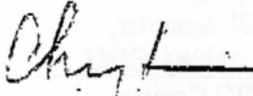


M E M O R A N D U M

DATE: October 21, 2005
 TO: Barry R. Wallerstein
 FROM: Chung Liu 
 SUBJECT: Ambient Air Measurements During the Topanga Fires

In response to air quality concerns relative to the Topanga Fire on September 29, 2005 during which at least one of the buildings located on the Rocketdyne facility was burned during the morning hours, staff deployed sampling equipment on the afternoon of September 29, 2005 and on September 30, 2005. Grab samples were collected during the evening of September 29th at three locations. In addition, VOC canisters, TSP Hi-Vol samplers, and hydrochloric acid (HCl) impingers were placed at two locations in the Chatsworth area based on wind patterns observed on that date. In addition to the VOC sampling, sampling was conducted for dioxins and furans at one location. Lastly, a portable GC/MS was used to analyze air at five locations surrounding the Rocketdyne site. Specific locations and types of sampling are provided in the following table and a map showing the location of the Rocketdyne facility and the sampling locations is provided in Figure 1.

Results of VOC Sampling

Sampling for VOCs was conducted using evacuated Summa canisters. Relative to quality assurance the canisters are cleaned before each sampling event with a canister cleaning oven system. Once a canister is cleaned it is analyzed to ensure that there is less than 0.2 ppb carbon per compound and 10-ppb carbon of total organic compounds. Any canister found to contain levels above these concentration levels is returned for another round of cleaning. The results of sampling are provided in Tables 2 and 3 for the sampling on September 29, 2005 and September 30, 2005, respectively.

Table 1. Location of Air Quality Sampling Locations During the Topanga Fire

(a) September 29, 2005

Site Number	Location	Sampler	Compounds of Interest
1	Chatsworth (Lassen & Topanga Canyon)	Canister- instantaneous	VOCs
2	Porter Ranch (Rinaldi & Corbin)	Canister- instantaneous	VOCs
3	West Hills (Woodlake & Platt)	Canister- instantaneous	VOCs

Table 1. Concluded.
(b) September 30, 2005

Site Number	Location	Sampler	Compounds of Interest
4	Chatsworth Park Elementary School (Devonshire & Topanga Canyon Rd.)	VOC Canister - integrated TSP Sampler, Impinger, PUF Sampler, Portable GC/MS	VOCs, Beryllium, HCL, Dioxins and Furans, VOCs
5	Fire Station No. 75 (Chatsworth)	VOC Canister, TSP Sampler, Impinger, Portable GC/MS	VOCs Beryllium, HCl VOCs
6	Entrance to Rocketdyne facility	Portable GC/MS	VOCs
7	Ranger Station (Chatsworth)	Portable GC/MS	VOCs
8	Davidson & Sterham (Santa Susana)	Portable GC/MS	VOCs



Figure 1. Sampling Locations Near the Topanga Fire. (Infrared-enhanced satellite image was collected by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on NASA's Terra satellite on October 4, 2005. Burned area appears black and vegetation appears red on the color version of image.)

Table 2. VOC Sampling Results of Samples Collected on September 29, 2005

Chemical Compound	Detection Limit	Site 1	Site 2	Site 3	Sun Valley*
		Sample Duration - Instantaneous Canister 54587	Sample Duration - Instantaneous b Canister 54687	Sample Duration - Instantaneous Canister 54651	24-hour Samples
Vinyl Chloride	0.2	ND	ND	ND	ND
1,3-Butadiene	0.2	0.22	ND	0.62	0.26
Methylene Chloride	0.1	0.11	ND	0.13	0.32
Chloroform	0.1	ND	ND	ND	ND
1,2-Dichloroethane (EDC)	0.1	ND	ND	ND	ND
Carbon Tetrachloride	0.1	0.10	0.10	0.10	ND
1,2-Dichloropropane	0.2	ND	ND	ND	ND
Trichloroethylene	0.1	ND	ND	ND	ND
1,2-Dibromoethane (EDB)	0.2	ND	ND	ND	ND
Perchloroethylene	0.1	ND	ND	ND	ND
Styrene	0.1	ND	ND	ND	0.11
1,4-Dichlorobenzene	0.3	ND	ND	ND	ND
	0.3				
1,2-Dichlorobenzene		ND	ND	ND	ND
Acetone	0.3	17.60	3.25	11.72	9.12
Methyl Tert Butyl Ether	0.3	ND	ND	ND	ND
2-Butanone (MEK)	0.3	0.41	ND	0.60	0.80
Benzene	0.1	1.45	0.14	2.51	0.41
Toluene	0.1	1.46	0.38	3.23	1.59
Ethylbenzene	0.1	0.18	ND	0.57	0.18
(m+p)-Xylene	0.1	0.52	0.18	1.51	0.71
o-Xylene	0.2	ND	ND	0.14	0.20

* Sun Valley data is the average of 24-hour samples taken on September 7, 10 & 13, 2005.

ND = None Detected

Table 3. VOC Sampling Results of Samples Collected on September 30, 2005

Chemical Compound	Detection Limit	Site 4	Site 5	Sun Valley*
		Sampling Duration - 1110 - 1600 hrs Canister #54069	Sampling Duration - 1110 - 1640 hrs Canister #53123	24-hour Samples
Vinyl Chloride	0.2	ND	ND	ND
1,3-Butadiene	0.2	ND	ND	0.26
Methylene Chloride	0.1	0.17	0.15	0.32
Chloroform	0.1	ND	ND	ND
1,2- Dichloroethane (EDC)	0.1	ND	ND	ND
Carbon Tetrachloride	0.1	0.10	ND	ND
1,2-Dichloropropane	0.2	ND	ND	ND
Trichloroethylene	0.1	ND	ND	ND
1,2-Dibromoethane (EDB)	0.2	ND	ND	ND
Perchloroethylene	0.1	ND	ND	ND
Styrene	0.1	ND	ND	0.11
1,4-Dichlorobenzene	0.3	ND	ND	ND
1,2-Dichlorobenzene	0.3	ND	ND	ND
Acetone	0.3	9.06	8.90	9.12
Methyl Tert Butyl Ether	0.3	ND	ND	ND
2-Butanone (MEK)	0.3	ND	0.36	0.80
Benzene	0.1	0.54	0.83	0.41
Toluene	0.1	1.04	1.11	1.59
Ethylbenzene	0.1	0.17	0.17	0.18
(m+p)-Xylene	0.1	0.39	0.41	0.71
o-Xylene	0.2	ND	ND	0.20

* Sun Valley data is the average of 24-hour samples taken on September 7, 10 & 13, 2005.

ND = None Detected

The focus of the analysis is on chlorinated solvents and other hydrocarbon compounds, which are known to affect human health. The results are compared to data collected at a nearby monitoring site (Sun Valley) in the weeks preceding the fire. For the grab samples collected on September 29th the compounds containing chlorine are typical of that found at the nearby location. At the West Hills site (Site 3) levels of benzene, toluene, ethylbenzene, (m+p)-xylene, and o-xylene were two to six times higher compared to those at Sun Valley. However, the values cannot be compared directly since the samples taken on September 29th are instantaneous (or a grab) and the measurements at Sun Valley are over a 24 hour period. Regardless, these compounds are typical of mobile source emissions and may reflect the area where the sample was collected and the influence of nearby traf-

fic. It should also be noted that grab samples are collected over a very short period of time and are therefore considered a "snapshot" at the time of collection.

Samples taken on September 30th were collected over an integrated (four to five hours) period of time and provide a more robust picture of the air quality during the fire. The results in Table 3 indicate that the chlorinated and petroleum-based compounds are comparable to or below average levels observed in Sun Valley, with many of the compound concentrations being below detection limits.

The detection limit is determined for the GC/MS by multiple injections of the lowest standard amount available (within 10 times the estimated LOD). A calibration curve is derived by injection of a gas standard containing the compounds of interest at ppb levels. Every sample run is preceded and ended with a calibration check. Every analysis day is begun with a system blank run and ended with a secondary standard check. The California Air Resources Board (CARB) performs an annually audit of the performance of the AQMD laboratory for Volatile Organic Hydrocarbons.

Results of Beryllium Sampling

Beryllium sampling was conducted using hi-volume samplers with glass fiber filters. With the exception of the length of time sampling occurred, sampling was conducted using the identical protocol as used for the U.S. Environmental Protection Agency (EPA) lead network.

Laboratory analysis for beryllium is conducted using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Particulate samples are collected on filters, which are in turn submerged in acid to dissolve the particulate, leaving the filter 'clean'. A small amount of the dissolved particulate solution is then diluted and introduced into the ICP-MS. The ICP-MS is calibrated by running a set of standards of known concentration which are made from a certified master standard. The particulate samples are then run in triplicate, and the beryllium concentration is determined by comparison to the calibration curve. A standard of known concentration is analyzed before and after the ambient samples to ensure that the instrument response remains constant. The detection limit for the analyses of beryllium in ambient air is $0.06 \mu\text{g}/\text{m}^3$. Beryllium levels from the samples collected at Chatsworth Park Elementary School (Site 4) and the Fire Station (Site 5) are below this detection level.

Results of HCl Sampling

Chloride is used as a surrogate analyte for hydrochloric acid. Since there are many more sources of chloride (for example, sea salt) than acidic chloride, chloride values represent the maximum potential hydrochloric acid value and are usually biased high.

Numerous steps are taken to ensure the appropriateness of chloride sampling equipment and accuracy of the final analysis. Sampling was performed using a modification (see below) of South Coast AQMD Method 5.1 for particulate matter. Quality control for Method 5.1 includes reagent water specification, balance calibration, equipment leak-checks, sample integrity examination, sample volume calibration, blanks, duplicate determinations and chain of custody. Chloride was analyzed using U.S. EPA Method 300.1 - Ion Chromatography. Analytical quality control includes sample preservation, independent calibration verification, duplicate sample injections, matrix spikes, and continuing calibration checks.

For the current sampling events, the sample impingers were recovered separately using minimum rinsing to preserve chloride concentrations. Also, because chloride is a ubiquitous contaminant, two field blanks were recovered instead of one to obtain a statistical view of potential blank values. The glass fiber filter normally included in the sampling method is a large potential source of chloride contamination and was eliminated from the procedure.

The chloride analysis results are presented in Table 4. There is a scarcity of ambient measurements of hydrochloric acid. However, hydrochloric acid has an acute reference exposure level (REL) of 2,100 $\mu\text{g}/\text{m}^3$ established by the California Environmental Protection Agency (CalEPA) Office of Environmental Health and Hazardous Assessment and a chronic REL of 9 $\mu\text{g}/\text{m}^3$. The maximum levels shown in Table 4 are much lower than reported RELs.

Table 4. Hydrochloric Acid Sampling Results Collected on September 30, 2005.

Location	Chloride ($\mu\text{g}/\text{m}^3$)	Max HCl ($\mu\text{g}/\text{m}^3$)
Chatsworth Park Elementary School (Site 6)	0.96	<1
School site blank	<0.22	
Fire Station No. 75 (Site 5)	1.06	None detected
Fire Station blank	1.95	

Results of Portable GC/MS Analyses

Analysis was conducted at five locations (as provided in Table 1b) in and around the burn area near the communities of Chatsworth and Simi Valley using Inficon HAPSITE GC/MS instruments. Three samples were taken to assess potential exposure to VOCs including chlorinated species in communities surrounding the burn area, and two samples were taken in the burn area itself. The HAPSITE GC/MS is designed to perform semi-

quantitative analysis of ambient organic compounds with a molecular weight between 40 and 300 in ambient air. The specific methodology employed has a "quantitation" limit of about 5 ppb, and the analyses were specifically focused on halogenated species. However, volatile and semi-volatile organic compounds within the molecular range stated above, such as benzene and other aromatic compounds can also be detected by the sampling instrument. A "quantitation" limit is the lowest measurable value from the instrument and is within the measurement uncertainty specified for the instrument. Typically, the "quantitation" limit is below a reported detection limit and provides a sense of the level of the chemical compound's concentration. None of the individual chemical compounds analyzed at the five locations have values at or above the 5 ppb "quantitation" limit.

Results of Dioxin and Furan Sampling

The dioxin/furan sample collected at Chatsworth Park Elementary School (Site 4) during the period from 10:00 a.m. to 3:00 p.m. on September 30th was sent to Alta Analytical Laboratory Inc., a California Certified Laboratory, for analysis of a selected group of 17 dioxin and furan compounds that have known toxicity. All but five dioxins and furans measured were below the detection limit. Concentrations observed were orders of magnitude less than the chronic inhalation risk level for non-cancer effects adopted by CalEPA.

The observed dioxin and furan concentrations (above detection limits) were multiplied by their respective toxicity equivalence factors (TEFs) adopted by the CalEPA Office of Environmental Health Hazard Assessment to yield a toxicity equivalence (TEQ) of 88 fg/m³. TEQs are numerical factors that express the equivalent level of each dioxin or furan relative to the toxicity of 2,3,7,8-Tetrachlorodibenzodioxin (TCDD). One fg (femtogram) is 10⁻¹⁵ grams. TCDD was chosen as the basis for the TEQ as it is the most toxic of the dioxins and furans.

CARB conducted a study to measure ambient dioxins and furans in 2002 and 2003 that includes nine sites in California, four of which are in the South Coast Basin. The CARB sampling were for 24 days and reported on a monthly basis. The TEQ was calculated using one-half the detection limit for any non-detected dioxins and furans. Observed ranges in the CARB network were from 5 to 185 fg/m³, with an annual 2003 TEQ average of 23 fg/m³.¹ The TEQ measured at Chatsworth Park Elementary School (Site 4) using the same calculation is 211 fg/m³. Annual average results of the four stations in the South Coast Basin ranged from 9 to 59 fg/m³, and higher TEQs were observed in the fall and winter than in the spring and summer indicative of seasonality.¹ Since the samples were taken in the fall, the ambient concentration of the dioxins and furans would already be elevated relative to the annual average.

¹ California Ambient Dioxin Air Monitoring Program (CADAMP) Presentation, October 2004, <http://www.arb.ca.gov/aqgm/qmosopas/dioxins/dioxinpdf.pdf>.

The TEQ from the Chatsworth Park Elementary School (Site 4) samples was higher than the range of values from the CARB monitoring program, and may be reflective of dioxins and furans that would be released during wildfire combustion. Studies have shown that dioxins and furans are present in wildfire smoke.^{2,3} A recent estimate by U.S. EPA of dioxin and furan emissions inventory for the year 2000 in the U.S. indicated that smoke from brush and wildfires may be the largest source category of emissions of dioxins and furans to the environment.⁴

While the sample collected showed higher levels TEQs than averages found in the CARB monitoring study, it can not be determined whether the source was from a specific facility or if it was from combustion of natural vegetation in the wildfire. Additionally, the concentration profile of dioxins and furans from forest fires provided in the U.S. EPA report⁴ is similar to that found in the Chatsworth Park Elementary School (Site 4) sample. This is consistent with the sources of the dioxin and furan emissions being derived from natural vegetation burning.

² Gullett, B.K. and Touati, A. PCDD/F emissions from forest fire simulations, *Atmospheric Environment* 37, p. 803-13, 2003.

³ Meyer, c., Beer, T., Muller, J. et al. Dioxin Emissions from Brushfires in Australia, National Dioxins Program Technical Report No. 1, Australian Government Department of the Environment and Heritage, Canberra, 2004
<http://www.deh.gov.au/settlements/publications/chemicals/dioxins/report-1/index.html>.

⁴ The Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States: The year 2000 Update (External Review Draft, March 2005; EPA/600/P-03/002A), <http://www.epa.gov/ncca/pdfs/dioxin/2k-update/>.