Biogenic Volatile Organic Compound Emission Inventory Improvement Project

Final Report

Prepared for the Clark County Division of Air Quality and Environmental Management

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September 19, 2006

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1. Executive summary

In December, 2005 Clark County's Division of Air Quality and Environmental Management requested a review of their current biogenic volatile organic compound (VOC) emission inventory. This initial inventory was prepared by Environmental Quality Management (EQM) of Las Vegas, NV and is based on the Biogenic Emission Inventory System (BEIS) from the US EPA. The county was concerned with this inventory since it projected biogenic VOC emissions that were four times greater than anthropogenic emissions. After reviewing the report, Dr. Mark Potosnak of the Desert Research Institute and Dr. Alex Guenther of the National Center for Atmospheric Research presented a series of recommendations that would improve the current emissions inventory. Highlights of the recommendations included the need for Clark County-specific measurements and the adoption of the MEGAN (Model of Emissions of Gases and Aerosols from Nature) framework which has improved land cover characterization compared to BEIS.

During the summer of 2006, Dr. Potosnak and Ms. Maria Papiez carried out an extensive survey of biogenic VOC emissions from plants within Clark County. The species measured accounted for over 85% of the vegetative cover within the county. Compared to the estimates provided by the BEIS framework, measured emissions of biogenic VOCs were much lower. In addition, Ms. Papiez prepared a comparison of land cover data used in the original EQM emission inventory with the Southwest Regional Gap Analysis Project dataset (SWReGAP). Although overall land cover classification differences were minor, this analysis uncovered that the original BEIS estimates of vegetation density were too high for the arid lands of Clark County. Using satellite derived estimates of leaf area index (LAI) substantially reduces predicted emissions.

In parallel to this work, Dr. Guenther adapted the MEGAN framework for Clark County. The initial MEGAN inventories are based on SWReGAP data and satellite LAI, and include emissions factors measured in Clark County. An analysis of this revised inventory reveals substantial reductions in biogenic VOC emissions due to the new emissions estimates and more realistic vegetation densities provided by the satellite data. This revised emission inventory presents a significant improvement over the previous inventory by incorporating county-specific data and satellite derived biomass estimates.

2. Introduction

Biogenic VOC emissions from plants can have substantial impacts on regional air quality (Chameides et al. 1988). As with anthropogenic VOCs, biogenic VOCs react with oxidants in the atmosphere and then promote the production ozone via the action of nitrogen oxides (NOx). Biogenic VOC emissions can dominate anthropogenic VOC emissions in some areas and have been shown to increase the ozone production efficiency of NOx present in power plant plumes (Ryerson et al. 2001). Early research on biogenic VOC emissions focused on the heavily forested regions of the East Coast (Trainer et al. 1987), and later some attention was focused on California (Winer et al. 1992). Initial attempts at global modeling (Guenther et al. 1995) required estimates for all land cover types, including arid lands, but little data was available. For arid regions such as Clark County, only recently have measurements entered the literature (Geron et al. 2006). This lack of knowledge presents obvious difficulties for modeling the impact of biogenic VOCs on ozone concentration in the Clark County urban area. Understanding this impact is crucial, since the effectiveness of control strategies for reducing ozone by limiting anthropogenic VOC and NO_x emissions depends on it.

2.1. Initial assessment

After a review of the Clark County biogenic volatile organic compound (VOC) emissions inventory produced by EQM, three important items were identified that required improvement. (1) The current emissions inventory relies on plant-specific emissions factors from the BEIS3 (Biogenic Emissions Inventory System, version 3) modeling framework. For many of the desert species in Clark County, there are no BEIS3 emissions factors available. Therefore, a majority of the modeling domain is assigned to the generic “shrubgrass” category. (2) The current inventory uses the standard BEIS3 emission algorithms, which will likely need adjustment for desert plants. For example, many desert species are drought deciduous. Bursage (*Ambrosia dumosa*) is a significant species in Clark County and is physiologically inactive during the dry summer months, but the BEIS3 algorithms do not account for this dormancy. (3) Although the current survey work based on the land cover database from RECON is adequate, there are additional sources of land cover data available that would improve the biogenic emissions inventory. In particular, the current survey only determined plant spatial coverage, and did not consider plant foliar densities, which are necessary for estimating biogenic VOC emissions. Instead, the current inventory used default foliar densities from the BEIS3 modeling framework. Again, these species densities are not appropriate for desert ecosystems, and other sources of land cover data have better estimates of species densities. We propose to correct these shortcomings by (1) conducting measurements on the species that dominate biogenic VOC emissions in Clark County, (2) comparing the current land cover database with other currently available databases and (3) deploying a more comprehensive and adaptable biogenic emissions model: the Model of Emissions of Gases and Aerosols from Nature (MEGAN), developed at the National Center for Atmospheric Research in Boulder, CO.

2.2. Overall plan

Based on the initial assessment, the following plan was developed. Dr. Potosnak and Ms. Papiez would perform a literature survey to collect biogenic VOC emission factors from species that made up over 85 % of the land cover or projected emissions based on the BEIS emission inventory (Section 3). Ms. Papiez carried out a comparison of the land characterization data used in the EQM inventory and the new SWReGAP data (Section 3). Dr. Potosnak and Ms. Papiez would conduct biogenic VOC measurements on all species described above (Section 4). Dr. Guenther would provide a beta version of the emission inventory based on existing MEGAN defaults (see MEGAN user manual). Dr. Guenther would provide a final emission inventory based on MEGAN, measured emission factors, and species information from the previously completed EQM surveys. The results of these tasks are presented in this report. A detailed list of deliverables and results is show in the section 8.

3. Land cover comparison and literature review

3.1. Land cover comparison

An extensive comparison of the land cover classifications was accomplished using a graphical information system (GIS, Arcview). The initial biogenic VOC emission inventory performed by EQM was based on data from the RECON land cover characterization. The MEGAN framework is based on data from the SWReGAP project. Although different land cover categories are used in these databases, there is a strong correspondence between the categories. Most of the disagreement was found in categories that only occurred at higher elevations.

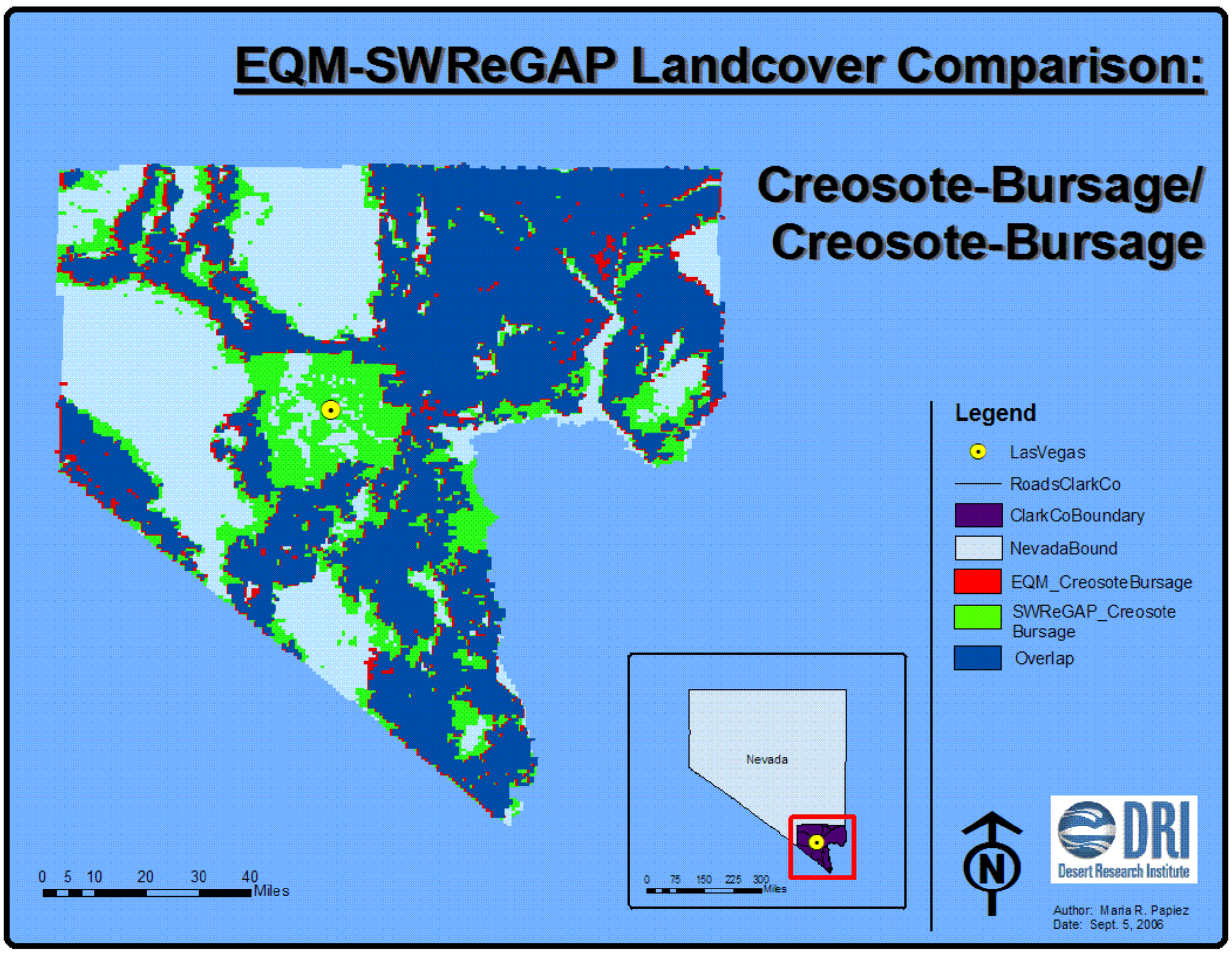

Figure 1 A comparison of the creosote-bursage category, which exists in both the SWReGAP and in the RECON dataset used by EQM. For this comparison, kilometer square grid cells were considered to be in the category if they contained more than 25 % coverage for that category.

Because of the small area of land cover types at high elevation, disagreements are not of significant importance. These detailed comparisons were presented at meeting with the Project Oversight Committee in July. Overall, there was good agreement between the major categories, and it was concluded that the selected land cover characterization scheme would not have a major impact on results. For example, the creosote-bursage category, which dominates the coverage of Clark County, occurs in both data sources. As seen in Figure 1, there is generally good agreement between these classification schemes. Note that the biggest discrepancy is located within the urban area. This might be due to different definitions of the categories. SWReGAP has only two urban classifications, while EQM/RECON had ten.

3.2. Literature review

Although the classification scheme would have little impact, MEGAN uses satellite-based LAI data to estimate biomass coverage. These biomass coverage estimates are much lower than used in the existing EQM/BEIS inventory, and these lower the emission inventory by a considerable amount. A literature review was also performed to gather emission estimates for the top 85 % of species present in Clark County. The species and associated references are listed below.

Species	Reference
Ambrosia	(Geron et al. 2006)
Artemesia	(Winer et al. 1983, Arey et al. 1995, Guenther et al. 1996b)
Atriplex	(Archer et al. 1994, Guenther et al. 1996b, Geron et al. 2006)
Creosote	(Geron et al. 2006)
Encelia	(Winer et al. 1983)
Ephedra	(Geron et al. 2006)
Eriogonum	(Winer et al. 1983)
Krameria	(Geron et al. 2006)
Opuntia	(Archer et al. 1994)

The combined effect of accounting for improvements in biomass characterization and the literature emission factors is substantial for both isoprene and monoterpene emissions. These factors were combined to create a new emission inventory based on the original EQM/BEIS framework. Although the county chose not to implement this intermediary inventory, the comparison with the original inventory shows the magnitude of the changes involved. Figure 2 details this impact for monoterpene emissions. Isoprene emissions showed little reduction or an increase, because one genus, *Ephedra* (Mormon tea), has a high isoprene emission rate in the literature (Geron et al. 2006) and occurs in many land cover types.

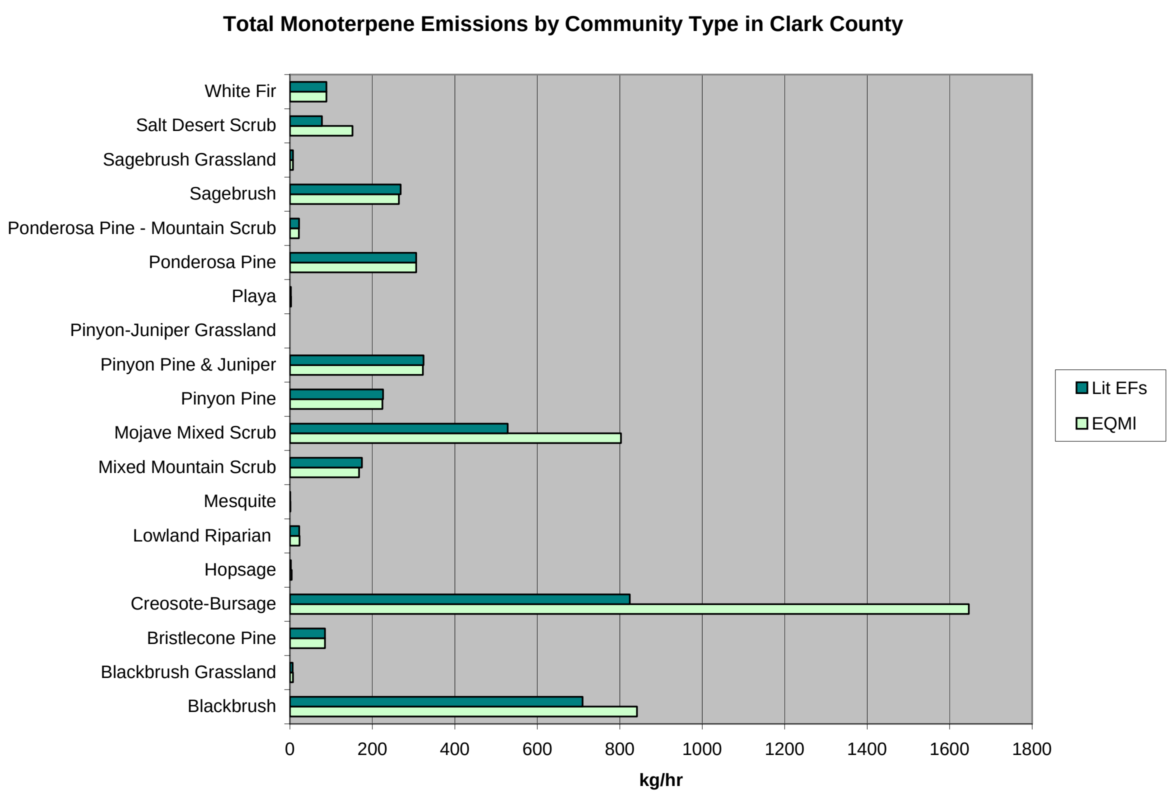

Figure 2 The effect of using literature values for plant emission factors (EFs) for monoterpene emissions and using new biomass estimates based on satellite LAI values.

4. Biogenic VOC measurements

Following the initial plan, an analysis of the previous EQM plant survey data and a review of the literature data were combined to identify plant species that accounted for 85% of land cover and 85% of biogenic VOC emissions (Table 1). Field measurements of plant biogenic emissions were carried out over four months (May—August). This allowed for repeated sampling of certain species.

Highest Emitters	Modified Highest Emitters	Highest Landcover
1.Oak	1.Oak	1.Creosote
2.Creosote	2.Ephedra	2.Ambrosia
3.Ambrosia	3.Ponderosa Pine	3.Grasses
4.Ponderosa Pine	4.Creosote	4.Blackbrush
5.Blackbrush	5.Ambrosia	5.Saltbush
6.Grasses	6.Blackbrush	6.Ephedra
7.Saltbush	7.Grasses	7.Juniper
8.Pinyon Pine	8.Pinyon Pine	8.Sage
9.Juniper	9.Juniper	9.Krameria
10.Ephedra	10.Saltbush	10.Pinyon
11.Sage	11.Sage	11.Yucca
12.Krameria	12.White Fir	12.Eriogonum
13.White Fir	13.Cottonwood	13.Cacti
14.Cacti	14.Acacia	14.Brittlebush
15.Cottonwood	15.Yucca	15.Oak
16.Acacia	16.Hopsage	
85.5% of total CC BVOCs	**84.8% of total CC BVOCs**	**46.9% (85% of non-barren or impervious land in CC)**

Table 1 Listing of the target species for this report. The names follow the conventions used in the EQM report. The "Highest Emitters" category is based on the EQM inventory, and the "Modified Highest Emitters" is the list based on literature values as detailed in section 3.2.

4.1. Methodology

A unique field-portable biogenic VOC sampling system that was specifically designed to measure arid species was employed for this project. This system is part of the equipment available at the Atmosphere-Biosphere Interactions laboratory of the Desert Research Institute. Quantification of biogenic VOCs was conducted with a field portable gas chromatograph and a flame ionization detector (GC/FID model 8610, SRI Instruments, Torrance, CA). VOCs were concentrated onto a solid absorbent (Tenax TA, Supelco, Bellefonte, PA) from 1 l of air (a flow rate of 50 standard cm^3 sec^{-1} for 20 minutes, as determined by an Aalborg mass flow controller), and then thermally desorbed at 275 °C for injection into the GC. The solid absorbent was contained in an 1/8″ OD silicon-treated tube and cooled with thermoelectric coolers. The GC has an Mtx-624 column (30 m length, 0.53 mm ID), and the temperature program was 2 minutes at 50 °C, 17.5 minutes ramping at 10 °C/min, and finally 5.5 minutes at 225 °C. This setup was able to quantify isoprene (C_5H_8), monoterpenes ($C_{10}H_{16}$) and sesquiterpenes ($C_{15}H_{24}$). The sesquiterpene measurements were an extension of the project funded by the Desert Research Institute and Guinn fellowship awarded to University of Nevada, Reno graduate student Maria Papiez. The results of these additional measurements will be reported by Ms. Papiez in her master's thesis (anticipated completion: December 2006). Plants were enclosed in a glass chamber (approximately 1.5 l volume) which contained a thermocouple to measure leaf temperature. Glass was selected since it is very inert for reactive compounds such as sesquiterpenes. Zero air for the system was provided by a Licor leaf gas exchange system (LI-6400, Licor Inc., Lincoln, NE) and two scrubbers were used to remove incoming hydrocarbons and ozone. The first larger scrubber contained granulated charcoal, and a second smaller scrubber used coconut charcoal. The second scrubber was disposable and replaced daily. The incoming gas flow rate was determined by the leaf gas exchange system, and was always set to 730 standard cm^3 min^{-1}. Biomass enclosed by the chamber was collected, and then dried and weighed in the laboratory for determining dry leaf weights.

Overall, one hour was necessary to perform one measurement: 20 minutes of collection time, 30 minutes of analysis time, and a 10 minute period to allow the GC to cool down. All measurements were repeated to minimize the effects of disturbance, and blank runs (no plant material in the chamber) performed at least twice per day. Professional judgment was used to assess repeated measurements for disturbance effects. Most importantly, care was taken in leaf chamber placement around branches and leaves. With these limitations, three individual plants could be measured in one day.

The plant samples enclosed in the glass chamber employed in the study were subjected to ambient light and ambient temperature. The chamber did have a thermal regulation system composed of two thermoelectric coolers, and these coolers could offset any heating due to solar forcing within the glass chamber. Ambient light was measured with a light sensor built into the leaf gas exchange system (LI-190, Licor Inc., Lincoln, NE). Leaf temperature was measured with a fine-wire thermocouple. For each species measured, light dependence of BVOC emissions was either measured directly or determined from the literature. If a species was light dependent, then emission factors were scaled to 30 °C using an exponential relationship, measured leaf temperature (T_{leaf}, in K) and a β factor of 0.09 according to the following equation:

$$EF = \frac{Emission}{\exp(\beta(T_{leaf} - 303))}$$

If emissions were determined to be light dependent, then both a more complicated temperature algorithm was applied and emissions were also scaled with light. These algorithms are employed in MEGAN, and therefore we applied the same algorithms to our data. The first light dependent emission algorithm determines a correction factor for temperature (C_T) which accounts for the previous month's temperature (T_{mon} in K), which was determined from measurements at McCarran International Airport. Since MEGAN will adjust emission factors based on monthly temperatures, it is necessary to adjust measured values. The following equations determine the correction factor:

$$T_{opt} = (313 + (0.6 \times (T_{mon} - 297)))$$

$$x = \frac{\frac{1}{T_{opt}} - \frac{1}{T_m}}{0.00831}$$

$$E_{opt} = 1.75 \times \exp(0.08 \times (T_{mon} - 297))$$

$$C_T = \frac{E_{opt} \times 200 \times \exp(80 \times x)}{200 - 80 \times (1 - \exp(200 \times x))}$$

The second algorithm corrects for light (*PAR* in μmol m^{-2} s^{-1}) dependence (C_L) in MEGAN:

$$C_L = \frac{0.0027 \times 1.066 \times PAR}{\sqrt{1 + (0.0027 \times PAR)^2}}$$

The final emission factor for light dependent BVOCs is then calculated as:

$$EF = \frac{Emission}{C_T \times C_L}$$

Calibration protocols are discussed in section 7. Identification of compounds was performed several ways. First, an authentic standard containing isoprene and α-pinene was used to determine the elution times of these compounds, and it was assumed that other monoterpenes had a similar response factor. Other compound elution times were determined by collecting samples in the field onto either a solid absorbent (SuperQ) or using solid-phase micro extraction (SPME). Samples were then analyzed on a gas chromatograph/mass spectrometer (GC/MS) after returning samples to the laboratory. The same column was used in the GC/MS as in the field portable GC, so retention times could be compared. Compound identification was accomplished with comparison to mass spectral libraries.

4.2. Research sites

Field sites were selected to meet multiple goals. First, the presence of multiple plant species was extremely important, since the sampling equipment took approximately one hour of setup time each day. If species were located within a reasonable distance (< 500 meters), then the equipment could be moved and multiple individual plants could be measured in one day. Second, a local knowledgeable expert on plant identification was desirable. This was particularly important for identifying species within the urban areas. Finally, sites were selected that were deemed to be representative of typical growing conditions for the species of interest.

4.2.1. Angel Park Golf Course

Angel Park is located in northwest Las Vegas, just south of the Summerlin community. The course contains a wide variety of vegetation, although it is dominated by grass species. Biogenic emissions from species of mesquite, cottonwood, shoestring acacia, and creosote bush were measured at this location.

4.2.2. Sunset Park

Sunset Park is located just east of McCarran International Airport in Las Vegas. It is one of the largest parks in the city and contains baseball fields, volleyball courts, a swimming pool and open space. Biogenic emissions from species of saltbush, mesquite, Arizona Ash, Mondel and Aleppo Pine, oleander, palm, mulberry, and barometerbush were measured at this location.

4.2.3. Deerbrooke Residential Neighborhood

The Deerbrooke neighborhood is located in northwest Las Vegas, just west of Highway 95. It is a typical suburban neighborhood with lot sizes ranging from quarter-acre to half-acre. Biogenic emissions from species of juniper, rosemary, and palm were measured at this location.

4.2.4. Desert Research Institute

DRI is located just east of Las Vegas Blvd. on Flamingo Road. The vegetation on the grounds was chosen with water conservation in mind and therefore, many drought-tolerant (xeriscape) native and non-native species were used in landscaping. Biogenic emissions from shoestring acacia, desert willow, and saguaro cactus were measured at this location.

4.2.5. Clark County Complex

The Clark County government buildings are located near the intersection of Interstate 15 and Highway 95. This location utilizes xeriscape vegetation, but also includes some large grassed areas. Biogenic emissions from species of mesquite and Mondel Pine were measured at this location.

4.2.6. Nevada Desert FACE Facility (NDFF)

NDFF is located on the grounds of the Nevada Test Site just north of Mercury, NV. This branch of the FACE network is setup to examine the effects of elevated carbon dioxide on desert ecosystems. This site was visited to determine biogenic emissions from creosote bush in a native setting.

4.2.7. Mount Charleston Wilderness Area

Mount Charleston is located in the Spring Mountain range northwest of Las Vegas. Climbing to an elevation of almost 12,000 feet, a number of different landcover types cover this wilderness and a large variety of vegetation is present. Measurements of biogenic emissions from pinyon pine, yucca, juniper, cliffrose, oak, blackbrush, and mountain mahogany were taken in this area.

Name	Geographic Location	Latitude/Longitude
Angel Park Golf Course	241 South Rampart Blvd., Las Vegas, NV 89145	36° 10' 20.49" N, 115° 17' 13.56" W
Sunset Park	SE corner, intersection of Sunset Rd. & Eastern Ave., Las Vegas, NV 89120	36° 04' 16.80" N, 115° 07' 06.24" W
Deerbrooke neighborhood	Intersection of Craig Rd. & Buffalo Dr., Las Vegas, NV 89129	36° 14' 26.77" N, 115° 15' 36.36" W
Desert Research Institute	755 E. Flamingo Rd., Las Vegas, NV 89119	36° 06' 52.23" N, 115° 08' 49.53" W
Clark County Complex	500 S. Grand Central Pkwy, Las Vegas, NV 89155	36° 09' 59.53" N, 115° 09' 18.39" W
Nevada Desert Face Facility	Mercury, NV, 60mi. NW of Las Vegas, NV	36° 45' 20" N, 115° 59' 15" W
Mt. Charleston Wilderness	Spring Mtns., 35 mi. WNW Las Vegas, NV (2 locations on an elevation gradient)	36° 16' 39" N, 115° 30' 21" W 36° 16' 24" N, 115° 35' 01" W

Table 2 Location of the research sites used in the present study.

4.3. Measurement results

Results from our measurements are summarized in Table 3 below. Additional species were collected in the urban areas and are available upon request, but these species are not included in the top 85 % of coverage of the county, and are therefore omitted from this report.

Species	Light Dependent?	Isoprene	α-pinene	Camphene	Sabiene β-pinene	3-carene	Other* MTs	Total MTs
Larrea tridentata	N	0.00	0.01	0.04	0.00	0.00	0.11	0.16
Coleogyne ramosissima	N	0.24	0.13	0.07	0.00	0.00	1.99	2.43
Atriplex sp.	N	0.00	0.00	0.00	0.00	0.00	0.30	0.30
Juniperus ssp.	Y	0.00	0.17	0.02	0.05	0.23	0.07	0.54
Pinus monophylla	N	0.00	0.00	1.65	0.05	0.15	0.08	1.93
Yucca sp.	N	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Carnegiea gigantean	N	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Artemisia tridentate	N	0.03	0.12	0.13	0.19	0.00	2.62	3.05
Purshia Mexicana	N	0.62	10.72	0.00	1.06	0.23	3.37	15.37
Cercocarpus montanus	Y	0.09	0.00	0.00	0.00	0.00	0.89	0.88
Quercus gambelii	Y	27.38	0.00	0.00	0.00	0.00	0.01	0.01

Table 3 Emission factors measured in Clark County for the primary species selected for study. Units are μg C gdw^{-1} hr^{-1}. The category "Other MTs" includes unidentified monoterpenes and some oxygenated monoterpenes. Values are normalized to 30 °C and 1000 μmol m^{-2} s^{-1}.

Of particular interest is the result that few of the species measured in Clark County are isoprene emitters. This is compared to results from Maricopa County (cf. Table 5 and Table 7) where isoprene emitters were found in typical abundances.

Species	Number of samples	Isoprene	α-pinene	Camphene	Sabiene β-pinene	3-carene	Other* MTs	Total MTs
Larrea tridentata	11	0.00	0.02	0.04	0.00	0.00	0.12	0.16
Coleogyne ramosissima	2	0.00	0.04	0.03	0.10	0.00	1.24	0.71
Atriplex sp.	4	0.00	0.00	0.00	0.00	0.00	0.20	0.20
Juniperus ssp.	5	0.00	0.08	0.01	0.02	0.15	0.03	0.26
Pinus monophylla	2	0.00	0.00	1.80	0.07	0.15	0.09	2.12
Yucca sp.	1	NA	NA	NA	NA	NA	NA	NA
Carnegiea gigantea	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Artemisia tridentata	6	0.07	0.04	0.04	0.06	0.00	0.98	0.79
Purshia mexicana	2	0.36	5.94	0.00	0.52	0.11	1.73	8.29

Species	Number of samples	Isoprene	α-pinene	Camphene	Sabiene β-pinene	3-carene	Other* MTs	Total MTs
Cercocarpus montanus	2	0.12	0.00	0.00	0.00	0.00	0.90	0.90
Quercus gambelii	2	0.75	0.00	0.00	0.00	0.00	0.01	0.01

Table 4 Emission factor standard deviations for the same data as **Table 3**.

Standard deviation data is reported in Table 4. As can be seen by comparing to Table 3, measurement errors for most species was considerable for some species. And because some measurements were repeats on the same individual, this error rate is more indicative of the analytical precision of the equipment, and as discussed in section 5, there are many more sources of variability when determining species emission factors. For example, biogenic emission capacities for individual leaves are known to vary based on light environment (Harley et al. 1996), growth temperatures (Monson et al. 1992), canopy position (Harley et al. 1996), nutrient availability (Harley et al. 1994) and carbon dioxide concentration (Rosenstiel et al. 2003).

Species	Light Dependent?	Isoprene	α-pinene	Camphene	Sabiene β-pinene	3-carene	Other* MTs	Total MTs
Ambrosia deltoidea	N	0.00	0.00	0.00	0.03	0.00	0.21	0.25
Encelia farinosa	N	0.00	1.40	0.01	0.61	0.07	0.72	2.80
Ephedra viridis	Y	5.32	0.00	0.00	0.00	0.00	0.00	0.00
Olneya tesota	Y	59.82	0.00	0.00	0.00	0.00	0.00	0.00
Simmondsia chinensis	Y	29.90	0.00	0.00	0.00	0.00	0.07	0.07
Juniperus ssp.	Y	0.00	0.16	0.00	0.14	0.01	0.07	0.38
Larrea tridentata	N	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parkinsonia microphylla	Y	0.00	0.00	0.00	0.00	0.00	0.09	0.09
Pinus monophylla	N	0.00	0.05	0.00	0.00	0.00	0.00	0.05
Atriplex canescens	N	0.00	0.00	0.00	0.00	0.06	0.00	0.06
Yucca sp.	N	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5 Emission factors measured in Maricopa County. Units are μg C gdw^{-1} hr^{-1}. Values are normalized to 30 °C and 1000 μmol m^{-2} s^{-1}.

Emission factors are also reported for measurements conducted by Dr. Potosnak in Maricopa County, since some species exist in both locations. These measurements are in addition to measurements performed by Dr. Brad Baker for the Maricopa County study and that are reported in Table 7.

Species	Number of samples	Isoprene	α-pinene	Camphene	Sabiene β-pinene	3-carene	Other* MTs	Total MTs
Ambrosia deltoidea	3	0.00	0.00	0.00	0.03	0.00	0.07	0.07
Encelia farinosa	4	0.00	0.44	0.03	0.43	0.05	0.29	0.94
Ephedra viridis	1	NA	NA	NA	NA	NA	NA	NA
Olneya tesota	2	1.51	0.00	0.00	0.00	0.00	0.00	0.00
Simmondsia chinensis	2	4.60	0.00	0.00	0.00	0.00	0.00	0.00
Juniperus ssp.	4	0.00	0.11	0.01	0.13	0.01	0.05	0.28
Larrea tridentata	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parkinsonia microphylla	12	0.00	0.00	0.00	0.00	0.00	0.19	0.15
Pinus monophylla	1	NA	NA	NA	NA	NA	NA	NA
Atriplex canescens	2	0.00	0.00	0.00	0.00	0.09	0.00	0.09
Yucca sp.	1	NA	NA	NA	NA	NA	NA	NA

Table 6 Emission factor standard deviations for the same data as Table 5.

4.3.1. Seasonality

As stated in the initial assessment (2.1), a goal of the current study was understand the influence of seasonality on BVOC emissions. Because creosote bush is a dominant species in the natural lands of Clark County, a majority of the effort was devoted to this species. But observed emission factors were consistently small (Table 3), and therefore no strong seasonal pattern emerged. There appeared to be a correlation between emissions and flowering (data not shown), but the relationship requires further study. Developing an algorithm to predict flowering would be difficult, since flower phenology depends strongly on climate and elevation.

5. Modeling

MEGAN driving variables that were revised for this project include land cover distributions, landscape average biogenic emission factors, plant functional type (PFT) cover fractions and Leaf Area Index.

5.1. Land cover distributions

The spatial distribution of land cover for most of the US is based on regional SWReGAP data (ftp://ftp.gap.uidaho.edu/products/regional). Urban areas in Clark County were revised using Clark county land-use geographical information. Land cover distributions in Mexico are characterized using the Olson et al. (2001) global ecoregion database.

5.2. Landscape average biogenic voc emission factors

Landscape average emission factors are determined from species specific emission factors and plant species composition estimates for each land cover types. Isoprene and monoterpene emission rate measurements conducted during summer 2006 characterized the dominant Clark County plant species in both wildland and urban landscapes. The field study results are shown in Table 3 along with literature emission rates for important Clark County plant species (Table 7). Measurements were made on all of the dominant plant species as well as many other common Clark County plant species. Many of the plant species examined during the summer 2006 had not previously been studied or had been characterized by only one or two measurements. A more detailed description of the methods and results will be published in a peer reviewed journal. Note that the emission rates reported by different studies can differ substantially. These differences may be due to within-species genetic variability or phenological and physiological variations. They could also be due to measurement errors or artificial disturbances associated with enclosure measurement techniques. We have used the approach of

Guenther et al. (1994), which considers the quantity and quality of the emission rate data, to integrate these observations and determine the MEGAN emission factors.

The 1997 USDA NASS crop statistics were used to quantify crop species composition in U.S. counties. Species composition for Clark County urban land cover types are based on the EQM land cover survey. The plant species composition of most US wildland landscapes is based on USDA FIA data for trees and NRCS data for shrubs and grass. The major land cover types are characterized by hundreds of FIA and NRCS plots. Species composition for some southwestern U.S. land cover types were revised based on the results of the EQM land cover surveys in Clark County and recent land cover surveys in Maricopa County. The plant species composition for land cover types in Mexico were based on descriptions provided in the Olson et al. (2001) global ecoregion database.

5.3. Plant Functional Type cover and Leaf Area Index

MODIS satellite observations were used to characterize PFT cover fractions and monthly LAI for agricultural landscapes and most wildland landscape types. Urban land cover PFT and LAI for Clark County were based on the results of the EQM land cover surveys in Clark County and additional surveys in Maricopa County, Arizona.

Analysis of field observations revealed that the MODIS based land cover estimates considerably underestimate vegetation cover in sparsely vegetated wildland landscapes within Clark County and other regions in the U.S. southwest. Based on the field study observations, a lower limit of 20% shrub and grass cover and an LAI of 0.5 (which results in an average LAI of 0.1) were used for all landscapes except for water and barren categories.

Reference[1]	Common Name	species	Iso-prene	α-pinene	β-pinene	cam-phene	myrcene	limo-nene	3-carene	g-terpinene	Other MT	Total MT
(Arey et al. 1995)	chamise	Adenostoma fasciculatum	0									0
(Arey et al. 1995)	manzanita	Arctostaphylos	0									0
(Arey et al. 1995)	California sagebrush	Artemisia californica	0									47
(Arey et al. 1995)	greenbark	Ceanothus spinosus	0									1.8
(Arey et al. 1995)	mountain mahogany	Cercocarpus betuloides	0									0
(Arey et al. 1995)	Black sage	Salvia mellifera	0									5
(Geron et al. 2006)		Ambrosia deltoidea	0	0.06	0.31	0.51	2.3	1	Not reported	Not reported	Not reported	4.1
(Geron et al. 2006)		Ambrosia dumosa	0	1.6	3	0.06	1.1	2	Not reported	Not reported	Not reported	7.9
(Geron et al. 2006)		Atriplex canescens	0	0	0	0.17	0.13	0	Not reported	Not reported	Not reported	0.31
(Geron et al. 2006)		Chrysothamnus nauseosus	0	0.28	0	0	0.16	0.21	Not reported	Not reported	Not reported	0.65
(Geron et al. 2006)		Ephedra nevadensis	10	0.05	0.03	0.01	0.09	0.11	Not reported	Not reported	Not reported	0.3
(Geron et al. 2006)		Hymenoclea salsola	0	1.4	0.06	0.02	0.35	0.3	Not reported	Not reported	Not reported	2.6
(Geron et al. 2006)		Krameria eracta	0	0.02	0.06	0.03	0.14	0.05	Not reported	Not reported	Not reported	0.3
(Geron et al. 2006)		Larrea tridentata	0	0.37	0.12	0.44	0.3	0.74	Not reported	Not reported	Not reported	2
(Geron et al. 2006)		Lycium andersonii	0	0.1	0.27	0.11	0.39	0.27	Not reported	Not reported	Not reported	1.1
(Geron et al. 2006)		Olneya tesota	~25	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
(Geron et al. 2006)		Psorothamnus fremontii	35	0.5	0	0	1	0.5	Not reported	Not reported	Not reported	2
(Guenther et al. 1999)	Acacia	Acacia greggii	0	0	0	0	0	0	0	0	0	0
(Helmig et al. 1999)	serviceberry	Amelanchier alnifolia	0	0	0	0	0	0	0	0	0	0
(Helmig et al. 1999)	sagebrush	Artemisia tridentata	0	0.2		0.5	0	0	0	0	9.2	9.9
(Helmig et al. 1999)	saltbush	Atriplex canescens	0	15	1.3	0.7	0.2	2.2			7	26.4

Reference[1]	Common Name	species	Iso-prene	α-pinene	β-pinene	cam-phene	myrcene	limo-nene	3-carene	g-terpinene	Other MT	Total MT
(Helmig et al. 1999)	mountian mahogany	Cercocarpus montanus	0	0	0	0	0	0	0	0	0	0
(Helmig et al. 1999)	rabbitbrush	Chrysothamnus nauseosus	0	15	1.7	2.3	1.6	39	0	2.9	18	80.5
(Helmig et al. 1999)	snowberry	Symphoricarpos occidentalis	0	0	0	0	0	0	0	0	0	0
(Knowlton et al. 1999)	Saltbrush	Atriplex	0	0.02	0.01	0	0.03	0.01	0.01	Not reported	Not reported	0.08
(Knowlton et al. 1999)	juniper	Juniperus	0	3.1	0.03	0.02	0.04	0.09	0.002	Not reported	Not reported	3.28
(Knowlton et al. 1999)	creosote	Larrea	0	0.1	0.06	0.04	0.09	0.09	0.08	Not reported	Not reported	0.46
(Knowlton et al. 1999)	mesquite	Prosopis	0	0.05	0	0	0.04	0.02	0	Not reported	Not reported	0.11
(Knowlton et al. 1999)	Oak	Quercus	26	0.02	0.03	0	0	0.02	0.01	Not reported	Not reported	0.08
(Knowlton et al. 1999)	sumac	Rhus	0	1.2	0.04	0.07	0	0	0	Not reported	Not reported	1.3
(Knowlton et al. 1999)	salt cedar	Tamarix	0	0	0.05	0.15	0.19	0	0.09	Not reported	Not reported	0.48
SAC-Maricopa		Acacia erioloba	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Ambrosia deltoidea	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Aristida longistea	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Atriplex canescens	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Brachychiton populneus	0.052	0.14	0	Not reported	0.038	0.02	0.003	Not reported	0.06	0.26
SAC-Maricopa		Brachychiton rupestris	0.03	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Buddleja marrubifola	0.42	0.079	0	Not reported	0	0	0	Not reported	0.39	0.47
SAC-Maricopa		Caesalpinia pulcherrima	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Caliandra eriophylla	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Carnegiea gigantea	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Chilopsis linearis	0	0	0	Not reported	0	0	0	Not reported	0	0

Reference[1]	Common Name	species	Iso-prene	α-pinene	β-pinene	cam-phene	myrcene	limo-nene	3-carene	g-terpinene	Other MT	Total MT
SAC-Maricopa		Cylindropuntia acanthocarpa	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Encelia farinosa	0	35	0.62	Not reported	0	0.2	0	Not reported	0.43	37
SAC-Maricopa		Ephedra nevadensis	46	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Fouquieria splendens	0.44	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Gleditsia triacanthos	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Juniperus osteosperma	0.044	1.7	0.52	Not reported	0.32	0.34	0	Not reported	0.49	3.4
SAC-Maricopa		Leucophyllum zygophyllum	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Mahonia fremontii	6.5	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Muhlenbergia lindheimeri	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Nerium oleander	1.2	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Olea europaea	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Olneya tesota	22	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		ornamental shrub	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Parkinsonia floridum	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Parkinsonia microphyllum	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Parkinsonia praecox	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Pinus monophylla	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Platanus wrightii	0.38	0.11	0	Not reported	0	0.19	0	Not reported	0	0.3
SAC-Maricopa		Proposis velutina	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Prosopis pubesens	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Quercus arizonica	8.4	0	0	Not reported	0	0	0	Not reported	0	0

Reference[1]	Common Name	species	Iso-prene	α-pinene	β-pinene	cam-phene	myrcene	limo-nene	3-carene	g-terpinene	Other MT	Total MT
SAC-Maricopa		Quercus buckleyi	11	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Quercus fusifornis	79	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Quercus suber	5.3	0.84	0.53	Not reported	0.11	0.14	0	Not reported	0.42	2.1
SAC-Maricopa		Salix gooddingii	15	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Sapium sebiferum	0	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Senna nemophila	0.052	0	0	Not reported	0	0.01	0	Not reported	0.021	0.031
SAC-Maricopa		Simmondsia chinensis	30	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Sophora secundiflora	19	0	0	Not reported	0	0	0	Not reported	0	0
SAC-Maricopa		Ungnadia speciosa	0.29	0	0	Not reported	0.27	15	0	Not reported	16	31.
Winer82		Encelia										6

Table 7 Emission rates (μg g^{-1} dry weight h^{-1}) for selected Clark and Maricopa County plant species determined during the June 2006 field study and comparison with other reported measurements. [1]The SAC-Maricopa measurements were conducted by Dr. Brad Baker and colleagues in Maricopa County, Arizona.

6. Emission inventory comparison

Two versions of the biogenic emission inventories are compared here. The first inventory was provided by Zheng Li at Clark County, and is based on the original EQM/BEIS inventory. The second inventory was produced for this contract by Dr. Guenther. Both inventories are based on MM5 model-simulated meteorological data. In addition to the new MEGAN modeling framework and the new emission factors, the MM5 data provided to Dr. Guenther has also changed since the original EQM/BEIS inventory. So, the emission comparisons presented below account for both changes in the biogenic emission inventory framework and differences in meteorological conditions as represented by the MM5 data.

Emissions produced in the MEGAN framework are much lower than the original EQM/BEIS inventory. As shown in Table 8, there are substantial reductions in most categories, but the reductions do depend on the selected grid. This is because the larger grids (e.g., 12 and 36 km) account from relatively large areas, and the two modeling frameworks treat some land cover types quite differently.

Grid	NO	ALD2	CO	ETH	FORM	ISOP	NR	OLE	PAR	TERPB	TOL	XYL
MEGAN												
1.3	32	43	186	34	6	217	229	56	465	22	0	0
4	203	278	1254	227	38	1548	1530	366	2997	141	1	2
12	2479	12327	34763	7365	1128	44062	46526	16801	129844	7233	40	76
36	5552	22909	70879	14964	2226	93871	93558	31288	253851	13047	88	159
BEIS												
1.3	40	164	658	101	88	273	389	383	2568	106	32	0
4	173	1751	5994	904	799	2628	3475	3423	23895	1236	282	0
12	4075	34108	92336	13870	12309	78025	53346	77911	459998	26943	4324	79
36	14614	64347	185735	27890	24761	150238	107248	145800	869052	49491	8688	179
Reduction (%)												
1.3	20	74	72	66	93	20	41	85	82	79	100	-562
4	-17	84	79	75	95	41	56	89	87	89	100	-519
12	39	64	62	47	91	44	13	78	72	73	99	3
36	62	64	62	46	91	38	13	79	71	74	99	11

Table 8 Comparison of emissions from the new MEGAN framework and the previous EQM/BEIS framework. The emissions are summed across the entire domains and across 25 hours (day of year 178, GMT). The domains have the grid spacing has indicated in the first column (km). The chemical species labels are as done in CBIV. The large

negative values under XYL are due to looking at differences between small numbers. The units are moles per second. Complete tables including total VOCs are given in section 9. Reduction percentages are calculated as (BEIS-MEGAN)/BEIS * 100%.

There are also large differences in the spatial pattern of emissions. The following figures show differences for one hour of the model run (4:00 p.m., Pacific Standard Time) which is the time of maximum emission for isoprene (ISOP). The data is again for day 178.

Figure 3 and Figure 4 compare the two inventories for the 1.3 km grid domain, which mostly includes Clark County. Several differences are evident. First, maximum emissions have shifted from the mountainous regions to the urban areas. The EQM/BEIS framework used unrealistically high biomass densities, and these were concentrated in the mountainous areas. The MEGAN framework overcomes this limitation by incorporating satellite derived estimates for LAI. On the other hand, EQM/BEIS had few emission estimates for urban vegetation, while MEGAN more properly accounts for this. Second, both figures use the same scale, and the overall decrease in the MEGAN inventory is highlighted by the lack of dark shading throughout the domain.

Figure 5 and Figure 6 compare the two inventories for the 36 km grid domain. Because most of this land is outside of Clark County, neither the EQM nor the present study has contributed to these inventories. Instead, this is primarily a comparison of BEIS with the new MEGAN framework. In this case, the spatial pattern of emissions is quite similar, but again the overall emissions are much lower in the case of the new MEGAN framework.

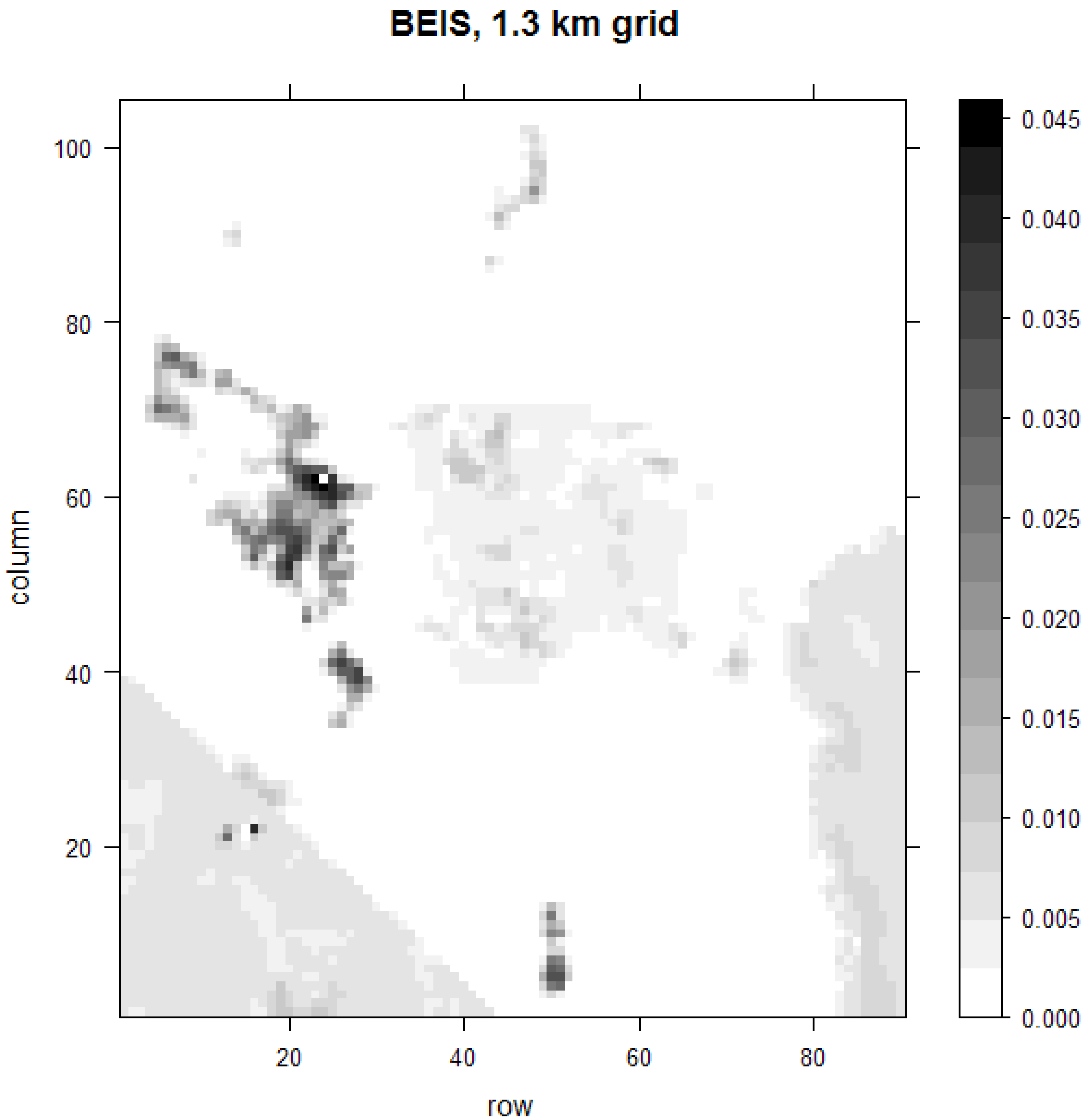

Figure 3 Isoprene emissions as predicted by the original EQM/BEIS model for 4:00 p.m. PST on day 178 for the 1.3 km grid.

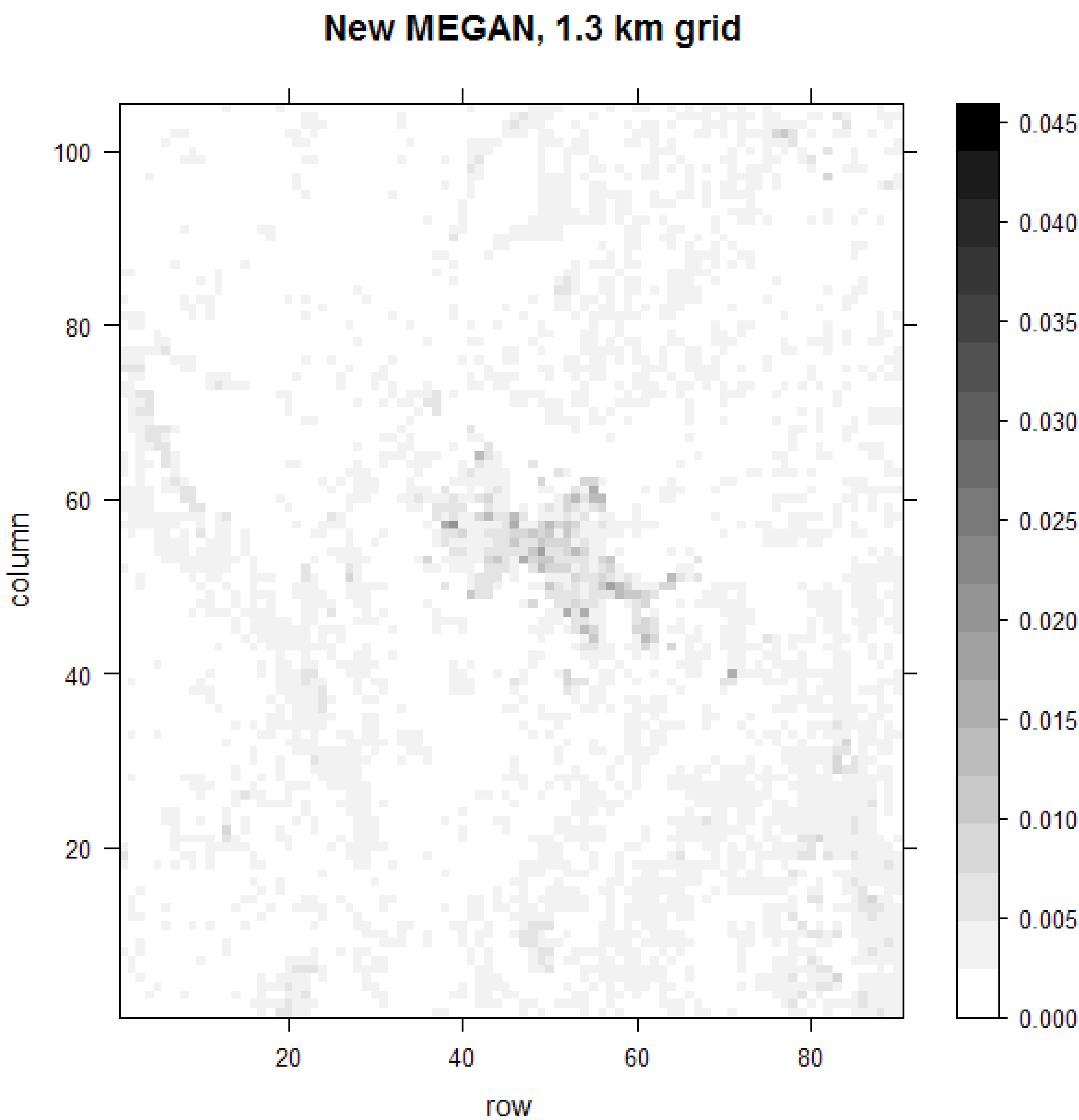

Figure 4 Isoprene emissions as predicted by the new MEGAN model for 4:00 p.m. PST on day 178 for the 1.3 km grid.

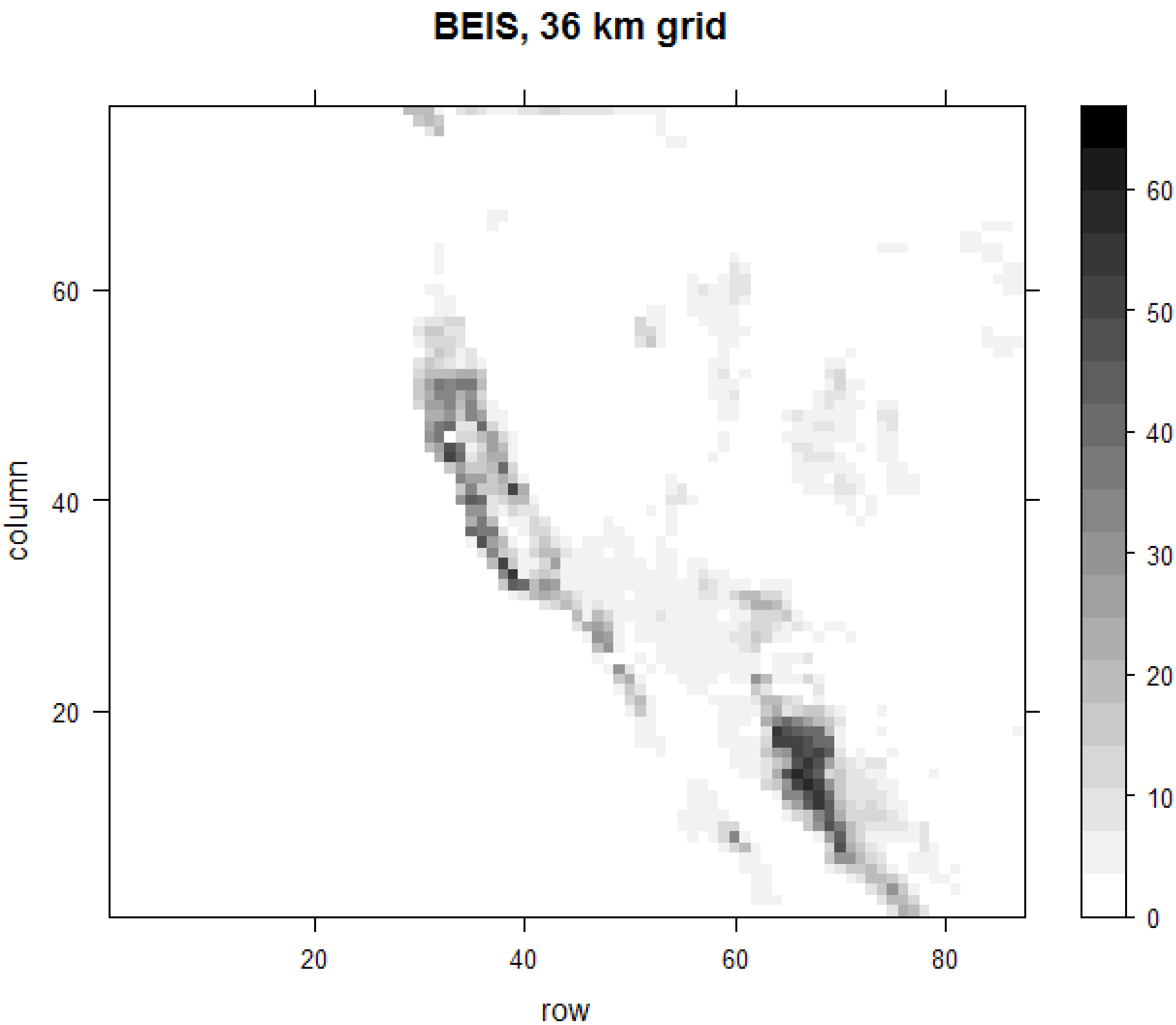

Figure 5 Isoprene emissions as predicted by the original EQM/BEIS model for 4:00 p.m. PST on day 178 for the 36 km grid.

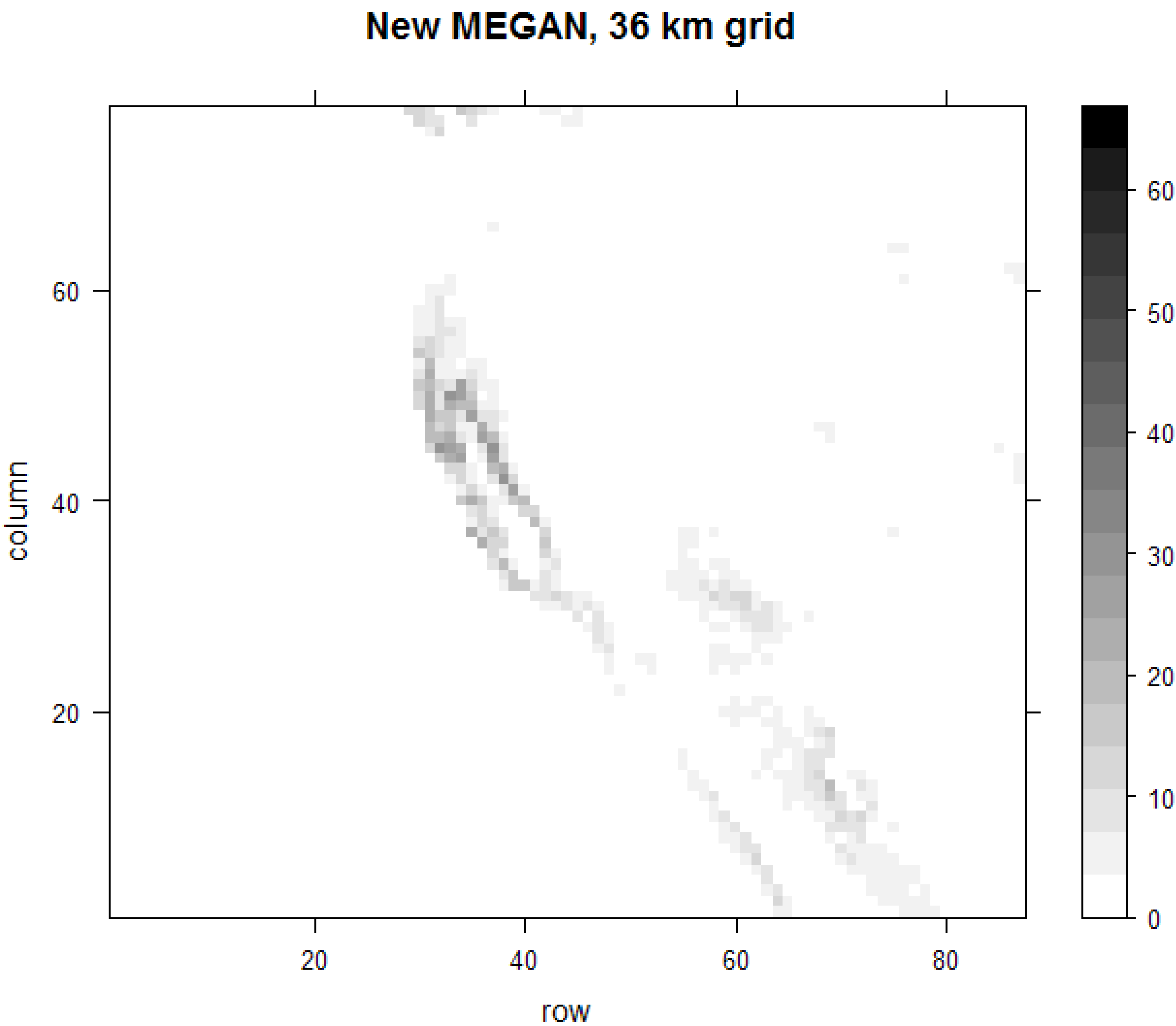

Figure 6 Isoprene emissions as predicted by the new MEGAN model for 4:00 p.m. PST on day 178 for the 36 km grid.

7. Quality assurance

All reasonable care has been taken to ensure that the current emission inventory is as accurate as possible. All measurements undertaken in this study were conducted in accordance with established techniques. The gas chromatograph was calibrated with a gas-phase standard purchased from Scott-Marrin Inc., Riverside, CA that contained high concentrations of isoprene and α-pinene. This standard was diluted with zero air using recently purchased mass flow controllers. In addition, and the system was also cross-calibrated at the National Center for Atmospheric Research with a wider range of monoterpenes. Finally, selected results from the Maricopa County measurements were compared to data independently collected by Dr. Brad Baker. Considering this, we believe our leaf-level measurements are accurate to within ± 10 %. As mentioned in above, this error estimate only considers the analytical precision and accuracy of our instrumentation, and is not related to the inherent variability of biogenic emission capacities.

Dr. Guenther's group at the National Center for Atmospheric Research leads the nation in conducting biogenic emission surveys within the United States (e.g., Guenther et al. 1994, e.g., Guenther et al. 1996b) and abroad (e.g., Guenther et al. 1996c, Guenther et al. 1999). Dr. Guenther assisted with the development of the original BEIS model, and is now leading the effort to create MEGAN. A complete discussion of error sources and impacts on the corresponding emission inventories is outside the scope of this report. Dr. Guenther has reported on the effectiveness of scaling emissions (Guenther et al. 1996a), and his inventories have been compared to satellite measurements (Palmer et al. 2003). In one previous study, uncertainty was estimated to be less than 50 % for maximum mid-day, summer isoprene emissions (Guenther et al. 2000) using modeling techniques similar to those employed in this study.

8. Checklist of deliverables

Task	Resolution
Development of work plan: Meet with the Project Oversight Committee (POC) to scope project and discuss methods to be used and issues related to this project. The POC will be the final decision authority over methods to be used for completing all elements of the project. Follow up meetings or conference calls will be conducted as necessary. **Milestone:** Meeting with Project Oversight Committee will be held within 5 days of contract award. Final work plan will be submitted within 10 days of contract award. **Deliverables:** Work plan.	Dr. Potosnak met with the POC on May 17, 2006.
Progress and status reports: Provide summary progress and status reports every two weeks during duration of contract. **Milestone:** Provide initial progress and status report within two weeks of approval of the final work plan, and then subsequent reports every two weeks thereafter until all contracted work is completed. **Deliverables:** Reports.	Dr. Potosnak sent email reports to Al Leskys every two weeks during the project.
Generate new BVOC emissions inventory: Based on available literature, revise plant specific emission factors for plant species that account for more than 85 percent of the emissions or land coverage in the current inventory—within the 1.3 and 4 km domains. Generate new emissions inventory based on BEIS3 framework and the revised emission factors. **Milestone:** Review BVOC emission factors of significant plant species, and generate emissions inventory. **Deliverables:** New emissions inventory based on BEIS3 framework.	Dr. Potosnak presented of the literature review at a meeting on July 6, 2006. The revised emission inventory is available, but DAQEM decided that it was not necessary to implement this inventory, since it did not address the 12 and 36 km grids.
Generate new BVOC emissions inventory: Compare land cover characterization scheme used in current inventory with data from Southwest Regional GAP (SWReGAP) database. If significant differences are observed generate a new emissions inventory based on BEIS3 framework and the SWReGAP land use classifications. **Milestone:** Compare land use categorizations and generate emissions inventory if appropriate. **Deliverables:** New emissions inventory based on BEIS3 framework.	Dr. Potosnak presented a comparison of the land cover characterizations for BEIS and SWReGAP at the July meeting. Comparisons are also provided in this final report.
Generate land cover characterization files: Based on current MM5/CMAQ grid domains for Clark County, generate MEGAN compatible land cover characterization files from the SWReGAP	Dr. Guenther completed this task, and has implemented this in

Task	Resolution
data. **Milestone:** Based on SWReGAP data, generate land cover characterization files. **Deliverables:** Land cover characterization files.	MEGAN.
Installation of MEGAN: Install a beta version of MEGAN that will produce CMAQ ready input files based on the MEGAN compatible classification files and MM5 meteorological files generated by the county. **Milestone:** Installation of the MEGAN model that will produce CMAQ ready input files. **Deliverables:** Beta version of MEGAN	Because the FORTRAN version of MEGAN is behind schedule, Dr. Guenther delivered a version written in Microsoft Acess.
Compare emission inventories: Compare generated BVOC emission inventories. **Milestone:** Include comparison in final report. **Deliverables:** Report.	The comparison of inventories is provided in this final report.
Presentation: Present analysis of newly generated emissions inventories. **Milestone:** Present results at a meeting held in Las Vegas. **Deliverables:** Presentation.	Drs. Potosnak and Guenther attended the Ozone Working Group meeting on August 16, 2006 and presented their results.
Measure plant emissions: Measure BVOC emissions from plants that account for more than 85 percent of the emissions or land coverage in the current inventory. Determine emission rates for relevant light, temperature and water availability regimes. **Milestone:** Include measurements in final report. **Deliverables:** Report.	Between May and August, 2006, Dr. Potosnak and Ms. Papiez measured all the required species in Clark County during four field campaigns. The results are included in the final report.
Deliver new land cover database: Deliver a new land cover database that integrates detailed Clark County land cover characteristic data into the MEGAN land cover database. **Milestone:** Demonstrate model to POC. **Deliverables:** Land cover database.	Dr. Guenther has integrated the land cover measurements with MEGAN.
Provide code and scripts: Provide MEGAN FORTRAN code and scripts that will generate CMAQ compatible input files directly from MM5 output files. **Milestone:** Demonstrate model to POC.	Although the FORTRAN code is still in development, Dr. Guenther has produced inventories based on MM5 output

Task	Resolution
Deliverables: Code and scripts.	provided by DAQEM.
Provide training: Install and train Clark County DAQEM personnel in the use of the new MEGAN framework. **Milestone:** Provide appropriate training to designated DAQEM personnel. **Deliverables:** Training.	This task was not accomplished in full, although Dr. Guenther provided training to Zheng Li on the Access version of MEGAN.
Submit final report: Provide the final report within two weeks of receiving comments from DAQEM concerning the draft final report. The final report will include a quality assured biogenic emissions inventory based on the new MEGAN framework, and an analysis of the reasonableness of the inventory. Such analysis may include, for example, comparative emission density maps, gridded graphs and summary tables. **Milestone:** Submit five (5) copies of final report. **Deliverables:** Final report.	This final report accomplishes all these objectives.
Presentation: Present the results of the entire project in a series of meetings. **Milestone:** Present results at meetings held in Las Vegas. **Deliverables:** Presentation.	As agreed to by the POC, the Drs. Guenther and Potosnak presented the results of this project at the Ozone Working Group meeting in August.

9. Daily emission summary tables

BVOC emissions (in tons/day) from Clark County:

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
5/19/03	4.4	21.7	0.0	0.1	3.5	15.2	2.7	0.5	8.2	38.2	14.7	3.1	46.4	86.3
5/20/03	5.1	25.2	0.0	0.1	4.1	18.0	3.1	0.6	9.5	47.2	17.6	3.3	56.7	103.5
5/21/03	6.0	30.0	0.0	0.1	4.9	21.4	3.7	0.7	11.3	56.5	20.7	3.8	67.8	123.3
5/22/03	6.5	32.5	0.0	0.2	5.5	22.3	4.0	0.7	12.4	56.9	21.2	4.1	69.3	128.6
5/23/03	6.7	33.1	0.0	0.2	5.7	22.3	4.0	0.7	12.7	55.6	21.0	4.3	68.3	128.3
5/24/03	6.6	33.0	0.0	0.2	5.7	22.0	4.0	0.7	12.7	54.4	20.6	4.3	67.0	126.5
5/25/03	6.3	31.2	0.0	0.2	5.2	21.7	3.8	0.7	11.8	56.2	20.8	4.0	68.0	125.2
5/26/03	6.0	29.6	0.0	0.1	5.0	20.4	3.6	0.6	11.3	51.7	19.4	3.9	63.0	117.0
5/27/03	8.1	40.4	0.0	0.2	6.9	28.5	4.9	0.9	15.2	75.8	27.3	4.7	91.0	165.7
5/28/03	9.6	48.4	0.0	0.2	8.6	32.7	5.8	1.0	18.5	83.2	30.2	5.6	101.7	189.5
5/29/03	9.2	46.3	0.0	0.2	8.3	30.7	5.6	0.9	17.8	76.2	28.2	5.6	93.9	177.4
5/30/03	8.0	40.0	0.0	0.2	6.9	27.1	4.8	0.8	15.3	68.9	25.4	4.9	84.2	156.8
5/31/03	7.4	37.0	0.0	0.2	6.4	25.4	4.5	0.8	14.1	64.8	23.9	4.6	78.9	146.5
6/1/03	7.3	36.4	0.0	0.2	6.2	25.5	4.5	0.8	13.8	67.2	24.3	4.7	81.0	148.1
6/2/03	8.1	40.4	0.0	0.2	7.0	28.5	4.9	0.9	15.3	75.6	27.0	5.1	90.8	165.5
6/3/03	8.2	40.7	0.0	0.2	7.1	28.5	5.0	0.9	15.4	75.0	26.9	5.1	90.5	165.5
6/4/03	7.8	38.6	0.0	0.2	6.7	27.1	4.7	0.8	14.6	71.5	25.7	4.9	86.1	157.3
6/5/03	7.1	35.3	0.0	0.2	6.0	24.8	4.3	0.8	13.3	65.5	23.7	4.6	78.8	144.0
6/6/03	7.0	34.5	0.0	0.2	5.8	24.6	4.2	0.8	13.0	65.6	23.6	4.5	78.6	142.6
6/7/03	7.6	37.9	0.0	0.2	6.5	26.8	4.6	0.8	14.3	71.5	25.6	4.8	85.8	156.0
6/8/03	7.7	38.6	0.0	0.2	6.6	27.2	4.7	0.8	14.6	72.2	25.9	4.9	86.8	158.1
6/9/03	6.5	32.2	0.0	0.2	5.6	21.8	3.9	0.7	12.4	54.8	20.4	4.5	67.1	125.6
6/10/03	5.4	26.4	0.0	0.1	4.4	18.5	3.2	0.6	10.0	47.8	17.8	3.8	57.8	106.4
6/11/03	5.3	25.8	0.0	0.1	4.2	18.3	3.2	0.6	9.7	48.0	17.7	3.7	57.7	105.5
6/12/03	5.2	25.5	0.0	0.1	4.2	18.3	3.2	0.6	9.6	48.4	17.8	3.6	58.0	105.5
6/13/03	5.4	26.4	0.0	0.1	4.3	19.1	3.3	0.6	9.9	51.1	18.7	3.6	61.0	110.3
6/14/03	6.3	31.2	0.0	0.1	5.2	22.7	3.8	0.7	11.7	61.7	22.1	4.1	73.3	131.8
6/15/03	7.0	34.7	0.0	0.2	5.8	25.1	4.3	0.8	13.0	68.1	24.3	4.4	81.1	146.0
6/20/03	4.8	23.7	0.0	0.1	3.9	16.7	2.9	0.5	9.0	42.7	16.1	3.5	51.7	95.4
6/21/03	4.6	22.7	0.0	0.1	3.7	16.2	2.8	0.5	8.5	42.2	15.7	3.3	50.7	92.8
6/22/03	4.8	23.3	0.0	0.1	3.8	16.5	2.9	0.5	8.8	42.6	16.0	3.4	51.4	94.4
6/23/03	4.7	23.1	0.0	0.1	3.8	16.4	2.9	0.5	8.7	42.2	15.9	3.4	51.0	93.8
6/24/03	3.7	18.0	0.0	0.1	3.0	12.3	2.2	0.4	6.9	29.5	11.7	2.9	36.4	69.1
6/25/03	4.5	22.0	0.0	0.1	3.5	16.0	2.7	0.5	8.2	42.5	15.7	3.2	50.7	91.8
6/26/03	5.8	28.7	0.0	0.1	4.7	20.6	3.5	0.6	10.8	54.5	19.9	3.9	65.3	118.7
6/27/03	7.1	35.4	0.0	0.2	6.0	25.3	4.3	0.8	13.3	67.7	24.3	4.5	81.0	146.8
6/28/03	8.5	42.5	0.0	0.2	7.4	29.8	5.2	0.9	16.1	78.7	28.1	5.2	94.8	173.2
6/29/03	9.1	45.9	0.0	0.2	8.2	31.3	5.5	1.0	17.5	80.6	29.0	5.7	98.1	181.9
6/30/03	7.8	39.1	0.0	0.2	6.9	26.8	4.8	0.8	14.9	68.1	24.9	5.1	83.0	154.5
7/1/03	7.8	38.8	0.0	0.2	6.6	28.5	4.8	0.9	14.3	78.5	27.6	4.9	92.9	166.1
7/2/03	7.9	39.3	0.0	0.2	6.7	28.7	4.9	0.9	14.5	78.7	27.7	5.0	93.3	167.2
7/3/03	8.1	40.3	0.0	0.2	6.9	29.6	5.0	0.9	15.0	81.8	28.6	5.0	96.8	172.8
7/4/03	9.0	44.9	0.0	0.2	7.8	32.8	5.5	1.0	16.7	90.2	31.4	5.5	106.9	191.5
7/5/03	9.8	49.2	0.0	0.2	8.6	35.7	6.0	1.1	18.3	98.2	34.0	5.9	116.5	208.9
7/6/03	9.3	46.7	0.0	0.2	8.2	33.8	5.7	1.1	17.4	92.5	32.2	5.7	109.9	197.6
7/7/03	8.5	42.4	0.0	0.2	7.3	30.9	5.2	1.0	15.8	84.7	29.6	5.3	100.5	180.2
7/8/03	8.7	43.6	0.0	0.2	7.5	31.9	5.4	1.0	16.2	88.2	30.7	5.3	104.4	186.6
7/9/03	10.0	50.3	0.0	0.2	8.8	36.7	6.2	1.2	18.7	101.4	35.0	5.9	120.1	214.9

BVOC emissions (in tons/day) from Clark County (cont'd):

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
7/10/03	11.9	59.8	0.0	0.3	10.9	42.9	7.3	1.3	22.4	116.2	40.0	6.8	138.6	250.6
7/11/03	11.4	57.3	0.0	0.3	10.6	39.7	7.0	1.2	21.7	104.2	36.5	6.9	125.9	231.6
7/12/03	11.4	57.2	0.0	0.3	10.4	40.5	7.0	1.3	21.6	108.7	37.7	6.7	130.2	236.6
7/13/03	11.6	58.3	0.0	0.3	10.8	40.3	7.1	1.2	22.1	105.4	36.9	7.0	127.5	235.0
7/14/03	11.6	58.7	0.0	0.3	10.8	40.9	7.1	1.3	22.2	107.5	37.6	7.0	129.7	238.3
7/15/03	11.2	56.5	0.0	0.3	10.5	38.8	6.9	1.2	21.4	100.6	35.4	6.9	122.0	225.9
7/16/03	8.4	41.7	0.0	0.2	8.1	24.7	5.0	0.7	16.6	51.1	20.6	6.2	67.7	139.9
7/17/03	8.0	39.9	0.0	0.2	7.3	26.4	4.9	0.8	15.4	64.4	23.9	5.5	79.8	151.8
7/18/03	8.8	43.8	0.0	0.2	7.8	29.9	5.4	0.9	16.7	77.0	27.7	5.7	93.7	173.8
7/19/03	6.7	33.2	0.0	0.2	5.7	23.4	4.1	0.7	12.6	61.8	22.4	4.5	74.4	135.8
7/20/03	8.7	43.3	0.0	0.2	7.5	30.9	5.3	1.0	16.2	83.0	29.3	5.5	99.2	179.9
7/21/03	10.4	51.9	0.0	0.2	9.2	37.0	6.3	1.2	19.5	100.0	34.8	6.3	119.5	216.3
7/22/03	9.1	45.4	0.0	0.2	8.4	29.8	5.5	0.9	17.6	72.1	26.7	6.1	89.7	171.5
7/23/03	8.3	41.7	0.0	0.2	7.5	27.9	5.1	0.8	16.0	69.2	25.5	5.7	85.2	160.8
7/24/03	6.1	30.0	0.0	0.2	5.3	19.7	3.7	0.6	11.6	47.3	18.1	4.5	58.9	112.8
7/25/03	4.0	19.0	0.0	0.1	3.5	10.2	2.3	0.3	7.9	15.8	8.2	3.7	23.7	55.2

Average summer day emissions ** :

	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
	7.8	**39.0**	**0.0**	**0.2**	**6.8**	**27.5**	**4.8**	**0.9**	**14.7**	**72.5**	**25.9**	**5.0**	**87.2**	**159.5**

* BVOC = OLE+PAR+TOL+XYL+ALD2+NR+ETH+FORM+ISOP (based on methodology used by EPA to create default 2002 BVOC EI)

** Average summer day emissions are based on data from (June 1, 2003 to June 15, 2003), and (June 20, 2003 to July 23, 2003).

BVOC emissions (in tons/day) from 1.3 km domain:

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
5/19/03	3.5	17.0	0.0	0.1	2.8	11.5	2.1	0.3	6.5	28.8	11.0	2.3	35.3	66.1
5/20/03	4.0	19.6	0.0	0.1	3.2	13.6	2.4	0.4	7.4	35.4	13.1	2.5	42.9	78.7
5/21/03	4.7	23.4	0.0	0.1	3.9	16.2	2.8	0.5	8.9	42.5	15.5	2.9	51.4	94.1
5/22/03	5.2	25.7	0.0	0.1	4.4	17.2	3.1	0.5	9.9	43.7	16.1	3.2	53.5	99.9
5/23/03	5.2	25.7	0.0	0.1	4.5	16.7	3.1	0.5	10.0	40.7	15.4	3.3	50.7	96.4
5/24/03	5.1	25.4	0.0	0.1	4.4	16.6	3.1	0.5	9.8	40.5	15.3	3.3	50.3	95.7
5/25/03	4.9	24.3	0.0	0.1	4.1	16.5	3.0	0.5	9.3	42.2	15.5	3.1	51.5	95.6
5/26/03	4.7	23.1	0.0	0.1	3.9	15.5	2.8	0.5	8.9	39.2	14.6	3.0	48.1	89.9
5/27/03	6.3	31.5	0.0	0.2	5.4	21.6	3.8	0.7	12.0	57.5	20.4	3.6	69.4	127.0
5/28/03	7.6	38.1	0.0	0.2	6.9	25.0	4.6	0.8	14.7	63.4	22.8	4.3	78.1	146.5
5/29/03	7.2	36.1	0.0	0.2	6.5	23.1	4.3	0.7	14.0	56.4	20.8	4.3	70.4	134.5
5/30/03	6.3	31.3	0.0	0.2	5.5	20.6	3.8	0.6	12.0	51.9	19.0	3.8	64.0	120.2
5/31/03	5.8	29.1	0.0	0.1	5.0	19.3	3.5	0.6	11.2	49.0	18.0	3.6	60.2	112.5
6/1/03	5.7	28.5	0.0	0.1	4.9	19.5	3.5	0.6	10.9	51.2	18.4	3.6	62.1	114.2
6/2/03	6.4	31.9	0.0	0.2	5.5	21.9	3.9	0.7	12.1	58.0	20.5	3.9	70.1	128.4
6/3/03	6.5	32.3	0.0	0.2	5.7	22.0	3.9	0.7	12.3	57.5	20.5	4.0	69.8	128.7
6/4/03	6.2	30.7	0.0	0.2	5.3	20.9	3.7	0.6	11.7	54.8	19.5	3.8	66.5	122.4
6/5/03	5.7	28.0	0.0	0.1	4.8	19.2	3.4	0.6	10.7	50.4	18.1	3.6	61.1	112.3
6/6/03	5.6	27.5	0.0	0.1	4.7	19.1	3.4	0.6	10.5	50.7	18.1	3.5	61.2	111.7
6/7/03	6.0	29.9	0.0	0.1	5.2	20.5	3.6	0.6	11.4	54.3	19.3	3.7	65.6	120.3
6/8/03	6.1	30.2	0.0	0.2	5.2	20.7	3.7	0.6	11.5	54.6	19.4	3.8	66.2	121.3
6/9/03	5.0	24.9	0.0	0.1	4.3	16.3	3.0	0.5	9.6	40.3	15.1	3.4	50.0	94.6
6/10/03	4.2	20.6	0.0	0.1	3.4	14.1	2.5	0.4	7.9	36.1	13.4	2.9	44.0	81.5

BVOC emissions (in tons/day) from 1.3 km domain (cont'd):

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
6/11/03	4.1	20.0	0.0	0.1	3.3	13.9	2.5	0.4	7.6	36.0	13.3	2.8	43.6	80.3
6/12/03	4.0	19.6	0.0	0.1	3.2	13.7	2.4	0.4	7.4	36.0	13.2	2.7	43.4	79.5
6/13/03	4.2	20.4	0.0	0.1	3.3	14.5	2.5	0.4	7.7	38.7	14.0	2.8	46.4	84.2
6/14/03	4.9	24.4	0.0	0.1	4.1	17.3	3.0	0.5	9.2	47.1	16.7	3.1	56.3	101.5
6/15/03	5.5	27.1	0.0	0.1	4.6	19.2	3.3	0.6	10.2	52.0	18.4	3.4	62.3	112.5
6/20/03	3.7	18.2	0.0	0.1	3.0	12.4	2.2	0.4	6.9	31.6	11.8	2.6	38.5	71.7
6/21/03	3.6	17.4	0.0	0.1	2.8	12.1	2.1	0.4	6.6	31.4	11.7	2.5	38.0	70.0
6/22/03	3.7	18.0	0.0	0.1	2.9	12.5	2.2	0.4	6.8	32.1	11.9	2.6	39.0	71.9
6/23/03	3.7	17.9	0.0	0.1	2.9	12.3	2.2	0.4	6.8	31.5	11.8	2.6	38.3	71.0
6/24/03	2.8	13.7	0.0	0.1	2.3	9.1	1.7	0.3	5.3	21.3	8.5	2.2	26.6	51.3
6/25/03	3.5	17.1	0.0	0.1	2.8	12.2	2.1	0.4	6.5	32.1	11.8	2.4	38.6	70.2
6/26/03	4.6	22.5	0.0	0.1	3.7	15.7	2.8	0.5	8.5	41.6	15.1	3.0	50.1	91.5
6/27/03	5.6	27.8	0.0	0.1	4.7	19.4	3.4	0.6	10.5	51.7	18.4	3.5	62.3	113.4
6/28/03	6.7	33.5	0.0	0.2	5.9	22.9	4.0	0.7	12.8	60.3	21.3	4.0	73.0	134.2
6/29/03	7.2	35.9	0.0	0.2	6.5	23.9	4.3	0.7	13.8	61.3	21.9	4.3	75.1	139.9
6/30/03	6.0	29.9	0.0	0.2	5.3	19.9	3.6	0.6	11.5	50.5	18.4	3.8	62.0	116.0
7/1/03	5.9	29.5	0.0	0.1	5.0	21.2	3.6	0.7	11.0	58.4	20.2	3.7	69.4	124.4
7/2/03	6.0	29.7	0.0	0.1	5.1	21.2	3.7	0.7	11.1	58.0	20.2	3.8	69.1	124.3
7/3/03	6.2	30.8	0.0	0.1	5.3	22.1	3.8	0.7	11.5	61.2	21.1	3.8	72.7	130.1
7/4/03	6.9	34.3	0.0	0.2	6.0	24.4	4.2	0.8	12.9	67.5	23.2	4.2	80.4	144.3
7/5/03	7.6	37.8	0.0	0.2	6.7	26.8	4.6	0.8	14.2	74.0	25.3	4.5	88.1	158.4
7/6/03	7.2	35.8	0.0	0.2	6.3	25.3	4.4	0.8	13.4	69.1	23.8	4.3	82.5	148.9
7/7/03	6.5	32.4	0.0	0.2	5.6	23.1	4.0	0.7	12.1	63.6	21.9	4.0	75.7	136.0
7/8/03	6.8	33.6	0.0	0.2	5.8	24.0	4.1	0.8	12.6	66.7	22.9	4.1	79.3	141.9
7/9/03	7.8	38.7	0.0	0.2	6.8	27.6	4.7	0.9	14.5	76.5	26.0	4.5	91.0	163.2
7/10/03	9.1	45.8	0.0	0.2	8.4	32.1	5.5	1.0	17.2	87.4	29.6	5.2	104.7	189.6
7/11/03	8.9	44.5	0.0	0.2	8.3	30.2	5.4	0.9	17.0	79.0	27.3	5.3	96.0	177.3
7/12/03	8.9	44.8	0.0	0.2	8.2	30.9	5.4	1.0	17.0	83.0	28.4	5.2	100.0	182.5
7/13/03	9.0	45.3	0.0	0.2	8.5	30.5	5.5	0.9	17.3	79.5	27.5	5.4	96.8	179.4
7/14/03	8.9	44.7	0.0	0.2	8.3	30.3	5.4	0.9	17.0	79.1	27.4	5.3	96.1	177.8
7/15/03	8.7	43.7	0.0	0.2	8.1	29.5	5.3	0.9	16.7	76.6	26.6	5.3	93.3	173.1
7/16/03	6.3	31.3	0.0	0.2	6.1	17.9	3.8	0.5	12.6	35.5	14.5	4.7	48.1	101.5
7/17/03	6.0	29.9	0.0	0.2	5.5	19.2	3.6	0.6	11.6	46.0	17.1	4.2	57.6	111.0
7/18/03	6.8	33.7	0.0	0.2	6.1	22.5	4.1	0.7	13.0	57.6	20.6	4.4	70.6	131.6
7/19/03	4.9	24.2	0.0	0.1	4.1	16.7	3.0	0.5	9.2	43.8	15.8	3.3	53.0	97.4
7/20/03	6.5	32.4	0.0	0.2	5.7	22.6	4.0	0.7	12.2	61.0	21.3	4.1	73.2	133.0
7/21/03	7.9	39.7	0.0	0.2	7.1	27.6	4.8	0.9	15.0	74.6	25.7	4.8	89.6	162.7
7/22/03	7.0	34.8	0.0	0.2	6.5	22.1	4.2	0.7	13.6	52.6	19.5	4.7	66.2	128.1
7/23/03	6.3	31.2	0.0	0.2	5.7	20.2	3.8	0.6	12.1	49.4	18.2	4.3	61.5	117.4
7/24/03	4.4	21.4	0.0	0.1	3.8	13.7	2.6	0.4	8.4	32.1	12.4	3.3	40.5	78.5
7/25/03	2.9	13.8	0.0	0.1	2.6	7.1	1.7	0.2	5.8	10.0	5.6	2.7	15.8	38.3

Average summer day emissions ** :

	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
	6.1	**30.1**	**0.0**	**0.1**	**5.3**	**20.7**	**3.7**	**0.6**	**11.5**	**54.4**	**19.3**	**3.8**	**65.8**	**121.0**

* BVOC = OLE+PAR+TOL+XYL+ALD2+NR+ETH+FORM+ISOP (based on methodology used by EPA to create default 2002 BVOC EI)

** Average summer day emissions are based on data from (June 1, 2003 to June 15, 2003), and (June 20, 2003 to July 23, 2003).

BVOC emissions (in tons/day) from 4 km domain:

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
5/19/03	23.1	112.0	0.1	0.6	18.1	79.1	13.9	2.4	42.2	211.2	76.3	14.7	253.4	460.4
5/20/03	27.3	133.6	0.1	0.7	21.7	96.1	16.6	3.0	49.9	267.3	93.4	16.3	317.2	566.3
5/21/03	32.5	159.8	0.1	0.8	26.3	114.6	19.7	3.6	59.7	321.2	110.7	18.5	380.9	678.6
5/22/03	35.1	173.3	0.1	0.9	29.4	120.3	21.3	3.7	65.4	321.2	113.9	20.4	386.6	705.2
5/23/03	35.4	173.9	0.1	0.9	29.7	118.1	21.3	3.6	66.4	310.7	110.8	20.8	377.1	693.7
5/24/03	34.9	171.6	0.1	0.9	29.4	115.3	21.1	3.5	65.9	298.7	107.8	20.9	364.6	675.5
5/25/03	31.9	156.0	0.1	0.8	26.0	108.6	19.2	3.3	59.3	292.9	103.7	18.8	352.2	638.8
5/26/03	30.6	149.2	0.1	0.8	24.8	103.7	18.4	3.2	56.7	279.6	99.0	18.1	336.3	610.1
5/27/03	42.1	208.7	0.1	1.0	35.4	148.2	25.5	4.6	78.3	419.4	141.5	22.5	497.7	885.1
5/28/03	50.2	250.3	0.1	1.2	44.6	169.8	30.4	5.2	95.4	454.0	156.6	27.0	549.4	1005.9
5/29/03	47.3	235.3	0.1	1.2	41.9	156.8	28.7	4.7	90.2	407.6	143.6	26.7	497.8	923.7
5/30/03	40.5	200.1	0.1	1.0	34.6	136.0	24.5	4.1	76.3	360.0	127.1	23.3	436.3	800.9
5/31/03	38.1	188.2	0.1	0.9	32.1	129.6	23.1	4.0	71.4	348.1	122.4	22.0	419.6	764.2
6/1/03	37.1	181.8	0.1	0.9	31.0	129.1	22.6	4.0	68.7	360.5	122.8	22.5	429.1	767.0
6/2/03	41.0	201.4	0.1	1.0	34.7	143.4	25.0	4.5	76.0	403.3	136.0	24.2	479.3	854.2
6/3/03	41.0	201.4	0.1	1.0	34.9	142.3	24.9	4.4	76.1	396.9	134.5	24.4	473.0	846.9
6/4/03	38.7	189.7	0.1	0.9	32.6	134.2	23.5	4.2	71.8	372.6	127.2	23.3	444.3	796.4
6/5/03	35.6	174.2	0.1	0.9	29.7	123.7	21.7	3.8	65.7	342.3	117.6	22.0	408.0	731.9
6/6/03	35.2	172.3	0.1	0.9	29.1	123.5	21.4	3.8	64.9	347.2	118.3	21.4	412.1	733.6
6/7/03	37.9	185.8	0.1	0.9	31.7	133.0	23.1	4.1	70.0	375.1	126.9	22.6	445.1	791.7
6/8/03	39.5	194.3	0.1	1.0	33.4	138.4	24.1	4.3	73.3	389.4	131.5	23.5	462.7	824.5
6/9/03	33.1	161.2	0.1	0.8	27.8	110.8	20.0	3.4	61.8	292.8	103.8	21.3	354.6	650.1
6/10/03	27.1	130.9	0.1	0.7	21.8	92.4	16.4	2.8	49.9	249.4	88.5	17.9	299.3	541.5
6/11/03	25.7	124.0	0.1	0.6	20.4	88.7	15.5	2.7	47.0	242.6	85.6	16.9	289.6	520.4
6/12/03	25.5	122.6	0.1	0.6	20.1	88.3	15.3	2.7	46.4	245.3	85.6	16.5	291.7	520.5
6/13/03	26.8	129.5	0.1	0.6	21.1	94.7	16.2	2.9	48.6	268.3	92.2	16.9	316.9	560.2
6/14/03	32.2	156.9	0.1	0.8	25.9	115.2	19.6	3.6	58.6	333.0	112.1	19.4	391.7	687.3
6/15/03	35.2	172.1	0.1	0.8	28.9	125.1	21.4	3.9	64.5	359.0	120.6	20.9	423.5	746.6
6/20/03	23.8	114.2	0.1	0.6	18.9	80.4	14.3	2.4	43.6	214.7	77.1	16.0	258.3	469.3
6/21/03	22.7	109.2	0.1	0.6	17.8	78.3	13.7	2.4	41.4	213.1	75.8	15.2	254.5	457.8
6/22/03	23.5	113.1	0.1	0.6	18.5	80.9	14.2	2.5	42.9	220.4	78.2	15.6	263.3	473.7
6/23/03	23.0	110.9	0.1	0.6	18.2	79.0	13.9	2.4	42.1	212.8	76.2	15.6	254.9	460.9
6/24/03	19.0	91.0	0.1	0.5	14.9	63.6	11.4	1.9	34.7	162.9	60.7	13.9	197.6	365.3
6/25/03	23.9	115.6	0.1	0.6	18.7	85.0	14.5	2.6	43.1	238.7	83.1	15.7	281.8	499.7
6/26/03	30.5	149.0	0.1	0.7	24.8	108.1	18.6	3.4	55.7	306.4	104.3	19.0	362.2	641.6
6/27/03	37.0	181.9	0.1	0.9	31.0	130.9	22.6	4.1	68.1	374.1	125.2	22.0	442.2	782.5
6/28/03	43.9	216.5	0.1	1.1	38.0	153.2	26.7	4.8	81.6	432.6	144.0	25.3	514.2	916.8
6/29/03	46.2	227.8	0.1	1.1	40.7	157.5	28.0	4.8	86.8	435.0	145.9	26.8	521.8	941.2
6/30/03	39.6	194.4	0.1	1.0	34.1	134.4	24.0	4.1	74.0	366.9	125.4	23.9	440.9	798.6
7/1/03	39.2	192.5	0.1	0.9	32.7	141.7	24.1	4.5	71.5	412.3	136.5	23.3	483.7	847.8
7/2/03	39.2	192.5	0.1	0.9	32.7	141.2	24.1	4.5	71.7	410.7	135.9	23.4	482.5	846.0
7/3/03	40.5	198.7	0.1	1.0	33.7	146.5	24.8	4.6	74.0	432.1	141.3	23.6	506.1	881.9
7/4/03	45.8	225.3	0.1	1.1	38.9	165.5	28.0	5.2	84.0	488.8	158.5	25.9	572.7	998.6
7/5/03	49.4	243.7	0.1	1.2	42.6	178.1	30.2	5.6	91.0	524.5	169.5	27.6	615.5	1075.4
7/6/03	45.6	224.4	0.1	1.1	39.0	163.1	27.9	5.1	84.1	475.1	155.3	26.2	559.2	981.4
7/7/03	41.9	205.6	0.1	1.0	35.2	150.2	25.6	4.7	77.0	437.6	144.0	24.4	514.6	901.9
7/8/03	43.3	212.7	0.1	1.0	36.4	156.4	26.5	4.9	79.4	459.8	150.3	24.9	539.3	941.1
7/9/03	50.6	249.4	0.1	1.2	43.5	183.4	30.9	5.8	93.1	546.0	175.1	27.8	639.0	1110.9
7/10/03	59.8	296.7	0.1	1.4	53.9	213.7	36.5	6.7	111.3	625.0	199.4	32.1	736.3	1293.9
7/11/03	57.0	282.0	0.1	1.4	51.4	198.5	34.7	6.2	106.9	560.8	183.5	32.0	667.7	1192.1

BVOC emissions (in tons/day) from 4 km domain (cont'd):

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
7/12/03	56.5	280.1	0.1	1.4	50.7	199.3	34.5	6.2	105.7	568.4	185.5	31.7	674.1	1197.2
7/13/03	57.1	283.4	0.1	1.4	52.0	197.7	34.9	6.1	107.5	550.9	181.5	32.5	658.4	1183.5
7/14/03	57.4	284.7	0.1	1.4	52.2	199.7	35.0	6.2	107.7	561.7	183.8	32.2	669.5	1198.4
7/15/03	55.1	273.6	0.1	1.4	50.6	188.1	33.6	5.8	104.2	506.2	171.1	32.1	610.4	1114.4
7/16/03	41.9	204.5	0.1	1.1	39.4	122.1	25.0	3.4	82.1	273.1	102.3	28.9	355.2	710.7
7/17/03	37.9	183.6	0.1	0.9	33.2	121.4	22.6	3.6	72.1	313.9	110.3	24.3	386.0	717.3
7/18/03	43.9	214.3	0.1	1.1	38.3	146.5	26.5	4.5	82.8	393.2	135.4	27.1	476.0	868.3
7/19/03	34.6	167.2	0.1	0.8	29.0	115.5	20.8	3.5	64.6	314.6	108.3	21.9	379.3	686.1
7/20/03	43.4	212.8	0.1	1.0	36.9	153.2	26.5	4.8	80.2	444.1	145.7	25.3	524.3	922.7
7/21/03	52.3	257.8	0.1	1.2	45.8	184.5	31.9	5.8	97.3	531.9	173.5	29.4	629.2	1111.3
7/22/03	48.0	236.0	0.1	1.2	43.4	158.1	29.1	4.8	91.3	413.1	143.0	29.6	504.4	933.7
7/23/03	42.4	208.4	0.1	1.1	37.9	137.9	25.8	4.1	80.6	350.0	124.5	27.7	430.5	807.6
7/24/03	32.5	157.0	0.1	0.8	27.8	103.2	19.5	3.1	61.4	254.9	94.1	22.3	316.3	598.8
7/25/03	21.0	98.7	0.1	0.6	18.2	54.9	12.3	1.4	40.8	95.5	45.3	17.9	136.3	302.6

Average summer day emissions ** :

	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
	39.3	**192.9**	**0.1**	**1.0**	**33.6**	**136.7**	**23.9**	**4.2**	**73.0**	**382.6**	**128.8**	**23.6**	**455.6**	**814.3**

* BVOC = OLE+PAR+TOL+XYL+ALD2+NR+ETH+FORM+ISOP (based on methodology used by EPA to create default 2002 BVOC EI)

** Average summer day emissions are based on data from (June 1, 2003 to June 15, 2003), and (June 20, 2003 to July 23, 2003).

BVOC emissions (in tons/day) from 12 km domain:

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
5/19/03	716.5	3272.5	1.8	13.0	538.2	1809.1	323.6	52.3	1415.0	4985.5	1643.7	159.8	6400.5	11712.4
5/20/03	862.8	3973.7	2.0	15.8	660.0	2182.1	394.4	63.8	1708.8	5977.0	1974.5	186.1	7685.8	14131.6
5/21/03	990.7	4582.7	2.2	18.1	764.9	2506.0	454.5	74.1	1962.7	6892.3	2263.9	210.4	8855.0	16285.6
5/22/03	1090.7	5068.1	2.4	20.1	851.4	2715.5	499.1	80.3	2175.9	7210.9	2432.8	229.5	9386.8	17538.5
5/23/03	1198.1	5596.2	2.6	22.1	941.1	2968.9	546.7	88.5	2402.5	7603.8	2657.1	246.7	10006.3	18968.1
5/24/03	1063.2	5015.0	2.5	20.7	846.5	2630.9	495.5	76.1	2174.4	6164.8	2337.8	244.6	8339.1	16315.2
5/25/03	829.3	3908.0	2.2	16.8	654.0	2101.7	396.0	59.0	1698.9	4882.7	1880.2	217.4	6581.6	12849.7
5/26/03	854.8	3997.3	2.1	16.8	660.5	2193.0	403.4	63.1	1718.0	5547.0	1988.3	214.8	7265.0	13737.9
5/27/03	1226.6	5717.6	2.6	22.3	952.1	3095.3	558.4	93.6	2432.3	8492.5	2804.8	252.8	10924.8	20161.1
5/28/03	1456.3	6872.6	3.0	27.4	1179.4	3616.7	673.7	108.0	2942.9	9316.4	3193.7	299.5	12259.3	23253.4
5/29/03	1364.4	6475.6	2.9	26.6	1119.3	3334.7	636.4	97.5	2806.6	7918.9	2910.0	297.8	10725.4	20976.4
5/30/03	1045.3	4947.6	2.5	21.0	843.5	2580.7	494.0	73.5	2157.2	6153.6	2272.6	258.9	8310.8	16161.6
5/31/03	1017.8	4739.6	2.4	19.4	790.3	2577.0	474.7	75.6	2032.7	6722.4	2326.4	238.4	8755.1	16419.1
6/1/03	1192.5	5491.7	2.7	21.9	926.2	2930.6	538.3	86.2	2387.3	7703.9	2624.3	240.4	10091.3	18894.0
6/2/03	1300.4	5985.4	2.8	23.5	1016.9	3190.2	584.0	94.7	2596.5	8571.1	2847.1	250.7	11167.6	20769.0
6/3/03	1391.3	6402.5	2.9	24.7	1094.0	3329.2	610.6	99.4	2808.1	8769.1	2951.2	249.1	11577.2	21723.6
6/4/03	1382.1	6404.0	2.9	24.3	1102.5	3233.6	596.8	96.1	2862.0	8268.0	2842.4	238.0	11130.0	21110.3
6/5/03	1416.7	6616.5	2.9	24.7	1151.1	3243.4	602.0	96.1	3008.9	7872.9	2822.1	228.1	10881.8	21026.4
6/6/03	1412.5	6611.3	2.9	24.8	1145.1	3255.1	603.2	96.6	3002.1	7774.9	2847.0	229.8	10777.0	20926.4
6/7/03	1351.7	6295.7	2.9	24.0	1080.1	3176.6	587.2	94.1	2823.6	7785.8	2804.2	236.4	10609.4	20398.2
6/8/03	1325.6	6158.9	2.9	24.0	1047.2	3174.8	585.8	93.9	2725.3	7927.1	2823.8	248.9	10652.4	20340.3
6/9/03	1175.1	5439.7	2.7	22.0	923.4	2764.1	520.0	79.8	2429.5	6480.1	2441.8	236.0	8909.6	17406.9
6/10/03	1042.4	4822.8	2.5	19.5	804.8	2490.9	461.3	71.8	2148.7	5752.4	2232.4	212.3	7901.1	15468.6
6/11/03	981.6	4539.1	2.4	18.4	753.4	2356.8	433.8	67.8	2021.3	5452.2	2120.3	202.5	7473.5	14605.3

BVOC emissions (in tons/day) from 12 km domain (cont'd):

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
6/12/03	966.6	4474.2	2.4	18.2	742.8	2324.3	428.8	66.6	1990.5	5336.6	2089.1	202.2	7327.1	14360.4
6/13/03	946.5	4372.3	2.4	18.1	727.6	2314.4	428.1	65.7	1933.2	5585.3	2081.4	206.7	7518.6	14460.5
6/14/03	1102.1	5080.6	2.5	20.2	836.9	2758.7	496.5	81.8	2192.7	7215.7	2515.8	225.3	9408.4	17595.0
6/15/03	1298.1	6009.9	2.8	23.6	1000.9	3222.2	582.5	96.7	2584.2	8555.4	2916.4	252.2	11139.6	20792.2
6/20/03	877.2	4051.0	2.3	17.0	676.0	2125.7	396.6	59.5	1797.2	5067.7	1897.7	197.7	6864.9	13273.0
6/21/03	804.2	3673.9	2.1	15.2	610.1	1978.6	361.7	55.6	1627.7	4936.0	1782.3	179.4	6563.7	12437.4
6/22/03	823.3	3754.2	2.1	15.3	621.5	2036.8	369.5	57.9	1651.7	5239.3	1841.2	179.7	6891.0	12919.9
6/23/03	803.3	3657.8	2.1	15.0	607.8	1976.5	360.7	55.6	1612.7	5031.5	1778.6	177.1	6644.1	12510.3
6/24/03	877.0	3960.7	2.1	15.6	657.8	2100.9	380.1	60.5	1753.1	5528.9	1889.1	170.8	7282.0	13583.8
6/25/03	1214.6	5527.6	2.6	20.8	933.9	2871.7	517.9	85.9	2448.7	7949.9	2565.5	197.8	10398.6	19124.8
6/26/03	1570.7	7237.7	3.0	26.9	1250.9	3677.8	669.1	111.2	3209.8	10057.3	3233.0	238.1	13267.1	24604.6
6/27/03	1768.7	8213.8	3.3	30.7	1442.5	4117.7	759.5	124.0	3650.0	10958.9	3570.1	272.8	14608.9	27419.1
6/28/03	1852.3	8667.8	3.5	32.5	1530.7	4333.4	801.3	130.5	3854.5	11285.2	3746.3	292.3	15139.7	28637.3
6/29/03	1733.6	8170.7	3.4	31.5	1426.5	4131.8	769.2	123.6	3610.6	10380.1	3603.9	301.6	13990.8	26770.6
6/30/03	1478.8	6908.0	3.1	27.7	1174.7	3593.5	667.6	106.6	2996.5	9231.8	3188.6	288.4	12228.3	23191.7
7/1/03	1368.6	5982.5	2.9	23.5	1028.4	3516.9	632.2	106.7	2533.9	9935.9	3199.1	281.9	12469.8	22597.6
7/2/03	1341.7	5850.6	2.8	22.9	1004.0	3452.4	617.9	105.1	2477.1	9904.2	3146.2	274.0	12381.3	22301.6
7/3/03	1415.9	6165.5	2.9	23.6	1052.8	3688.7	650.8	113.8	2584.6	10951.9	3385.8	280.1	13536.4	24065.8
7/4/03	1518.5	6605.6	3.0	25.0	1132.6	3954.6	694.4	122.8	2757.2	12060.8	3624.3	291.4	14818.0	26117.3
7/5/03	1586.0	6906.6	3.1	26.1	1190.7	4131.2	727.1	128.3	2882.1	12495.3	3776.0	302.9	15377.4	27194.4
7/6/03	1512.1	6592.1	3.0	25.3	1137.5	3901.8	693.6	120.1	2778.1	11429.3	3556.5	296.4	14207.4	25414.8
7/7/03	1446.8	6305.6	3.0	24.2	1082.5	3719.6	662.3	114.2	2668.5	10644.0	3398.3	285.5	13312.5	24002.2
7/8/03	1404.4	6128.2	2.9	23.6	1050.7	3658.4	648.3	112.4	2579.6	10919.6	3349.9	281.9	13499.3	23948.5
7/9/03	1684.0	7319.8	3.2	27.1	1264.0	4358.9	762.5	136.6	3061.9	13218.0	3985.6	304.4	16280.0	28774.0
7/10/03	1924.7	8388.5	3.5	31.3	1472.0	4909.3	869.6	153.4	3520.5	14604.8	4431.4	340.5	18125.4	32357.1
7/11/03	1904.8	8295.8	3.5	31.6	1462.2	4788.2	863.1	148.0	3502.8	13880.8	4288.3	347.6	17383.5	31378.0
7/12/03	1882.4	8220.5	3.5	31.6	1447.8	4786.9	862.1	147.9	3457.1	13799.0	4296.9	352.4	17256.1	31181.7
7/13/03	1716.5	7547.5	3.4	29.5	1332.4	4421.2	800.5	135.0	3171.0	12777.2	3961.0	346.5	15948.2	28763.2
7/14/03	1796.7	7806.6	3.4	29.8	1374.2	4567.0	818.4	141.0	3266.9	13492.8	4098.6	344.8	16759.7	30030.0
7/15/03	1857.8	8058.2	3.5	31.3	1433.7	4624.8	846.9	141.1	3401.2	12979.5	4099.8	356.9	16380.7	29977.0
7/16/03	1758.2	7603.8	3.4	29.7	1347.5	4306.3	795.6	130.6	3225.0	11901.3	3806.3	335.4	15126.3	27876.4
7/17/03	1910.1	8213.4	3.6	31.4	1466.8	4523.3	839.3	137.7	3519.9	12351.4	3953.8	330.5	15871.3	29476.9
7/18/03	2005.9	8623.1	3.7	32.7	1553.0	4714.2	875.9	143.5	3720.2	12553.5	4099.9	330.8	16273.6	30505.5
7/19/03	1973.6	8586.5	3.7	32.8	1557.6	4671.2	874.3	141.4	3736.1	12123.0	4044.6	330.3	15859.1	29964.0
7/20/03	2010.9	8743.1	3.7	33.0	1578.5	4783.8	884.5	145.9	3794.9	12935.0	4168.3	337.1	16729.9	31118.3
7/21/03	2135.9	9287.4	3.8	34.6	1691.0	5005.9	927.8	152.8	4062.6	13386.5	4328.5	341.6	17449.2	32625.8
7/22/03	2189.3	9467.3	3.9	35.5	1718.9	5125.8	950.6	156.6	4109.3	13682.2	4437.6	351.2	17791.5	33330.1
7/23/03	2110.1	9142.2	3.9	34.8	1664.1	4922.5	923.2	148.9	3970.0	12923.0	4237.3	348.6	16893.0	31872.8
7/24/03	1718.9	7603.2	3.6	30.5	1402.3	4048.5	785.8	117.9	3374.3	9697.2	3435.6	325.6	13071.5	25407.8
7/25/03	1504.5	6627.6	3.3	26.8	1208.6	3530.8	687.3	102.1	2956.1	8567.7	3014.6	300.4	11523.8	22258.7

Average summer day emissions ** :

	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
	1480.5	**6619.8**	**3.0**	**25.5**	**1149.6**	**3617.2**	**659.9**	**109.0**	**2867.5**	**9789.1**	**3219.0**	**272.4**	**12656.6**	**23453.5**

* BVOC = OLE+PAR+TOL+XYL+ALD2+NR+ETH+FORM+ISOP (based on methodology used by EPA to create default 2002 BVOC EI)

** Average summer day emissions are based on data from (June 1, 2003 to June 15, 2003), and (June 20, 2003 to July 23, 2003).

BVOC emissions (in tons/day) from 36 km domain:

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
5/19/03	1460.4	7091.1	4.0	27.5	1124.9	4108.5	740.8	118.1	2694.9	13498.5	3726.3	435.2	16193.4	28173.9
5/20/03	1602.6	7723.3	4.2	30.4	1235.6	4312.2	782.0	124.1	3050.4	14274.6	3891.4	429.2	17325.0	30089.1
5/21/03	1780.2	8640.5	4.6	34.4	1378.4	4866.5	881.9	141.6	3379.5	15882.6	4417.0	467.5	19262.1	33610.7
5/22/03	1988.2	9693.4	5.0	38.6	1553.1	5398.6	988.4	157.8	3774.7	17023.0	4878.1	516.4	20797.7	36846.2
5/23/03	2254.6	11002.3	5.4	43.6	1771.4	6010.0	1106.9	177.4	4304.5	17845.5	5408.1	562.9	22150.0	40217.1
5/24/03	2264.0	11130.6	5.5	45.3	1792.0	5926.0	1107.2	172.9	4392.4	16505.5	5299.9	574.0	20897.9	38949.0
5/25/03	1874.2	9273.0	5.0	39.2	1482.6	4974.3	938.9	140.9	3652.1	14188.8	4445.3	528.1	17840.9	32916.8
5/26/03	1810.3	8956.6	4.9	37.3	1408.8	4961.5	918.6	142.6	3449.4	15183.9	4495.6	510.7	18633.3	33424.5
5/27/03	2246.1	10952.4	5.4	44.1	1747.6	5970.1	1094.7	176.6	4283.5	17875.6	5396.1	549.3	22159.0	40112.7
5/28/03	2657.4	13073.4	6.1	53.1	2125.3	6957.5	1293.2	206.1	5153.0	19782.4	6208.0	616.1	24935.4	46154.4
5/29/03	2707.3	13500.7	6.3	55.0	2180.7	7237.0	1352.5	214.3	5197.6	20724.2	6458.4	653.9	25921.8	47978.0
5/30/03	2304.9	11540.1	5.8	47.9	1858.4	6250.6	1179.1	181.3	4438.5	18550.8	5577.5	619.1	22989.3	41918.9
5/31/03	2012.5	9884.1	5.2	40.5	1589.8	5476.9	1018.1	158.8	3846.4	16813.5	4927.3	559.5	20659.9	36999.4
6/1/03	2395.5	11694.9	6.2	47.9	1890.4	6335.3	1179.5	182.3	4627.9	18736.0	5662.8	559.2	23363.9	42468.0
6/2/03	2470.8	12006.8	6.2	48.8	1949.6	6503.8	1204.7	188.4	4778.4	18843.0	5815.9	563.0	23621.4	43222.0
6/3/03	2574.2	12438.4	6.3	49.8	2032.7	6604.6	1225.1	192.1	5022.0	18431.0	5874.7	558.7	23453.0	43554.1
6/4/03	2628.5	12718.7	6.3	50.7	2098.1	6565.5	1221.7	191.0	5264.2	17959.0	5798.6	535.8	23223.2	43439.5
6/5/03	2707.8	13131.4	6.4	52.4	2204.5	6500.5	1223.8	187.7	5607.6	16635.9	5650.1	509.2	22243.5	42650.3
6/6/03	2686.7	13055.1	6.4	52.3	2198.0	6456.2	1211.8	186.5	5618.7	16567.6	5615.6	492.5	22186.4	42420.6
6/7/03	2680.1	13002.2	6.3	52.1	2166.2	6561.0	1220.6	190.9	5516.6	17340.5	5766.6	508.9	22857.1	43220.0
6/8/03	2679.3	13046.7	6.5	53.4	2138.6	6722.7	1249.6	195.5	5417.0	18222.5	5974.0	538.6	23639.5	44314.8
6/9/03	2473.2	12157.9	6.4	50.8	1968.5	6374.8	1199.7	182.5	4912.1	17403.0	5672.0	546.9	22315.1	41816.8
6/10/03	2244.3	11027.4	6.0	46.3	1764.8	5826.2	1094.1	165.1	4426.2	15545.1	5208.0	516.4	19971.3	37719.3
6/11/03	2201.8	10881.2	5.9	45.1	1718.9	5862.2	1087.6	167.7	4271.9	16288.2	5285.7	511.8	20560.1	38258.5
6/12/03	2297.9	11389.5	6.1	47.3	1794.6	6087.0	1128.1	175.0	4467.0	16529.6	5494.3	520.1	20996.6	39455.0
6/13/03	2247.6	11178.2	6.1	47.6	1777.8	5996.3	1128.1	169.5	4381.8	16980.9	5372.0	534.2	21362.7	39532.0
6/14/03	2426.3	11982.1	6.2	49.4	1887.9	6587.7	1211.1	191.9	4613.8	20246.8	5973.8	553.1	24860.6	44589.4
6/15/03	2783.3	13735.0	6.7	56.0	2174.8	7463.6	1368.4	221.0	5300.0	22808.3	6756.4	593.1	28108.3	50617.1
6/20/03	2126.4	10636.3	6.0	45.7	1689.4	5832.9	1102.3	163.6	4067.8	16786.9	5220.6	532.0	20854.6	38389.6
6/21/03	1967.2	9820.7	5.7	41.2	1542.6	5582.1	1036.8	157.7	3656.7	16563.0	5045.2	507.8	20219.7	36717.1
6/22/03	1992.3	9947.5	5.6	40.9	1560.0	5700.8	1048.8	162.5	3686.9	17208.7	5172.3	512.0	20895.6	37667.1
6/23/03	1993.9	9920.3	5.7	41.1	1562.9	5586.6	1039.0	157.9	3704.0	16454.6	5028.9	511.5	20158.6	36762.0
6/24/03	2076.0	10194.2	5.7	41.8	1624.8	5601.2	1040.0	159.4	3940.2	16184.2	5019.7	493.0	20124.4	36927.3
6/25/03	2433.6	11773.4	6.0	46.9	1919.2	6244.0	1152.5	181.3	4769.5	17716.9	5559.9	509.3	22486.4	41474.0
6/26/03	2971.3	14421.2	6.8	56.9	2380.5	7530.6	1384.9	222.9	5900.3	21350.0	6686.0	563.0	27250.3	50325.0
6/27/03	3280.9	16009.3	7.3	63.8	2670.9	8287.9	1541.4	245.1	6554.5	23537.6	7296.0	613.4	30092.1	55644.1
6/28/03	3494.3	17150.7	7.6	68.0	2870.5	8853.2	1642.8	263.5	7023.0	24649.4	7791.2	646.0	31672.4	59000.0
6/29/03	3472.4	17096.0	7.7	69.8	2857.5	8658.6	1627.6	254.9	7067.8	22897.5	7590.7	652.9	29965.3	56942.0
6/30/03	3167.1	15677.1	7.4	65.7	2550.5	8219.2	1539.2	240.9	6244.2	22820.5	7320.0	647.7	29064.7	54287.5
7/1/03	3286.0	15344.8	7.7	61.8	2518.8	9167.9	1662.3	276.1	5820.5	29605.1	8361.2	666.0	35425.6	61930.4
7/2/03	3261.0	15324.0	7.7	61.6	2519.9	9235.4	1679.8	277.7	5732.4	29888.9	8404.4	677.7	35621.3	62256.1
7/3/03	3349.9	15731.2	7.7	62.3	2580.1	9456.6	1711.0	286.2	5880.2	30943.0	8618.0	687.4	36823.1	64128.0
7/4/03	3426.7	16006.5	7.8	63.1	2632.8	9548.1	1724.2	289.6	6050.9	30971.3	8693.7	690.5	37022.1	64670.0
7/5/03	3486.7	16263.2	7.9	64.2	2684.8	9736.4	1755.0	295.5	6171.3	31919.4	8870.9	696.5	38090.7	66213.1
7/6/03	3400.5	15840.0	7.8	63.0	2621.8	9297.5	1694.2	280.3	6090.3	29399.2	8416.1	677.0	35489.5	62604.3
7/7/03	3304.9	15331.0	7.6	61.5	2535.6	8798.4	1610.2	263.9	6017.3	27411.9	7942.6	642.3	33429.1	59324.9
7/8/03	3178.9	14896.7	7.5	60.2	2468.6	8702.0	1591.5	259.5	5789.7	27381.9	7867.7	645.7	33171.6	58546.8
7/9/03	3552.4	16421.6	7.8	64.0	2725.6	9667.4	1740.2	294.5	6345.5	30228.1	8778.0	677.7	36573.6	64701.7
7/10/03	4082.5	18804.4	8.5	72.8	3156.5	10900.7	1958.2	335.5	7359.4	34435.0	9851.1	726.8	41794.4	73753.9
7/11/03	4242.7	19623.7	8.8	77.4	3309.0	11141.9	2032.0	340.2	7721.3	35181.1	9977.0	756.7	42902.4	75956.8
7/12/03	4278.5	19856.8	8.9	78.8	3350.1	11333.2	2068.8	345.6	7774.3	35815.4	10152.9	777.1	43589.7	77136.0

BVOC emissions (in tons/day) from 36 km domain (cont'd):

Date	OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO	ISOP+TERPB	BVOC *
7/13/03	3960.4	18702.0	8.7	75.0	3155.1	10960.1	2008.3	330.7	7157.9	35988.0	9831.0	786.6	43146.0	75188.4
7/14/03	3941.3	18639.2	8.6	73.1	3122.1	11029.4	2008.5	334.7	7009.7	36533.7	9924.6	788.8	43543.5	75690.7
7/15/03	4096.0	19118.1	8.8	76.1	3236.7	11030.3	2034.9	332.9	7362.6	34432.4	9835.3	794.9	41795.0	74366.4
7/16/03	4125.6	19185.4	8.9	77.8	3264.0	10969.6	2041.7	329.3	7439.5	34295.6	9727.7	791.2	41735.2	74298.0
7/17/03	4231.3	19474.6	9.0	78.2	3328.5	11022.3	2055.8	331.5	7611.9	33791.1	9728.5	774.3	41403.0	74322.3
7/18/03	4424.2	20330.0	9.2	81.2	3498.6	11297.3	2112.6	340.2	8059.3	33693.8	9915.2	768.2	41753.1	75787.0
7/19/03	4606.0	21309.0	9.5	85.6	3686.9	11777.8	2204.5	354.9	8504.4	35474.8	10315.0	783.3	43979.2	79509.0
7/20/03	4526.4	20999.9	9.4	83.9	3623.9	11694.1	2179.9	352.6	8361.0	35203.5	10280.7	787.0	43564.5	78673.7
7/21/03	4449.7	20568.5	9.3	81.1	3564.5	11275.1	2109.9	339.2	8296.6	32742.4	9855.2	770.1	41039.0	75139.7
7/22/03	4627.0	21305.0	9.4	84.2	3684.8	11559.5	2159.8	348.8	8621.8	34092.8	10099.1	778.3	42714.6	77871.2
7/23/03	4694.7	21741.3	9.6	87.0	3774.4	11850.1	2221.1	356.3	8765.4	35159.0	10338.1	804.1	43924.4	79893.6
7/24/03	4237.3	19958.2	9.3	81.9	3470.3	11151.7	2114.8	330.2	7906.8	33513.0	9729.4	798.3	41419.9	74866.9
7/25/03	3915.7	18502.5	9.0	76.6	3201.0	10386.2	1988.4	305.0	7237.2	30833.4	9044.6	773.7	38070.7	69217.9

Average summer day emissions ** :

3204.2	**15243.0**	**7.4**	**61.3**	**2531.4**	**8448.9**	**1560.7**	**250.9**	**6016.0**	**25291.7**	**7539.5**	**636.3**	**31307.7**	**56599.5**

* BVOC = OLE+PAR+TOL+XYL+ALD2+NR+ETH+FORM+ISOP (based on methodology used by EPA to create default 2002 BVOC EI)

** Average summer day emissions are based on data from (June 1, 2003 to June 15, 2003), and (June 20, 2003 to July 23, 2003).

Average molecular weight (g/mole):

OLE	PAR	TOL	XYL	ALD2	NR	ETH	FORM	TERPB	ISOP	CO	NO
28.4	17.1	22.5	108.8	31.7	24.1	28.0	30.0	136.0	68.0	28.0	30.0

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