POTENTIAL BACKGROUND CONSTITUENT LEVELS IN STORM WATER AT BOEING'S SANTA SUSANA FIELD LABORATORY

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Executive Summary

The Boeing Santa Susana Field Laboratory (SSFL) is approximately 2850 acres in size and straddles the Simi Hills at the border of Ventura and Los Angeles Counties. Runoff from the SSFL eventually flows into both the Los Angeles River and Calleguas Creek Watersheds. The SSFL NPDES Permit (Order No. R4-2006-0008) include numeric limits for storm water discharges that are very low. Boeing has expressed concern about its ability to comply with these limits, particularly for metals and dioxins. As part of an evaluation of these concerns, this report presents information on sources of constituents that are regulated at the site.

The data detailed in this report describe the impacts of atmospheric deposition, erosion of native soils, and forest fires on storm water concentrations of metals and dioxin. In addition, concentrations of other regulated constituents, including metals and dioxin, in storm water runoff from the SSFL are compared to concentrations of these constituents in storm water flows and in receiving waters throughout the region. Major conclusions of this report are described below.

> **Atmospheric deposition.** Many of the metals and dioxins that are regulated in storm flows from the site are present in ambient air in southern California. The mass loading of these constituents deposited on land via dry deposition is large, and studies have shown th

regulated constituents. These effects have been widely documented and have been observed at the SSFL site, 70% of which burned during the fall 2005 wild fires.

Native soils. Samples of soils collected both at SSFL and off-site show the presence of regulated constituents. Soil concentrations off-site are similar, both in magnitude and variability, to concentrations measured on-site at the SSFL. Order-of-magnitude calculations show that erosion of native soils will contribute concentrations of regulated constituents to storm flows, often at levels that could approach or exceed SSFL permit limits.

Storm water runoff. Concentrations of metals in storm water runoff from the SSFL are similar to (and often lower than) concentrations in storm water runoff from other open space, natural areas. These concentrations are also similar (and often lower than) those detected in storm water runoff from certain major land use types (light industry, transportation, and commercial) and in the Los Angeles River during storm events. Average concentrations of dioxin in storm water runoff from the SSFL are lower than average dioxin concentrations in wet weather samples collected in the Santa Monica Basin. They are also lower than the average dioxin

1. INTRODUCTION

The Boeing Santa Susana Field Laboratory (SSFL) straddles the Santa Susana Mountains of southeastern Ventura County, and contributes runoff to both the Los Angeles River and Calleguas Creek Watersheds. Both of these waterbodies are listed as 303(d) impaired waters for certain constituents. Past and current NPDES waste discharge requirements for the SSFL have utilized a Reasonable Potential Analysis (RPA) to determine the likelihood that runoff containing certain constituents in storm water runoff could exceed a receiving water quality objective. Several analytes, including cadmium, copper, lead, mercury, and 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) toxic equivalent (TEQ)[1], were found by the Los Angeles Regional Board to have reasonable potential to exceed a receiving water quality objective at one or more of the designated outfalls.[2] However, storm water runoff from the site will contain significant concentrations and loads of these constituents from background sources not related to site activities, including:

Atmospheric deposition, which may include:
(a) urban atmospheric emissions
(b) products of native soil erosion by wind

Sediment loads from native soil erosion by runoff

Combustion products, smoke, and ash from forest fires

Each of these sources contributes to the annual load and to concentrations of constituents of concern in storm water runoff. Available information regarding these background sources can be used to calculate order-of-magnitude estimates for ambient constituent loadings in surface water at the SSFL.

This report also presents the results of tests of materials, including sand and gravel, that were considered for use in best management practices (BMPs) at the site. In addition to these BMP materials, hydromulch materials were also evaluated. Several different types of tests were conducted to assess the potential for these materials to contribute regulated constituents to storm water runoff and to enable Boeing to select the cleanest materials available for use at the site.

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[1] The Regional Board requires measurement of dioxins as a 2,3,7,8-TCDD toxic equivalent (TEQ). This mass TEQ is equal to the sum of each dioxin-like congener's mass multiplied by a congener-specific toxicity equivalence factor determined by the EPA and World Health Organization.

[2] Los Angeles Regional Water Quality Control Board, Order No R4-2004-0111, Waste Discharge Requirements for the Boeing Company, July 1, 2004. pp. 25-26. Also Order R4-2006-0008, January 19, 2006. pp. 25-30, and Order R4-2006-0036, April 28, 2006. pp. 26-31. Note that comments on the reasonable potential analyses and interim and final numeric effluent limits calculated by the Regional Board have been provided separately by Boeing on December 30, 2005, and January 5, 2006. Reasonable potential analysis methodology is described in MWH and Flow Science, 2006.

the SSFL site at levels that exceed the NPDES permit limits. The SSFL site is located within two air basins, the South Central Coast Air Basin (including parts of San Luis Obispo, Santa Barbara, and Ventura Counties) and the South Coast Air Basin (including parts of Los Angeles, Orange, Riverside, and San Bernardino Counties). Primary emissions sources for metals and dioxins, including automobile and other transportation emissions, waste incineration, and residential waste burning (referred to as backyard barrel burning by CARB) are included in Table 1. Potentially large emissions from forest fires are not included in Table 1.

Table 1 – 2004 Estimated Air Basin Emissions for Key SSFL Constituents of Concern (Excluding Wildland Fires)[4]

Constituent of Concern	Los Angeles County (kg/yr)	Ventura County (kg/yr)

Table 2 – Atmospheric Concentrations and Deposition Fluxes of Metals

Table 3 – Maximum Observed Total Metals Concentrations for Storm Water from Watersheds with Significant Natural (Open Space) Areas

Watershed	%-Natural	Maximum Observed Storm Water Concentrations (μg/L)		
		Copper	Lead	Zinc
Sawpit Creek (November 1998 – March 2001)	98	51	5.05	229
Malibu Creek (November 2001 – March 2005)	80	91.6	21.5	102
Los Angeles River (at Wardlow) (October 1998 – January 2005)	44	805	1070	1235
Boeing SSFL 2006 NPDES Permit Daily Average Levels	---	13.5 -14.0	5.2	119

Source: "Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report" and "Los Angeles County 1994-2005 Integrated Receiving Water Impacts Report", LACDPW.
Note: Concentrations are in terms of total metal, not dissolved metal.

Additional studies by SCCWRP and others are in the planning stages or currently underway. These studies are intended to help assess atmospheric deposition rates, to refine estimates of transmission efficiencies, particularly from natural areas, and to quantify the relative contribution of atmospheric deposition to storm water metals concentrations and loadings. Nonetheless, the data presented by Sabin et al. (2004 and 2005) and the analysis presented in this report indicate that atmospheric deposition is likely a significant source of metals in storm water.

2.1.3 Atmospheric Deposition of Dioxins

Global atmospheric deposition rates for dioxins have been estimated in multiple studies through a mass balance between emissions and deposition of dioxins measured in soils, surface water, and in plant uptake. Estimated global emissions of dioxins range from 1,800 (Baker and Hites, 2000) to 3,000 kg/yr (Brzuzy and Hites, 1996), but Wagrowski and Hites (2000) estimate atmospheric deposition of dioxins to be 5,500 kg/yr. Wagrowski and Hites (2000) reasoned that the discrepancy between emissions and deposition could be due to uncertainty in NO_x emission rates or dioxin deposition rates, while Baker and Hites (2000) found that the difference could be explained by the conversion of pentachlorophenol to dioxin congeners in the atmosphere. Wagrowski and Hites (2000) also studied emission sources and nearby localized deposition rates, and estimated that dioxin emissions travel through the atmosphere for relatively limited distances, roughly 60 to 125 miles, before depositing to the earth's surface. Once deposited, fate and transport of dioxins will depend upon surface, hydrologic, and atmospheric conditions. The Bay Area Air Quality Management District (BAAQMD) estimates total regional emissions for the Bay Area to be about 2.2 g TEQ/yr (BAAQMD 2000).

Wagrowski and Hites (2000) found that anthropogenic fluxes of nitrogen oxides (NO_x) correlated well with atmospheric deposition fluxes of dioxins and benzofurans, and developed a model for estimating atmospheric deposition of dioxins and benzofurans to soils based upon a logarithmic regression with regional emissions of NO_x. This is shown in the following equation.

$$\log(\text{dioxin and benzofuran flux}) = 0.512 + 0.401 (\log NO_x)$$

The mass of dioxins and benzofurans deposited from the atmosphere within Ventura and Los Angeles Counties has been estimated by Flow Science using this model, as shown in Table 4.

Table 4 – Estimated Atmospheric Deposition of Dioxins and Benzofurans to Los Angeles and Ventura Counties

Region	**Area (m^2)**	**2005 NO_X Emissions (tons/yr)***	**Estimated Dioxin and Benzofuran Deposition Rate** ($ng/m^2/yr$)**	**Deposition Estimated for Regional Area*** (g/yr)**
Los Angeles County	$1.1x10^{10}$	$2.3x10^5$	340	3580
Ventura County	$4.8\ x10^9$	$2.3x10^4$	184	880
Los Angeles + Ventura County	$1.5\ x10^{10}$	$2.5x10^5$	304	4650

[*] Source: California Air Resources Board emissions inventory data for 2005.

[**] Calculations assume that the ratio of NO to NO_2 in area emissions is 0.9 to 0.1, with negligible contributions from other NO_x components.

[***] Dioxin deposition estimates in Table 4 are one to four orders of magnitude greater than dioxin emissions estimates

[redacted]

[redacted]

20 pg/m^3 [6], with before and after fire background atmospheric concentrations at non-detect levels. A recent memorandum published by the South Coast Air Quality Management District (SCAQMD) reported dioxin concentrations of 211 fg (femtograms, or 10^{-15} grams) TEQ/ m^3 at the Chatsworth Park Elementary School on September 30, 2005, during the Chatsworth/ Topanga Fire (Liu 2005). (See Appendix Table A-7 for a discussion of units.) By contrast, average SCAQMD ambient concentrations for dioxin range from 9 to 59 fg TEQ/m^3, or a factor of 3.5 or more times lower than atmospheric dioxin concentrations during the Topanga fire. The SCAQMD concludes that the source of the increased dioxin levels "may be reflective of dioxins and furans…released during wildfire combustion (processes)." This conclusion is consistent with recent reports published by Gullet and Touati (2003) and Meyer et al. (2004). In the Bay Area, wood burning is estimated to release approximately 0.84 grams TEQ per year, greater than the estimated contribution from mobile sources (Connor et al., 2005).

An order of magnitude estimate for the mass equivalent of dioxins emitted by southern California forest fires may be made by assuming a dioxin emission rate similar to that measured from wood stoves. Based on residential wood stove studies performed in Europe by Schatowitz et al. (1993) and Vikelsoe et al. (1993), wood stoves release approximately 2 nanograms TEQ per kilogram of wood burned. Ward et al. (1976) estimated biomass consumption rates from forest fires at roughly 9.4 metric tons/acre. From these data and the area of forest fires in southern California, an estimate can be made of the mass of TEQs (dioxin-like substances) emitted due to fires. Because available biomass, biomass conversion rates, and dioxin emission rates may vary significantly, a range of TEQ mass emissions, utilizing the estimated dioxin emission level as the geometric mean with a factor of 10 between high and low range estimates, has been calculated. Table 6 summarizes Flow Science's estimated dioxin emissions for recent Southern California fires. These emission rates are of the same order as dioxin emission rates reported by the SCAQMD (see Table 1). Thus, it appears that forest fires are a significant source of dioxins, particularly for land areas located near the fires.

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[6] Note that these airborne concentrations of dioxins have not been converted into mass TEQ/volume units and cannot be compared to the SCAQMD air concentrations reported in TEQ/volume units.

Table 6 – Estimated Dioxin Total Equivalence (TEQ) Mass Emissions from Recent Southern California Forest Fire Events

Fire Event	**Forest fire Area (acres)**[*]	**Biomass Consumption Forest Fire (kg)**[**]	**Estimated Total Dioxin Emissions (g TEQ)**[***]	**Range of Estimated Dioxin Emissions (g TEQ)**
Topanga (2005)	24,000	2.3×10^8	0.45	0.14 – 1.4
Burbank (2005)	700	6.6×10^6	0.01	0.004 – 0.04
Cedar Fire (2003)	280,000	2.6×10^9	5.3	1.7 – 17
Total Southern California Fires (2003)[****]	744,000	7.0×10^9	14	4.4 – 44

storm water runoff concentrations was noticed for silver, arsenic, boron, cobalt, chromium, manganese, nickel, tin, strontium, thallium, vanadium, and zinc. Furthermore, Hinojosa et al. (2004a) report that the dioxin congeners OCDD and HpCDD were above reporting limits[8] in most post-fire soil samples, with the highest TCDD total equivalent measurement of 2.9×10^{-5} TEQ mg/kg. Hinojosa et al. (2004b) note that “although there are no pre-fire results to compare against, the detection of dioxin in the ash-rich sediment deposits upstream of LANL supports the possibility that dioxins were formed by the Cerro Grande fire.” Likewise, no pre-fire measurements for dioxin-like compounds were taken for the Rio

Table 7 – Metals Atmospheric Concentration and Deposition Data for SSFL

Metal	Average Air Concentration (ng/m^3)			Average Daily Atmospheric Deposition Flux (μg/m^2/day)			Estimated Annual Deposition to SSFL (Malibu to Tillman range shown in parenthesis) (kg/yr)
	Tillman Water Reclamation Plant	Malibu Creek	Estimated SSFL (Avg. of Malibu Creek & Tillman)	Tillman Water Reclamation Plant	Malibu Creek	Estimated SSFL (Avg. of Malibu Creek & Tillman)	
Chromium	1.1	0.41	0.755	3.2	1.1	2.15	9.1 (1.6-13.5)
Copper	5.2	2.9	4.05	11	3.7	7.35	30.9 (15.6-46.3)

transported in an average year’s rainfall.

Table 8 compares the order-of-magnitude estimate for metals concentrations in storm water runoff at the SSFL due to atmospheric deposition with the NPDES permit limits that apply to storm water discharges from the SSFL. As shown in Table 8, the atmospheric deposition of copper, lead, and zinc may provide substantial contributions to permit exceedances at the site.

Table 8 – Estimated Average Metals Concentration in Storm Water Resulting from Atmospheric Deposition at SSFL

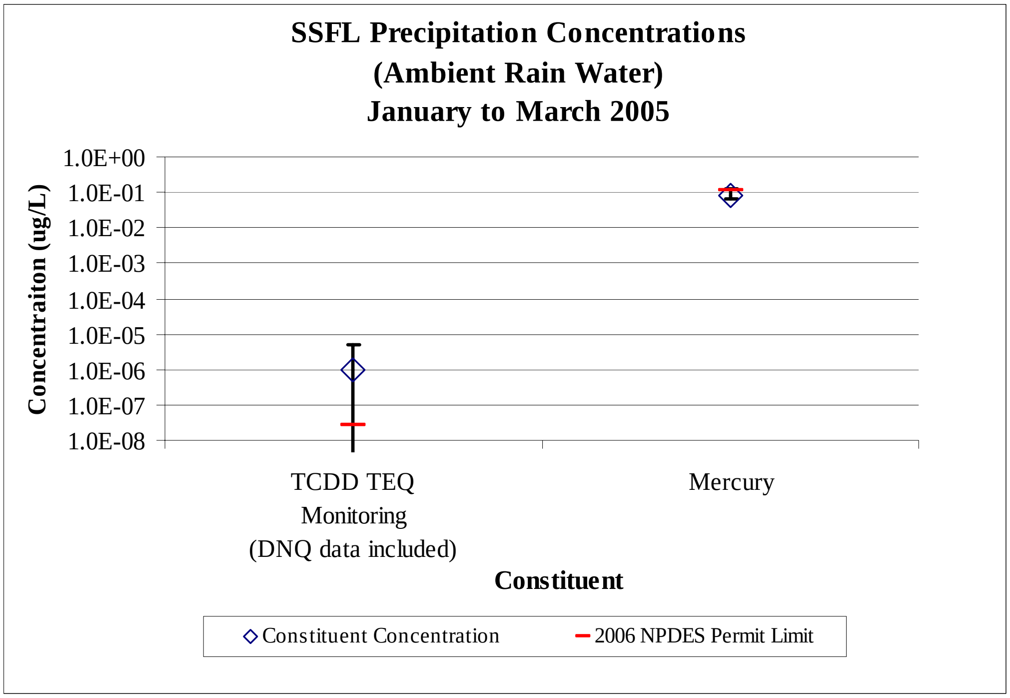
Constituents	Average Yearly Rainfall o6.7 ge

Equivalence Factor (TEF) of 0.0001 has been used. This is the TEF for Octachlorodibenzodioxins (OCDD), the most prevalent TCDD congener group (see Wagrowski and Hites (2000)). Using this conversion factor, annual dioxin deposition rates to the SSFL are estimated to be 3.5×10^{-4} TEQ (g/yr). Although no estimates of transmission efficiencies could be found for dioxins, a transmission efficiency of 8% applied to the annual mass of dioxin deposited to the SSFL from the atmosphere (and excluding any dioxin from fires) would result in storm water concentrations that exceed the monthly average TCDD (TEQ) NPDES permit limit for the estimated average storm water volume leaving the SSFL. Thus, even in the absence of fires, atmospheric deposition clearly has the potential to contribute significantly to both concentrations and loads of dioxin in storm water from the SSFL.

Table 9 - Atmospheric Deposition of Dioxins and Benzofurans to the SSFL

Estimated Dioxin and Benzofuran Deposition Rate to SSFL, 2005 ($ng/m^2/yr$)*	Estimated Range of Dioxin Deposition Rates to SSFL, 2005 ($ng/m^2/yr$)	SSFL Area (m^2)	Estimated 2005 Dioxin Deposition at SSFL (g/yr)	Estimated Range, 2005 (Applying LA and Ventura County as upper and lower limits.) (g/yr)
304	184-340	1.2×10^7	3.5	(2.1-3.9)

Figure 3 – SSFL Precipitation Constituent Concentrations



Sampling Notes:

1. Rainwater sampling occurred on 1/7/05, 2/11/05, 2/18/05, 3/4/05, 3/23/05. Only three of the five samples were analyzed for dioxins. Figure 3 was generated using the same data criteria and summation methods employed by the Regional Board in Reasonable Potential Analyses conducted for storm water runoff from the SSFL.
2. Four rainwater samples have been validated for mercury. Mercury concentrations represent laboratory estimated concentrations, and were reported with a J or U qualifier. One of the four estimated values was above the 2006 NPDES Permit Limit of 0.1 (µg/L). Estimated values for each of the four samples were >0.05 (µg/L). These data criteria and summation methods employed by the Regional Board in Reasonable Potential Analyses conducted for storm water runoff from the SSFL.

3. 2 Fire Impacts at the SSFL

The Chatsworth Topanga (Topanga) Fire of 2005 burned roughly 70% of the land area at the SSFL, completely destroying seven buildings and badly burning three other buildings. The overall fire area, both on-site and off-site water discharges at the time of sampling.[10] All results validated to date are included in Appendix A of this report and are discussed in greater detail below. Sampling locations where storm water, soil and ash samples were collected are shown in Table A-5 and in Figures A-1 and A-2. Continued sampling and assessment of these ambient surface water drainages is planned.

3.2.1 Boeing Measurements of Soil and Ash Before and After the Topanga Fire

Prior to the Topanga and Harvard Fires in the Fall of 2005, Boeing characterized naturally that non-detect values were equal to the detection limit. There is considerable variability in constituent concentrations at all locations, but concentrations are generally consistent between in off-site reference and background media.

Table 10 – Concentrations of Metals and Dioxin in Ash and Soil Samples Collected On-Site[12], Off-Site, and Background Samples

Constituent	Units	DTSC Pre Fire SSFL Soil Background Comparison Value	Post Fire Soil Concentrations from SSFL Background Sites: Average (Range)	Post Fire Soil Concentrations in Off-site Reference Samples: Average (Range)	Post Fire Ash Concentrations from SSFL Background Sites: Average (Range)	Post Fire Ash Concentrations in Off-site Reference Samples: Average (Range)
TCDD TEQ	(ng/kg)	0.98	0.53 (0.12-1.3)	0.17 (0.01-0.57)	1.6 (0.59-3.2)	3.0 (0.009-17.4)
Antimony	(mg/kg)	8.7	0.81 (0.81-0.81)	0.11 (0.04-0.19)	1.7 (1.6-1.7)	0.4 (0.12-0.7)
Arsenic	(mg/kg)	15	4.9 (2.7-11)	6.0 (0.9-13)	2.6 (1.2-3.9)	4.5 (0.6-10)
Barium	(mg/kg)	140	83 (59-110)	103 (43-230)	260 (130-360)	325 (140-630)
Beryllium	(mg/kg)	1.1	0.51 (0.45-0.62)	0.5 (0.2-0.8)	0.53 (0.4-0.88)	0.6 (0.2-1.1)
Boron	(mg/kg)	9.7	4.5 (1.0-6.6)	6.5 (1-14)	88 (48-160)	140 (10-330)
Cadmium	(mg/kg)	1	0.55 (0.47-0.62)	0.15 (0.03-0.52)	0.7 (0.4-1.1)	0.5 (0.08-1.5)
Chromium	(mg/kg)	36.8	16 (12-18)	13.5 (3.6-20)	10 (2.3-18)	15 (3.8-35)
Copper	(mg/kg)	29	10 (8-13)	15.0 (5.6-30)	34 (15-64)	47 (13-84)
Iron	(mg/kg)	28000	17200 (15000-19000)	18800 (11000-32000)	9600 (4200-17000)	17000 (8700-33000)
Lead	(mg/kg)	34	17 (9.5-27)	8.4 (2.4-14)	28 (5.2-64)	18 (9.4-42)
Manganese	(mg/kg)	495	320 (260-390)	480 (140-1700)	470 (220-610)	650 (270-1400)
Mercury	(mg/kg)	0.09	0.009 (0.003-0.017)	0.004 (0.003-0.006)	0.018 (0.003-0.058)	0.007 (0.003-0.029)
Nickel	(mg/kg)	29	14 (11-21)	10.4 (3.1-18)	15 (7-24)	18 (4.5-37)
Selenium	(mg/kg)	0.655	1.6 (1.0-2.2)	0.8 (0.2-3.2)	2.6 (2-4.4)	1.0 (0.2-3.8)
Silver	(mg/kg)	0.79	0.62 (0.4-0.87)	0.04 (0.02-0.06)	1.1 (0.8-1.8)	0.15 (0.06-0.23)
Thallium	(mg/kg)	0.46	2.8 (1.8-4.5)	0.3 (0.1-0.4)	2.5 (1.6-3.5)	0.21 (0.16-0.34)
Vanadium	(mg/kg)	62	29 (23-37)	34 (18-80)	21 (8.4-35)	37 (15-71)
Zinc	(mg/kg)	110	59 (51-67)	61 (29-100)	115 (57-190)	160 (58-350)

All samples were collected between October 2005 and February 2006.

These results show the variability of constituent concentrations in ash and soil following a wildfire event. Additionally, Table 10 illustrates that soil and ash constituent concentrations at SSFL following the Chatsworth Topanga Fire are very similar to post-fire off-site constituent concentrations. Furthermore, results to date show that the upper range of observed SSFL post-fire background and off-site soil concentrations for TCDD TEQ, barium, boron, copper, iron, manganese, selenium, silver, thallium, and vanadium exceed DTSC pre-fire background concentration comparison values. Likewise, results to date show

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[12] Boeing SSFL's post-fire background location soil sampling occurred at six DTSC-approved background locations. The DTSC pre-fire background comparison values were determined using samples from 29 locations on the SSFL determined to be representative of background conditions.

that the upper range for ash constituent concentrations at both background locations and regional off-site drainage locations are above DTSC pre-fire approved background concentrations for the constituents TCDD TEQ, barium, boron, cadmium, copper, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc.

3.2.2 Fire Impacts on Dioxin Emissions At or Near the SSFL

Dioxin emissions from the 2005 Topanga Fire can be estimated for both the portions of the SSFL site that burned and for the overall burn area. Table 11 applies the wood stove estimates developed in Table 6 to estimate the possible range of dioxin emissions from these areas and from other major southern California fires.

Table 11 – Estimated Dioxin Emissions From Various Fires At or Near the SSFL

Fire Location	**Fire Size (acres)**	**Estimated Dioxin Emitted by Forest Fire (g TEQ)**	**Potential Range in Dioxin Emitted by Forest Fire (g TEQ)**
SSFL 2005 Fire (Part of Topanga Fire)	2,000	0.04	(0.01-0.12)
Topanga, 2005	24,000	0.45	(0.14-1.4)
Burbank Fire, 2005	700	0.013	(0.0042-0.042)
Piru/Simi Valley, 2003	172,000	2.6	(0.82-8.2)
Total Southern California Fires (2003) *	744,000	14	(4.4-44)

*2003 Southern California Fires include Cedar, Mountain, Camp Pendleton, Dulzura, Grand Prix, Old, Padua, Paradise, Piru, Simi Valley, and Verdale Fires.

The methodology used in Table 8 can be used to provide an order of magnitude estimate of potential dioxin concentrations in storm water due to the Topanga Fire at SSFL. This order-of-magnitude calculation, as shown in Table 12, was made assuming that dioxins will have transmission efficiencies similar to metals, and indicates that average storm water concentrations due to dioxin emissions following the 2005 Topanga fire at the SSFL may be one to three orders of magnitude greater than the 2006 NPDES permit limit. The range of potential dioxin storm water concentrations presented in Table 13 also falls within the range of dioxin storm water concentrations measured at the SSFL in October and November of 2005, and presented in Figure 8 in Section 3.4.1.

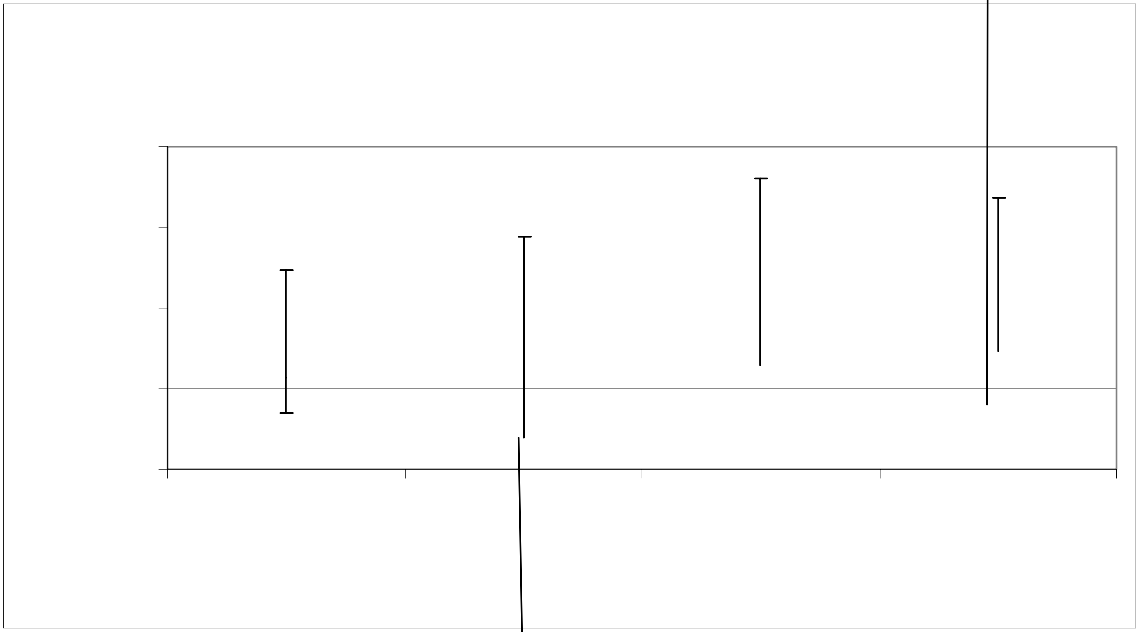
Table 12 – Order of Magnitude Estimate for Dioxin Concentration in

Table 13 – Statistical Distribution of SSFL TSS Concentrations

	Pre Fire Data			**Post Fire Data**		
TSS Data Comparison	Pre Fire Geometric Mean (mg/L)	Pre Fire Max Observed (mg/L)	Data Size (# Detects / # Samples)	Post Fire Geometric Mean (mg/L)	Post Fire Max Observed (mg/L)	Data Size (# Detects / # Samples)
North Slope (Outfalls 003-007, 009, 010)	14	300	(55/98)	20	4000	(30/62)
South Slope (Outfalls 001,002, 008, 011,018)	9	760	(58/140)	30	2300	(23/32)

Note: Determination of the statistical distribution assumed that non-detect TSS loads were equal to half the detection limit of 10 mg/L. Monitoring data utilized are from October 1998 to May 2006.

Figure 4 – Statistical Distribution of TSS Concentrations at the SSFL



(see Section 3.2.1) by the catchment-specific pre-fire TSS concentrations (see Section 3.3.1). The contribution of native soils to pre-fire storm water constituent concentrations is presented in Table 14a. Post-fire estimates were made using the average post-fire soil concentrations, average post-fire ash concentrations, and post-fire TSS concentrations, and are compared with pre-fire DTSC background soil comparison data, as shown in Table 14b. As presented in Table 11 and Appendix A, concentrations of regulated constituents are often higher in ash than they are in post-fire soils, although the post-fire soils data set is limited in size. Thus, the presence of ash in storm water runoff could result in even higher concentrations of regulated constituents than are presented in Tables 14a and 14b.

Table 14a – Estimated Storm Water Constituent Concentrations from Soil Erosion at the SSFL prior to the 2005 Topanga Fire

Metal	SSFL DTSC Pre-Fire Background Soil Comparison Concentration (mg/kg)	Pre-Fire SSFL TSS Associated Storm Water Concentration, North Slope [TSS 14 (5-300) (mg/L)] (µg/L)	Pre-Fire SSFL TSS Associated Storm Water Concentration, South Slope [TSS 9 (2.5-760) (mg/L)] (µg/L)	2006 NPDES Daily Maximum Permit Level (µg/L)	2006 NPDES Monthly Average Permit Limit (µg/L)
Antimony	8.7	0.12 (0.09-2.6)	0.1 (0.05-6.6)	6	--
Arsenic *	15	0.21 (0.15-4.5)	0.1 (0.1-11)	10	--
Barium	140	2.0 (1.4-42)	1.3 (0.8-110)	1000	--
Beryllium *	1.1	0.02 (0.01-0.3)	0.01 (0.01-0.8)	4	--
Boron	9.7	0.14 (0.10-2.9)	0.1 (0.06-7.4)	1000	--
Cadmium	1	0.01 (0.01-0.3)	0.01 (0.01-0.8)	3.1	2
Chromium *	36.8	0.5 (0.4-11)	0.4 (0.2-28)	16.3	8.1
Copper	29	0.4 (0.3-8.7)	0.3 (0.2-22)	14	7.1
Iron *	28000	390 (280-8400)	270 (170-21,300)	300	--
Lead	34	0.5 (0.3-10.2)	0.3 (0.2-26)	5.2	2.6
Manganese *	495	6.9 (5.0-150)	4.7 (3.0-380)	50	--
Mercury	0.09	0.001 (0.001-0.03)	0.001 (0.001-0.07)	0.1	0.05
Nickel *	29	0.4 (0.3-8.7)	0.3 (0.2-22)	96	35
Selenium *	0.655	0.01 (0.01 -0.2)	0.01 (0.004-0.5)	5.0	4.1
Silver *	0.79	0.01 (0.01 -0.2)	0.01 (0.005-0.6)	4.1	2
Thallium	0.46	0.01 (0.005-0.1)	0.01 (0.003-0.35)	2	--
Zinc *	110	1.5 (1.1-33)	1.1 (0.66-83.6)	119	54

The results shown in these graphs include the average, minimum, and maximum measured concentrations.

LACDPW Land Use Storm Water Data Set (red square): The LACDPW monitored storm water constituent concentrations in samples collected from various land use types from 1994 to 2000. Catchments representative of the eight dominant land use types within the County were used for these sampling events (see Los Angeles County, 2000). LACDPW reports the average and median concentrations and the coefficient of variation for each data set. Figures 5-7 presents the average concentration with error bars at plus or minus two standard deviations[14].

LACDPW Receiving Water Data (green triangle): LACDPW collects storm water samples from the Los Angeles River at the Wardlow Gage Station (near the Los Angeles River estuary) and from Sawpit Creek, a catchment that is 98% open space and located in the foothills of the San Gabriel Mountains. The plot includes the average, minimum, and maximum measured concentrations for samples collected from October 1998 to February 2006 (Los Angeles River) and November 1998 to March 2001 (Sawpit Creek). Sampling data were taken from the LACDPW's annual storm water quality reports (on line at http://ladpw.org/wmd/NPDES/report_directory.cfm).

Boeing Post Topanga Fire- Regional Drainage Storm Water Monitoring (purple circle): This data set is described in Section 3.2.1, and laboratory data can be found in Table A-3 in Appendix A. A total of 38 surface water wet weather samples were collected for copper, lead, and zinc at twelve sites from October 2005 to May 2006, following the Topanga and Harvard Fires.

Analysis of the data discussed above assumed that non-detect values were half of the detection limit[15].

Note that a similar comparison could not be made for mercury. LACDPW data could not be included, as the LACDPW laboratory analysis method for mercury uses a detection limit of 1 (µg/L). Almost all LACDPW samples resulted in non-detect levels of mercury (i.e., concentrations below 1 (µg/L)). Mercury concentrations in samples collected from the SSFL from September 2004 to November 2005 were analyzed and reported at a limit of 0.20 (µg/L).

As seen in Figures 5, 6, and 7 average concentrations of total copper, total lead, and total zinc in storm water samples collected from the SSFL before the 2005 Topanga fire are lower than average concentrations in storm water samples collected from several land use types (light industrial, transportation, commercial, and multi-family residential) within the Los Angeles Region, and are significantly lower than average concentrations in the Los Angeles River following storm events. The figures also show that even the maximum observed concentrations of total copper, lead and zinc in pre-fire storm water runoff from the SSFL

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[14] The standard deviation was calculated as the product of the mean and the coefficient of variation.

[15] Detection limit for copper = 5 µg/L for LACDPW data, 0.25-0.5 µg/L for Boeing data; lead = 5 µg/L for LACDPW data, 0.04-0.16 µg/L for Boeing data; zinc = 50 µg/L for LACDPW data, 3.7-15 µg/L for Boeing data.

are lower than the average measured concentrations of these metals in storm water runoff from several land use types and lower than the average measured concentrations of these metals in samples collected from the Los Angeles River following storm events.

Figure 5– Total Copper Concentrations in Storm Water Runoff from the SSFL, from Various Land Use Types, and in Surface Water in the Los Angeles Region

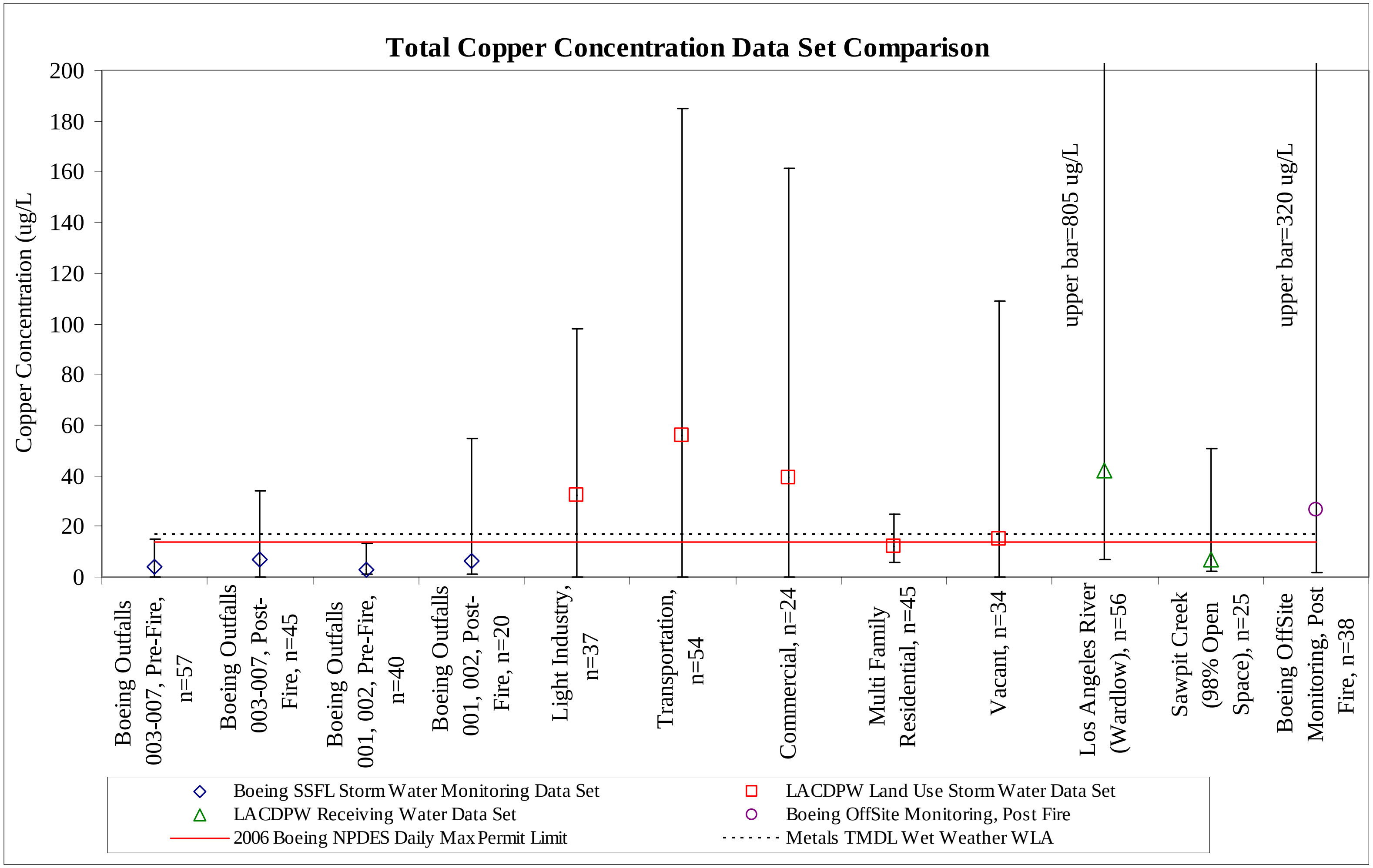
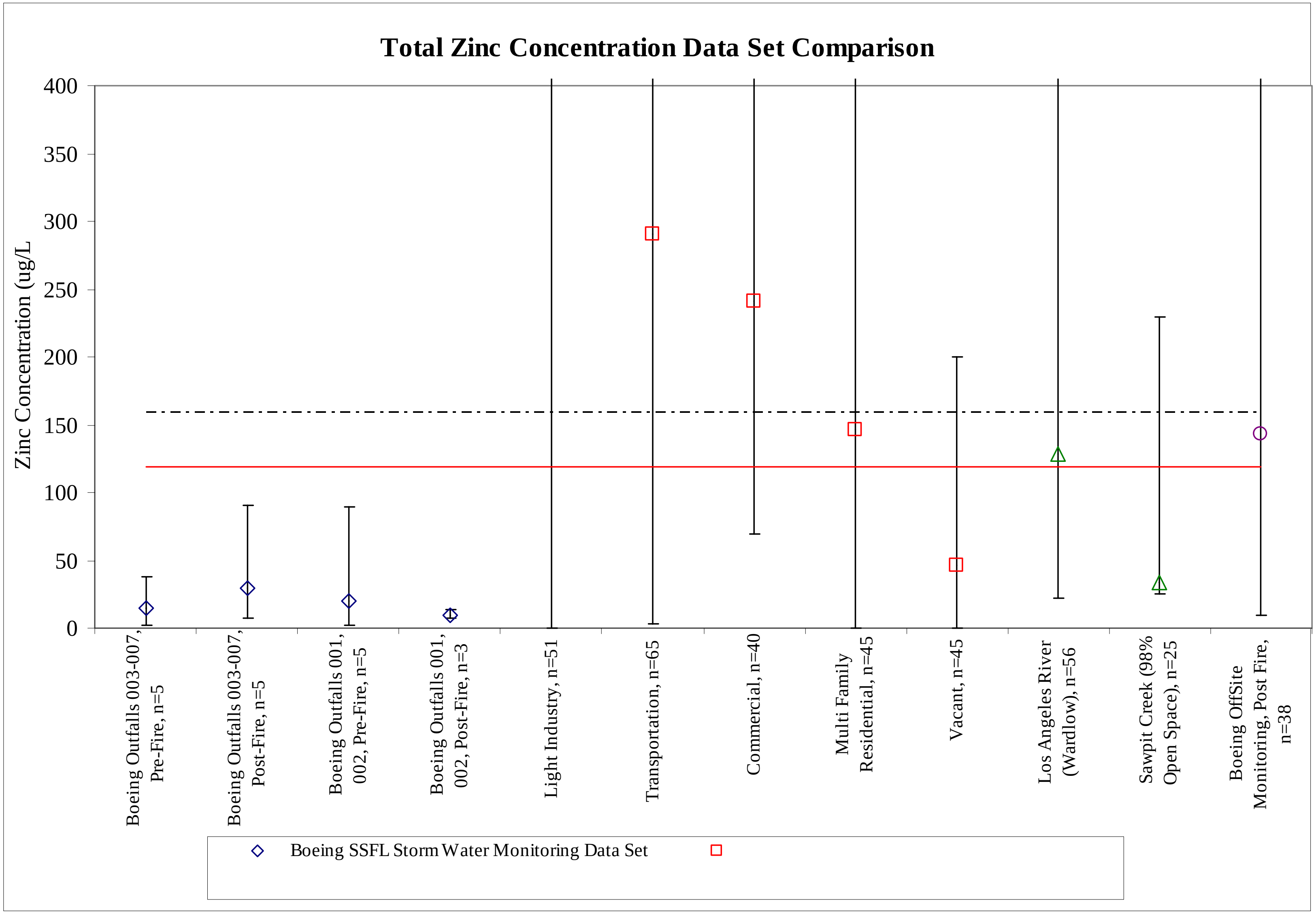


Figure 7– Total Zinc Concentrations in Storm Water Runoff from the SSFL, from Various Land Use Types, and in Surface Water in the Los Angeles Region



3.4.2 Concentrations of Dioxin in storm water runoff from SSFL, from Various Land Use Types, and Within Receiving Waters in the Los Angeles Region

Figure 8 summarizes available information on dioxin concentrations in storm flows from industrial facilities and in urban runoff throughout the Los Angeles Region and in runoff from the SSFL site. Data shown in Figure 8 can be characterized as follows:

Boeing SSFL Storm Water Monitoring Data Set (blue diamond): Storm water monitoring data from samples collected from September 2004 to November 2005 were divided into three representative data sets, as follows:

Pre-fire samples from Outfalls 003-007 (87 samples from October 2004 to April 2005)

Post-fire samples from Outfalls 003-007 (68 samples from October 2005 to May 2006)

Pre-fire samples from Outfalls 001 and 002 (37 samples from October 2004 to May 2005).

Post-fire samples from Outfalls 001 and 002 (14 samples from October 2005 to May 2006).

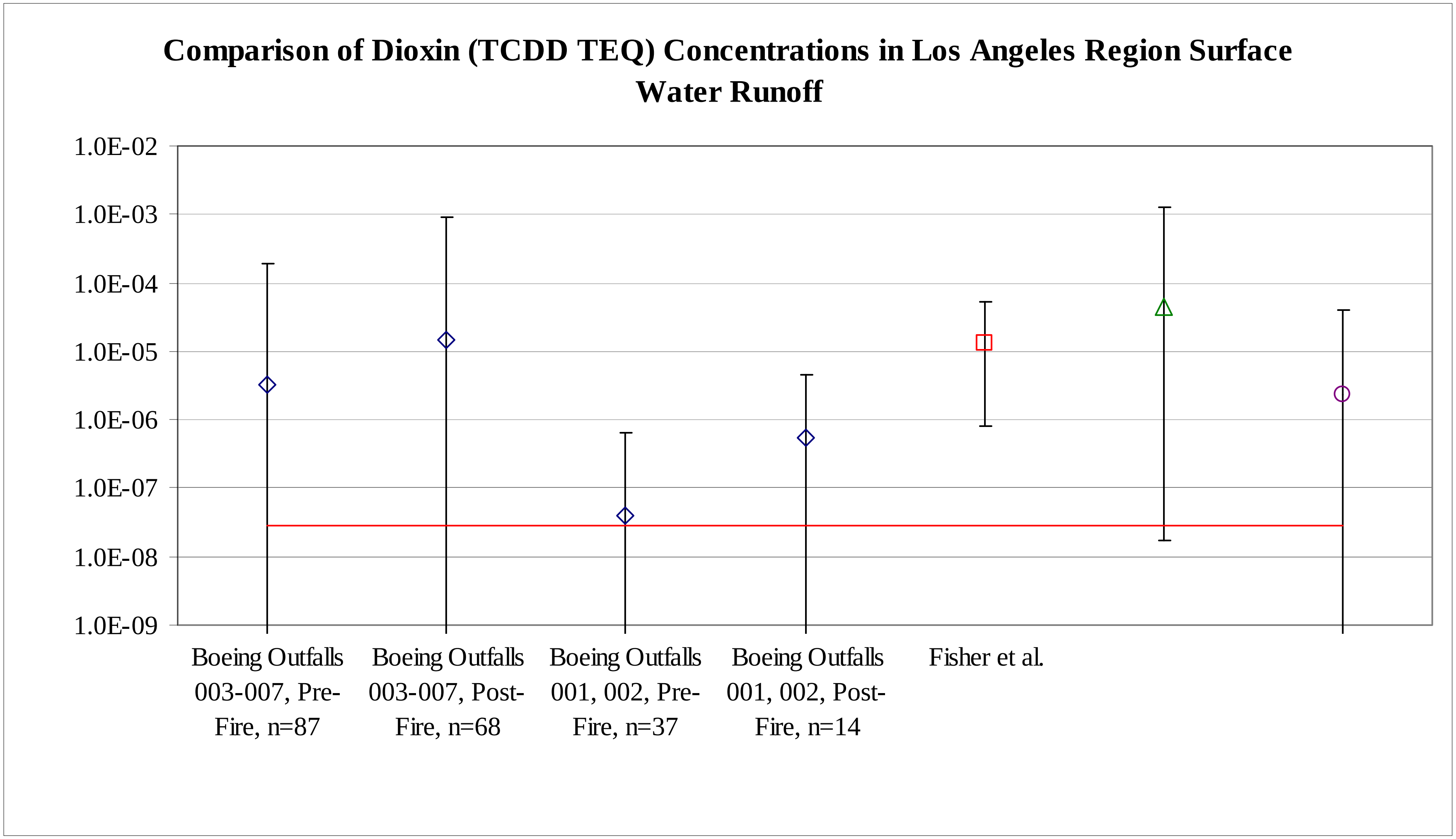
The results shown in these graphs include the average, minimum, and maximum measured concentrations.

Fisher et al., 1999, data set (red square): Fisher et al. collected 18 samples, including 12 dry weather samples and six wet weather samples from four sampling sites in the Santa Monica Basin during 1988-1989. The average, minimum, and maximum TCDD (TEQ) concentrations from wet weather events are shown in this figure.

Los Angeles Regional Board data set (green triangle): The Regional Board issued a Cal. Water Code §13267 request on August 3, 2001 asking for monitoring data for priority pollutants regulated pursuant to the California Toxics Rule, including TCDD (TEQ) ("dioxin"). Preliminary review of records received by the Regional Board for storm water samples collected by ten different permittees and at two non-permitted sites is shown in Figure 8. This plot shows the preliminary data analysis for the average, minimum, and maximum concentrations from 38 samples collected at 21 sites between September 2001 and March 2005. Samples were collected during both wet and dry weather conditions from industrial process water, storm flow runoff, and receiving waters. (Note that Boeing participated in this survey and submitted data on dioxin concentrations measured in storm water from the SSFL. Samples results from samples collected by Boeing were not included in the data represented by the green triangle.)

Boeing Post Topanga Fire Regional Drainage Storm Water Monitoring (purple circle): This data set is outlined in Section 3.2.1 with accompanying Table A-3 in Appendix A. Post Topanga and Harvard Fires Sampling occurred at ten sites with a total of 19 surface water wet weather samples from October 2005 to January 2006.

Figure 8– Comparison of Dioxin [TCDD (TEQ)] Concentrations in Storm Water Runoff from the SSFL, from Los Angeles Region Land Use Types, and in Surface Water



As shown in Figure 8, dioxin concentrations in storm water runoff are highly variable (note the logarithmic scale), and average dioxin con

4. RESULTS OF TESTS OF BMP AND HYDROMULCH MATERIALS

4.1 BMP AND HYDROMULCH MATERIALS TEST METHODOLOGY

Boeing conducted a series of tests in 2005 and 2006 to estimate the concentrations of regulated constituents in various best management practice (BMP) materials and to facilitate selection of materials that would minimize the potential for exceedances of permit limits in storm water runoff from the SSFL site. BMP materials are used to manage and filter storm water runoff at multiple locations on the SSFL site.

A wide range of BMP materials were tested, including several types of sand and gravel. Hydromulch materials considered for use following the 2005 Topanga fire were also tested. Several testing procedures were followed for each

Table 16 – BMP and Erosion Control Materials and Testing Procedures

Sample ID	BMP/ Erosion Control Material Group	BMP Material	Variable Testing Procedures
IOJ1924-01 DIWET	Sand	Colorado filter sand	Leached (1 hr.), filtered
IOJ1924-01RE1 DIWET	Sand	Colorado filter sand	Rinsed, leached (1 hr.), filtered
IOJ1924-02	Sand	Colorado filter sand	Rinsed, leached (1 hr.)
IOJ1924-03	Sand	Colorado filter sand	Rinsed, soaked (1 hr.)
IOJ1924-04	Sand	Colorado filter sand	Rinsed, soaked (15 min.)
IOJ1230-01 DIWET	Sand	Corona filter sand	Leached (24 hr.), filtered
IOJ1230-01RE1 DIWET	Sand	Corona filter sand	Leached (1 hr.), filtered
IOJ1230-01RE2 DIWET	Sand	Corona filter sand	Rinsed, leached (1 hr.), filtered
IOJ1230-02	Sand	Corona filter sand	Rinsed, leached (1 hr.)
IOJ1230-03	Sand	Corona filter sand	Rinsed, soaked (1 hr.)
IOJ1230-04	Sand	Corona filter sand	Material from IOJ1230-02 used, soaked (15 min.)
IPH2374-05	Sand	Moorpark filter sand	Leached (18 hrs.)
IPH2374-06	Sand	Irwindale filter sand	Leached (18 hrs.)
IPH2351-07	Sand	#8 Sand	Leached (18 hrs.)
IOK0111-01	Gravel	Road gravel	Rinsed, soaked (15 min.), filtered and unfiltered
IOK0111-02	Gravel	Pea bag gravel	Rinsed, soaked (15 min.), filtered and unfiltered
IOK0111-03	Gravel	Birds eye gravel	Rinsed, soaked (15 min.), filtered and unfiltered
IPH2351-08	Rock	Gabion rock	Crushed, leached (18 hrs.)
IPH2351-09	Rock	2”<Rock	Crushed, leached (18 hrs.)
IPH2351-10	Rock	Riprap	Leached (18 hrs.)
IOK1695-01	Hydromulch	Naka Hydroseed	Leached, soaked (15 min.), filtered and unfiltered
IOK0964-01	Hydromulch	Soil Set	Liquid material analysis
IOK0964-02	Hydromulch	StarTak 600	Water analysis, filtered and unfiltered
IOK0964-03	Hydromulch	Eco Fibre	Water analysis, filtered and unfiltered
IOK0964-04	Hydromulch	Eco Aegis	Water analysis, filtered and unfiltered
IOK0964-05	Hydromulch	Applegate N/D	Water analysis, filtered and unfiltered
IOK0964-06	Hydromulch	Applegate W/D	Water analysis, filtered and unfiltered
IOK0964-07	Hydromulch	Soil Guard	Water analysis, filtered and unfiltered
IOK0964-08	Hydromulch	Mat Fibre	Water analysis, filtered and unfiltered
IOK0964-09	Hydromulch	Eco Blend	Water analysis, filtered and unfiltered
IOK0964-10	Hydromulch	StarTak 600	Solid material analysis
IOK0964-11	Hydromulch	Eco Fibre	Solid material analysis
IOK0964-12	Hydromulch	Eco Aegis	Solid material analysis
IOK0964-13	Hydromulch	Applegate N/D	Solid material analysis
IOK0964-14	Hydromulch	Applegate W/D	Solid material analysis
IOK0964-15	Hydromulch	Soil Guard	Solid material analysis
IOK0964-16	Hydromulch	Mat Fibre	Solid material analysis
IOK0964-17	Hydromulch	Eco Blend	Solid material analysis
IPJ1500-02	Hydromulch	FlexTerra Hydromulch	Water analysis

Source: Boeing, 2005, 2006.

Table 17 – Regulated Constituents Analyzed During BMP and Erosion Control Materials

Constituent	SSFL 2006 NPDES Permit Limit (Daily Maximum)
Antimony	6.0 µg/l
Arsenic*	50 µg/l
Barium	1.0 mg/l
Beryllium	4.0 µg/l
Boron	1.0 µg/l
Cadmium	3.1 µg/l
Chromium*	16.3 µg/l
Copper	14.0 µg/l
Iron*	0.3 mg/l
Lead	5.2 µg/l
Manganese*	50 µg/l
Mercury	0.10 µg/l
Nickel*	96 µg/l
Selenium*	5.0 µg/l
Silver*	4.1 µg/l
Thallium	2.0 µg/l
Zinc*	119 µg/l
Dioxin TEQ	2.8×10^{-8} µg/l

Source: SSFL 2006 NPDES Permit (Order No. R4-2006-008).
* These constituents have permit limits for Outfalls 001, 002, 011, and 018 only.

4.2 BMP MATERIALS TESTING RESULTS

Given that, once in place, the BMP materials function as filters at the site, the passive soaking methodology best represents concentrations that would result from contact of storm water with BMP materials. Results presented in this section are a subset of the complete results of Boeing's BMP materials testing program as described above. (Complete results are presented in Appendix B.) The results summarized in Tables 18a through 18q include data from tests where BMP materials were soaked and the supernatant was not filtered. In the sand and gravel cases presented in Table 18, the materials were also rinsed before ed a5exceede07 -

After reviewing the results of these tests, Boeing selected the Corona filter sand and the Bird’s eye gravel for use in the BMPs empl

Table 18b– Contributions to ARSENIC Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (ug/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	ND	50	0.00
Sand	Corona Filter Sand	14	50	0.28
Sand	Moorpark Filter Sand	ND	50	0.00
Sand	Irwindale Filter Sand	4.4	50	0.09
Sand	#8 Sand	ND	50	0.00
Gravel	Birds Eye Gravel	13	50	0.26
Gravel	Pea Bag Gravel	70	50	**1.40**
Gravel	Road Gravel	11	50	0.22
Rock	Gabion Rock	ND	50	0.00
Rock	2"<Rock	ND	50	0.00
Rock	Riprap	ND	50	0.00
Hydroseed	Applegate N/D	ND	50	0.00
Hydroseed	Applegate W/D	ND	50	0.00
Hydroseed	Eco Aegis	12	50	0.24
Hydroseed	Eco Blend	ND	50	0.00
Hydroseed	Eco Fibre	ND	50	0.00
Hydroseed	Mat Fibre	ND	50	0.00
Hydroseed	Naka Hydroseed	6.8	50	0.14
Hydroseed	Soil Guard	ND	50	0.00
Hydroseed	Soil Set	ND	50	0.00
Hydroseed	Star Tak	ND	50	0.00
Hydromulch	FlexTerra	5.4	50	0.11

Source: Boeing, 2005, 2006.

Table 18c – Contributions to BARIUM Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (mg/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	0.056	1	0.06
Sand	Corona Filter Sand	0.052	1	0.05
Sand	Moorpark Filter Sand	0.017	1	0.02
Sand	Irwindale Filter Sand	0.054	1	0.05
Sand	#8 Sand	0.014	1	0.01
Gravel	Birds Eye Gravel	0.32	1	0.32
Gravel	Pea Bag Gravel	0.78	1	0.78
Gravel	Road Gravel	0.23	1	0.23
Rock	Gabion Rock	ND	1	0.00
Rock	2"<Rock	ND	1	0.00
Rock	Riprap	ND	1	0.00

Table 18e – Contributions to BORON Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (mg/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	ND	---	---
Sand	Corona Filter Sand	ND	---	---
Sand	Moorpark Filter Sand	0.026	---	---
Sand	Irwindale Filter Sand	0.095	---	---
Sand	#8 Sand	0.046	---	---
Gravel	Birds Eye Gravel	ND	---	---
Gravel	Pea Bag Gravel	0.064	---	---
Gravel	Road Gravel	0.010	---	---
Rock	Gabion Rock	0.089	---	---
Rock	2"<Rock	0.04	---	---
Rock	Riprap	0.032	---	---
Hydroseed	Applegate N/D	0.40	---	---
Hydroseed	Applegate W/D	0.17	---	---
Hydroseed	Eco Aegis	0.030	---	---
Hydroseed	Eco Blend	ND	---	---
Hydroseed	Eco Fibre	0.041	---	---
Hydroseed	Mat Fibre	ND	---	---
Hydroseed	Naka Hydroseed	0.057	---	---
Hydroseed	Soil Guard	0.012	---	---
Hydroseed	Soil Set	0.0084	---	---
Hydroseed	Star Tak	ND	---	---
Hydromulch	FlexTerra	0.44	---	---

Source: Boeing, 2005, 2006.

Table 18f – Contributions to CADMIUM Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (ug/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	0.15	3.1	0.05
Sand	Corona Filter Sand	0.045	3.1	0.01
Sand	Moorpark Filter Sand	ND	3.1	0.00
Sand	Irwindale Filter Sand	0.034	3.1	0.01
Sand	#8 Sand	ND	3.1	0.00
Gravel	Birds Eye Gravel	1.4	3.1	0.45
Gravel	Pea Bag Gravel	0.77	3.1	0.25
Gravel	Road Gravel	0.63	3.1	0.20
Rock	Gabion Rock	ND	3.1	0.00
Rock	2"<Rock	ND	3.1	0.00
Rock	Riprap	ND	3.1	0.00
Hydroseed	Applegate N/D	0.13	3.1	0.04

Hydroseed	Applegate W/D	0.15	3.1	0.05
Hydroseed	Eco Aegis	0.18	3.1	0.06
Hydroseed	Eco Blend	0.11	3.1	0.04
Hydroseed	Eco Fibre	0.24	3.1	0.08
Hydroseed	Mat Fibre	0.041	3.1	0.01
Hydroseed	Naka Hydroseed	0.31	3.1	0.10
Hydroseed	Soil Guard	0.47	3.1	0.15
Hydroseed	Soil Set	0.70	3.1	0.23
Hydroseed	Star Tak	ND	3.1	0.00
Hydromulch	FlexTerra	ND	3.1	0.00

Source: Boeing, 2005, 2006.

Table 18g – Contributions to CHROMIUM Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (ug/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	10	16.3	0.61
Sand	Corona Filter Sand	15	16.3	0.92
Sand	Moorpark Filter Sand	15	16.3	0.92
Sand	Irwindale Filter Sand	ND	16.3	0.00
Sand	#8 Sand	ND	16.3	0.00
Gravel	Birds Eye Gravel	58	16.3	**3.56**
Gravel	Pea Bag Gravel	100	16.3	**6.13**
Gravel	Road Gravel	38	16.3	**2.33**
Rock	Gabion Rock	ND	16.3	0.00
Rock	2"<Rock	ND	16.3	0.00
Rock	Riprap	ND	16.3	0.00

Table 18h – Contributions to COPPER Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (ug/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	17	14	**1.21**
Sand	Corona Filter Sand	22	14	**1.57**
Sand	Moorpark Filter Sand	0.4	14	0.03
Sand	Irwindale Filter Sand	3.4	14	0.24
Sand	#8 Sand	0.35	14	0.03
Gravel	Birds Eye Gravel	32	14	**2.29**
Gravel	Pea Bag Gravel	86	14	**6.14**
Gravel	Road Gravel	25	14	**1.79**
Rock	Gabion Rock	0.27	14	0.02
Rock	2"<Rock	ND	14	0.00
Rock	Riprap	0.33	14	0.02
Hydroseed	Applegate N/D	7.1	14	0.51
Hydroseed	Applegate W/D	10	14	0.71
Hydroseed	Eco Aegis	8.4	14	0.60
Hydroseed	Eco Blend	4.2	14	0.30
Hydroseed	Eco Fibre	11	14	0.79
Hydroseed	Mat Fibre	2.8	14	0.20
Hydroseed	Naka Hydroseed	9.2	14	0.66
Hydroseed	Soil Guard	5.9	14	0.42
Hydroseed	Soil Set	140	14	**10.00**

Sand	Corona Filter Sand	140	50	**2.80**
Sand	Moorpark Filter Sand	ND	50	0.00
Sand	Irwindale Filter Sand	52	50	**1.04**
Sand	#8 Sand	ND	50	0.00
Gravel	Birds Eye Gravel	400	50	**8.00**
Gravel	Pea Bag Gravel	3300	50	**66.00**
Gravel	Road Gravel	610	50	**12.20**
Rock	Gabion Rock	12	50	0.24
Rock	2"<Rock	ND	50	0.00
Rock	Riprap	ND	50	0.00
Hydroseed	Applegate N/D	65	50	**1.30**
Hydroseed	Applegate W/D	44	50	0.88
Hydroseed	Eco Aegis	300	50	**6.00**
Hydroseed	Eco Blend	63	50	**1.26**
Hydroseed	Eco Fibre	540	50	**10.80**
Hydroseed	Mat Fibre	67	50	**1.34**
Hydroseed	Naka Hydroseed	280	50	**5.60**
Hydroseed	Soil Guard	190	50	**3.80**
Hydroseed	Soil Set	33	50	0.66
Hydroseed	Star Tak	ND	50	0.00
Hydromulch	FlexTerra	ND	50	0.00

Source: Boeing, 2005, 2006.

Table 18l – Contributions to MERCURY Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (ug/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	ND	0.1	0.00
Sand	Corona Filter Sand	ND	0.1	0.00
Sand	Moorpark Filter Sand	ND	0.1	0.00
Sand	Irwindale Filter Sand	ND	0.1	0.00
Sand	#8 Sand	ND	0.1	0.00
Gravel	Birds Eye Gravel	0.086	0.1	0.86
Gravel	Pea Bag Gravel	0.23	0.1	**2.30**
Gravel	Road Gravel	0.12	0.1	**1.20**
Rock	Gabion Rock	ND	0.1	0.00
Rock	2"<Rock	ND	0.1	0.00
Rock	Riprap	ND	0.1	0.00
Hydroseed	Applegate N/D	ND	0.1	0.00
Hydroseed	Applegate W/D	ND	0.1	0.00
Hydroseed	Eco Aegis	ND	0.1	0.00
Hydroseed	Eco Blend	ND	0.1	0.00
Hydroseed	Eco Fibre	ND	0.1	0.00
Hydroseed	Mat Fibre	ND	0.1	0.00
Hydroseed	Naka Hydroseed	ND	0.1	0.00
Hydroseed	Soil Guard	ND	0.1	0.00

Hydroseed	Soil Set	ND	0.1	0.00
Hydroseed	Star Tak	ND	0.1	0.00
Hydromulch	FlexTerra	ND	0.1	0.00

Source: Boeing, 2005, 2006.

Table 18m – Contributions to NICKEL Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (ug/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	4	96	0.05
Sand	Corona Filter Sand	12	96	0.13
Sand	Moorpark Filter Sand	ND	96	0.00
Sand	Irwindale Filter Sand	2.8	96	0.03
Sand	#8 Sand	ND	96	0.00
Gravel	Birds Eye Gravel	26	96	0.27
Gravel	Pea Bag Gravel	59	96	0.61
Gravel	Road Gravel	27	96	0.28
Rock	Gabion Rock	ND	96	0.00
Rock	2"<Rock	ND	96	0.00
Rock	Riprap	ND	96	0.00
Hydroseed	Applegate N/D	ND	96	0.00
Hydroseed	Applegate W/D	ND	96	0.00
Hydroseed	Eco Aegis	ND	96	0.00
Hydroseed	Eco Blend	ND	96	0.00
Hydroseed	Eco Fibre	2.2	96	0.02
Hydroseed	Mat Fibre	ND	96	0.00
Hydroseed	Naka Hydroseed	4.1	96	0.04
Hydroseed	Soil Guard	3.4	96	0.04
Hydroseed	Soil Set	7.2	96	0.08
Hydroseed	Star Tak	ND	96	0.00
Hydromulch	FlexTerra	ND	96	0.00

Source: Boeing, 2005, 2006.

Table 18n – Contributions to SELENIUM Concentrations from BMP Materials

BMP/Erosion Control Material Type	BMP Material	Concentration (ug/l)	SSFL 2006 NPDES Daily Max Permit Limit	Sample Result / Permit Limit
Sand	Colorado Filter Sand	0.96	8.2	0.12
Sand	Corona Filter Sand	1.5	8.2	0.18
Sand	Moorpark Filter Sand	ND	8.2	0.00
Sand	Irwindale Filter Sand	ND	8.2	0.00
Sand	#8 Sand	4.1	8.2	0.50
Gravel	Birds Eye Gravel	12	8.2	**1.46**
Gravel	Pea Bag Gravel	ND	8.2	0.00

Gravel	Road Gravel	1.1	8.2	0.13
Rock	Gabion Rock	ND	8.2	0.00
Rock	2"<Rock	ND	8.2	0.00
Rock	Riprap	ND	8.2	0.00
Hydroseed	Applegate N/D	ND	8.2	0.00
Hydroseed	Applegate W/D	ND	8.2	0.00
Hydroseed	Eco Aegis	ND	8.2	0.00

Hydroseed	Applegate W/D	22	119	0.18
Hydroseed	Eco Aegis	32	119	0.27
Hydroseed	Eco Blend	26	119	0.22
Hydroseed	Eco Fibre	41	119	0.34
Hydroseed	Mat Fibre	15	119	0.13
Hydroseed	Naka Hydroseed	51	119	0.43
Hydroseed	Soil Guard	67	119	0.56
Hydroseed	Soil Set	54	119	0.45
Hydroseed	Star Tak	ND	119	0.00
Hydromulch	FlexTerra	ND	119	0.00

Source: Boeing, 2005, 2006.

Table 18r – Contributions to DIOXIN TEQ

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APPENDIX A

ANALYTICAL DATA SUMMARY

APPENDIX A T6w

The folders of this appendix also contain electronic copies of validation reports, chain-of-custody (COC) forms, and chain-of-custody analytical re

Table A-1

Soil Background Metals Data Set		**10,000**	1	U	3.2	77.2	0.34	**2.7**	UJ	0.25		13.9	5
BKND-6	0	**8,500**	1.1	U	6.3	110	0.37	**2.7**		0.23		15.8	5.8
BKND-7	0	**11,000**	1.1	U	3.9	109	0.48	**4.5**		0.4		21.9	10
BZSS01D01	0.5	10,300	8.7	J	5.9	58.6	0.63	**2.7**		0.06	UJ	16.3	7.2

BZSS01S01	0.5	10,700		6.4	J	5.8		62.8		0.59		**2.3**		0.06	UJ	16.7	7.5	8.7	**1.9**	UJ	**17,000**	8	**19**	J	**320**	0.07		5.2		13.8
BZSS02S01	0.5	11,900		4.4	J	4.2		69.2		0.47		**1.2**	U	0.06	UJ	16.6	5.4	8.2	**2.3**	UJ	**17,000**	18	**16**	J	**210**	0.07		2.6		12
BZSS03S01	0.5	15,800		7.4	J	8.4		103		0.85		**5.3**	UJ	0.06	UJ	23.2	7.5	14.5	**2.9**	UJ	**24,000**	14.4	**28**	J	**320**	0.07		1.1		16.6
BZSS03S02	1	18,100		8.7	J	8.5		106		0.99		**6.2**	UJ	0.06	UJ	26.2	8.4	15.1	**4**	UJ	**28,000**	10.8	**34**	J	**330**	0.08		0.83	U	17.4
BZSS04S01	0.5	14,500		6.3	J	3.2		91.8		0.63		**2.6**		0.06	UJ	18.8	6.2	8.9	**2**	UJ	**20,000**	14.3	**16**	J	**290**	0.09		0.77	U	11.9
SGSS01S01	0	12,000		0.982	U	0.982	U	106		0.463		1.31	U	0.655	U	18.3	7.59	7.77	**1.7**	UJ	**18,000**	10.9	**23**	J	**320**	0.11	U	0.328	U	13.9
BZSS06S01	0	12,400		1.03	U	1.03	U	90.4		0.468		1.37	U	0.685		18.4	8.1	7.99	**1.9**	UJ	**17,000**	12.8	**21**	J	**310**	0.115	U	0.343	U	12.2
BZSS05S01	0	**10,000**		**0.66**	UJ	**4.1**		**66**		**0.48**		**3.6**	UJ	**0.39**		**15**	**4.9**	**11**	**2.6**	UJ	**14,000**	**14**	**15**	J	**310**	**0.02**		**0.62**		**11**
BG01005	0 - 1	**12,000**		**0.47**	UJ	2.1	J	**75**		0.66		**0.97**	U	0.5	U	21	**5.4**	11	**3.2**	J	**20,000**	18	**16**	J	**260**	**0.027**		**0.62**		16
BG01008	0 - 1	**13,000**		**0.48**	UJ	2.2	J	**72**		0.61		**0.98**	U	0.5	U	21	**6.9**	11	**2.6**	J	**13,000**	9.5	**15**	J	**310**	**0.029**		**0.69**		16
BG01100	0 - 1	**12,000**		**0.49**	UJ	1.7	J	**69**		0.71		**1**	U	0.5	U	22	**5.4**	12	**3.1**	UJ	**20,000**	26	**18**	J	**300**	**0.026**		**0.7**		16
BG02007	0 - 1	**9,600**		**0.5**	UJ	3.6	J	**71**		0.53		**8**	UJ	0.5	U	14	**4.7**	10	**2.4**	UJ	**19,000**	34	**19**	J	**300**	**0.031**		**0.94**		9.1
BG02074	0 - 1	**9,500**		**0.5**	UJ	1.7	J	**76**		0.46		**5.2**	UJ	0.5	U	16	**21**	17	**3.3**	UJ	**15,000**	6.5	**18**	J	**350**	**0.039**		**0.82**		14
BG02076	0 - 1	**9,200**		**0.55**	UJ	2.9	J	**68**		0.54		**4.6**	UJ	0.5	U	14	**4.5**	11	**3.2**	UJ	**14,000**	12	**16**	J	**270**	**0.029**		**0.8**		10
BG04025	0 - 1	**20,000**		2.5	UJ	3.3	J	**92**		0.65		**9.7**	J	0.5	U	23	**9.3**	20	**3**	J	**28,000**	18	**37**	J	**380**	**0.034**		**0.41**		16
BG04029	0 - 1	**14,000**		2.5	UJ	3	J	**84**		0.73		**8.5**	J	0.5	U	23	**8.3**	14	**2.6**	J	**26,000**	15	**33**	J	**350**	**0.031**		**0.47**		15
BG04090	0 - 1	**13,000**		2.5	UJ	3	J	**80**		0.65		**8.6**	J	0.5	U	24	**8.1**	14	**2.4**	J	**26,000**	20	**35**	J	**340**	**0.04**		**0.47**		14
BCSS09S01	0	5,600		**0.18**	UJ	9		36		0.5	U	**3**	UJ	1	U	9	4	6	2.2		**25,000**	7	**27**	J	**300**	**0.032**		**0.76**		7
BCSS11S01	0	13,000		**0.46**	UJ	5	U	97		0.7		**5.9**	UJ	1		17	5	8	1.7		**20,000**	10	**12**	J	**410**	**0.048**		**4.4**		14
BCSS12S01	0	11,000		**0.6**	UJ	6	U	82		0.7		**4**		1	U	16	6	9	4.3		**28,000**	14	**29**	J	**420**	**0.019**		**2**		12
BCSS13S01	0	13,000	J	**0.38**	UJ	5	U	84	J	1.1		**6.6**	UJ	1	U	22	8	17	2.7		**23,000**	25	**29**	J	**370**	**0.054**		**0.93**		17
BCBS09S01	0	18,000	J	--		14		140	J	1.1		--		1	U	29	12	28	6.7		--	29	--		--	--		--		29
BCSS14S01	0	16,000	J	**0.56**	UJ	16		87	J	1		**5.6**		1	U	25	10	30	3.5		**27,000**	23	**31**	J	**390**	**0.023**		**0.73**		

Table A-1
Soil Background Metals Data Set
Santa Susana Field Laboratory

Page 2 of 2

SAMPLE ID	Depth (ft. bgs)																		
BGSS01S01	0.5	**3,100**		0.47	U	0.76	U	**100**	J	**0.21**	UJ	38.2		70.4		**1.9**	U	**6.82**	J
BGSS02S01	0.5	**1,800**		0.46	U	0.74	U	**50**		**0.19**	UJ	16.7		41.8		**1.7**	U	**7.27**	J
BGSS02S02	1	**2,000**		0.47	U	0.75	U	**45**		**0.16**	UJ	14.7		40.7		**1.6**	U	**7.07**	J
BGSS03D01	0.5	**4,300**		0.72		0.75	U	**63**	J	**0.31**		27.3		63.6		**3.1**	J	**8.25**	J
BGSS03S01	0.5	**3,900**		0.59		0.74	U	**57**	J	**0.31**		25.5		61.3		**3.3**	J	**8.08**	J
BGSS03S02	1	**3,900**		0.53		0.74	U	**66**	J	**0.29**	J	28.1		62.8					
BGSS04S01	0.5																		
BGSS06S01	0.5																		
BGSS07S01	0.5																		
BKND-1	0																		
BKND-2	0																		
BKND-3	0																		
BKND-4	0																		
BKND-5	0																		
BKND-6	0																		
BKND-7	0																		
BZSS01D01	0.5																		
BZSS01S01	0.5																		
BZSS02S01	0.5																		
BZSS03S01	0.5																		
BZSS03S02	1																		
BZSS04S01	0.5																		
SGSS01S01	0																		
BZSS06S01	0																		
BZSS05S01	0																		
BG01005	0 - 1																		
BG01008	0 - 1																		
BG01100	0 - 1																		
BG02007	0 - 1																		
BG02074	0 - 1																		
BG02076	0 - 1																		
BG04025	0 - 1																		
BG04029	0 - 1																		
BG04090	0 - 1																		
BCSS09S01	0																		
BCSS11S01	0																		
BCSS12S01	0																		
BCSS13S01	0																		
BCBS09S01	0																		
BCSS14S01	0																		
BCSS14D01	0																		
Comparison Value																			

Table A-2
Soil Background Dioxins Data Set
Santa Susana Field Laboratory

Page 1 of 2

SAMPLE ID	Depth (feet bgs)	2,3,7,8-TCDD		2,3,7,8-TCDF		1,2,3,7,8-PeCDD		1,2,3,7,8-PeCDF		2,3,4,7,8-PeCDF		1,2,3,4,7,8-HxCDD		1,2,3,6,7,8-HxCDD		1,2,3,7,8,9-HxCDD		1,2,3,4,7,8-HxCDF		1,2,3,6,7,8-HxCDF		1,2,3,7,8,9-HxCDF		2,3,4,6,7,8-HxCDF		1,2,3,4,6,7,8-HpCDD		1,2,3,4,6,7,8-HpCDF	
BCBS09S01	0	2	U	2	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
BCSS09S01	0	0.99	U	0.99	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
BCSS11S01	0	1	U	1	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
BCSS12S01	0	0.99	U	0.99	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
BCSS13S01	0	1	U	1	U	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U	5	U	5.2	U
BCSS14D01	0	1.3	U	1.3	U	6.4	U	6.4	U	6.4	U	6.4	U	6.4	U	6.4	U	6.4	U	6.4	U	6.4	U	6.4	U	6	U	6.4	U
BCSS14S01	0	1.4	U	1.4	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	7	U	6.8	U
BKND-1	0	0.57	U	0.72	J	0.12	J	0.21	J	0.33	UJ	0.41	U	0.43	J	0.48	J	0.35	J	0.44	U	0.23	U	5.1	U	7		1.7	UJ
BKND-2	0	0.66	U	1.1	J	0.26	UJ	0.4	J	0.38	J	0.27	J	0.63	J	0.77	J	0.48	J	0.58	U	0.21	U	5.4	U	8		1.6	UJ
BKND-3	0	0.78	U	0.45	UJ	0.44	U	0.48	U	0.17	J	0.2	UJ	0.49	UJ	0.69	J	0.23	UJ	0.62	U	0.33	UJ	5	U	9		1.6	J
BKND-4	0	0.44	U	0.29	J	0.24	U	0.32	U	0.12	U	0.13	UJ	0.57	J	0.63	J	0.28	J	0.43	U	0.27	UJ	5.1	U	8	J	1.7	J
BKND-5	0	0.52	U	1.4		0.46	U	0.45	J	0.44	J	0.18	J	0.74	J	0.7	J	0.57	UJ	0.71	U	0.1	J	5.2	U	9	J	2.4	UJ
BKND-6	0	0.84	U	1.8	J	0.76	U	0.59	J	0.64	J	0.75	U	0.95	J	1.1	J	0.73	J	1	U	0.43	J	5.3	U	11	J	3.6	UJ
BKND-7	0	0.6	U	1.3	UJ	0.18	J	0.34	U	0.5	J	0.2	J	0.76	UJ	0.81	J	0.56	J	0.69	U	0.21	U	5.3	U	9		2	UJ
BZSS05S01	0	0.16	U	0.15	U	0.4	U	0.18	U	0.16	U	0.13	U	0.84	J	1	J	0.16	U	0.16	U	0.1	U	0.14	U	4	UJ	0.8	J
BZSS06S01	0	0.15	U	0.18	U	0.31	U	0.31	U	0.28	U	0.21	U	0.22	U	0.2	U	0.11	U	0.11	U	0.088	U	0.09	U	2	UJ	0.49	
SGSS01S01	0	0.24	U	0.34	J	0.43	U	0.22	U	0.54		0.34	J	0.77	J	0.64	J	0.47		0.3		0.14	U	0.45		13		2.5	
Comparison Value		0.5 (d)		1.8		0.18		0.59		0.64		0.34		0.95		1.1		0.73		0.3		0.43		0.45		13		2.5	

(a) TEQ values were calculated using detected congener concentrations and WHO toxicity equivalency factors. For comparison, western United States dioxin TEQs typically range up to 2 pg/g or parts per trillion.

(b) TEQ values do not include total dioxin or total furan concentrations.

(c) Data set is for characterization and risk assessment evaluation of onsite investigational units for the SSFL RCRA Program.

(d) = values correspond to the representative soil reporting limit (as analyzed by Alta Analytical Laboratory).

Example:

TOTAL TCDF

| 0.99 | U |

Sample Result Data Qualifier

All sample results in picograms per gram (pg/g)
bgs = below ground surface

Source of information in table:
MWH 2005. Standardized Risk Assessment Methodology (SRAM) Work Plan, Revision 2 - Final. September 2005. Appendix D; Soil Background Report, Final.

- - = Not Applicable

Table A-2
Soil Background Dioxins Data Set
Santa Susana Field Laboratory

SAMPLE ID	Depth (feet bgs)
BCBS09S01	0
BCSS09S01	0
BCSS11S01	0
BCSS12S01	0
BCSS13S01	0
BCSS14D01	0
BCSS14S01	0
BKND-1	0
BKND-2	0
BKND-3	0
BKND-4	0
BKND-5	0
BKND-6	0
BKND-7	0
BZSS05S01	0
BZSS06S01	0
SGSS01S01	0
Comparison Value	

Table A-3
Post-Topanga Fire Soil, Ash, and Surface Water Drainage Results
Santa Susana Field Laboratory

	Sample Identification	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1-D	CF-1-D	CRP-1	CRP-1	CRP-1
	Sample Type	Soil	Ash	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Soil	Surface Water	Surface Water
	Sampling Date	10/07/2005	10/07/2005	10/18/2005	01/01/2006	01/03/2006	01/14/2006	02/19/2006	02/28/2006	03/03/2006	03/11/2006	03/28/2006	04/04/2006	04/14/2006	05/22/2006	04/04/2006	02/28/2006	10/07/2005	01/02/2006	02/28/2006
	Location	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage
	EPA Identification	WL008	WL009	WL033	WL038	WL044	WL050	WL053	WL062	WL067	WL070	WL074	WL079	WL086	WL090	WL080	WL063	WL007	WL040	WL059
Group	**Constituent**																			
DIOXIN	1,2,3,4,6,7,8-HpCDD	1.06 J	0.581 J	< 1.50E-06 U	< 1.02E-06 U	< 9.96E-07 U	< 2.93E-06 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	3.41	5.23E-05	- -
DIOXIN	1,2,3,4,6,7,8-HpCDF	< 0.0986 U	< 0.107 U	< 1.40E-06 U	< 1.48E-06 U	< 6.15E-07 U	< 1.17E-06 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.36 UJ	2.80E-05	- -
DIOXIN	1,2,3,4,7,8,9-HpCDF	< 0.075 U	< 0.153 U	< 1.70E-06 U	< 1.35E-06 U	< 6.05E-07 U	< 1.12E-06 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.0951 U	< 8.91E-06 U	- -
DIOXIN	1,2,3,4,7,8-HxCDD	< 0.106 U	< 0.419 U	< 1.30E-06 U	< 1.02E-06 U	< 1.37E-06 U	< 1.67E-06 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.164 U	< 3.44E-06 U	- -
DIOXIN	1,2,3,4,7,8-HxCDF	< 0.0589 U	0.11 J	< 9.80E-07 U	< 6.24E-07 U	< 2.63E-07 U	< 5.53E-07 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.119 U	< 2.45E-06 U	- -
DIOXIN	1,2,3,6,7,8-HxCDD	0.178 J	< 0.421 U	< 1.30E-06 U	< 1.09E-06 U	< 1.38E-06 U	< 1.93E-06 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.331 J	3.84E-06 J	- -
DIOXIN	1,2,3,6,7,8-HxCDF	0.102 J	< 0.0717 U	< 9.90E-07 U	< 6.86E-07 U	< 2.58E-07 U	< 5.20E-07 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.11 U	< 2.53E-06 U	- -
DIOXIN	1,2,3,7,8,9-HxCDD	0.148 J	< 0.422 U	< 1.30E-06 U	< 1.03E-06 U	< 1.34E-06 U	< 1.74E-06 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.155 U	< 3.30E-06 UJ	- -
DIOXIN	1,2,3,7,8,9-HxCDF	< 0.082 U	< 0.112 U	< 1.30E-06 U	< 9.68E-07 U	< 4.36E-07 U	< 8.75E-07 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.198 U	< 3.35E-06 U	- -
DIOXIN	1,2,3,7,8-PeCDD	< 0.0699 U	< 0.154 U	< 1.60E-06 U	< 5.90E-07 U	< 7.65E-07 U	< 1.21E-06 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.277 U	< 1.89E-06 U	- -
DIOXIN	1,2,3,7,8-PeCDF	< 0.157 UJ	< 0.231 U	< 1.80E-06 U	< 9.43E-07 U	< 8.24E-07 U	< 1.16E-06 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.231 U	< 2.29E-06 U	- -
DIOXIN	2,3,4,6,7,8-HxCDF	< 0.0616 U	< 0.0764 U	< 1.10E-06 U	< 6.88E-07 U	< 2.99E-07 U	< 5.72E-07 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.128 U	< 2.58E-06 U	- -
DIOXIN	2,3,4,7,8-PeCDF	0.137 J	< 0.212 U	< 9.20E-07 U	< 7.63E-07 U	< 7.42E-07 U	< 1.15E-06 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.215 U	< 2.60E-06 UJ	- -

Table A-3
Post-Topanga Fire Soil, Ash, and Surface Water Drainage Results
Santa Susana Field Laboratory

Sample Identification	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1-D	CF-1-D	CRP-1	CRP-1	CRP-1
Sample Type	Soil	Ash	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Soil	Surface Water	Surface Water
Sampling Date	10/07/2005	10/07/2005	10/18/2005	01/01/2006	01/03/2006	01/14/2006	02/19/2006	02/28/2006	03/03/2006	03/11/2006	03/28/2006	04/04/2006	04/14/2006	05/22/2006	04/04/2006	02/28/2006	10/07/2005	01/02/2006	02/28/2006
Location	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage
EPA Identification	WL008	WL009	WL033	WL038	WL044	WL050	WL053	WL062	WL067	WL070	WL074	WL079	WL086	WL090	WL080	WL063	WL007	WL040	WL059
Group Constituent							ter	Surface Water	Surface Water	Surface Water	Soil	Surface Water	Surface Water						

Table A-3
Post-Topanga Fire Soil, Ash, and Surface Water Drainage Results
Santa Susana Field Laboratory

Sample Identification		CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1	CF-1-D	CF-1-D	CRP-1	CRP-1	CRP-1
Sample Type		**Soil**	**Ash**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Soil**	**Surface Water**	**Surface Water**
Sampling Date		**10/07/2005**	**10/07/2005**	**10/18/2005**	**01/01/2006**	**01/03/2006**	**01/14/2006**	**02/19/2006**	**02/28/2006**	**03/03/2006**	**03/11/2006**	**03/28/2006**	**04/04/2006**	**04/14/2006**	**05/22/2006**	**04/04/2006**	**02/28/2006**	**10/07/2005**	**01/02/2006**	**02/28/2006**
Location		**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**
EPA Identification		**WL008**	**WL009**	**WL033**	**WL038**	**WL044**	**WL050**	**WL053**	**WL062**	**WL067**	**WL070**	**WL074**	**WL079**	**WL086**	**WL090**	**WL080**	**WL063**	**WL007**	**WL040**	**WL059**
Group	**Constituent**																			
SVOC	Indeno(1,2,3-cd)pyrene	- -	- -	< 2 U	< 1.9 U	< 1.9 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 2 U	- -
SVOC	Isophorone	- -	- -	0.9 J	< 0.96 UJ	< 0.96 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.18 J	- -
SVOC	Naphthalene	- -	- -	< 1 U	< 0.96 U	< 0.96 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 1 U	- -
SVOC	Nitrobenzene	- -	- -	< 1 U	< 0.96 U	< 0.96 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 1 U	- -
SVOC	N-Nitrosodimethylamine	- -	- -	< 2 U	< 1.9 U	< 1.9 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 2 U	- -
SVOC	N-Nitroso-di-n-propylamine	- -	- -	< 2 U	< 1.9 U	< 1.9 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 2 U	- -
SVOC	N-Nitrosodiphenylamine	- -	- -	< 1 U	< 0.96 U	< 0.96 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 1 U	- -
SVOC	Pentachlorophenol	- -	- -	< 2 U	< 1.9 U	< 1.9 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 2 U	- -
SVOC	Phenanthrene	- -	- -	< 0.5 U	< 0.48 U	< 0.48 UJ	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.5 U	- -
SVOC	Phenol	- -	- -	13	< 0.96 U	< 0.96 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 1 U	- -
SVOC	Pyrene	- -	- -	< 0.5 U	< 0.48 U	< 0.48 U	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	< 0.5 U	- -

Sample Identification
Sample Type
Sampling Date
Location
EPA Identification

Group	Constituent
SVOC	Indeno(1,2,3-cd)pyrene
SVOC	Isophorone
SVOC	Naphthalene
SVOC	Nitrobenzene
SVOC	N-Nitrosodimethylamine
SVOC	N-Nitroso-di-n-propylamine
SVOC	N-Nitrosodiphenylamine
SVOC	Pentachlorophenol
SVOC	Phenanthrene
SVOC	Phenol
SVOC	Pyrene
WETCHEM	Ammonia-N
WETCHEM	Ammonia-NH3
WETCHEM	Nitrate/Nitrite-N
WETCHEM	Sulfate
WETCHEM	Surfactants (MBAS)
WETCHEM	Total Cyanide
WETCHEM	pH
WETCHEM	Total Suspended Solids

Table A-3
Post-Topanga Fire Soil, Ash, and Surface Water Drainage Results
Santa Susana Field Laboratory

Sample Identification		PCC-1	PCC-1	PCC-1	PCC-1	PCC-1	RP-1	RP-1	RP-1	RP-1	SC-1	SC-1	SC-1	SC-1	SJBC-1	SJBC-2	SORP-1	SSM-1	SSM-1
Sample Type		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Soil	Surface Water	Surface Water	Surface Water	Soil	Ash	Surface Water	Surface Water	Surface Water	Surface Water	Soil	Soil	Ash
Sampling Date		03/11/2006	03/28/2006	04/04/2006	04/14/2006	05/22/2006	10/06/2005	01/02/2006	03/28/2006	04/04/2006	10/10/2005	10/10/2005	01/02/2006	01/03/2006	01/03/2006	01/03/2006	02/23/2006	10/13/2005	10/13/2005
Location		Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage	Drainage
EPA Identification																			
Group	**Constituent**																		
DIOXIN	1,2,3,4,6,7,8-HpCDD																		
DIOXIN	1,2,3,4,6,7,8-HpCDF																		
DIOXIN	1,2,3,4,7,8,9-HpCDF																		
DIOXIN	1,2,3,4,7,8-HxCDD																		
DIOXIN	1,2,3,4,7,8-HxCDF																		
DIOXIN	1,2,3,6,7,8-HxCDD																		
DIOXIN	1,2,3,6,7,8-HxCDF																		
DIOXIN	1,2,3,7,8,9-HxCDD																		
DIOXIN	1,2,3,7,8,9-HxCDF																		
DIOXIN	1,2,3,7,8-PeCDD																		
DIOXIN	1,2,3,7,8-PeCDF																		
DIOXIN	2,3,4,6,7,8-HxCDF																		
DIOXIN	2,3,4,7,8-PeCDF																		
DIOXIN	2,3,7,8-TCDD																		
DIOXIN	2,3,7,8-TCDF																		
DIOXIN	OCDD																		
DIOXIN	OCDF																		
DIOXIN	TCDD TEQ (with DNQ)																		
DIOXIN	TCDD TEQ (no DNQ)																		
DIOXIN	Total HpCDD																		
DIOXIN	Total HpCDF																		
DIOXIN	Total HxCDD																		
DIOXIN	Total HxCDF																		
DIOXIN	Total PeCDD																		
DIOXIN	Total PeCDF																		
DIOXIN	Total TCDD																		
DIOXIN	Total TCDF																		
METALS	Aluminum																		
METALS	Antimony																		
METALS	Arsenic																		
METALS	Barium																		
METALS	Beryllium																		
METALS	Boron																		
METALS	Cadmium																		
METALS	Chromium																		
METALS	Cobalt																		
METALS	Copper																		
METALS	Iron																		
METALS	Lead																		
METALS	Lithium																		
METALS	Manganese																		
METALS	Mercury																		
METALS	Molybdenum																		
METALS	Nickel																		
METALS	Potassium																		
METALS	Selenium																		
METALS	Silver																		
METALS	Sodium																		
METALS	Thallium																		
METALS	Vanadium																		
METALS	Zinc																		
METALS	Zirconium																		
PAH	1-Methylnaphthalene																		
PAH	2-Methylnaphthalene																		
PAH	Acenaphthene																		
PAH	Acenaphthylene																		
PAH	Anthracene																		
PAH	Benzo(a)anthracene																		
PAH	Benzo(a)pyrene																		
PAH	Benzo(b)fluoranthene																		
PAH	Benzo(g,h,i)perylene																		
PAH	Benzo(k)fluoranthene																		
PAH	Chrysene																		
PAH	Dibenzo(a,h)anthracene																		

Table A-3

Table A-3
Post-Topanga Fire Soil, Ash, and Surface Water Drainage Results
Santa Susana Field Laboratory

Sample Identification
Sample Type
Sampling Date
Location
EPA Identification

Group	Constituent
SVOC	Indeno(1,2,3-cd)pyrene
SVOC	Isophorone
SVOC	Naphthalene
SVOC	Nitrobenzene
SVOC	N-Nitrosodimethylamine
SVOC	N-Nitroso-di-n-propylamine
SVOC	N-Nitrosodiphenylamine

Table A-3
Post-Topanga Fire Soil, Ash, and Surface Water Drainage Results
Santa Susana Field Laboratory

Sample Identification		SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	WC-1	WC-1	WC-1	WCWP-1	WCWP-1	WCWP-1	Upstream-001	Upstream-001	Upstream-002	Upstream-002
Sample Type		**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Soil**	**Ash**	**Surface Water**	**Soil**	**Surface Water**	**Surface Water**	**Soil**	**Ash**	**Soil**	**Ash**
Sampling Date		**10/18/2005**	**01/01/2006**	**01/03/2006**	**02/28/2006**	**03/03/2006**	**03/11/2006**	**03/28/2006**	**04/04/2006**	**05/22/2006**	**10/10/2005**	**10/10/2005**	**10/18/2005**	**02/23/2006**	**03/03/2006**	**04/05/2006**	**10/06/2005**	**10/06/2005**	**10/06/2005**	**10/06/2005**
Location		**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**	**Drainage**
EPA Identification		**WL032**	**WL036**	**WL042**	**WL060**	**WL066**	**WL071**	**WL072**	**WL082**	**WL088**	**WL015**	**WL014**	**WL035**	**WL055**	**WL068**	**WL083**	**WL002**	**WL001**	**WL004**	**WL005**
Group	**Constituent**																			
DIOXIN	1,2,3,4,6,7,8-HpCDD																			
DIOXIN	1,2,3,4,6,7,8-HpCDF																			
DIOXIN	1,2,3,4,7,8,9-HpCDF																			
DIOXIN	1,2,3,4,7,8-HxCDD																			
DIOXIN	1,2,3,4,7,8-HxCDF																			
DIOXIN	1,2,3,6,7,8-HxCDD																			
DIOXIN	1,2,3,6,7,8-HxCDF																			
DIOXIN	1,2,3,7,8,9-HxCDD																			
DIOXIN	1,2,3,7,8,9-HxCDF																			
DIOXIN	1,2,3,7,8-PeCDD																			
DIOXIN	1,2,3,7,8-PeCDF																			
DIOXIN	2,3,4,6,7,8-HxCDF																			
DIOXIN	2,3,4,7,8-PeCDF																			
DIOXIN	2,3,7,8-TCDD																			
DIOXIN	2,3,7,8-TCDF																			
DIOXIN	OCDD																			
DIOXIN	OCDF																			
DIOXIN	TCDD TEQ (with DNQ)																			
DIOXIN	TCDD TEQ (no DNQ)																			
DIOXIN	Total HpCDD																			
DIOXIN	Total HpCDF																			
DIOXIN	Total HxCDD																			
DIOXIN	Total HxCDF																			
DIOXIN	Total PeCDD																			
DIOXIN	Total PeCDF																			
DIOXIN	Total TCDD																			
DIOXIN	Total TCDF																			
METALS	Aluminum																			
METALS	Antimony																			
METALS	Arsenic																			
METALS	Barium																			
METALS	Beryllium																			
METALS	Boron																			
METALS	Cadmium																			
METALS	Chromium																			
METALS	Cobalt																			
METALS	Copper																			
METALS	Iron																			
METALS	Lead																			
METALS	Lithium																			
METALS	Manganese																			
METALS	Mercury																			
METALS	Molybdenum																			
METALS	Nickel																			
METALS	Potassium																			
METALS	Selenium																			
METALS	Silver																			
METALS	Sodium																			
METALS	Thallium																			
METALS	Vanadium																			
METALS	Zinc																			
METALS	Zirconium																			
PAH	1-Methylnaphthalene																			
PAH	2-Methylnaphthalene																			
PAH	Acenaphthene																			
PAH	Acenaphthylene																			
PAH	Anthracene																			
PAH	Benzo(a)anthracene																			
PAH	Benzo(a)pyrene																			
PAH	Benzo(b)fluoranthene																			
PAH	Benzo(g,h,i)perylene																			
PAH	Benzo(k)fluoranthene																			
PAH	Chrysene																			
PAH	Dibenzo(a,h)anthracene																			

Table A-3
Post-Topanga Fire Soil, Ash, and Surface Water Drainage Results
Santa Susana Field Laboratory

Sample Identification
Sample Type
Sampling Date
Location
EPA Identification

Group	Constituent
PAH	Fluoranthene
PAH	Fluorene
PAH	Indeno(1,2,3-cd)pyrene
PAH	Naphthalene
PAH	Phenanthrene
PAH	Pyrene
SVOC	1,2,4-Trichlorobenzene
SVOC	1,2-Dichlorobenzene
SVOC	1,2-Diphenylhydrazine/Azobenzene
SVOC	1,3-Dichlorobenzene
SVOC	1,4-Dichlorobenzene
SVOC	2,4,5-Trichlorophenol
SVOC	2,4,6-Trichlorophenol
SVOC	2,4-Dichlorophenol
SVOC	2,4-Dimethylphenol
SVOC	2,4-Dinitrophenol
SVOC	2,4-Dinitrotoluene
SVOC	2,6-Dinitrotoluene
SVOC	2-Chloronaphthalene
SVOC	2-Chlorophenol
SVOC	2-Methylnaphthalene
SVOC	2-Methylphenol
SVOC	2-Nitroaniline
SVOC	2-Nitrophenol
SVOC	3,3-Dichlorobenzidine
SVOC	3-Nitroaniline
SVOC	4,6-Dinitro-2-methylphenol
SVOC	4-Brom1laphthalene

Table A-3
Post-Topanga Fire Soil, Ash, and Surface Water Drainage Results
Santa Susana Field Laboratory

Sample Identification		SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	SSM-1	WC-1	WC-1	WC-1	WCWP-1	WCWP-1	WCWP-1	Upstream-001	Upstream-001	Upstream-002	Upstream-002
Sample Type		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Soil	Ash	Surface Water	Soil	Surface Water	Surface Water	Soil	Ash	Soil	Ash
Sampling Date		10/18/2005	01/01/2006	01/03/2006	02/28/2006	03/03/2006	03/11/2006	03/28/2006	04/04/2006	05/22/2006	10/10/2005	10/10/2005	10/18/2005	02/23/2ound sS.						
Location																				
EPA Identification																				
Group	**Constituent**																			
SVOC	Indeno(1,2,3-cd)pyrene																			
SVOC	Isophorone																			
SVOC	Naphthalene																			
SVOC	Nitrobenzene																			
SVOC	N-Nitrosodimethylamine																			
SVOC	N-Nitroso-di-n-propylamine																			
SVOC	N-Nitrosodiphenylamine																			
SVOC	Pentachlorophenol																			
SVOC	Phenanthrene																			
SVOC	Phenol																			
SVOC	Pyrene																			
WETCHEM	Ammonia-N																			
WETCHEM	Ammonia-NH3																			
WETCHEM	Nitrate/Nitrite-N																			
WETCHEM	Sulfate																			
WETCHEM	Surfactants (MBAS)																			
WETCHEM	Total Cyanide																			
WETCHEM	pH																			
WETCHEM	Total Suspended Solids																			

Table A-4
Post-Topanga Fire
Soil and Ash Background Sample Results
Santa Susana Field Laboratory

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Sample Identification		**SGSS01S01**	**SGSS01S01**	**BKND-5**	**BKND-5**	**BKND-1**	**BCSS09S01**	**BCSS09S01**	**BZSS05S01**	**BZSS05S01**	**BZSS06S01**
Sample matrix		**Soil**	**Ash**	**Soil**	**Ash**	**Soil**	**Soil**	**Ash**	**Soil**	**Ash**	**Soil**
Collection date		**10/13/2005**	**10/13/2005**	**10/13/2005**	**10/13/2005**	**10/13/2005**	**10/14/2005**	**10/14/2005**	**10/14/2005**	**10/14/2005**	**10/14/2005**
Location		**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**
EPA Identification		**WL016**	**WL017**	**WL018**	**WL019**	**WL021**	**WL025**	**WL024**	**WL026**	**WL028**	**WL027**
Sample depth (ft bgs)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
group	**Constituent**										
DIOXIN	1,2,3,4,6,7,8-HpCDD	23	5.87	20.4	100	3.4	< 0.686 UJ	3.27	2.47	2.55 J	2.53
DIOXIN	1,2,3,4,6,7,8-HpCDF	3.73	0.485 J	3.16	3.45 J	0.561 J	< 0.147 UJ	0.32 J	0.804 J	3.06	0.738 J
DIOXIN	1,2,3,4,7,8,9-HpCDF	0.308 J	< 0.218 U	0.331 J	0.491 J	< 0.0839 U	< 0.0864 U	< 0.152 U	< 0.116 U	< 0.537 U	< 0.168 U
DIOXIN	1,2,3,4,7,8-HxCDD	0.607 J	< 0.596 U	0.449 J	0.916 J	0.192 J	< 0.118 U	< 0.328 U	< 0.309 U	< 0.233 U	< 0.169 U
DIOXIN	1,2,3,4,7,8-HxCDF	0.375 J	0.268 J	< 0.287 UJ	< 0.241 UJ	0.135 J	0.154 J	0.167 J	0.234 J	1.4 J	0.177 J
DIOXIN	1,2,3,6,7,8-HxCDD	1.29 J	< 0.613 U	0.95 J	5.57	0.174 J	< 0.115 U	< 0.303 U	< 0.316 U	0.622 J	0.275 J
DIOXIN	1,2,3,6,7,8-HxCDF	0.382 J	0.184 J	0.27 J	< 0.195 UJ	0.0912 J	0.133 J	0.148 J	0.177 J	0.964 J	0.144 J
DIOXIN	1,2,3,7,8,9-HxCDD	1.2 J	0.562 J	0.888 J	3.35 J	< 0.0894 U	< 0.117 U	0.378 J	< 0.314 U	0.519 J	0.284 J
DIOXIN	1,2,3,7,8,9-HxCDF	< 0.0918 U	< 0.148 U	< 0.13 UJ	< 0.0764 U	< 0.0588 U	< 0.0905 U	< 0.0797 U	0.216 J	< 0.377 U	0.175 J
DIOXIN	1,2,3,7,8-PeCDD	0.334 J	0.288 J	0.279 J	0.749 J	< 0.0646 U	< 0.0826 U	0.289 J	0.0958 J	0.424 J	< 0.118 UJ
DIOXIN	1,2,3,7,8-PeCDF	0.275 J	< 0.295 U	0.178 J	< 0.159 U	< 0.0811 UJ	< 0.291 UJ	0.206 J	< 0.125 UJ	1.07 J	0.118 J
DIOXIN	2,3,4,6,7,8-HxCDF	0.42 J	< 0.109 U	0.337 J	0.281 J	< 0.0852 UJ	< 0.0588 U	0.115 J	0.2 J	0.835 J	0.201 J
DIOXIN	2,3,4,7,8-PeCDF	0.418 J	0.286 J	0.293 J	< 0.139 U	< 0.137 UJ	0.197 J	< 0.174 UJ	0.249 J	1.08 J	0.226 J
DIOXIN	2,3,7,8-TCDD	< 0.138 U	< 0.175 U	< 0.087 U	0.363 J	< 0.0622 U	< 0.109 U	0.134 J	< 0.113 U	0.23 J	< 0.106 U
DIOXIN	2,3,7,8-TCDF	0.284 J	0.212 J	< 0.301 UJ	< 0.114 U	0.163 J	0.279 J	0.389 J	0.159 J	0.727 J	< 0.0831 U
DIOXIN	OCDD	168	23.8	211	470	48	4.23 J	9.35	19	10.2	18.7
DIOXIN	OCDF	8.37	< 0.661 UJ	9.83	17	0.97 J	< 0.325 U	< 0.469 U	< 0.83 U	1.67 J	1.16 J
DIOXIN	TCDD TEQ (ND = 0)	1.3	0.62	0.98	3.2	0.12	0.16	0.59	0.35	1.8	0.28
DIOXIN	Total HpCDD	46.5	16	42.8	171	9.59	1.02	7.28	5.8	5.6	6.04
DIOXIN	Total HpCDF	9.09	1.03	8.59	12.1	1.27	< 0.147 U	0.32	1.47	4.17	1.35
DIOXIN	Total HxCDD	12.7	7.42	9.75	42.7	1.3	0.279	5.54	1.35	7.18	1.86
DIOXIN	Total HxCDF	6.19	1.36	4.17	2.76	1.03	0.689	0.661	2.12	10	2.01
DIOXIN	Total PeCDD	3.21	3.55	2.48	12.5	0.149	< 0.0826 U	4.15	0.751	12.7	0.604
DIOXIN	Total PeCDF	5.08	1.46	3.83	0.986	1.02	2.2	1.2	2.57	16.3	2.4
DIOXIN	Total TCDD	1.19	< 0.22 U	0.774	7.1	< 0.0622 U	< 0.109 U	2.72	0.232	47.6	< 0.106 U
DIOXIN	Total TCDF	5.23	2.16	3.13	0.481	0.163	2.53	4.37	1.31	18.6	1.18
METALS	Aluminum	11000 J	12000 J	9800 J	3400 J	12000 J	9900	13000	11000	4400	12000
METALS	Antimony	1.6 R	1.6 R	1.7 R	3.5 R	1.7 R	< 0.81 U	< 1.7 U	< 0.81 U	< 1.6 U	< 0.81 U
METALS	Arsenic	2.7	2.6 J	3.9	< 2.7 U	3.4	11	3.9	4.9	< 1.2 U	3.6
METALS	Barium	110	240	76	360	59	69	300	100	130	82
METALS	Beryllium	0.45	0.41	0.47	< 0.88 U	0.54	0.54	< 0.41 U	0.62	< 0.4 U	0.45
METALS	Boron	6.4	57	6	85	6.6	3.5	160	3.2	48	< 1 U
METALS	Cadmium	0.59	1.1	0.48	< 0.88 U	0.57	0.47	< 0.41 U	0.62	< 0.4 U	0.54
METALS	Chromium	17	18	12	2.3	16	15	15	17	6.1	18
METALS	Cobalt	4.9	5.4	4.1	1.6	6.3	4.5	4.5	5.3	1.6	5.4
METALS	Copper	11	30	8	25	12	9.2	64	13	15	8.9
METALS	Iron	17000	17000	15000	4200	19000	16000	12000	17000	5300	19000
METALS	Lead	24	64	27	5.2	9.5	10	9.7	17	33	12
METALS	Lithium	20	16	19	9.4	18	17	14	20	7.6	28
METALS	Manganese	310	540	270	610	390	260	520	340	220	350
METALS	Mercury	0.017	0.058	0.0091	0.0053	0.011	< 0.003 UJ	0.0038	0.0031	< 0.003 U	0.011
METALS	Molybdenum	0.54	1	< 0.44 U	< 0.88 U	< 0.41 U	0.42	1.7	0.34	< 0.4 U	0.27
METALS	Nickel	21 J	21 J	11 J	7 J	14 J	11	24	12	9.3	12
METALS	Potassium	4300	9400	3300	58000	3400	3700	53000	5400	17000	3900
METALS	Selenium	< 2 U	< 2 U	< 2.2 U	< 4.4 U	< 2.1 U	< 1 U	< 2.1 U	< 1 U	< 2 U	< 1 U
METALS	Silver	< 0.81 U	< 0.81 U	< 0.87 U	< 1.8 U	< 0.83 U	< 0.4 U	< 0.83 U	< 0.4 U	< 0.8 U	< 0.41 U
METALS	Sodium	110	430	69	1000	64	150	3100	180	1200	86
METALS	Thallium	4.5	3.2	3.3	< 3.5 U	3.3	1.9	< 1.7 U	1.8	< 1.6 U	2.2
METALS	Vanadium	30	35	23	8.4	27	27	28	32	11	37
METALS	Zinc	64	190	55	64	51	53	150	67	57	61
METALS	Zirconium	1.6	2.8	1.7	< 3.3 U	< 1.6 U	1.6	4.1	< 1.5 U	< 3 U	2.4

Table A-4
Post-Topanga Fire
Soil and Ash Background Sample Results
Santa Susana Field Laboratory

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Sample Identification		SGSS01S01	SGSS01S01	BKND-5	BKND-5	BKND-1	BCSS09S01	BCSS09S01	BZSS05S01	BZSS05S01	BZSS06S01
Sample matrix		**Soil**	**Ash**	**Soil**	**Ash**	**Soil**	**Soil**	**Ash**	**Soil**	**Ash**	**Soil**
Collection date		**10/13/2005**	**10/13/2005**	**10/13/2005**	**10/13/2005**	**10/13/2005**	**10/14/2005**	**10/14/2005**	**10/14/2005**	**10/14/2005**	**10/14/2005**
Location		**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**
EPA Identification		**WL016**	**WL017**	**WL018**	**WL019**	**WL021**	**WL025**	**WL024**	**WL026**	**WL028**	**WL027**
Sample depth (ft bgs)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
group	**Constituent**										
PAH	1-Methylnaphthalene	24 J	22 J	42	41 J	< 20 U	17 J	94	11 J	31	< 21 U
PAH	2-Methylnaphthalene	33 J	33 J	51	57 J	< 20 U	22	140	15 J	45	< 21 U
PAH	Acenaphthene	12 J	< 20 U	12 J	< 22 U	< 20 U	< 20 U	< 21 U	< 20 U	< 20 U	< 21 U
PAH	Acenaphthylene	9.9 J	< 20 U	< 22 U	< 22 U	< 20 U	< 20 U	13 J	< 20 U	< 20 U	< 21 U
PAH	Anthracene	< 20 U	< 20 U	< 22 U	< 22 U	< 20 U	< 20 U	22	< 20 U	< 20 U	< 21 U
PAH	Benzo(a)anthracene	9.3 J	< 20 U	< 22 U	< 22 U	< 20 U	< 20 U	16 J	< 20 U	19 J	< 21 U
PAH	Benzo(a)pyrenea(20 U5l.3(< 21 U)TJ .56a 21 U										
PAH544M6.J<											
PAH	Anthracene 20 U5l.3(< 21 UU)-60144(9.3 J)-6474.5(<)(PAH)-504a.9(544M6.J)-6588.g,h,i-60er(20 U)-0437.9(<(9.3 64191.AnthracenJ911.27505)-62enJ911.27505)-62enJ911.27505< 21 UU								15 J	45 < 21 UU	

Table A-5
Post-Topanga Fire Sample Locations and Coordinates

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Sample ID	Northing	Easting
BKND-1	265758	1782330
BKND-5	263776	1787630
BCSS09	261455	1792980
BZSS05	264261	1796440
BZSS06	269756	1788400
SGSS01	270853	1796080
RP-1	280335	1807240
CRP-1	270608	1810160
SSM-1	277839	1811361
CF-1	254631	1765620
PCC-1	250619	1774856
SC-1	260356	1907364
WC-1	258856	1912225
Upstream 001	262292	1791830
Upstream 002	263095	1786570
FC-1	126431	2106313
KD-1	289046	1612156
LFBS54	267205	1794155
SJBC-1	288950	1617040
SJBC-2	290829	1617053
SORP-1	117940	2073123
WCWP-1	125104	2081898

All coordinates in State Plane NAD 27, Zone 5

Table A-6
SSFL Precipitation Concentrations
(Ambient Rain Water)
January to March 2005

Page 1 of 1

			Collection Dates				
Group	**Constituent**	**units**	**01/07/2005**	**02/11/2005**	**02/18/2005**	**03/04/2005**	**03/23/2005**
DIOXIN	1,2,3,4,6,7,8-HpCDD	µg/L	< 5.00E-05 UJ	- -	< 6.23E-06 U	- -	2.39E-04
DIOXIN	1,2,3,4,6,7,8-HpCDF	µg/L	5.50E-06 J	- -	< 3.08E-06 U	- -	3.45E-05 J
DIOXIN	1,2,3,4,7,8,9-HpCDF	µg/L	< 2.40E-06 U	- -	< 3.63E-06 U	- -	< 4.13E-06 U
DIOXIN	1,2,3,4,7,8-HxCDD	µg/L	< 1.90E-06 U	- -	< 4.74E-06 U	- -	< 3.60E-06 U
DIOXIN	1,2,3,4,7,8-HxCDF	µg/L	< 1.60E-06 U	- -	< 1.86E-06 U	- -	2.38E-06 J
DIOXIN	1,2,3,6,7,8-HxCDD	µg/L	< 1.60E-06 U	- -	< 4.84E-06 U	- -	6.60E-06 J
DIOXIN	1,2,3,6,7,8-HxCDF	µg/L	< 1.50E-06 U	- -	< 1.78E-06 U	- -	2.28E-06 J
DIOXIN	1,2,3,7,8,9-HxCDD	µg/L	< 1.60E-06 U	- -	< 4.78E-06 U	- -	5.72E-06 J
DIOXIN	1,2,3,7,8,9-HxCDF	µg/L	< 2.10E-06 U	- -	< 3.08E-06 U	- -	< 1.87E-06 U
DIOXIN	1,2,3,7,8-PeCDD	µg/L	< 2.90E-06 U	- -	< 2.34E-06 U	- -	< 1.32E-06 U
DIOXIN	1,2,3,7,8-PeCDF	µg/L	< 1.80E-06 U	- -	< 4.99E-06 U	- -	< 2.08E-06 U
DIOXIN	2,3,4,6,7,8-HxCDF	µg/L	< 1.20E-06 U	- -	< 1.95E-06 U	- -	2.24E-06 J
DIOXIN	2,3,4,7,8-PeCDF	µg/L	< 2.00E-06 U	- -	< 4.62E-06 U	- -	< 1.89E-06 U
DIOXIN	2,3,7,8-TCDD	µg/L	< 3.50E-06 U	- -	< 2.69E-06 U	- -	< 1.78E-06 U
DIOXIN	2,3,7,8-TCDF	µg/L	< 3.40E-06 U	- -	< 3.02E-06 U	- -	< 1.57E-06 U
DIOXIN	OCDD	µg/L	< 1.00E-04 UJ	- -	< 1.27E-05 U	- -	3.42E-03
DIOXIN	OCDF	µg/L	< 1.00E-04 UJ	- -	< 1.02E-05 U	- -	4.49E-05 J
DIOXIN	TCDD TEQ_with DNQ	µg/L	5.50E-08	- -	0	- -	5.00E-06
DIOXIN	TCDD TEQ_no DNQ	µg/L	0	- -	0	- -	2.73E-06
DIOXIN	Total HpCDD	µg/L	2.00E-05 J	- -	< 6.23E-06 U	- -	8.36E-04
DIOXIN	Total HpCDF	µg/L	1.50E-05 J	- -	< 3.32E-06 U	- -	8.58E-05 J
DIOXIN	Total HxCDD	µg/L	2.40E-06 J	- -	< 4.79E-06 U	- -	5.51E-05 J
DIOXIN	Total HxCDF	µg/L	< 1.60E-06 U	- -	< 2.11E-06 U	- -	6.90E-05 J
DIOXIN	Total PeCDD	µg/L	< 2.90E-06 U	- -	< 2.34E-06 U	- -	< 1.32E-06 U
DIOXIN	Total PeCDF	µg/L	< 1.90E-06 U	- -	< 4.80E-06 U	- -	9.17E-06 J
DIOXIN	Total TCDD	µg/L	< 3.50E-06 U	- -	< 2.69E-06 U	- -	< 1.78E-06 U
DIOXIN	Total TCDF	µg/L	< 3.40E-06 U	- -	< 3.02E-06 U	- -	< 1.57E-06 U
METALS	Antimony	mg/L	- -	< 0.002 UJ	< 0.00018 U	< 0.001 UJ	< 0.002 UJ
METALS	Arsenic	mg/L	- -	< 0.0038 U	< 0.0038 U	< 0.0038 U	< 0.0038 U
METALS	Barium	mg/L	- -	< 0.0028 U	< 0.0028 U	< 0.0028 U	< 0.0028 U
METALS	Beryllium	mg/L	- -	< 0.00062 U	< 0.00062 U	< 0.00062 U	< 0.00062 U
METALS	Boron	mg/L	- -	< 0.0074 U	< 0.0074 U	< 0.0074 U	< 0.0074 U
METALS	Cadmium	mg/L	- -	< 0.000015 U	< 0.000015 U	< 0.000015 U	0.000033 J
METALS	Chromium	mg/L	- -	0.0007 J	< 0.00068 U	0.0007 J	0.0011 J
METALS	Cobalt	mg/L	- -	< 0.00089 U	< 0.00089 U	< 0.00089 U	< 0.00089 U
METALS	Copper	mg/L	- -	< 0.00049 U	< 0.00049 U	0.00065 J	0.00072 J
METALS	Iron	mg/L	- -	< 0.0088 U	< 0.0088 U	0.015 J	0.039 J
METALS	Lead	mg/L	- -	< 0.00013 U	< 0.00013 U	0.00026 J	0.00019 J
METALS	Manganese	mg/L	- -	< 0.0032 U	< 0.0032 U	< 0.0032 U	< 0.0032 U
METALS	Mercury	mg/L	- -	0.00012 J	< 0.000063 U	< 0.000063 U	< 0.000063 U
METALS	Nickel	mg/L	- -	< 0.002 U	< 0.002 U	0.0025 J	< 0.002 U
METALS	Selenium	mg/L	- -	< 0.00036 U	< 0.00036 U	< 0.00036 U	< 0.00036 U
METALS	Silver	mg/L	- -	< 0.000089 UJ	< 0.000089 U	< 0.000089 U	< 0.000089 UJ
METALS	Thallium	mg/L	- -	< 0.000075 UJ	< 0.000075 U	< 0.000075 U	< 0.000075 U
METALS	Vanadium	mg/L	- -	< 0.0014 U	< 0.0014 U	< 0.0014 U	< 0.0014 U
METALS	Zinc	mg/L	- -	< 0.0037 U	< 0.0037 U	< 0.0037 U	0.0058 J

U = not detected J = estimated value

Note:

Results qualified as non-detected due to blank contamination are reported as non-detected at the laboratory RL rather than the laboratory MDI

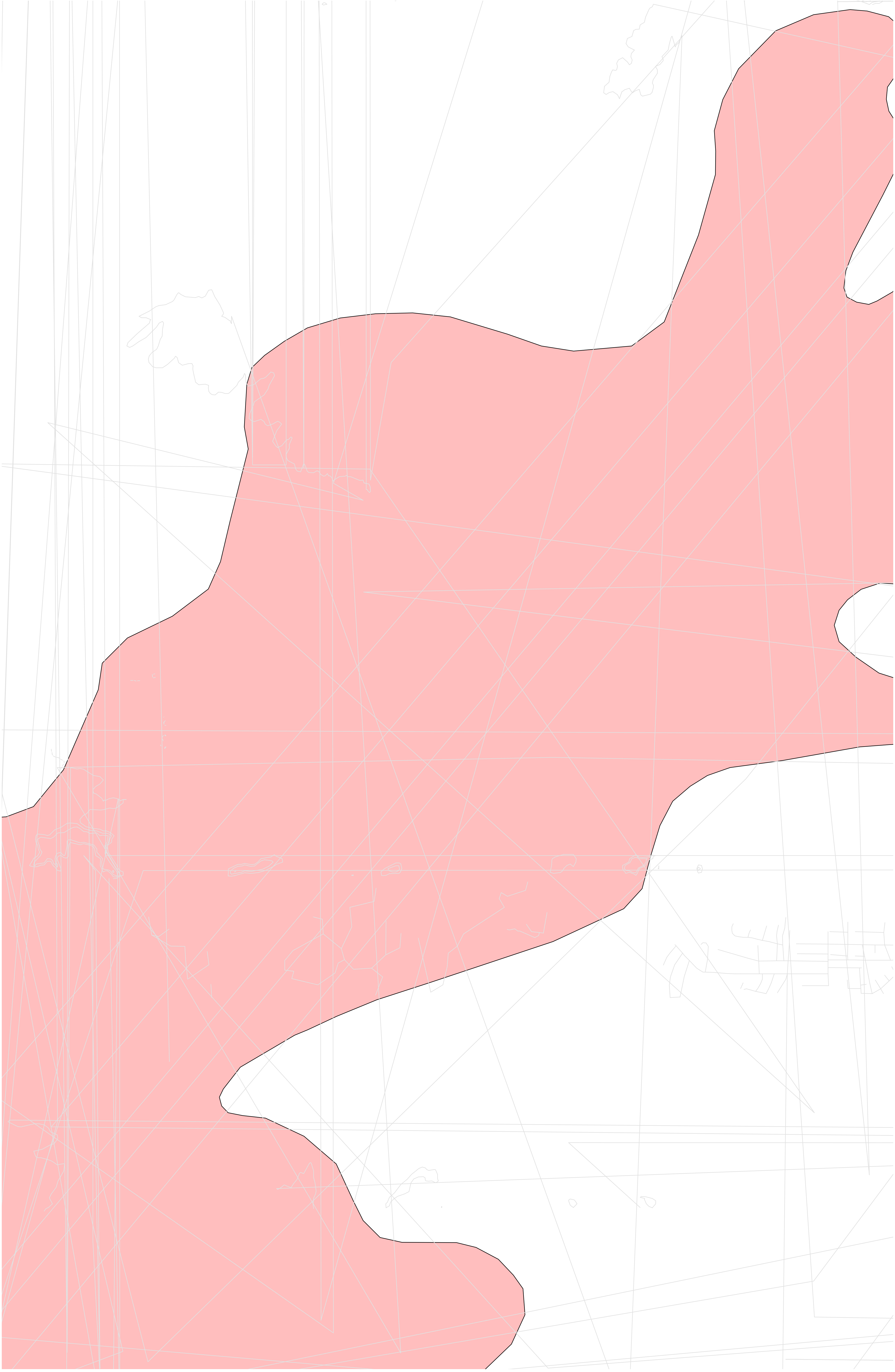
In some cases, the RL has been elevated due to the blank contamination, as determined by the data validators.

Table A-7

Units Conversion Table

Page 1 of 1

Units From:	Multiplication Factor to grams
Metric Ton (MT)	1,000,000
Kilograms (kg)	1,000
Grams (g)	1
Milligrams (mg)	1.0E-03
Micrograms (µg)	1.0E-06
Nanograms (ng)	1.0E-09
Picograms (pg)	1.0E-12
Femtograms (fg)	1.0E-15



APPENDIX B
BMP AND EROSION CONTROL MATERIALS TESTING LABORATORY REPORTS

POTENTIAL BACKGROUND CONSTITUENT LEVELS IN STORM WATER AT BOEING'S SANTA SUSANA FIELD LABORATORY VENTURA COUNTY, CALIFORNIA