.84	3.46	91.3±14.1	7.4±0.0	0.0±0.0	1.6±0.2	2.5±0.8	1.6±0.2	0.3±0.3	2.8±0.3	2.4±0.2	0.4±0.1	0.9±0.2
15	9	18.9±10.1	0.83	3.74	96.2±9.6	8.2±0.0	0.0±0.0	1.6±0.3	0.9±1.0	1.2±0.1	0.6±0.2	2.7±0.3	1.9±0.2	0.3±0.0	0.3±0.2
16	9	21.4±9.1	0.83	3.67	92.9±14.7	7.8±0.5	0.3±0.5	1.8±0.2	1.3±0.8	1.5±0.2	0.5±0.2	2.5±0.2	2.2±0.2	0.3±0.0	0.7±0.2
17	11	21.1±12.2	0.79	4.60	91.3±13.3	7.0±0.9	1.6±0.9	1.6±0.3	1.8±1.0	1.0±0.2	0.8±0.1	2.2±0.1	1.4±0.2	0.4±0.1	0.4±0.3
18	9	23.8±15.0	0.83	3.88	89.8±12.0	7.0±1.0	2.6±1.0	1.8±0.4	2.1±0.9	1.3±0.2	0.3±0.3	2.4±0.2	1.7±0.2	0.6±0.1	0.5±0.3
19	9	34.4±22.2	0.80	5.47	89.7±11.4	10.5±1.1	6.2±1.1	2.2±0.4	2.4±0.8	1.6±0.3	0.2±0.3	2.6±0.2	2.3±0.3	0.5±0.1	1.2±0.5
20	5	30.2±12.0	0.88	2.90	94.7±7.4	12.3±1.0	3.4±1.0	1.2±0.3	1.5±1.0	1.2±0.1	0.2±0.3	2.3±0.2	4.4±0.3	0.2±0.0	1.3±0.5
21	6	42.5±23.0	0.85	5.36	97.7±8.8	18.6±1.4	3.3±1.4	4.0±0.8	1.7±1.1	1.7±0.2	0.1±0.3	1.6±0.1	7.5±0.9	0.1±0.0	1.6±0.5
22	5	42.2±25.3	0.80	6.33	93.0±5.4	12.0±1.2	7.4±1.2	5.4±1.0	1.4±0.8	2.3±0.2	0.1±0.3	2.3±0.4	6.1±0.9	0.1±0.0	1.3±0.5
23	10	48.3±19.0	0.86	4.64	93.1±13.1	19.6±1.3	5.1±1.3	3.9±0.5	0.8±1.1	2.1±0.2	0.7±0.2	5.0±1.0	6.3±1.2	0.1±0.1	1.1±0.5
<u>Percent Contributions</u>															
0	5	51.3±17.5	0.83	5.80	89.3±11.7	32.9±12.9	12.3±12.9	9.0±7.7	2.2±3.4	4.3±4.0	1.2±1.4	9.8±10.5	13.0±8.9	0.4±0.7	4.1±5.8
1	7	51.8±32.6	0.87	4.28	93.4±10.8	33.2±17.8	19.4±17.8	10.6±4.6	0.4±1.0	6.6±4.1	2.7±4.1	7.1±5.4	11.4±7.6	0.5±0.7	1.5±3.4
2	5	61.6±14.1	0.86	5.91	91.4±14.3	39.4±7.6	10.5±7.6	9.2±4.2	0.6±0.8	4.5±2.6	1.0±0.9	2.7±4.7	20.5±14.9	0.4±0.7	2.5±3.9
5	6	68.7±32.4	0.84	6.45	90.9±14.0	42.5±11.9	10.3±11.9	9.3±6.6	2.9±3.8	4.4±2.1	0.7±1.1	4.6±9.8	15.7±10.7	0.3±0.6	0.2±0.4
6	6	88.1±42.9	0.86	5.50	88.6±9.6	47.2±15.1	9.7±15.1	7.8±5.5	0.9±1.3	3.7±2.2	1.0±0.7	4.8±5.9	13.1±9.0	0.4±0.5	0.1±0.3
7	8	91.0±34.3	0.87	5.16	92.2±12.0	46.1±12.6	5.7±12.6	7.8±5.9	2.3±2.7	3.2±2.4	0.6±0.7	9.5±14.5	15.6±9.1	0.3±0.5	1.1±2.5
8	10	59.6±27.9	0.85	5.51	91.4±10.9	39.8±17.2	12.3±17.2	6.8±6.7	4.1±5.6	4.0±1.8	0.6±0.6	7.9±5.3	14.3±9.3	0.3±0.6	1.3±2.6
9	10	37.9±13.7	0.82	5.21	89.7±11.3	41.5±0.0	0.0±0.0	9.8±12.6	4.3±5.5	6.4±4.6	0.9±1.0	10.2±5.5	13.9±9.3	0.6±0.7	2.1±3.8
10	9	34.9±10.6	0.81	5.57	96.4±12.2	43.9±0.8	0.3±0.8	5.7±4.8	5.5±7.5	5.5±2.8	1.2±1.6	11.0±7.7	18.0±13.4	0.6±1.1	4.7±5.3
11	10	36.2±15.8	0.84	5.24	94.9±8.8	39.1±2.6	1.2±2.6	8.5±5.0	7.4±9.2	6.6±4.1	1.2±1.4	12.0±9.1	16.0±7.7	0.6±0.9	2.2±3.7
12	7	26.7±10.7	0.87	2.99	93.7±11.7	30.6±7.1	3.5±7.1	6.6±4.7	8.7±9.7	7.0±5.3	1.3±1.4	12.5±7.3	17.4±12.5	1.1±1.6	5.0±8.0
13	9	21.0±8.2	0.89	1.98	95.8±7.4	36.1±4.6	1.5±4.6	9.6±5.2	5.7±8.4	5.2±3.1	1.4±1.0	15.5±6.3	16.3±11.0	1.2±1.8	3.2±3.6
14	9	22.8±11.3	0.84	3.46	91.3±14.1	31.2±0.0	0.0±0.0	8.4±6.4	10.2±10.1	6.0±5.4	1.3±1.8	14.2±7.8	13.3±7.8	1.2±1.5	5.6±7.0
15	9	18.9±10.1	0.83	3.74	96.2±9.6	40.6±0.0	0.0±0.0	9.1±6.5	4.0±7.4	5.5±3.5	3.9±4.5	17.2±11.8	11.8±7.4	1.5±1.4	2.5±3.8
16	9	21.4±9.1	0.83	3.67	92.9±14.7	36.6±3.5	1.2±3.5	9.6±7.2	5.3±8.5	6.0±6.4	3.1±3.9	12.6±7.5	13.0±9.0	1.2±1.0	4.4±6.7
17	11	21.1±12.2	0.79	4.60	91.3±13.3	32.9±9.5	6.5±9.5	6.7±5.5	8.4±11.4	4.3±4.2	4.7±3.9	14.3±8.6	9.8±10.3	1.5±1.3	2.2±3.5
18	9	23.8±15.0	0.83	3.88	89.8±12.0	30.8±10.2	7.3±10.2	6.7±6.8	10.4±13.5	5.0±6.5	1.5±1.6	13.8±9.1	9.8±8.6	2.0±1.3	2.6±4.2
19	9	34.4±22.2	0.80	5.47	89.7±11.4	31.8±13.5	14.2±13.5	5.8±6.8	9.2±12.6	4.7±5.8	0.5±0.6	10.5±8.8	7.7±6.9	1.5±1.0	3.7±5.2
20	5	30.2±12.0	0.88	2.90	94.7±7.4	41.5±11.1	10.9±11.1	4.5±4.6	3.6±4.9	3.7±2.0	0.8±1.1	8.7±5.9	16.4±8.8	0.4±0.3	4.2±5.2
21	6	42.5±23.0	0.85	5.36	97.7±8.8	47.8±8.5	6.5±8.5	7.8±5.5	3.7±6.1	3.8±1.9	0.2±0.2	4.4±3.1	18.7±10.3	0.1±0.2	4.7±5.2
22	5	42.2±25.3	0.80	6.33	93.0±5.4	30.7±18.3	18.0±18.3	10.3±7.7	2.7±2.9	5.7±3.1	0.3±0.4	5.9±5.2	15.6±10.7	0.1±0.1	3.7±4.3
23	10	48.3±19.0	0.86	4.64	93.1±13.1	42.6±13.9	10.1±13.9	7.5±7.0	1.9±3.1	4.4±3.5	1.9±2.2	9.3±7.7	12.1±7.9	0.3±0.6	3.0±4.6

Table 3.3-1c. Hourly average source contributions to sum of PAMS VOCs for auto-GC/MS data at Sunol during CCOS IOPs.

Hour (PDT)	# in Avg	PAMS (ug/m ³)	R ²	χ ²	% PAMS Explained	Gasoline Exhaust	Liquid Gasoline	Gasoline Vapor	Diesel Exhaust	Consumer Products	Coatings	CNG	LPG	Biogenic	Biomass Burning
Absolute Contributions (ug/m³)															
0	9	30.4±12.9	0.89	2.64	95.6±5.8	17.6±0.9	0.9±0.9	2.3±0.2	0.6±1.0	2.0±0.3	1.4±0.2	1.1±0.1	1.8±0.1	0.3±0.0	1.0±0.3
1	10	26.9±15.7	0.89	2.61	94.2±6.0	14.6±1.0	1.5±1.0	2.0±0.3	0.2±0.7	1.8±0.3	1.2±0.2	1.1±0.1	1.7±0.2	0.2±0.0	0.7±0.3
2	11	32.1±19.1	0.89	2.55	92.9±4.7	18.4±1.0	1.0±1.0	2.7±0.3	0.3±1.0	1.7±0.3	1.6±0.3	1.2±0.1	1.9±0.2	0.2±0.0	0.7±0.3
5	11	34.0±19.7	0.85	3.23	92.6±5.1	20.5±0.7	0.4±0.7	2.2±0.4	0.8±1.0	1.8±0.3	1.3±0.3	1.1±0.2	2.4±0.2	0.2±0.0	0.5±0.3
6	11	36.0±20.1	0.84	3.30	90.7±4.6	20.9±1.0	0.6±1.0	1.9±0.4	0.8±0.9	1.9±0.3	1.4±0.3	1.1±0.3	2.9±0.3	0.2±0.0	0.6±0.4
7	11	40.0±20.4	0.84	3.66	114.2±75.1	24.8±0.9	1.1±0.9	2.4±0.3	0.5±1.1	1.5±0.3	1.4±0.2	1.1±0.4	5.8±2.3	0.5±0.0	0.5±0.3
8	10	44.5±23.1	0.83	4.15	115.9±72.5	27.6±1.2	1.1±1.2	3.0±0.4	1.1±0.9	2.0±0.4	1.5±0.3	0.6±0.3	5.7±2.5	1.6±0.1	0.5±0.4
9	8	42.2±15.2	0.88	3.65	94.2±3.8	23.9±1.2	0.8±1.2	3.7±0.3	1.1±1.3	1.9±0.3	1.4±0.1	0.7±0.2	2.6±0.3	3.1±0.2	0.5±0.4
10	9	41.2±26.8	0.87	3.71	96.5±5.7	21.9±1.2	1.6±1.2	3.1±0.5	1.2±1.1	1.6±0.3	1.4±0.4	1.1±0.1	2.0±0.4	4.3±0.4	0.8±0.4
11	9	43.2±37.4	0.87	3.65	119.6±69.7	22.4±1.2	1.4±1.2	3.4±0.7	1.2±1.0	1.5±0.4	1.2±0.4	0.9±0.2	5.9±2.6	4.8±0.4	1.4±0.6
12	8	48.2±45.3	0.88	3.74	97.6±4.0	23.7±1.3	1.7±1.3	4.9±0.9	2.1±1.2	1.9±0.3	2.0±0.9	1.1±0.3	2.4±0.6	5.4±0.4	1.0±0.4
13	9	41.1±34.9	0.87	3.25	100.7±4.3	21.6±0.7	0.7±0.7	4.1±0.6	1.6±1.0	1.0±0.1	1.7±0.7	0.9±0.3	2.1±0.4	6.1±0.7	0.8±0.2
14	8	41.2±33.2	0.88	3.03	100.5±4.6	21.4±1.2	1.3±1.2	3.7±0.7	1.0±1.0	1.4±0.1	2.1±0.7	0.9±0.2	2.8±0.5	5.6±0.6	0.7±0.3
15	8	37.4±29.2	0.88	2.74	102.7±4.9	18.7±0.8	1.3±0.8	4.4±0.7	1.3±0.6	1.0±0.2	1.9±0.6	1.0±0.1	2.5±0.5	5.0±0.5	0.5±0.3
16	9	37.7±22.8	0.88	2.85	100.9±6.0	17.8±0.0	0.0±0.0	4.3±0.6	1.3±0.9	1.7±0.2	1.7±0.6	0.8±0.1	2.1±0.3	6.9±0.8	0.8±0.3
17	9	44.9±24.0	0.89	3.06	99.0±4.6	20.2±1.1	1.9±1.1	4.2±0.6	1.4±1.1	2.1±0.3	1.7±0.4	0.8±0.2	2.8±0.4	8.0±1.1	0.6±0.3
18	9	48.3±23.3	0.89	3.43	95.1±3.3	23.3±1.3	3.3±1.3	4.7±0.4	1.0±1.1	1.8±0.3	1.8±0.3	0.6±0.2	3.2±0.3	5.1±0.4	0.8±0.4
19	9	54.9±27.7	0.90	3.34	93.2±2.8	30.4±1.4	3.4±1.4	4.5±0.6	0.8±1.1	1.8±0.2	3.0±0.6	0.4±0.3	3.9±0.4	4.8±0.2	0.8±0.4
20	7	52.0±24.6	0.91	3.16	94.4±1.7	29.4±1.5	3.3±1.5	3.7±0.5	1.3±1.1	1.8±0.3	2.3±0.4	0.4±0.2	3.8±0.4	2.2±0.2	0.7±0.4
21	6	37.3±16.7	0.91	2.44	95.6±2.9	23.0±0.9	2.2±0.9	2.5±0.3	0.4±0.6	1.6±0.3	1.4±0.3	0.5±0.2	2.7±0.2	0.9±0.1	0.6±0.3
22	7	32.5±15.4	0.92	2.10	95.4±2.1	19.4±1.1	2.0±1.1	1.9±0.3	0.8±1.0	1.3±0.2	1.2±0.1	0.6±0.1	2.5±0.2	0.6±0.1	0.6±0.3
23	9	30.1±13.4	0.90	2.48	94.8±5.7	17.7±0.8	0.9±0.8	2.1±0.3	0.3±0.9	2.0±0.2	1.6±0.3	0.7±0.1	1.8±0.2	0.3±0.0	0.9±0.3
Percent Contributions															
0	9	30.4±12.9	0.89	2.64	95.6±5.8	56.6±5.4	2.6±5.4	7.0±5.4	2.7±4.8	5.5±5.9	4.3±2.8	4.8±5.3	6.4±3.4	1.4±2.0	4.3±4.2
1	10	26.9±15.7	0.89	2.61	94.2±6.0	53.9±7.2	4.4±7.2	6.7±4.2	0.7±2.3	5.9±5.5	5.3±3.4	6.5±6.2	6.6±4.1	1.0±1.4	3.2±3.2
2	11	32.1±19.1	0.89	2.55	92.9±4.7	56.7±4.9	2.2±4.9	6.9±4.8	1.5±4.1	4.4±4.5	4.5±2.8	6.4±6.1	6.1±4.2	0.6±0.7	3.6±3.2
5	11	34.0±19.7	0.85	3.23	92.6±5.1	54.9±2.5	0.8±2.5	6.6±7.7	4.6±7.1	4.6±4.7	3.5±2.7	6.0±7.0	7.5±3.5	1.0±1.8	3.2±4.8
6	11	36.0±20.1	0.84	3.30	90.7±4.6	52.8±3.4	1.6±3.4	5.9±6.6	4.7±8.8	4.3±3.8	3.6±2.5	5.1±5.6	8.5±4.2	0.9±1.4	3.4±4.1
7	11	40.0±20.4	0.84	3.66	114.2±75.1	58.8±5.7	2.5±5.7	6.5±4.4	1.7±4.9	3.5±3.7	3.5±2.3	4.5±6.2	28.4±70.8	1.5±0.8	3.3±5.0
8	10	44.5±23.1	0.83	4.15	115.9±72.5	58.8±3.7	1.6±3.7	7.3±4.9	4.0±8.7	3.2±4.5	3.5±2.8	3.5±7.2	27.0±69.8	4.1±2.4	3.0±4.2
9	8	42.2±15.2	0.88	3.65	94.2±3.8	56.4±2.3	1.2±2.3	8.6±3.8	2.3±3.9	4.1±4.5	3.4±1.9	2.2±2.1	6.0±2.3	8.1±5.7	1.8±3.5
10	9	41.2±26.8	0.87	3.71	96.5±5.7	51.7±4.8	2.3±4.8	6.9±4.5	4.0±7.7	4.2±3.4	3.3±2.5	4.7±4.8	4.0±2.8	12.4±7.6	2.9±3.1
11	9	43.2±37.4	0.87	3.65	119.6±69.7	52.5±4.3	2.2±4.3	7.6±4.3	3.8±7.7	3.7±4.5	2.4±1.6	3.5±3.6	27.1±67.3	13.6±7.2	3.3±3.0
12	8	48.2±45.3	0.88	3.74	97.6±4.0	44.5±4.6	2.6±4.6	10.0±3.7	6.6±10.4	4.8±4.5	2.6±2.7	4.3±4.4	3.8±2.4	14.4±6.3	4.0±4.5
13	9	41.1±34.9	0.87	3.25	100.7±4.3	46.7±4.4	1.5±4.4	9.5±5.3	6.5±10.2	3.3±3.1	3.3±4.1	5.1±5.6	4.1±2.8	16.5±8.6	4.2±4.8
14	8	41.2±33.2	0.88	3.03	100.5±4.6	50.4±5.0	2.1±5.0	7.6±6.8	3.0±5.2	3.6±2.6	4.3±2.9	4.7±4.8	5.7±4.1	15.4±8.4	3.7±4.2
15	8	37.4±29.2	0.88	2.74	102.7±4.9	46.8±5.9	2.1±5.9	9.7±5.6	7.1±13.7	3.0±2.7	4.2±3.6	5.4±5.2	5.6±4.0	15.7±7.1	3.1±4.7
16	9	37.7±22.8	0.88	2.85	100.9±6.0	45.8±0.0	0.0±0.0	8.9±7.0	6.2±12.6	4.0±3.9	4.0±3.9	4.0±4.7	4.9±2.7	19.4±13.3	3.4±4.2
17	9	44.9±24.0	0.89	3.06	99.0±4.6	43.4±7.2	2.8±7.2	8.6±4.9	6.5±11.5	4.0±3.9	3.4±2.6	3.9±4.8	6.0±2.2	17.9±13.8	2.5±3.7
18	9	48.3±23.3	0.89	3.43	95.1±3.3	48.9±9.6	4.0±9.6	9.9±4.1	1.9±2.5	3.5±4.6	4.2±3.1	1.9±2.1	6.6±0.9	11.4±6.9	2.8±4.5
19	9	54.9±27.7	0.90	3.34	93.2±2.8	56.4±8.4	4.1±8.4	7.3±4.2	1.6±3.4	3.3±3.0	4.6±3.1	1.4±2.5	7.0±2.1	4.5±2.1	3.0±4.6
20	7	52.0±24.6	0.91	3.16	94.4±1.7	58.0±7.4	4.3±7.4	7.0±3.0	2.9±5.8	3.0±3.5	3.9±2.7	1.0±1.3	7.5±3.1	4.7±2.6	2.0±2.1
21	6	37.3±16.7	0.91	2.44	95.6±2.9	60.6±10.9	4.4±10.9	7.0±3.6	1.7±4.1	3.6±4.1	3.9±2.6	1.9±2.0	7.3±1.9	3.2±3.0	2.1±2.3
22	7	32.5±15.4	0.92	2.10	95.4±2.1	58.0±8.8	4.6±8.8	5.8±2.4	3.8±5.0	3.6±3.6	3.3±2.1	2.7±2.4	7.9±3.0	2.7±3.0	3.0±3.3
23	9	30.1±13.4	0.90	2.48	94.8±5.7	57.6±6.3	2.7±6.3	6.1±4.9	1.9±4.0	6.1±6.1	5.2±2.7	3.3±3.0	6.1±2.5	1.3±2.3	4.4±4.0

Table 3.3-2. Average 3-hour source contributions for sum of PAMS VOC for GC/MS data at research sites during CCOS non-IOPs.

Site	Hour (PDT)	# in Avg	PAMS (ug/m ³)	R ²	χ ²	% PAMS Explained	Gasoline Exhaust	Liquid Gasoline	Gasoline Vapor	Diesel Exhaust	Consumer Products	Coatings	CNG	LPG	Biogenic	Biomass Burning
Absolute Contributions (ug/m³)																
GNBY	0	13	15.4±3.2	0.82	2.45	85.5±9.4	6.4±0.7	1.7±0.7	1.1±0.1	0.4±0.9	0.6±0.1	0.8±0.2	0.6±0.0	0.5±0.2	0.8±0.0	0.1±0.3
	6	9	23.8±3.6	0.79	4.42	89.8±3.2	8.6±0.5	6.6±0.5	0.8±0.3	0.1±0.7	1.4±0.1	1.6±0.1	0.7±0.0	0.7±0.2	0.8±0.0	0.0±0.0
	9	9	25.7±3.2	0.79	4.77	88.4±6.5	10.5±0.6	5.3±0.6	0.8±0.3	0.3±0.9	1.7±0.1	1.7±0.1	0.9±0.0	0.8±0.2	0.9±0.0	0.0±0.0
	12	10	15.2±3.0	0.84	2.25	95.6±4.9	6.8±0.5	2.6±0.5	1.1±0.2	0.4±0.8	0.9±0.0	0.9±0.1	0.5±0.0	0.6±0.1	0.9±0.0	0.0±0.0
	15	10	13.6±2.0	0.88	1.60	97.4±5.1	5.1±0.3	2.8±0.3	0.9±0.2	1.0±0.8	0.8±0.0	0.4±0.2	0.7±0.0	0.5±0.1	1.1±0.0	0.1±0.2
	18	11	16.4±2.4	0.83	2.28	88.8±4.6	7.6±0.6	1.8±0.6	1.0±0.3	0.3±0.8	0.7±0.0	0.8±0.1	0.9±0.0	0.3±0.1	1.3±0.1	0.0±0.0
	21	12	15.8±2.2	0.87	1.76	92.6±8.2	6.5±0.7	2.9±0.7	0.9±0.2	0.4±0.8	0.8±0.1	0.7±0.1	0.8±0.0	0.5±0.1	1.0±0.0	0.2±0.3
PLR	0	17	44.6±11.2	0.67	9.29	87.6±7.1	14.4±0.6	0.8±0.6	0.9±0.4	4.0±0.7	0.8±0.1	0.3±0.3	7.7±1.0	8.0±1.0	0.0±0.1	2.4±0.3
	6	16	72.7±9.9	0.77	9.71	93.6±5.8	23.2±1.2	10.4±1.2	2.5±0.7	7.6±0.7	3.3±0.1	0.2±0.3	8.8±1.1	10.2±0.8	0.0±0.1	1.9±0.6
	9	17	75.6±9.7	0.77	10.14	90.9±8.7	25.5±1.1	10.4±1.1	2.6±0.7	7.6±0.8	3.7±0.1	0.3±0.4	6.0±1.1	10.7±0.8	0.0±0.1	1.9±0.7
	12	16	34.9±7.0	0.74	6.80	88.8±5.8	13.5±1.0	2.0±1.0	0.9±0.4	3.3±0.7	0.9±0.0	0.5±0.3	2.5±0.6	6.4±0.7	0.1±0.0	1.3±0.3
	15	17	26.7±4.0	0.75	5.83	89.3±4.8	12.6±0.8	0.8±0.8	0.9±0.3	2.7±0.7	1.4±0.0	0.4±0.3	1.9±0.2	3.1±0.4	0.1±0.0	0.0±0.2
	18	15	26.1±3.5	0.72	6.74	86.3±5.9	9.9±0.8	2.6±0.8	0.2±0.3	4.3±0.5	1.6±0.0	0.3±0.3	1.8±0.3	1.7±0.4	0.1±0.0	0.2±0.2
	21	14	26.1±3.7	0.74	5.84	88.8±6.9	12.3±0.7	0.5±0.7	0.6±0.3	4.3±0.5	0.9±0.0	0.3±0.3	1.1±0.2	2.6±0.3	0.1±0.0	0.4±0.3
SUNO	0	14	19.6±7.5	0.92	1.13	89.1±5.4	6.0±0.9	1.1±0.9	0.8±0.2	1.8±0.8	0.4±0.1	0.3±0.3	0.6±0.2	1.5±0.2	0.6±0.0	4.5±0.2
	6	15	26.0±5.0	0.88	2.48	85.9±6.7	9.2±1.0	2.0±1.0	2.9±0.1	2.8±1.0	0.5±0.1	1.1±0.1	0.7±0.2	1.2±0.3	0.4±0.0	1.5±0.3
	9	14	30.5±7.4	0.88	2.78	85.0±7.6	11.7±0.9	2.9±0.9	2.6±0.1	2.4±1.1	0.6±0.1	1.5±0.1	0.6±0.2	1.1±0.2	0.6±0.0	2.0±0.3
	12	13	21.0±6.6	0.87	1.99	89.2±8.4	7.8±1.0	0.9±1.0	1.1±0.2	1.5±0.9	0.3±0.1	0.6±0.1	0.5±0.2	1.4±0.2	0.9±0.0	3.9±0.3
	15	13	23.3±4.9	0.88	2.09	91.3±6.6	9.2±0.8	0.5±0.8	2.6±0.1	3.3±0.6	0.3±0.1	0.7±0.2	0.6±0.2	0.7±0.1	1.1±0.1	2.5±0.3
	18	13	25.0±3.8	0.88	2.48	90.7±6.3	8.6±0.8	0.5±0.8	3.8±0.1	4.4±0.6	0.5±0.0	0.9±0.2	0.6±0.2	0.5±0.1	0.9±0.0	2.0±0.2
	21	12	18.5±5.0	0.89	1.61	90.3±6.4	7.7±0.8	0.2±0.8	1.6±0.1	1.4±0.9	0.3±0.1	0.6±0.2	0.5±0.2	0.8±0.1	0.6±0.0	2.9±0.1
Percent Contributions																
GNBY	0	13	15.4±3.2	0.82	2.45	85.5±9.4	42.1±9.9	11.1±9.9	7.2±5.6	2.6±3.8	3.5±3.6	5.4±2.4	4.3±2.9	3.0±3.8	5.6±2.2	0.8±1.7
	6	9	23.8±3.6	0.79	4.42	89.8±3.2	37.1±11.4	27.0±11.4	3.6±6.2	0.4±0.9	6.1±4.8	6.4±2.9	3.1±1.3	2.6±3.1	3.5±1.2	0.0±0.0
	9	9	25.7±3.2	0.79	4.77	88.4±6.5	41.0±12.2	20.4±12.2	3.1±5.0	1.0±1.6	6.5±3.5	6.4±2.4	3.7±1.5	2.7±3.6	3.7±1.1	0.0±0.0
	12	10	15.2±3.0	0.84	2.25	95.6±4.9	43.7±11.3	16.8±11.3	7.4±6.7	2.7±4.2	6.1±4.5	5.7±1.8	3.6±1.9	3.5±3.1	6.2±2.7	0.0±0.0
	15	10	13.6±2.0	0.88	1.60	97.4±5.1	38.6±7.0	19.9±7.0	6.1±3.6	6.6±9.2	6.1±2.0	2.7±1.5	5.0±1.5	3.7±3.3	8.0±2.5	0.5±1.2
	18	11	16.4±2.4	0.83	2.28	88.8±4.6	46.4±13.7	11.0±13.7	5.5±5.5	2.1±3.2	4.1±2.8	4.7±2.7	5.4±1.8	1.7±2.4	7.8±2.7	0.0±0.0
	21	12	15.8±2.2	0.87	1.76	92.6±8.2	41.7±13.5	18.3±13.5	5.3±4.3	2.5±5.5	5.2±4.5	4.3±1.8	4.7±1.5	3.1±4.0	6.5±1.9	1.0±1.5
PLR	0	17	44.6±11.2	0.67	9.29	87.6±7.1	33.8±5.0	2.1±5.0	1.8±3.5	9.6±8.7	1.8±1.6	0.7±1.0	16.3±14.3	16.5±8.9	0.0±0.0	4.9±4.2
	6	16	72.7±9.9	0.77	9.71	93.6±5.8	31.3±11.1	15.2±11.1	3.2±5.7	10.8±6.9	4.6±1.3	0.3±0.5	11.9±9.4	13.7±5.3	0.0±0.0	2.6±3.1
	9	17	75.6±9.7	0.77	10.14	90.9±8.7	33.8±9.0	14.1±9.0	3.1±5.9	10.4±8.0	5.1±1.6	0.3±0.5	7.7±7.4	13.9±4.7	0.0±0.0	2.5±3.4
	12	16	34.9±7.0	0.74	6.80	88.8±5.8	38.6±9.1	6.3±9.1	2.5±3.6	9.9±9.3	2.6±1.7	1.3±1.5	6.5±7.2	17.4±7.7	0.2±0.1	3.5±3.2
	15	17	26.7±4.0	0.75	5.83	89.3±4.8	46.5±6.8	3.6±6.8	3.1±3.9	10.9±11.4	5.4±1.7	1.4±2.0	6.9±4.6	11.1±6.8	0.3±0.2	0.1±0.3
	18	15	26.1±3.5	0.72	6.74	86.3±5.9	37.7±11.4	10.3±11.4	0.9±2.3	16.5±9.6	6.2±2.2	1.0±1.4	6.6±5.5	6.1±6.4	0.4±0.2	0.5±2.1
	21	14	26.1±3.7	0.74	5.84	88.8±6.9	47.8±3.9	1.8±3.9	2.2±3.6	16.7±13.3	3.3±2.5	1.2±2.5	4.5±4.1	9.5±5.5	0.3±0.2	1.5±3.1
SUNO	0	14	19.6±7.5	0.92	1.13	89.1±5.4	26.9±7.6	6.5±7.6	5.1±5.2	10.8±10.4	2.1±1.7	1.6±1.8	4.1±5.1	6.9±3.5	2.8±2.2	22.2±6.0
	6	15	26.0±5.0	0.88	2.48	85.9±6.7	34.8±8.2	8.0±8.2	11.6±3.6	11.0±9.9	1.9±2.2	4.5±2.2	2.7±2.7	4.1±4.9	1.5±1.2	5.7±4.0
	9	14	30.5±7.4	0.88	2.78	85.0±7.6	36.9±10.0	10.4±10.0	9.0±4.1	8.3±8.2	1.9±2.0	4.9±2.2	1.8±2.1	3.1±3.0	2.1±1.2	6.5±4.6
	12	13	21.0±6.6	0.87	1.99	89.2±8.4	36.5±6.2	4.7±6.2	5.3±3.3	7.0±6.9	1.5±1.5	3.0±1.9	2.9±4.5	5.9±5.3	4.6±2.4	17.7±5.9
	15	13	23.3±4.9	0.88	2.09	91.3±6.6	37.9±4.4	2.2±4.4	11.5±6.0	14.1±10.7	1.1±1.4	3.1±3.1	2.8±3.5	2.9±2.5	5.0±2.7	10.7±5.8
	18	13	25.0±3.8	0.88	2.48	90.7±6.3	33.1±4.3	2.2±4.3	15.6±6.1	17.6±11.1	2.1±1.2	3.5±3.3	2.5±3.5	2.0±1.9	3.7±1.8	8.3±4.9
	21	12	18.5±5.0	0.89	1.61	90.3±6.4	39.6±2.3	1.2±2.3	9.9±6.3	9.2±11.3	1.7±1.6	3.4±2.1	3.0±4.3	4.0±2.9	3.0±2.1	15.4±7.4

Table 3.3-3a. Average 3-hour source contributions for sum of PAMS VOC for canister samples during CCOS IOPs at coastal background sites.

Site	Hour (PDT)	# in Avg	PAMS (ug/m ³)	R ²	χ ²	% PAMS Explained	Gasoline Exhaust	Liquid Gasoline	Gasoline Vapor	Diesel Exhaust	Consumer Products	Coatings	CNG	LPG	Biogenic	Biomass Burning
<u>Absolute Contributions (ug/m3)</u>																
BODB	0	16	7.8±7.3	0.93	2.69	82.0±26.7	0.6±1.0	0.0±1.0	1.3±0.3	2.2±1.6	0.6±0.1		0.8±0.2	0.8±0.2	0.0±0.0	0.7±0.4
	6	15	8.5±7.0	0.94	2.39	92.7±26.5	0.9±1.2	0.3±1.2	1.6±0.3	2.3±1.8	0.6±0.1		0.6±0.2	1.1±0.2	0.0±0.0	0.7±0.4
	13	13	34.0±87.5	0.92	4.27	86.7±28.2	0.7±0.8	0.1±0.8	15.8±4.1	4.4±2.0	1.3±0.4		0.7±0.2	1.9±0.6	0.0±0.1	0.8±0.5
	17	12	8.9±7.9	0.93	3.42	88.1±31.2	1.3±0.0	0.0±0.0	1.6±0.3	3.1±1.7	0.6±0.1		0.4±0.1	1.7±0.4	0.0±0.0	0.8±0.3
PIED	0	7	22.3±23.0	0.91	5.98	184.0±70.0	0.1±0.0	0.0±0.0	3.9±0.8	19.8±0.8	0.9±0.1		0.8±0.2	5.4±1.5	0.3±0.0	0.6±0.3
	6	6	37.4±26.2	0.84	13.14	196.5±73.8	3.0±0.0	0.0±0.0	2.0±0.7	44.6±1.4	1.5±0.1		2.6±0.6	7.3±1.6	0.3±0.0	0.8±0.6
	13	4	222.0±126.7	0.90	10.49	96.2±49.4	2.9±0.0	0.0±0.0	6.1±0.4	10.0±3.3	10.1±0.9		3.3±2.2	127.9±12.4	0.5±0.1	16.0±3.2
	17	3	30.6±21.8	0.79	12.96	117.9±48.2	2.0±0.0	0.0±0.0	3.7±0.5	8.5±1.8	1.2±0.0		0.2±0.1	12.2±2.5	0.1±0.0	1.5±0.4
<u>Percent Contributions</u>																
BODB	0	16	7.8±7.3	0.93	2.69	82.0±26.7	3.5±1.5	0.5±1.5	13.4±5.9	25.0±24.9	6.3±3.5		11.3±7.4	9.3±7.4	0.2±0.6	12.6±10.0
	6	15	8.5±7.0	0.94	2.39	92.7±26.5	6.0±16.5	7.0±16.5	14.2±9.4	29.9±34.9	5.2±3.5		7.7±6.8	14.0±7.7	0.2±0.5	8.6±8.6
	13	13	34.0±87.5	0.92	4.27	86.7±28.2	7.5±9.9	3.4±9.9	16.6±15.8	22.7±22.1	6.7±4.7		7.8±6.7	12.4±22.0	0.6±1.3	8.9±7.6
	17	12	8.9±7.9	0.93	3.42	88.1±31.2	6.0±0.0	0.0±0.0	14.9±9.6	26.4±25.0	6.1±3.3		7.8±6.6	14.3±21.2	0.3±0.9	12.3±10.3
PIED	0	7	22.3±23.0	0.91	5.98	184.0±70.0	2.4±0.0	0.0±0.0	8.6±11.6	134.2±85.3	4.8±2.1		8.5±8.8	18.0±28.7	2.0±1.1	5.4±7.5
	6	6	37.4±26.2	0.84	13.14	196.5±73.8	3.3±0.0	0.0±0.0	2.3±5.5	154.8±82.5	4.4±1.7		10.6±13.4	17.1±10.8	1.2±1.2	2.8±4.3
	13	4	222.0±126.7	0.90	10.49	96.2±49.4	1.0±0.0	0.0±0.0	2.7±0.4	12.8±22.2	3.7±2.3		5.4±10.9	48.7±21.5	0.2±0.1	21.7±38.9
	17	3	30.6±21.8	0.79	12.96	117.9±48.2	3.7±0.0	0.0±0.0	21.0±24.8	47.9±52.6	5.6±4.7		1.1±2.0	32.0±27.7	0.4±0.3	6.2±8.6

Table 3.3-3b. Average 3-hour source contributions for sum of PAMS VOC for canister samples during CCOS IOPs at downwind sites.

Site	Hour (PDT)	# in Avg	PAMS (ug/m ³)	R ²	χ ²	% PAMS Explained	Gasoline Exhaust	Liquid Gasoline	Gasoline Vapor	Diesel Exhaust	Consumer Products	Coatings	CNG	LPG	Biogenic	Biomass Burning
Absolute Contributions (ug/m3)																
FLN	0	2	22.9±5.8	0.90	2.74	120.6±13.8	14.1±1.3	1.0±1.3	2.1±0.1	3.1±0.0	0.6±0.0	0.6±0.6	0.1±0.3	2.6±0.2	1.7±0.2	1.2±0.5
	6	6	34.9±15.8	0.92	2.59	106.8±2.0	24.8±0.6	1.9±0.6	1.4±0.3	1.8±1.5	1.0±0.0	1.2±0.1	0.5±0.3	3.3±0.3	1.3±0.1	0.0±0.0
	13	3	24.7±6.6	0.96	2.68	131.8±25.0	10.1±0.0	0.0±0.0	3.9±0.3	6.0±0.5	1.2±0.1	4.3±6.9	1.2±0.3	1.3±0.0	4.3±0.2	1.4±0.2
	17	3	32.5±8.3	0.93	1.96	115.1±3.1	19.0±0.9	0.5±0.9	3.8±0.2	3.8±0.6	1.5±0.2	0.1±0.4	0.5±0.2	1.3±0.1	6.8±0.3	0.1±0.5
SGS	0	8	48.2±24.7	0.85	4.69	97.3±13.4	6.5±0.6	10.7±0.6	4.6±0.6	6.4±1.5	1.4±0.1	0.7±0.3	2.1±0.5	11.6±2.5	1.7±0.3	0.0±0.0
	6	9	75.9±39.5	0.84	5.43	87.4±5.7	18.1±1.3	7.1±1.3	7.1±1.0	1.5±1.7	1.6±0.3	0.8±0.4	1.9±0.3	25.2±1.6	3.2±0.2	0.0±0.4
	13	6	23.4±10.8	0.94	3.05	130.8±28.3	3.3±1.6	1.4±1.6	3.0±0.4	8.0±1.8	1.1±0.1	3.2±6.4	0.8±0.0	2.6±0.3	6.2±0.3	0.6±0.4
	17	5	19.3±11.4	0.95	2.02	135.8±26.9	1.2±2.2	1.5±2.2	3.3±0.4	8.4±0.6	0.7±0.0	0.8±1.9	1.2±0.1	1.3±0.1	5.2±0.6	0.4±0.5
TSM	0	9	151.8±189.6	0.85	8.00	103.2±15.8	8.9±5.4	66.6±5.4	24.6±5.0	19.8±3.2	3.0±0.5	2.7±6.6	4.9±0.8	5.5±0.9	0.9±0.1	0.0±0.0
	6	13	84.9±52.9	0.90	4.91	104.1±6.1	25.4±1.8	21.2±1.8	11.1±1.3	12.7±2.9	3.8±0.4	1.4±0.6	4.0±0.6	8.0±1.0	0.4±0.0	0.0±0.0
	13	10	29.4±11.0	0.93	2.42	116.0±6.4	8.9±0.8	5.4±0.8	5.8±0.4	6.5±0.5	1.9±0.1	0.4±0.4	1.4±0.2	1.8±0.1	1.4±0.1	0.3±0.4
	17	11	41.0±15.4	0.92	3.02	111.2±8.3	15.9±1.0	6.4±1.0	7.7±0.4	6.5±1.3	1.8±0.1	0.8±0.4	2.2±0.5	1.9±0.2	1.5±0.1	0.0±0.0
WCM	0	6	13.2±9.7	0.97	1.13	102.9±29.7	2.9±0.9	0.4±0.9	1.9±0.4	3.8±0.9	0.7±0.1	0.0±0.0	1.0±0.0	0.5±0.1	1.0±0.1	0.7±0.2
	6	5	8.9±2.9	0.92	1.69	122.0±24.7	1.9±0.0	0.0±0.0	1.5±0.4	4.6±1.3	0.1±0.1	0.4±1.6	1.1±0.1	0.1±0.1	0.6±0.0	0.2±0.5
	13	10	16.9±8.9	0.95	0.83	156.6±156.7	3.2±0.5	0.5±0.5	0.5±0.1	7.1±2.1	0.1±0.1	17.9±40.2	0.8±0.3	0.3±0.1	5.5±0.3	0.5±0.5
	17	4	43.8±35.3	0.95	2.03	65.8±33.6	8.3±0.8	3.3±0.8	2.4±0.4	1.3±2.5	0.5±0.1	0.4±0.3	0.5±0.0	0.7±0.0	3.5±0.3	0.7±0.6
Percent Contributions																
FLN	0	2	22.9±5.8	0.90	2.74	120.6±13.8	60.5±5.5	3.9±5.5	8.9±2.4	15.3±13.3	2.7±0.1	2.5±0.0	0.4±0.6	11.0±1.9	9.0±11.0	6.2±8.8
	6	6	34.9±15.8	0.92	2.59	106.8±2.0	69.1±4.7	5.4±4.7	3.9±1.3	6.1±6.2	3.3±1.4	3.2±0.9	1.7±2.2	10.0±4.7	4.3±3.9	0.0±0.0
	13	3	24.7±6.6	0.96	2.68	131.8±25.0	39.3±0.0	0.0±0.0	15.4±4.1	24.0±10.5	5.2±4.0	13.2±22.8	6.0±7.1	5.1±0.5	18.1±7.0	5.5±4.7
	17	3	32.5±8.3	0.93	1.96	115.1±3.1	57.4±3.8	2.2±3.8	10.7±6.0	12.2±9.4	4.1±4.6	0.4±0.7	1.4±1.4	3.8±1.1	22.5±10.2	0.3±0.6
SGS	0	8	48.2±24.7	0.85	4.69	97.3±13.4	18.2±15.9	24.5±15.9	9.8±6.1	12.9±16.5	3.4±1.8	2.1±2.0	4.5±3.6	18.0±18.6	3.9±6.5	0.0±0.0
	6	9	75.9±39.5	0.84	5.43	87.4±5.7	24.0±7.5	7.4±7.5	7.9±4.4	2.3±3.4	1.8±1.2	1.2±1.4	2.5±1.8	35.0±8.3	5.4±3.8	0.0±0.0
	13	6	23.4±10.8	0.94	3.05	130.8±28.3	11.3±6.5	3.7±6.5	12.6±8.2	41.9±34.0	5.6±3.6	8.0±16.5	3.9±1.0	11.4±7.9	28.3±11.3	4.1±6.4
	17	5	19.3±11.4	0.95	2.02	135.8±26.9	16.0±8.7	4.7±8.7	14.0±8.9	48.1±19.5	4.5±2.9	3.8±8.4	7.5±3.0	6.6±1.5	27.1±16.7	3.5±6.1
TSM	0	9	151.8±189.6	0.85	8.00	103.2±15.8	14.1±9.8	36.1±9.8	16.1±3.5	17.6±9.9	3.5±2.0	2.2±2.7	5.7±4.5	5.9±4.5	1.8±2.7	0.0±0.0
	6	13	84.9±52.9	0.90	4.91	104.1±6.1	33.2±15.7	22.7±15.7	12.3±4.7	14.4±8.8	4.9±2.6	1.8±1.2	4.8±2.9	9.4±3.3	0.5±0.4	0.0±0.0
	13	10	29.4±11.0	0.93	2.42	116.0±6.4	33.2±10.4	17.1±10.4	18.8±4.2	21.7±10.0	6.7±3.5	1.3±1.7	5.1±3.2	6.4±3.3	4.6±2.8	1.1±2.5
	17	11	41.0±15.4	0.92	3.02	111.2±8.3	38.5±12.1	16.5±12.1	18.3±5.2	16.7±11.3	4.7±2.5	2.4±2.2	5.1±5.6	4.8±2.2	4.1±2.5	0.0±0.0
WCM	0	6	13.2±9.7	0.97	1.13	102.9±29.7	20.7±3.3	1.4±3.3	8.5±10.3	35.6±21.9	5.6±9.5	0.0±0.0	10.9±6.0	3.2±2.7	8.6±8.4	8.5±8.5
	6	5	8.9±2.9	0.92	1.69	122.0±24.7	21.2±0.0	0.0±0.0	12.2±21.6	59.4±31.0	0.5±0.7	3.8±8.5	14.2±8.6	1.1±1.3	7.4±5.0	2.3±3.2
	13	10	16.9±8.9	0.95	0.83	156.6±156.7	21.7±6.1	1.9±6.1	3.2±1.6	31.4±33.2	1.3±2.4	46.8±148.1	6.8±6.0	2.7±2.0	36.9±17.0	4.0±3.8
	17	4	43.8±35.3	0.95	2.03	65.8±33.6	24.6±19.3	9.6±19.3	6.2±4.9	5.6±9.7	1.8±2.7	1.1±2.1	2.0±2.0	2.2±1.3	9.2±5.8	3.6±6.7

Table 3.3-3c. Average 3-hour source contributions for sum of PAMS VOC for canister samples during CCOS IOPs at interbasin transport sites.

Site	Hour (PDT)	# in Avg	PAMS (ug/m ³)	R ²	χ ²	% PAMS Explained	Gasoline Exhaust	Liquid Gasoline	Gasoline Vapor	Diesel Exhaust	Consumer Products	Coatings	CNG	LPG	Biogenic	Biomass Burning
Absolute Contributions (ug/m³)																
ANGI	0	6	34.4±38.7	0.80	7.38	98.2±31.5	8.4±0.0	0.0±0.0	3.0±0.2	4.8±1.6	1.6±0.1	1.1±0.6	1.8±0.2	7.5±2.7	0.5±0.1	0.2±0.4
	6	3	31.5±25.9	0.85	5.76	100.5±5.6	7.9±1.4	3.7±1.4	5.7±0.8	2.9±0.3	2.0±0.1	0.5±0.6	1.7±0.4	4.0±1.0	1.6±0.4	1.0±0.4
	13	10	13.7±14.7	0.89	4.47	122.5±21.9	0.9±1.4	1.6±1.4	3.5±0.8	6.2±0.7	0.7±0.1	1.9±4.5	1.8±0.1	1.2±0.1	0.0±0.0	0.5±0.4
	17	8	11.7±6.1	0.92	3.83	127.3±19.6	1.7±2.6	0.5±2.6	2.1±0.3	5.7±1.3	0.9±0.0	0.1±1.6	1.8±0.1	2.1±0.2	0.1±0.1	0.2±0.8
BTI	0	9	136.3±157.6	0.85	4.43	148.3±160.7	30.7±2.1	11.3±2.1	27.1±7.6	0.2±1.0	7.9±0.8	317.3±632.9	10.2±2.3	4.6±4.2	0.2±4.1	1.8±13.3
	6	10	82.2±32.5	0.89	4.33	124.7±112.4	27.8±3.6	0.5±3.6	13.1±1.0	5.6±8.3	8.1±0.7	27.7±59.9	9.1±0.7	5.8±0.6	0.1±0.3	0.5±2.0
	13	11	23.3±12.7	0.93	4.13	154.3±153.8	4.1±0.0	0.0±0.0	3.5±0.7	6.2±4.5	2.6±0.4	13.7±31.7	2.1±0.4	1.2±0.2	0.6±0.2	2.1±1.0
	17	9	41.4±16.6	0.91	3.80	166.6±188.9	9.4±1.1	2.2±1.1	8.9±0.4	5.7±5.5	3.8±1.0	38.0±78.6	3.1±0.9	3.2±0.7	2.2±0.4	1.4±2.4
ELK	0	6	21.7±14.9	0.92	3.17	132.4±27.3	10.8±1.1	1.2±1.1	2.9±0.2	4.1±0.7	2.1±0.3	0.0±0.3	1.4±0.3	2.5±0.3	0.2±0.1	0.3±0.5
	6	6	50.0±35.6	0.90	3.19	106.7±15.8	17.6±1.1	1.2±1.1	6.1±0.3	4.6±0.9	2.9±0.2	0.5±0.3	1.3±0.4	14.8±4.2	0.1±0.1	0.2±0.4
	17	1		0.94	1.95											
KRV	0	9	11.2±5.1	0.89	3.10	155.0±37.4	3.0±0.4	0.9±0.4	0.8±0.3	6.0±1.3	0.4±0.1	0.6±1.0	1.3±0.1	0.8±0.1	1.6±0.1	0.9±0.5
	6	11	19.5±6.1	0.92	6.62	116.7±23.7	2.4±0.0	0.0±0.0	1.1±0.2	6.1±0.7	0.4±0.0	0.5±1.7	1.0±0.1	2.7±0.2	5.8±0.4	2.0±0.1
	13	10	21.2±4.6	0.89	3.45	120.9±14.6	3.4±0.4	0.2±0.4	0.9±0.2	4.0±1.5	1.2±0.2	0.8±1.5	1.4±0.1	1.8±0.1	9.4±0.4	1.9±0.3
	17	11	20.6±5.9	0.92	4.93	129.6±18.6	3.5±0.4	1.1±0.4	1.1±0.3	4.2±1.1	1.9±0.3	0.8±1.6	0.9±0.1	1.4±0.1	9.6±0.6	2.2±0.3
PATP	0	9	7.6±4.9	0.94	1.10	125.7±22.6	2.6±0.0	0.0±0.0	1.0±0.4	3.0±0.6	0.8±0.2	0.0±0.0	1.0±0.1	0.3±0.1	0.1±0.0	0.7±0.5
	6	9	6.9±1.5	0.96	1.18	117.0±17.9	2.5±0.0	0.0±0.0	0.6±0.3	2.5±0.6	0.6±0.1	0.0±0.0	1.1±0.1	0.2±0.1	0.1±0.0	0.5±0.4
	13	10	13.7±5.7	0.95	2.65	140.7±11.7	6.5±0.0	0.0±0.0	2.0±0.1	4.3±1.3	0.8±0.0	1.1±2.4	0.7±0.2	0.9±0.1	0.1±0.0	2.7±0.2
	17	8	20.6±9.0	0.98	0.91	121.1±14.8	14.0±0.0	0.0±0.0	2.8±0.1	1.5±2.2	0.6±0.0	1.2±2.4	0.6±0.2	1.2±0.1	1.0±0.1	1.5±0.4
PCP	0	6	73.7±112.7	0.88	4.84	116.8±18.9	9.3±3.2	22.7±3.2	16.5±3.9	12.2±1.0	1.9±0.6	3.8±7.2	1.1±0.2	1.0±0.1	1.0±0.2	0.5±0.6
	6	10	12.6±4.0	0.97	1.24	157.7±42.8	1.7±1.9	3.1±1.9	1.4±0.3	8.0±1.0	0.7±0.0	1.5±4.1	1.1±0.0	0.4±0.0	0.9±0.0	0.2±0.4
	13	5	21.3±28.3	0.95	2.86	149.4±34.3	11.3±1.7	1.2±1.7	1.1±0.6	7.0±1.0	1.1±0.1	0.7±0.6	1.8±0.3	0.6±0.1	1.6±0.1	0.3±0.3
	17	9	64.9±86.1	0.89	4.77	135.0±35.2	3.6±2.8	20.2±2.8	12.7±2.9	15.3±2.4	2.1±0.5	8.4±19.0	1.0±0.2	0.6±0.1	2.2±0.2	0.4±0.4
SUTT	0	5	9.5±5.1	0.84	21.16	84.4±7.5	2.2±0.2	0.8±0.2	0.3±0.1	0.9±0.1	0.1±0.0	0.8±0.4	1.3±0.0	0.3±0.0	0.6±0.1	0.6±0.1
	6	4	15.6±12.2	0.80	16.08	82.5±8.3	3.8±0.6	3.4±0.6	0.7±0.2	0.4±0.3	0.2±0.0	0.6±0.4	1.7±0.2	0.3±0.1	1.4±0.2	0.7±0.1
	13	9	23.9±30.0	0.83	17.83	187.2±220.7	1.6±2.8	2.0±2.8	3.0±1.3	7.7±6.5	0.5±0.8	38.8±55.3	1.0±0.7	0.7±0.3	4.2±0.4	1.5±1.7
	17	10	29.7±41.8	0.85	15.55	106.1±24.8	2.7±2.4	5.1±2.4	5.7±1.5	7.1±3.4	0.7±0.2	10.7±22.9	1.1±0.1	0.3±0.2	2.3±0.2	0.7±0.2

Table 3.3-3c (continued).

site	hour (PDT)	# in Avg	PAMS (ug/m3)	r2	χ^2	% PAMS explained	gasoline exhaust	liquid gasoline	gasoline vapor	diesel exhaust	consumer products	coatings	CNG	LPG	biogenic	biomass burning
Percent Contributions																
ANGI	0	6	34.4±38.7	0.80	7.38	98.2±31.5	24.0±0.0	0.0±0.0	12.6±9.4	25.6±19.7	6.4±3.7	4.4±9.5	9.4±6.5	13.2±10.8	1.3±2.4	1.3±3.1
	6	3	31.5±25.9	0.85	5.76	100.5±5.6	14.6±10.8	6.2±10.8	16.9±2.2	10.0±13.0	8.5±4.4	0.9±1.5	11.7±11.5	17.3±17.9	2.7±4.7	11.6±18.1
	13	10	13.7±14.7	0.89	4.47	122.5±21.9	9.1±9.3	2.9±9.3	20.0±8.2	36.3±26.9	7.0±4.1	6.9±15.8	20.0±11.0	13.3±7.5	0.1±0.4	6.7±7.3
	17	8	11.7±6.1	0.92	3.83	127.3±19.6	10.9±7.7	4.0±7.7	16.7±4.9	46.3±29.7	8.3±1.2	0.3±0.9	17.6±9.9	19.1±9.1	0.5±0.5	3.6±5.5
BTI	0	9	136.3±157.6	0.85	4.43	148.3±160.7	37.2±10.5	8.8±10.5	14.0±10.8	0.4±1.3	9.1±6.4	63.3±178.3	9.7±7.0	5.3±3.8	0.2±0.2	0.3±1.0
	6	10	82.2±32.5	0.89	4.33	124.7±112.4	32.3±2.7	0.9±2.7	16.9±7.0	8.8±16.9	10.2±3.1	35.8±108.5	11.7±3.6	7.2±3.1	0.1±0.2	0.8±1.8
	13	11	23.3±12.7	0.93	4.13	154.3±153.8	21.6±0.0	0.0±0.0	15.7±7.9	30.4±15.9	11.2±8.5	46.8±153.9	11.1±5.3	5.7±2.4	2.7±1.4	9.1±4.8
	17	9	41.4±16.6	0.91	3.80	166.6±188.9	21.6±6.9	4.5±6.9	22.2±7.9	16.5±18.1	10.7±5.5	66.3±196.8	8.5±4.6	6.9±4.2	5.1±2.7	4.3±3.9
ELK	0	6	21.7±14.9	0.92	3.17	132.4±27.3	48.8±4.0	3.5±4.0	12.8±6.5	32.0±28.1	10.6±8.4	0.1±0.1	8.2±6.6	11.4±5.5	1.4±1.2	3.7±5.7
	6	6	50.0±35.6	0.90	3.19	106.7±15.8	41.7±4.8	2.3±4.8	17.2±18.6	13.8±16.6	6.6±5.1	1.0±0.6	3.7±3.9	19.6±17.2	0.1±0.1	0.7±1.6
	17	1	15.7±15.7	0.94	1.95	116.9±116.9										
KRV	0	9	11.2±5.1	0.89	3.10	155.0±37.4	23.5±22.4	7.5±22.4	6.5±3.8	65.5±49.0	3.8±1.6	3.2±6.0	12.5±4.4	7.6±4.1	15.6±9.9	9.4±8.1
	6	11	19.5±6.1	0.92	6.62	116.7±23.7	12.9±0.0	0.0±0.0	5.7±8.4	32.0±15.6	2.5±1.5	2.2±4.0	5.4±3.2	15.3±6.9	30.1±12.4	10.8±6.8
	13	10	21.2±4.6	0.89	3.45	120.9±14.6	16.1±3.9	1.2±3.9	4.5±3.0	20.8±15.4	5.5±6.3	4.2±8.9	7.1±2.3	8.6±2.4	43.7±7.3	9.3±5.7
	17	11	20.6±5.9	0.92	4.93	129.6±18.6	19.4±14.6	4.4±14.6	4.8±4.3	22.6±14.0	7.1±10.2	4.0±6.7	4.5±4.1	6.9±3.1	45.5±15.8	10.5±6.9
PATP	0	9	7.6±4.9	0.94	1.10	125.7±22.6	41.4±0.0	0.0±0.0	8.1±10.2	43.4±25.2	5.6±10.3	0.0±0.0	15.5±6.5	2.6±2.2	1.1±1.5	8.1±8.7
	6	9	6.9±1.5	0.96	1.18	117.0±17.9	36.9±0.0	0.0±0.0	7.4±6.4	37.8±26.9	7.2±8.8	0.0±0.0	16.3±3.8	2.4±1.9	2.4±4.7	6.6±5.1
	13	10	13.7±5.7	0.95	2.65	140.7±11.7	45.4±0.0	0.0±0.0	13.7±6.4	37.3±23.2	6.2±4.8	5.3±8.5	7.0±6.4	5.9±2.9	0.4±0.3	19.6±9.9
	17	8	20.6±9.0	0.98	0.91	121.1±14.8	64.9±0.0	0.0±0.0	13.2±3.7	11.5±20.0	2.8±0.9	5.2±5.8	4.3±6.4	5.8±2.6	4.8±2.2	8.6±6.9
PCP	0	6	73.7±112.7	0.88	4.84	116.8±18.9	27.0±16.0	16.5±16.0	13.6±9.5	32.7±17.6	3.4±1.5	12.1±25.4	4.5±3.9	3.5±2.5	2.5±3.5	0.9±2.2
	6	10	12.6±4.0	0.97	1.24	157.7±42.8	12.0±36.6	25.2±36.6	11.2±3.5	71.2±37.6	5.4±3.9	8.7±26.8	9.8±5.6	3.9±3.2	7.4±4.6	2.7±4.7
	13	5	21.3±28.3	0.95	2.86	149.4±34.3	18.8±3.8	1.7±3.8	7.5±3.8	70.1±43.7	6.2±4.8	1.0±2.1	19.6±16.5	4.0±3.1	17.6±11.7	3.1±4.2
	17	9	64.9±86.1	0.89	4.77	135.0±35.2	7.8±19.0	12.7±19.0	13.3±7.2	58.8±40.4	4.1±2.9	14.7±32.4	6.6±6.5	3.0±3.4	13.1±15.1	1.0±2.6
SUTT	0	5	9.5±5.1	0.84	21.16	84.4±7.5	24.4±9.1	4.1±9.1	3.6±2.2	12.0±10.2	1.3±1.1	4.4±9.7	16.0±6.5	3.5±2.6	6.1±10.6	9.1±8.3
	6	4	15.6±12.2	0.80	16.08	82.5±8.3	21.8±21.0	10.5±21.0	4.3±2.1	6.2±6.7	1.3±2.1	3.6±4.3	15.2±7.8	2.4±1.1	9.5±10.2	7.7±5.8
	13	9	23.9±30.0	0.83	17.83	187.2±220.7	16.6±5.4	2.4±5.4	6.7±6.9	16.8±17.4	2.7±3.2	95.5±230.2	7.8±5.3	4.7±4.5	25.6±18.6	8.4±8.3
	17	10	29.7±41.8	0.85	15.55	106.1±24.8	16.1±13.9	5.8±13.9	8.2±9.2	20.2±18.2	4.4±10.7	15.0±25.3	9.6±6.4	1.5±1.9	19.7±15.6	5.5±5.0

Table 3.3-3d. Average 3-hour source contributions for sum of PAMS VOC for canister samples during CCOS IOPs at urban sites.

Site	Hour (PDT)	# in Avg	PAMS (ug/m ³)	R ²	χ ²	% PAMS Explained	Gasoline Exhaust	Liquid Gasoline	Gasoline Vapor	Diesel Exhaust	Consumer Products	Coatings	CNG	LPG	Biogenic	Biomass Burning
Absolute Contributions (ug/m3)																
CLO	0	11	102.7±93.5	0.91	4.49	107.3±5.5	52.2±2.6	5.5±2.6	20.9±2.4	6.2±3.7	4.4±0.5	1.2±0.6	8.5±3.3	8.0±1.6	0.2±0.1	0.0±0.5
	5	10	114.4±81.5	0.88	5.71	107.5±9.3	50.6±3.0	10.2±3.0	14.4±1.7	14.4±4.3	4.5±0.5	5.9±11.6	10.9±2.2	8.7±1.2	0.3±0.1	0.0±0.0
	12	9	45.8±24.4	0.92	3.45	119.5±10.6	17.0±1.9	3.2±1.9	9.7±0.7	10.4±2.1	1.9±0.1	4.2±8.6	2.5±0.4	3.1±0.3	2.8±0.2	0.1±0.5
	16	9	44.4±17.7	0.87	5.02	108.5±18.5	8.9±0.9	9.1±0.9	6.5±0.4	10.9±0.7	1.7±0.1	1.3±2.7	2.7±0.6	3.1±0.5	2.0±0.1	0.0±0.0
LEAN	0	10	56.5±20.8	0.94	2.43	97.3±4.0	39.6±1.1	2.1±1.1	4.8±0.5	0.5±1.6	2.3±0.2	2.0±0.3	1.8±0.3	1.4±0.2	0.1±0.0	0.1±0.5
	6	10	91.0±75.4	0.93	2.70	87.5±19.7	35.6±1.7	1.6±1.7	4.8±0.7	2.9±4.8	1.8±0.2	16.9±20.6	2.3±0.7	1.5±0.3	0.2±0.1	2.5±1.0
	13	9	68.1±23.5	0.95	2.08	100.7±3.0	44.9±0.0	0.0±0.0	9.3±0.5	0.6±2.1	2.6±0.3	5.0±0.6	0.7±0.2	3.5±0.3	1.7±0.1	0.2±0.4
	17	9	59.1±24.4	0.96	1.39	99.5±2.4	44.2±0.0	0.0±0.0	5.4±0.4	1.3±1.8	1.8±0.3	2.4±0.3	0.6±0.3	1.6±0.2	1.3±0.1	0.1±0.4
M29	5	7	75.9±26.2	0.90	3.76	100.0±7.7	40.5±1.0	0.0±1.0	5.9±0.7	1.7±2.0	6.0±0.3	0.8±0.3	1.7±0.3	19.6±1.8	0.1±0.1	0.1±0.9
	12	4	11.6±4.1	0.97	1.88	179.3±60.6	2.0±0.0	0.0±0.0	1.4±0.2	8.7±0.8	1.3±0.1	0.0±0.0	2.1±0.2	2.3±0.3	0.1±0.0	1.1±0.4
	16	7	9.3±4.4	0.99	0.76	183.4±28.2	2.9±0.0	0.0±0.0	1.0±0.3	7.2±1.1	0.4±0.0	0.0±0.0	1.2±0.1	2.1±0.4	0.2±0.0	1.4±0.2
NAT	0	3	173.8±63.7	0.91	5.29	105.0±2.2	126.8±0.0	0.0±0.0	28.5±1.4	6.9±2.6	7.4±0.8	4.7±1.5	0.0±0.0	6.6±0.8	0.9±0.1	0.0±0.0
	6	9	67.7±50.3	0.93	2.93	108.8±6.0	52.8±1.0	0.7±1.0	7.1±1.0	2.3±2.4	2.3±0.2	1.6±0.5	0.3±0.2	5.1±0.8	0.2±0.0	0.1±0.4
	13	2	68.9±67.0	0.90	4.66	111.9±13.5	44.5±0.0	0.0±0.0	13.2±1.4	2.0±5.0	4.3±0.7	4.2±1.8	0.5±0.3	3.6±0.7	0.2±0.0	0.0±0.0
	17	4	32.6±6.5	0.90	3.18	107.7±4.4	21.0±1.1	3.4±1.1	5.4±0.2	0.8±1.8	1.6±0.2	0.8±0.1	0.3±0.2	1.2±0.1	0.8±0.1	0.0±0.6
SDP	0	4	123.6±99.0	0.94	3.43	128.5±9.3	55.0±5.5	6.0±5.5	26.1±3.1	18.9±8.5	7.3±1.4	36.7±26.6	0.9±1.0	4.5±0.7	1.4±0.2	0.5±2.2
	6	9	128.7±96.2	0.92	3.78	105.1±2.9	104.0±4.6	2.1±4.6	11.1±2.1	1.6±3.3	4.0±0.5	4.6±1.3	0.5±0.7	5.1±0.8	0.5±0.1	0.1±0.4
	13	3	29.0±16.7	0.94	2.59	126.7±18.4	19.3±1.8	0.3±1.8	4.3±0.2	6.2±0.2	1.5±0.1	0.3±0.4	0.3±0.2	0.9±0.2	1.3±0.1	0.5±0.8
	17	4	68.1±30.8	0.93	4.10	112.5±10.3	39.3±1.8	8.1±1.8	9.8±0.6	7.6±2.5	1.6±0.1	0.8±0.5	0.3±0.5	1.6±0.2	4.7±0.4	0.6±0.6
Percent Contributions																
CLO	0	11	102.7±93.5	0.91	4.49	107.3±5.5	50.9±11.0	7.6±11.0	15.9±8.2	8.6±9.6	6.5±4.3	1.7±1.6	6.6±8.1	9.1±3.6	0.3±0.5	0.0±0.0
	5	10	114.4±81.5	0.88	5.71	107.5±9.3	41.0±11.5	11.7±11.5	11.5±4.4	14.8±8.8	5.5±3.9	4.4±7.0	9.1±5.4	9.2±3.2	0.2±0.1	0.0±0.0
	12	9	45.8±24.4	0.92	3.45	119.5±10.6	40.8±7.3	4.4±7.3	20.8±8.6	22.6±15.0	4.4±1.9	6.6±11.4	5.7±4.3	7.0±1.2	7.0±4.9	0.2±0.4
	16	9	44.4±17.7	0.87	5.02	108.5±18.5	23.2±11.5	18.0±11.5	15.7±9.0	25.6±15.8	3.8±1.5	2.9±5.4	6.4±8.2	6.8±4.7	5.9±5.0	0.0±0.0
LEAN	0	10	56.5±20.8	0.94	2.43	97.3±4.0	69.6±7.7	4.0±7.7	8.7±6.0	1.0±1.8	4.2±4.1	3.5±1.9	3.4±1.8	2.6±1.6	0.2±0.1	0.1±0.2
	6	10	91.0±75.4	0.93	2.70	87.5±19.7	51.5±10.0	3.2±10.0	6.1±3.3	3.6±7.1	3.2±3.4	11.0±15.3	3.6±2.8	1.9±1.2	0.3±0.4	3.2±3.6
	13	9	68.1±23.5	0.95	2.08	100.7±3.0	66.2±0.0	0.0±0.0	13.4±3.9	0.9±1.8	3.7±2.9	7.1±1.9	1.4±1.1	4.9±1.6	2.7±1.4	0.4±1.2
	17	9	59.1±24.4	0.96	1.39	99.5±2.4	75.6±0.0	0.0±0.0	8.5±4.7	2.1±3.2	3.3±4.3	4.0±1.0	1.3±1.0	2.6±1.3	2.0±0.8	0.2±0.3
M29	5	7	75.9±26.2	0.90	3.76	100.0±7.7	51.4±0.1	0.0±0.1	7.2±3.1	2.8±3.3	8.9±5.2	0.9±0.7	2.4±1.6	26.0±14.0	0.1±0.1	0.2±0.6
	12	4	11.6±4.1	0.97	1.88	179.3±60.6	13.8±0.0	0.0±0.0	11.7±2.7	93.6±73.1	11.3±5.6	0.0±0.0	19.2±8.4	17.1±11.7	1.3±1.1	11.4±8.4
	16	7	9.3±4.4	0.99	0.76	183.4±28.2	25.3±0.0	0.0±0.0	11.6±4.8	90.0±47.0	4.9±1.8	0.0±0.0	13.6±5.7	19.0±11.2	1.9±1.2	17.1±7.6
NAT	0	3	173.8±63.7	0.91	5.29	105.0±2.2	73.4±0.0	0.0±0.0	16.5±5.1	4.3±7.4	4.0±1.7	2.6±2.2	0.0±0.0	3.9±2.3	0.4±0.3	0.0±0.0
	6	9	67.7±50.3	0.93	2.93	108.8±6.0	74.1±3.4	1.6±3.4	11.3±4.5	5.7±6.1	4.2±2.5	2.4±1.2	0.9±1.9	7.8±6.0	0.3±0.2	0.5±0.9
	13	2	68.9±67.0	0.90	4.66	111.9±13.5	65.0±0.0	0.0±0.0	22.7±7.3	1.7±2.4	4.1±4.4	9.8±7.7	2.3±3.2	5.9±1.2	0.3±0.0	0.0±0.0
	17	4	32.6±6.5	0.90	3.18	107.7±4.4	63.2±13.6	11.5±13.6	16.2±4.1	2.0±4.0	5.1±7.1	2.6±0.3	1.2±1.4	3.6±1.4	2.2±1.5	0.0±0.1
SDP	0	4	123.6±99.0	0.94	3.43	128.5±9.3	51.9±4.5	4.9±4.5	17.7±6.4	15.6±5.0	5.1±2.2	26.0±16.2	0.6±0.7	4.8±2.1	1.4±0.9	0.5±0.7
	6	9	128.7±96.2	0.92	3.78	105.1±2.9	79.4±1.8	1.0±1.8	8.2±4.8	2.9±3.4	4.3±2.9	2.9±1.6	1.1±1.5	4.6±2.3	0.3±0.2	0.3±0.9
	13	3	29.0±16.7	0.94	2.59	126.7±18.4	64.0±1.1	0.6±1.1	13.3±5.5	30.0±23.7	4.9±2.1	0.7±0.6	2.5±4.1	2.7±2.4	5.2±2.2	2.9±3.3
	17	4	68.1±30.8	0.93	4.10	112.5±10.3	56.0±10.6	10.2±10.6	15.6±4.8	13.8±11.9	3.6±4.5	1.1±1.4	0.6±0.8	3.3±3.3	6.1±2.5	2.2±4.4

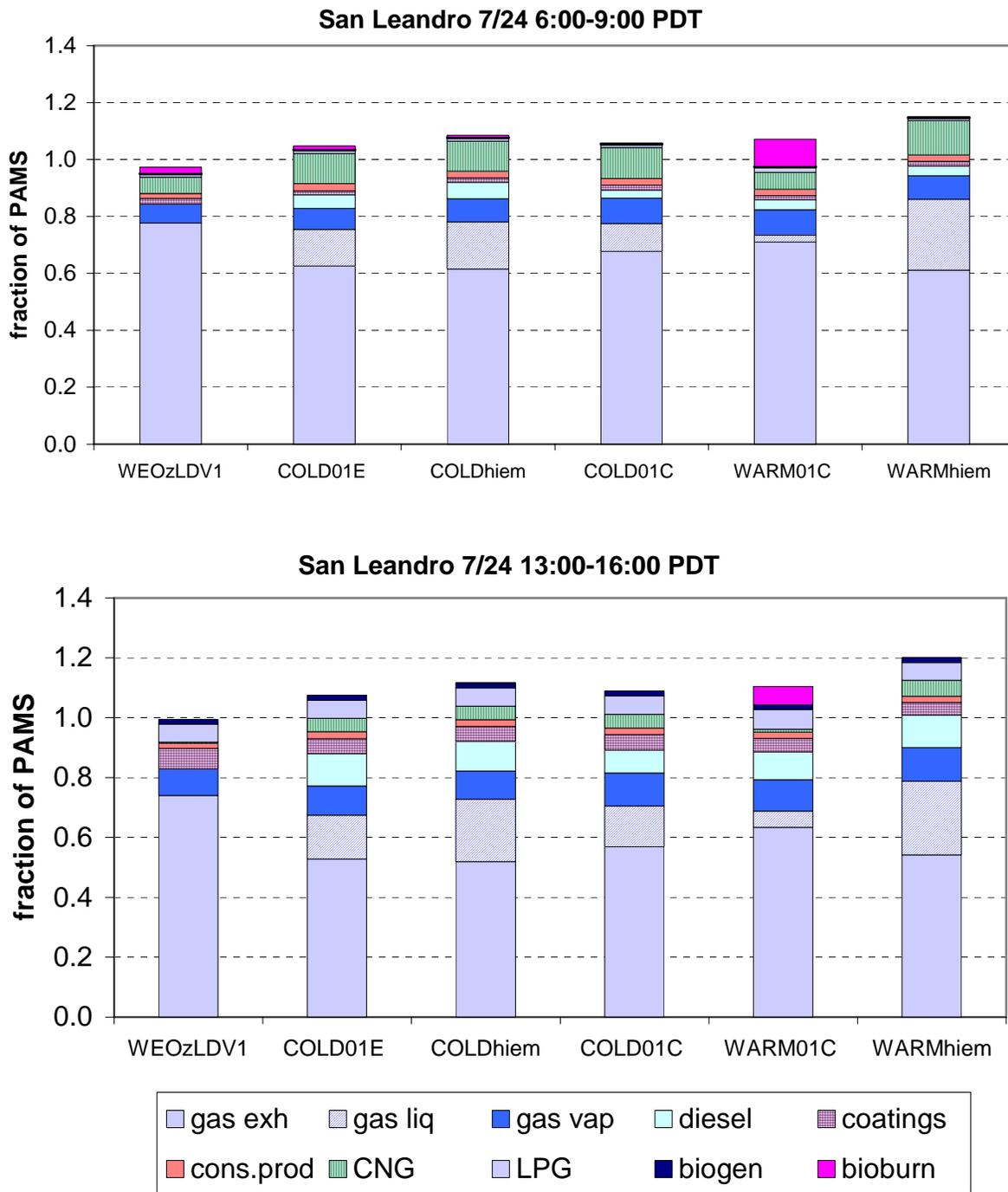


Figure 3.2-1. Sensitivity of VOC apportionments to alternative gasoline exhaust profiles applied to morning and afternoon samples from San Leandro.

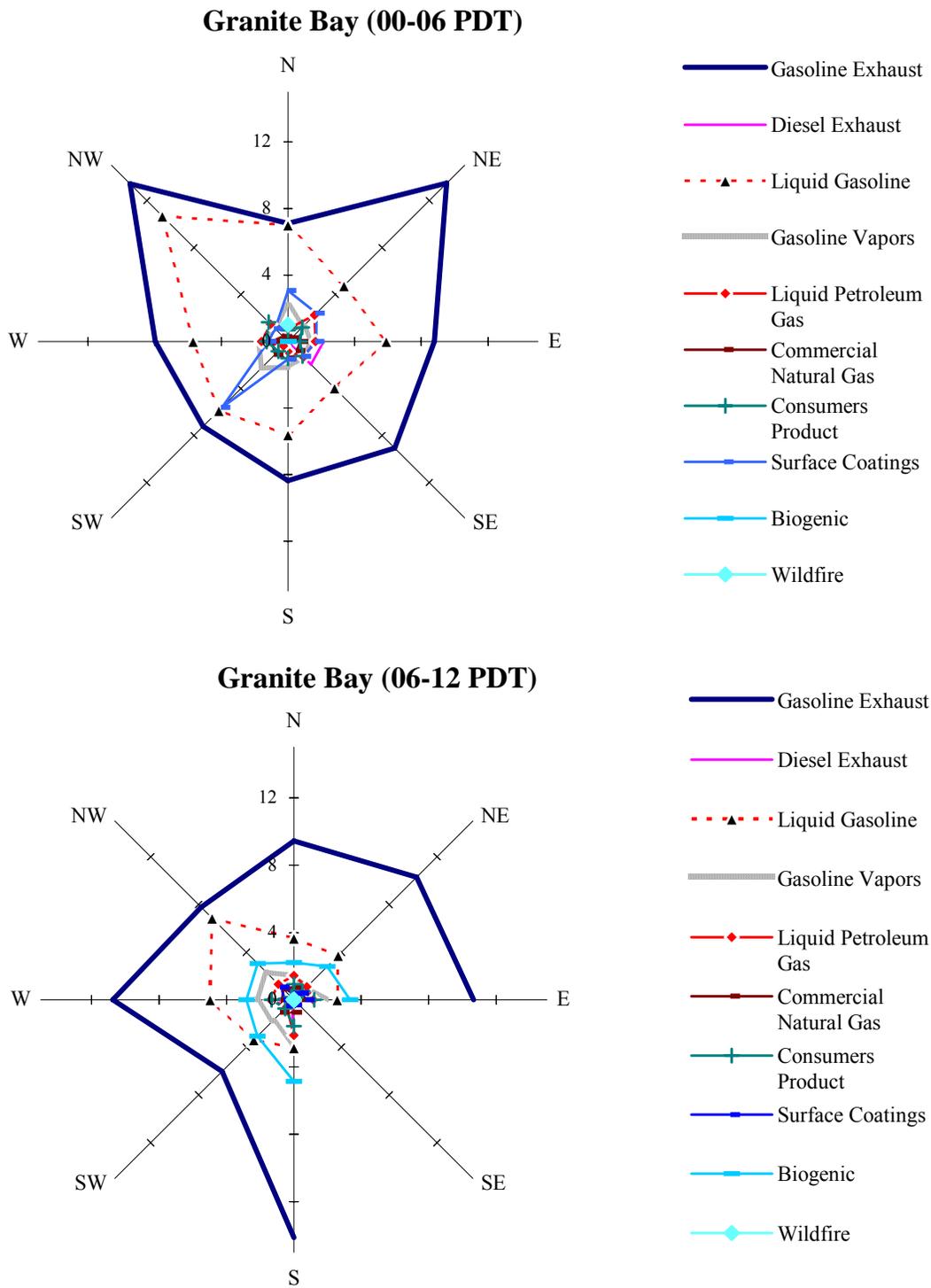


Figure 3.3-1a. Wind and wind speed directional dependence of source contributions by time of the day during the CCOS IOPs at Granite Bay.

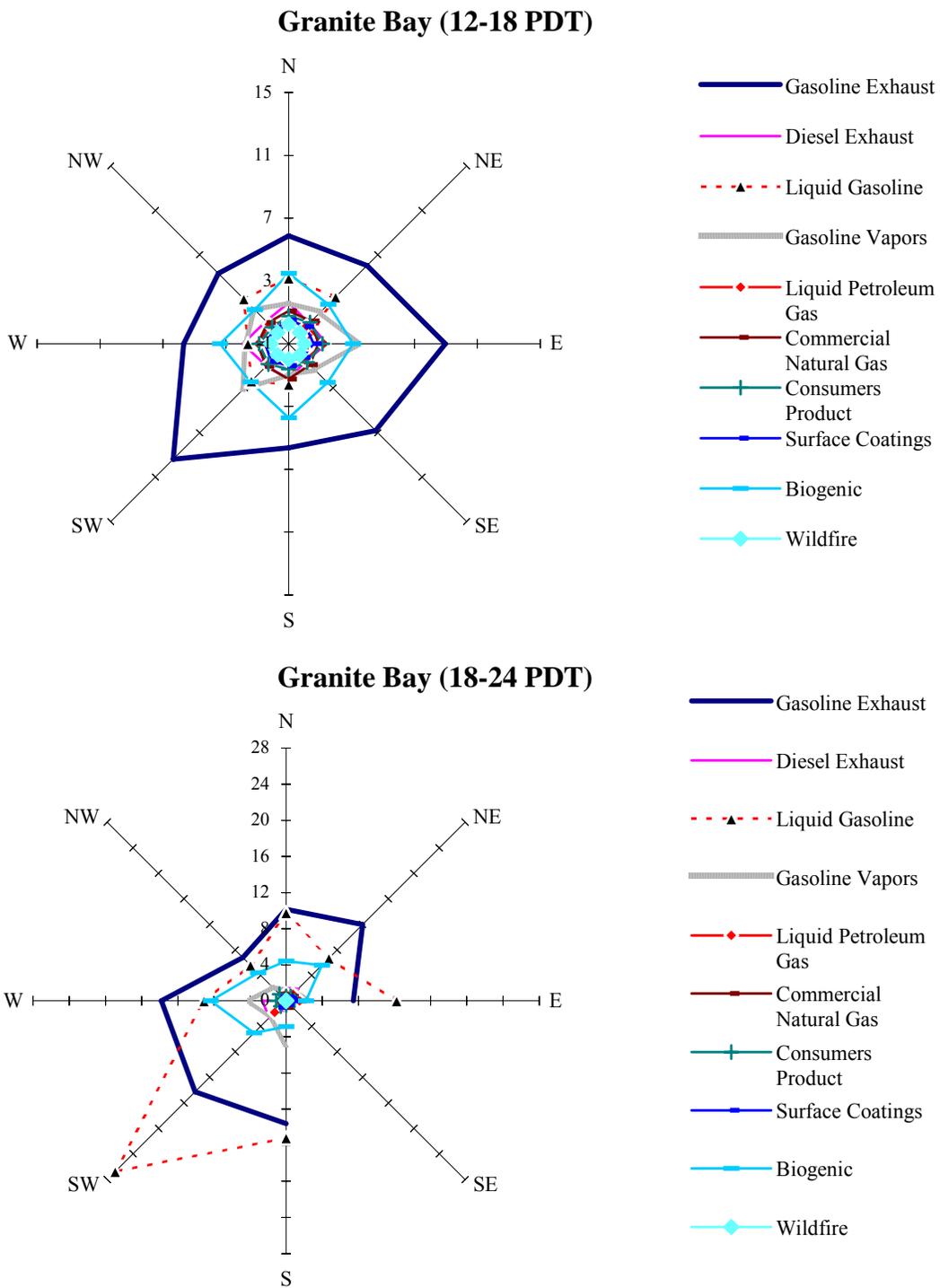


Figure 3.3-1a (cont). Wind and wind speed directional dependence of source contributions by time of the day during the CCOS IOPs at Granite Bay.

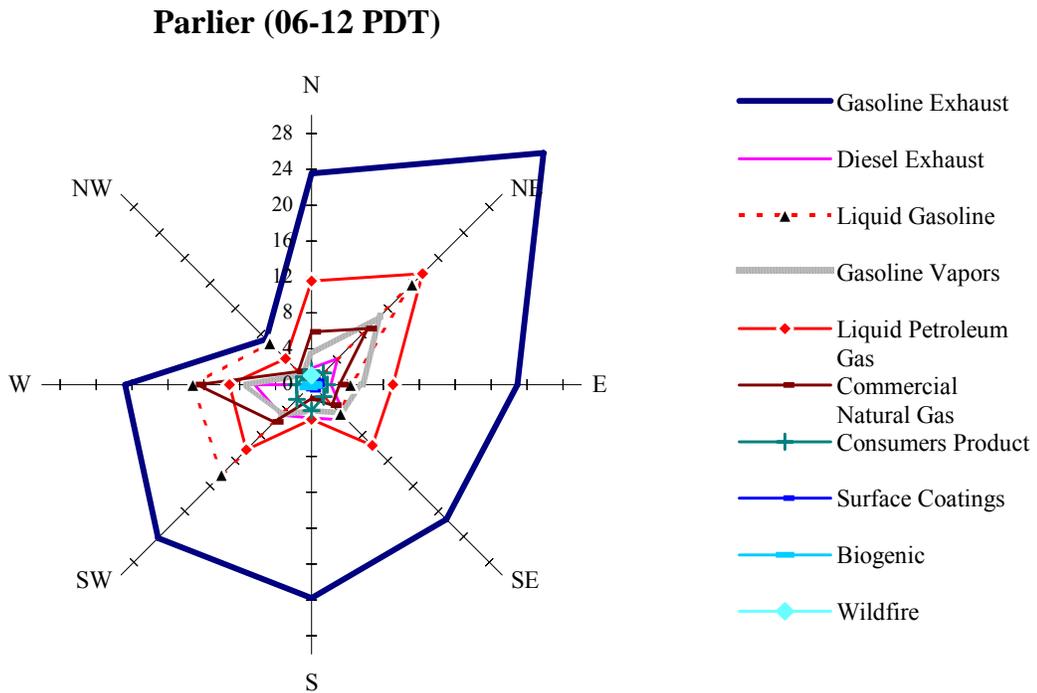
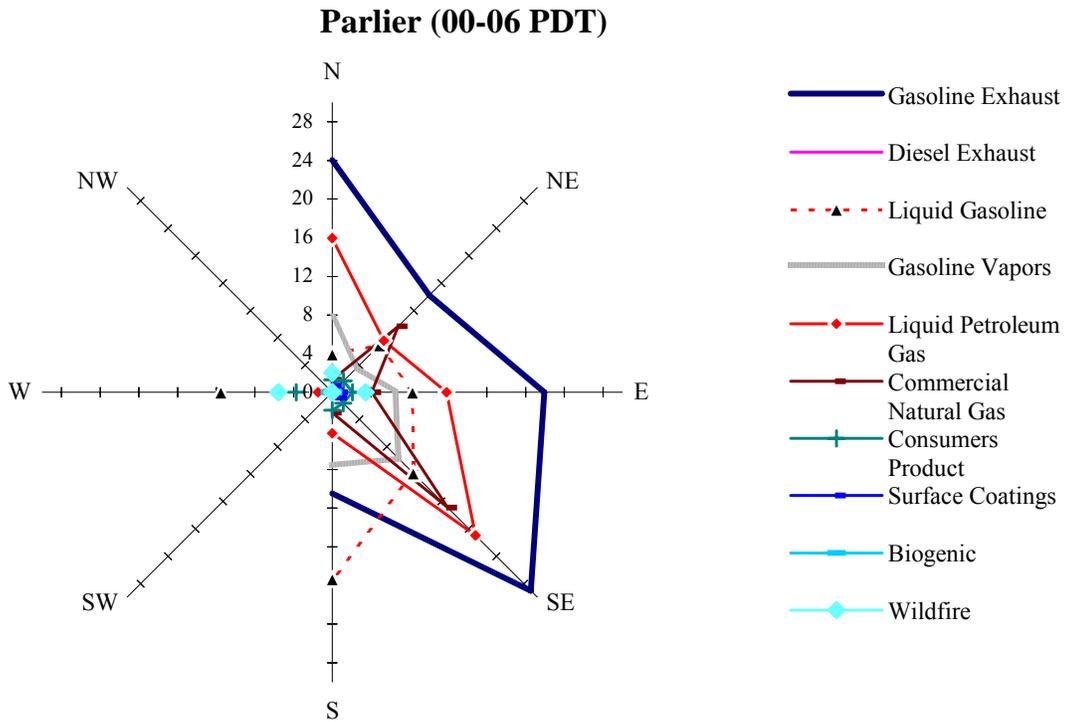


Figure 3.3-1b. Wind and wind speed directional dependence of source contributions by time of the day during the CCOS IOPs at Parlier.

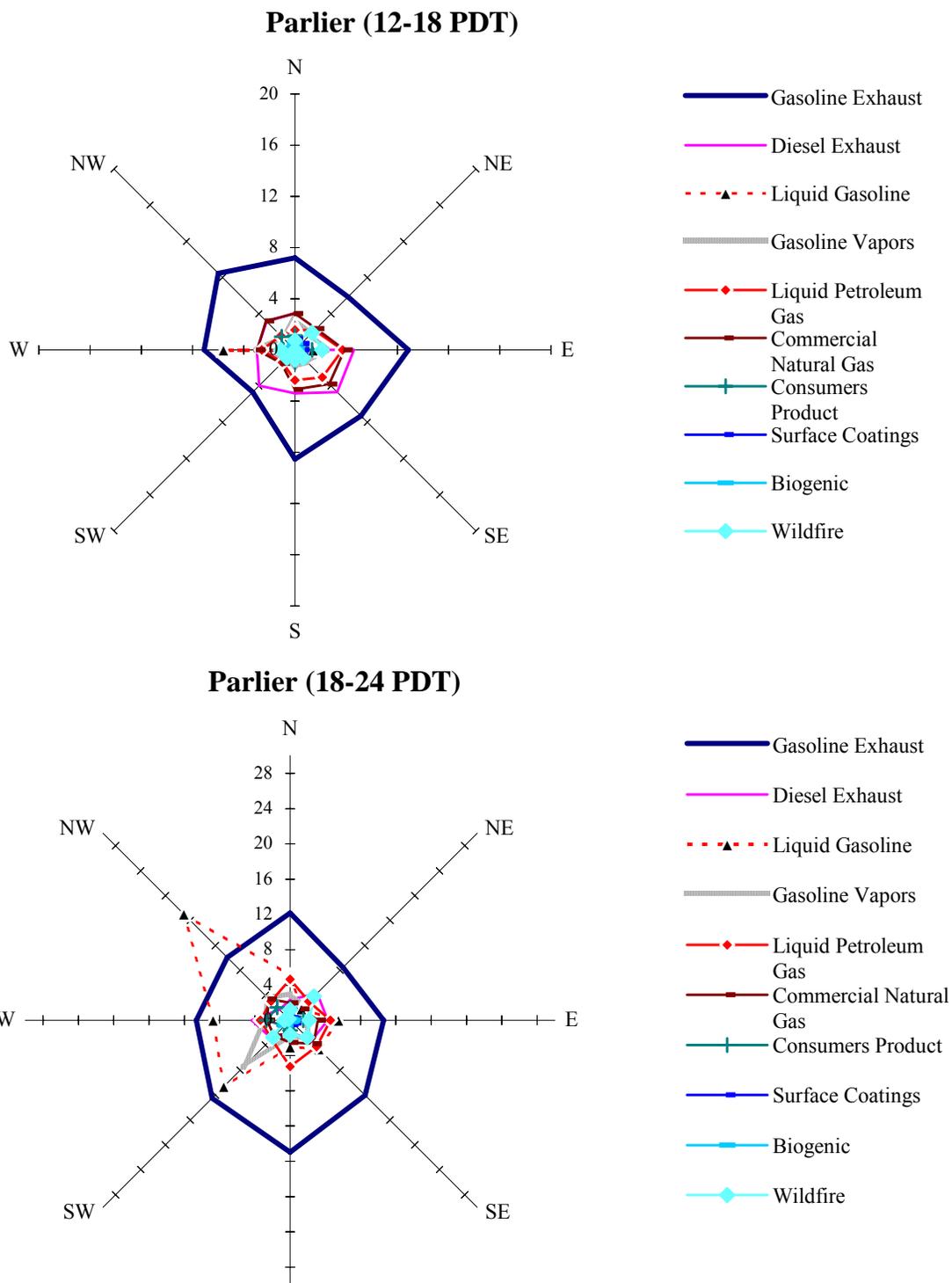


Figure 3.3-1b (continued). Wind and wind speed directional dependence of source contributions by time of the day during the CCOS IOPs at Parlier.

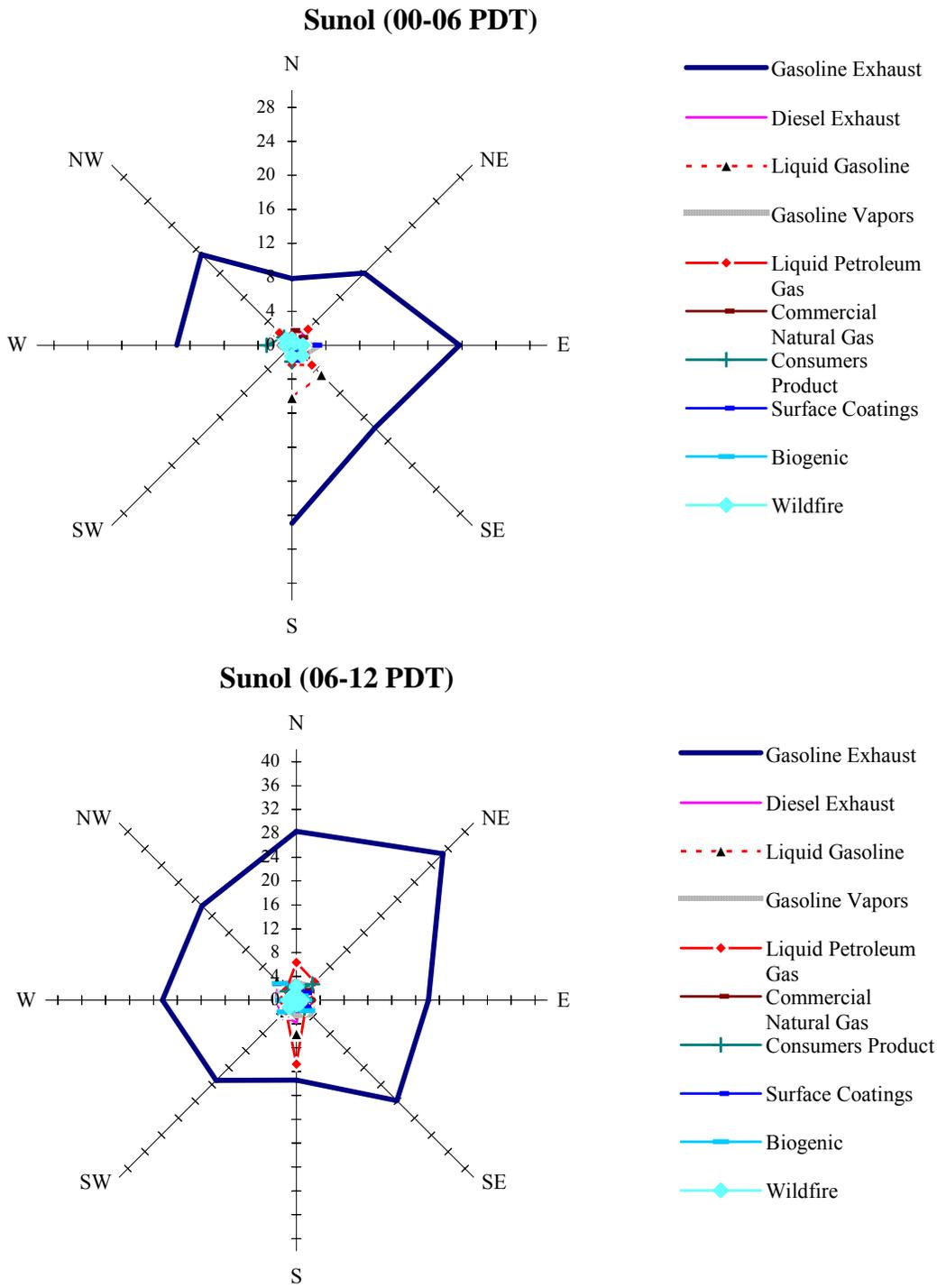


Figure 3.3-1c. Wind and wind speed directional dependence of source contributions by time of the day during the CCOS IOPs at Sunol.

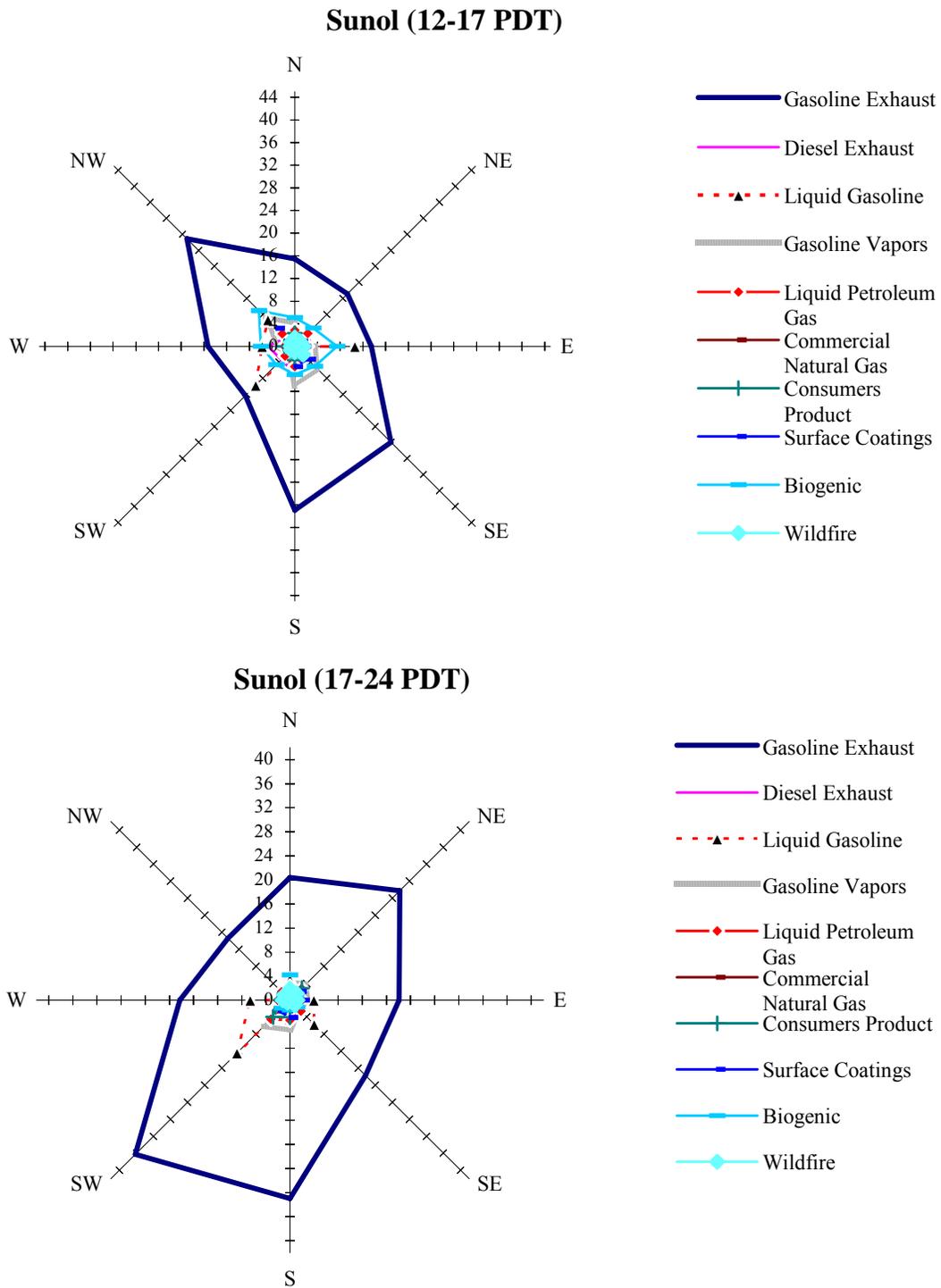


Figure 3.3-1c (continued). Wind and wind speed directional dependence of source contributions by time of the day during the CCOS IOPs at Sunol.