SURVEY OF STORM WATER RUNOFF FOR DIOXINS IN THE SAN FRANCISCO BAY AREA

February 1997

Prepared by the
California Regional Water Quality Control Board
San Francisco Bay Region

Participants:
Western States Petroleum Association
Chevron U.S.A.
Exxon Corp.
Shell Martinez Refining Co.
Tosco Corp.
Unocal
Santa Clara Valley Water District
Alameda County Public Works
Contra Costa County Public Works Dept.
Fairfield Suisun Sewer District

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Background

Dioxins refer to a group of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD and PCDF. Seventeen of these dioxin compounds (or congeners) have been grouped together because of their similarities in chemical, physical, and toxic properties. The most toxic and most researched of the group is 2,3,7,8-tetrachlorinated dibenzo-p-dioxin (2,3,7,8-TCDD). The other sixteen compounds are congeners of 2,3,7,8-TCDD. The toxicity of mixtures of dioxins and furans is determined from the toxicity of each congener relative to the toxicity of 2,3,7,8-TCDD.

The only significant transformation process for dioxins is degradation by sunlight of unabsorbed dioxins. However, because dioxins are primarily adsorbed onto particulate and organic matter due to their lipophilicity and low solubility in water, they are very stable in the environment. Dioxins released to the environment are either photodegraded or deposited onto the soil where they are buried or eroded with the soil into the aquatic environment.

A study conducted in 1994 found dioxins and other contaminants including polychlorinated biphenyls, methyl mercury, and DDT in the tissue of fish caught from various locations within San Francisco Bay (SFRWQCB, 1995). The concentrations of dioxins found were well within the reported background range established in a recent USEPA survey (U.S. EPA, 1992). The USEPA has expressed concern that the background levels may be too high, considering the extreme toxicity of dioxins. Based on the results from the San Francisco Bay study, the California Office of Environmental Health Hazard Assessment issued an interim advisory in December 1994, for consumption of fish from the Bay because of the levels of all the contaminants found. Monitoring data for point source discharges to the Bay have shown the presence of dioxins in the discharges from a number of sewage treatment plants and petroleum refineries. A study conducted in Germany, and an ongoing study by the Tosco Corporation indicate the presence dioxins in urban runoff.

The purpose of this survey is to confirm the presence of dioxins in storm water runoff in the Bay Area, and to determine if there is a significant difference between runoff from urban areas compared to runoff from petroleum refineries. The types of areas sampled during this survey include petroleum refinery process areas, residential and commercial areas and open space areas.

The participants and contributors to this survey are the Western States Petroleum Association and its San Francisco Bay Area members (Chevron U.S.A., Exxon Corp., Shell Martinez Refining Co., Tosco Corp., and Unocal), the Santa Clara Valley Water District, Alameda County Public Works, Contra Costa County Public Works Department, Fairfield Suisun Sewer District, and the San Francisco Bay Regional Water Quality Control Board.

Sampling Stations

There were a total of thirteen stations in this survey. The locations are shown on Figure 1. Runoff at six of the stations are from large urban areas consisting of a mixture of developed, undeveloped, residential, commercial, light industrial, and heavy industrial land uses. The other seven stations consist of runoff from areas within and/or adjacent to petroleum refineries. All the stations are described in more detail on Table 1. Additionally, this report summarizes and incorporates data collected by Tosco Corp. at three other stations located in Sonoma, Napa and Contra Costa Counties as part of a separate investigation.

There are five petroleum refineries in the Bay Area. Runoff from process areas at four of them are currently combined with process wastewaters and treated at that refinery's wastewater treatment plant. Therefore, the runoff sampled at these facilities consist of runoff from "non-process" areas such as tank farms, roads, and adjacent open space. The fifth refinery, Shell, occasionally discharges runoff from a portion of its process area. The runoff from this area is normally diverted to the treatment plant. However, if the intensity of a storm exceeds diversion capacity, overflow from the diversion system drains to a series of retention ponds prior to discharge to the Bay. Shell sampled both the overflow entering the retention ponds and the discharge from the last retention pond for this survey.

Like Shell, Tosco also sampled at two locations. Runoff from Tosco's secondary containment around a tank farm drains into an earthen impoundment prior to discharge into Pacheco Slough. Samples of the runoff flowing into and out of the impoundment was collected for this survey.

Sampling and Analytical Methods

Two storm events during the 95/96 wet weather season were sampled at each station. Personnel from each of the entities responsible for that discharge performed the sampling. For example, Shell personnel sampled their two stations, and Contra Costa County personnel sampled their two stations. Written sampling procedures (Appendix A) and sample bottles from one laboratory was distributed to each participant to reduce data variability from sample collection. Data variability was further minimized by having all analysis performed by one laboratory: Alta Analytical Laboratory Inc. in El Dorado Hills, California. As a check on data reproducibility, five out of the thirty samples analyzed for this survey were duplicate samples.

The analytical method used is the USEPA Method 1613a for Tetra- through Octa- Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS. Alta Analytical is certified by the California Department of Health Services to perform this procedure.
Suspended solids for each sample was determined using a method developed by Alta Analytical (Appendix B). This method is slightly different than Standard Methods 2540D for Total Suspended Solids dried at 103-105C. Alta's procedure involves filtering a sample through a 0.42 µm cellulose acetate filter, and drying the filter and residue at room temperature until constant weight. The increase in weight of the filter is the suspended solids from the sample.

Survey Results

The 1989 international scheme, which has been adopted by the USEPA (Appendix C), was used to calculate the toxicity equivalence (TEQ) of each sample. The TEQ is a weighted sum of the concentrations of the seventeen congeners of 2,3,7,8-TCDD. Analytical results below the reporting limit was assumed to be zero in calculating the TEQ for this survey. Table 2 summarizes the TEQ and suspended solids data. Tables 3 through 32 present the detailed results for each sample. Laboratory reports and other sample documentation are included in Appendix D. Appendix D is a separate volume of this report and is available upon written request to the Regional Water Quality Control Board.

The duplicate results for dioxins and furans were very good with relative percent differences ranging from 1 to 33 percent. The duplicate results for suspended solids were not as good. The relative percent differences range from 0 to 100 percent.

Conclusions

The results confirmed the presence of dioxins in urban runoff and runoff from petroleum refinery property. The predominate congeners found were the highly chlorinated ones. Generally, more of the PCDDs were detect than the PCDFs.

Because of the limited sample size, any trends or lack of trends are not definitive. However, the following observations are made to stimulate further discussion of these matters.

There is a fair correlation of 2,3,7,8-TCDD TEQ to suspended solids as shown in Figure 2. The coefficient of correlation is 0.58. The line shown on Figure 2 is from least square regression. The results from duplicate samples were averaged for these calculations. The increase in dioxins with increasing suspended solids is expected and fits into the theory that dioxins adsorb onto particulates and are carried to the aquatic environment by erosion.

There does not appear to be significant difference in the congener profiles between general urban runoff and refinery runoff as shown in Figures 3 through 5. Also, there does not appear to be significant difference in dioxins concentrations between northern and southern/central drainages in the Bay Area. The slightly higher concentrations in the southern drainage stations may be due

more to higher suspended solids in those samples. The higher suspended solids could be due to when each sample was collected relative to when the storm started.

The data do show that sedimentation basins are very effective in minimizing the amount of dioxins that reach the Bay as shown by Shell and Tosco's impoundment inlet and outlet samples.

The USEPA water quality criterion for 2,3,7,8-TCDD is 0.014 pg/l for fresh waters which are not drinking water sources. This value is based on a 10^{-6} cancer risk level from fish consumption. The detection limits from all the samples collected in this survey were too high to determine if this level is achieved in the creeks and rivers sampled. For comparative purposes, if the criterion of 0.014 pg/l is applied to the mixture of congeners, in other words as 0.014 pg/l TEQ, all except two of the samples in this survey exceed this value.

If there are future efforts, the analytical quantification limit should be lowered to enable quantification of 2,3,7,8-TCDD. This may be accomplished through concentration of the sample by solid phase extraction in the field.

REFERENCES

San Francisco Regional Water Quality Control Board, State Water Resources Control Board, California Department of Fish and Game (1995) Contaminant Levels in Fish Tissue in San Francisco Bay.

U.S. Environmental Protection Agency (1992) National Study of Chemical Residues in Fish, EPA-823-R-02-008. Office of Science and Technology, Washington, D.C.

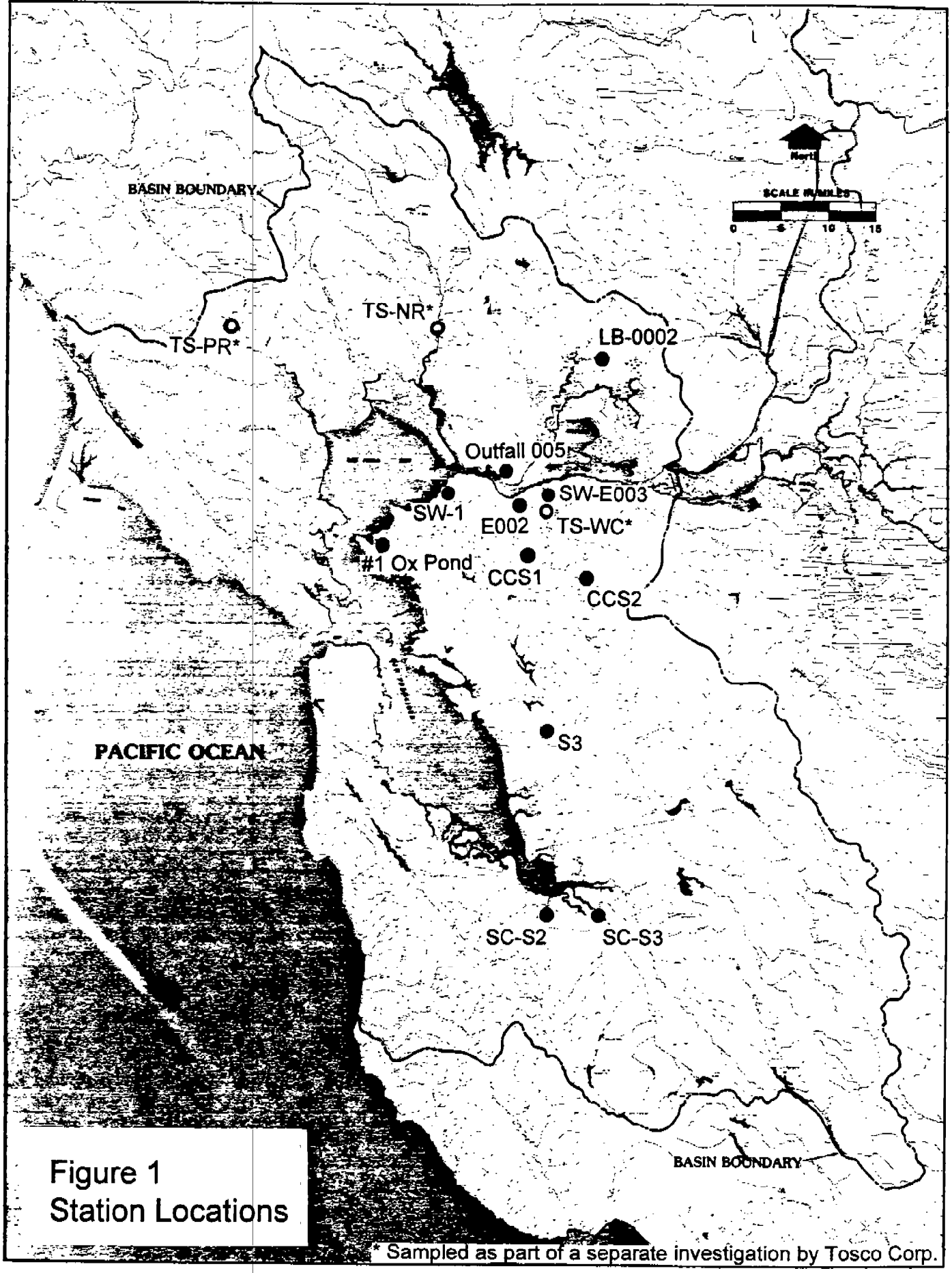


Figure 1
Station Locations

* Sampled as part of a separate investigation by Tosco Corp.

Table 1 Sample Stations

Station	Sampled By	Description
SC-S2	Kinnetic Laboratories, Inc. for the Santa Clara Valley Water District	Sunnyvale East Channel at Awhanee Ave. This point receives drainage from an area of 3300 acres. The area is wholly urbanized consisting of residential (68%), and commercial (32%).
SC-S3	Kinnetic Laboratories, Inc. for the Santa Clara Valley Water District	Guadalupe River downstream of the confluence with Los Gatos Creek. This station has a total drainage area of 93,400 acres consisting of open space (30%), residential (61%), commercial (5%) and industrial (4%).
S3	Alameda Public Works Department	Castro Valley Creek station receives drainage from an area of 3260 acres consisting of residential (73%), commercial (7%), and open space (20%).
CCS1	Contra Costa County Public Works Department	Rheem Creek station receives drainage from a 9,660-acre of open space (22%), agricultural (64%), residential (13%), commercial/industrial (1%).
CCS2	Contra Costa County Public Works Department	Walnut Creek station receives drainage from a 54,530-acre area of open space (35%), agricultural (19%), residential (42%), and commercial/industrial (4%).
#1 OX Pond	Chevron U.S.A.	Overflow from a storm water impoundment basin (Oxidation Pond #1) that receives drainage from 500 acres of open space (75%), and parking lots and roadways (25%).
SW-1	Unocal	Unnamed creek draining primarily undeveloped land, portions of the town of Rodeo, and Interstate 80.
E002-Feed	Shell Martinez Refining Co.	Inlet to a storm water impoundment basin (Lake Slobonik) that receives drainage from 231 acres of refinery process areas (Light Oil Processing and Clean Fuels Project areas), and tank farms.
E002-Discharge	Shell Martinez Refining Co.	Outlet from storm water impoundment basin (Lake Slobonik).
SW-E003 In	Tosco Corp.	Inlet to an earthen storm water impoundment basin that receives drainage from 115 acres of unpaved tank farm areas.
SW-E003 Out	Tosco Corp.	Outlet from storm water impoundment basin.

Station	Sampled By	Description
TS-WC[#]	Tosco Corp.	Walnut Creek at Frontage Road. Approximately 6 miles downstream of Station CCS2.
Outfall 005	Exxon Corp.	Unnamed creek draining 69 acres of open space, equipment laydown areas, and small portion of paved areas (1%) consisting of roadways and parking lots.
LB-0002	Fairfield Suisun Sewer District	Laurel Creek Flood Control Channel in Suisun City.
TS-NR[#]	Tosco Corp.	Napa River in Napa at Jefferson Street Bridge
TS-PR[#]	Tosco Corp.	North Corona Road Drainage System just upstream of the Petaluma River in Petaluma.

[#] Station sampled as part of a special investigation currently being conducted by Tosco Corp. in accordance with a compliance order.

Table 2 Data Summary

Station	Sample Date	2,3,7,8-TCDD TEQ (pg/l)	Suspended Solids (mg/l)
SC-S2	14-Dec-95	11	170
	1-Apr-96	1.1	12
SC-S3	14-Dec-95	15	130
	1-Apr-96	4.1	140
	1-Apr-96 (duplicate[1])	4	160
S3	16-Jan-96	11	0
	16-Jan-96 (duplicate)	10	1200
	1-Apr-96	26	312
CCS1	11-Dec-95	14	410
	1-Apr-96	11	238
CCS2	11-Dec-95	6.1	300
	1-Apr-96	5.1	1050
LB-0002	11-Dec-95	0.64	91
	11-Dec-95 (duplicate)	0.68	not avail.
	1-Apr-96	0.14	36
#1 Ox Pond	12-Dec-95	8.3	62
	21-Feb-96	0.08	8.1
SW-1	11-Dec-95	68	470
	15-Feb-96	3	170
E002-Feed	11-Dec-95	60	1200
	15-Feb-96	56	3443
E002-Discharge	11-Dec-95	1.1	40
	11-Dec-95 (duplicate)	0.77	40
	18-Feb-96	0	0
SW-E003-IN	11-Dec-95	2.6	640 [15]
	15-Feb-96	2.9	422 [200]
	15-Feb-96 (duplicate)	5.8	183
SW-E003-OUT	21-Feb-96	0.47	1 [26]
Outfall 005	11-Dec-95	9.9	1800 [772][2]
	15-Feb-96	0.74	177
TS-WC*	16-Jan-96	3.1	154 [59]
	12-Mar-96	0.71	0 [270]
TS-NR*	27-Feb-96	0.14	81 [2]
	10-Mar-96	0.52	10 [4]
TS-PR*	27-Feb-96	1.1	14 [36]
	10-Mar-96	0.2	2 [13]

[ ] Data using Standard Method 2540D for Total Suspended Solids.

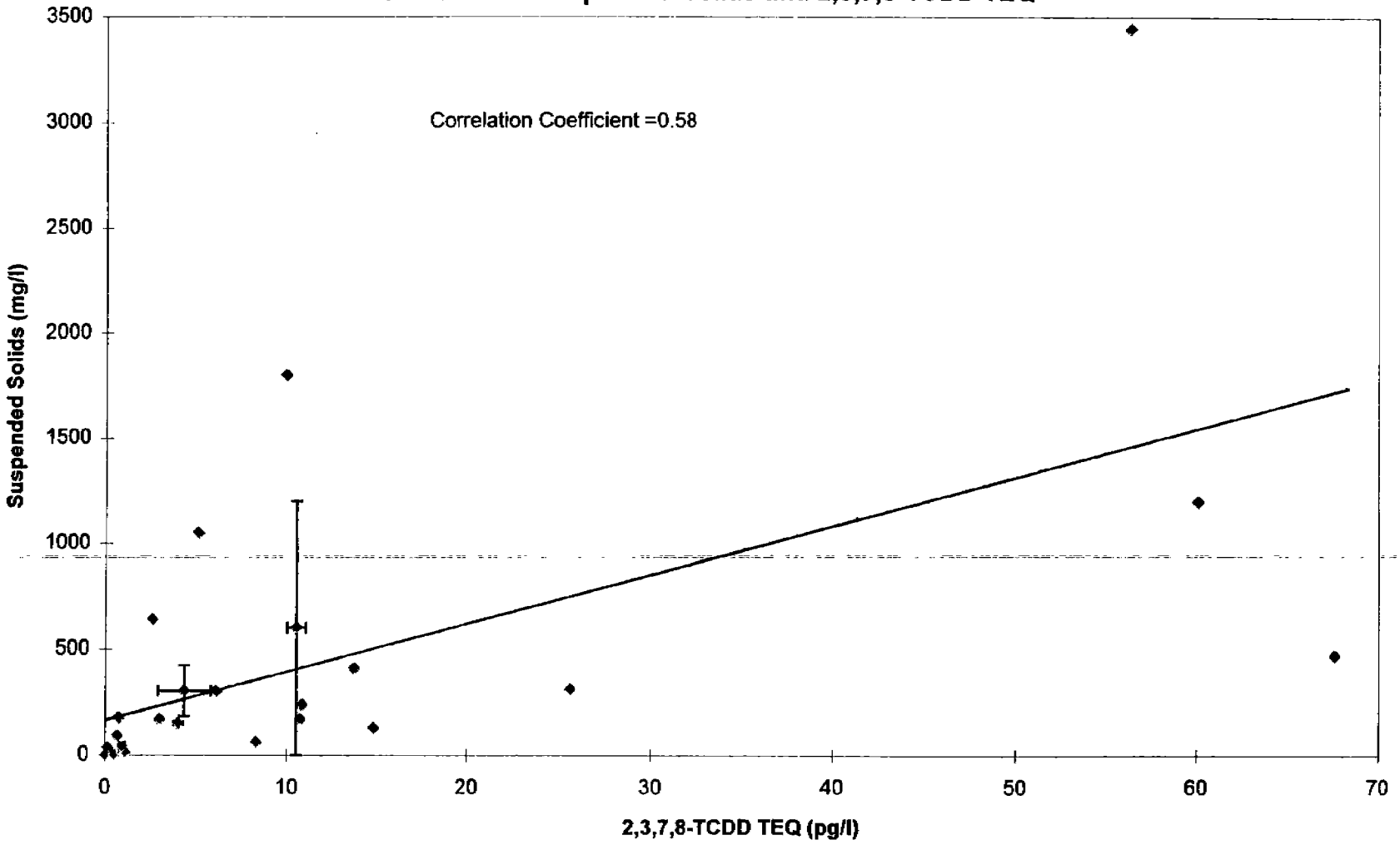
[1] This sample is a blind duplicate unknown to the laboratory. The other duplicate samples were known by the laboratory to be duplicates.

[2] TSS data from this station using a sample collected 30 minutes before the grab sample for dioxins.

* Data on stations TS-WC, NR and PR are summarized here for information only. These stations are sampled by Tosco Corp. as part of a separate investigation.

Figure 2

Correlation of Suspended Solids and 2,3,7,8-TCDD TEQ



Error bars show range of suspended solids and TEQ results for duplicate samples

Figure 3

General Urban and Refinery Runoff Data

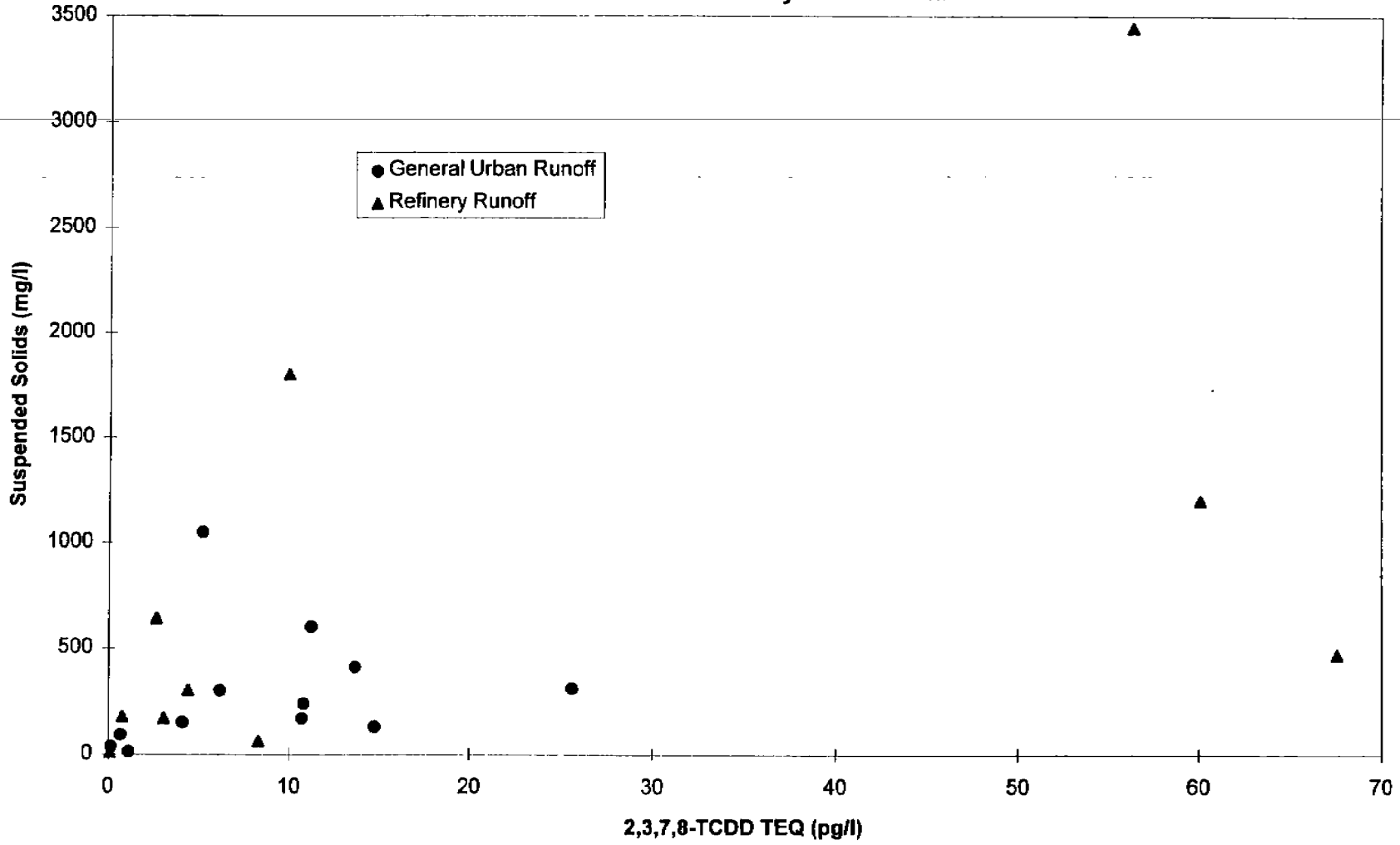


Figure 4 Congener Profiles
First Samples

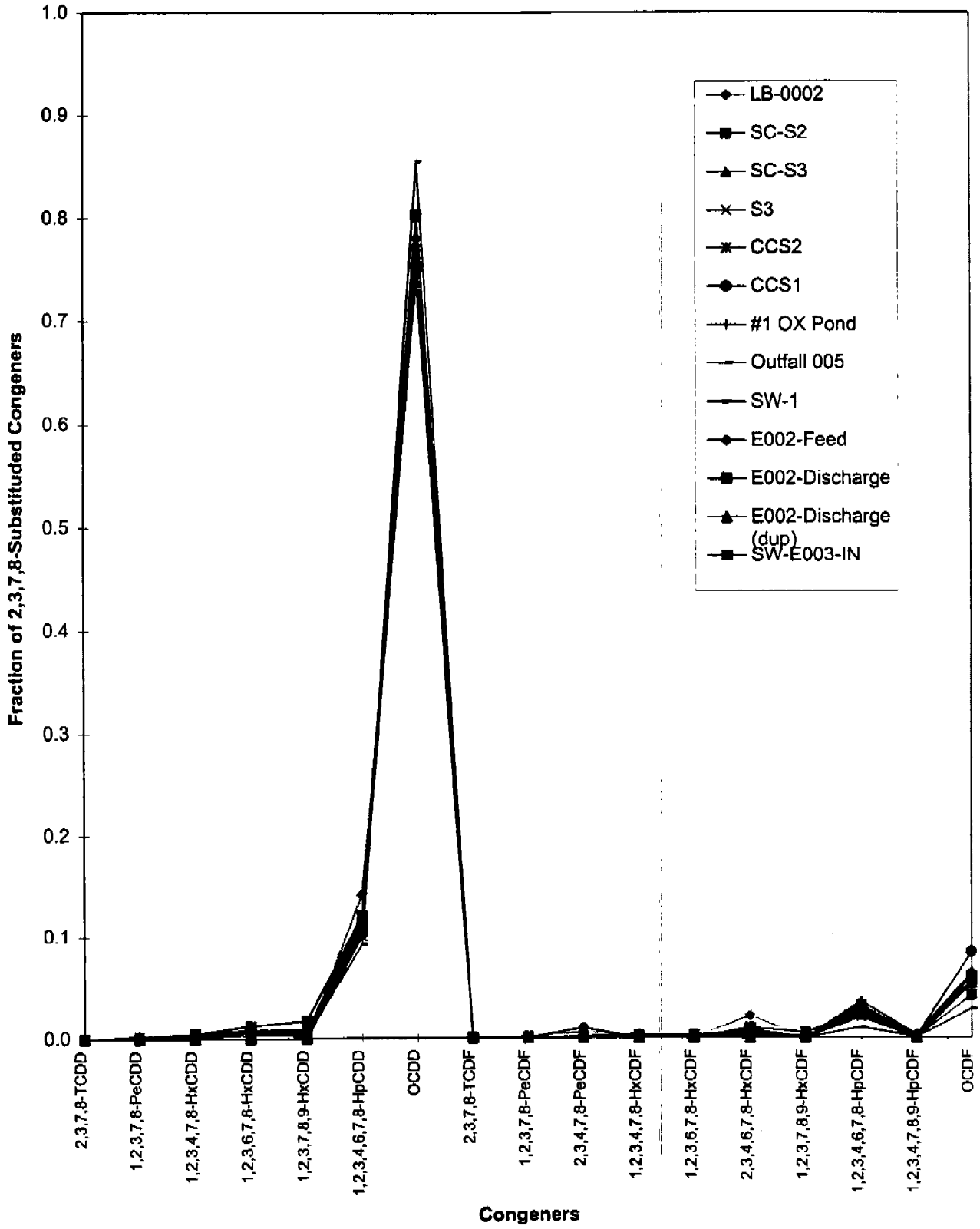


Figure 5 Congener Profiles
Second Samples

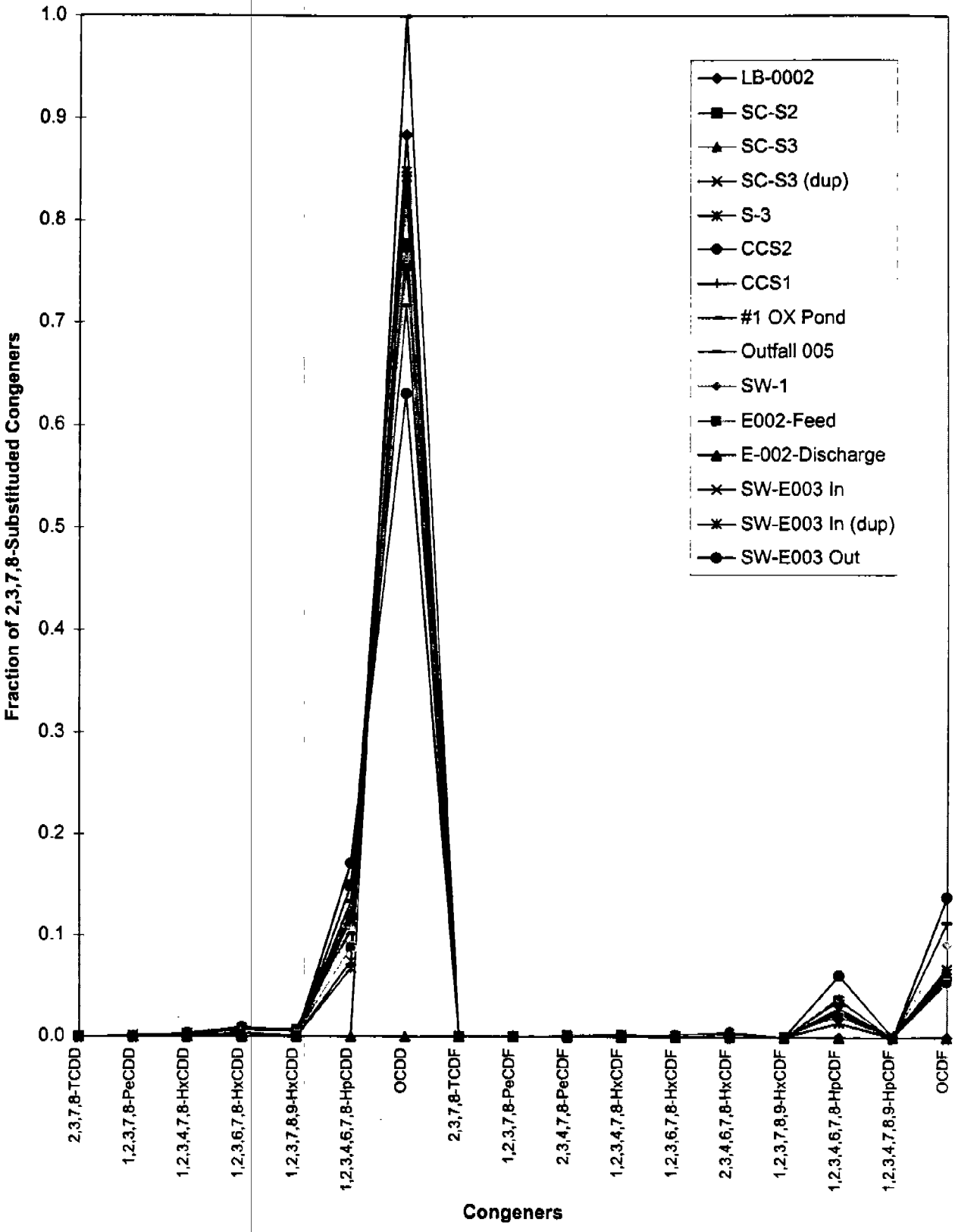


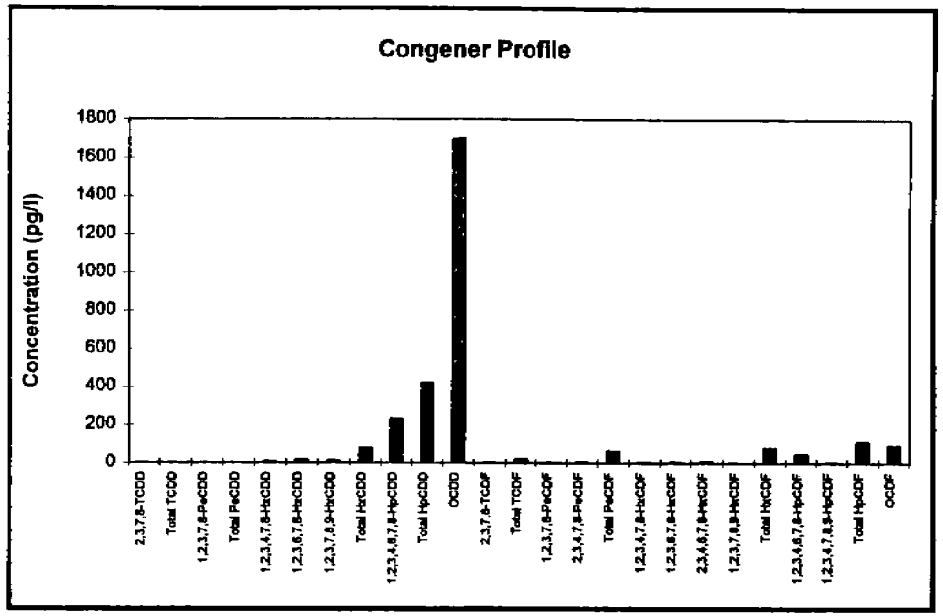
Table 3 Santa Clara County Sunnyvale East Channel Station SC-S2

Sample Date: Dec. 14, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	0.9	0
Total TCDD		ND	0.9	
1,2,3,7,8-PeCDD	0.5	ND	2.5	0
Total PeCDD		ND	2.5	
1,2,3,4,7,8-HxCDD	0.1	4.5		0.45
1,2,3,6,7,8-HxCDD	0.1	14		1.4
1,2,3,7,8,9-HxCDD	0.1	9.4		0.94
Total HxCDD		75		
1,2,3,4,6,7,8-HpCDD	0.01	230		2.3
Total HpCDD		420		
OCDD	0.001	1700		1.7
2,3,7,8-TCDF	0.1	1.2		0.12
Total TCDF		17		
1,2,3,7,8-PeCDF	0.05	1.8		0.09
2,3,4,7,8-PeCDF	0.5	3.2		1.6
Total PeCDF		60		
1,2,3,4,7,8-HxCDF	0.1	3.8		0.38
1,2,3,6,7,8-HxCDF	0.1	5.3		0.53
2,3,4,6,7,8-HxCDF	0.1	6.4		0.64
1,2,3,7,8,9-HxCDF	0.1	ND	0.98	0
Total HxCDF		75		
1,2,3,4,6,7,8-HpCDF	0.01	46		0.46
1,2,3,4,7,8,9-HpCDF	0.01	2.4		0.02
Total HpCDF		110		
OCDF	0.001	88		0.09
2,3,7,8-TCDD Toxicity Equivalents				11

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	4.2
1,6-HxCDD	13.1
1,7-HxCDD	8.8
HpCDD	21.5
OCDD	15.9
TCDF	1.1
1-PeCDF	0.8
4-PeCDF	14.9
1,4-HxCDF	3.5
1,6-HxCDF	4.9
4,6-HxCDF	6.0
1,9-HxCDF	0
1,4,6-HpCDF	4.3
1,4,9-HpCDF	0.2
OCDF	0.8

Non-detect values considered to be zero.



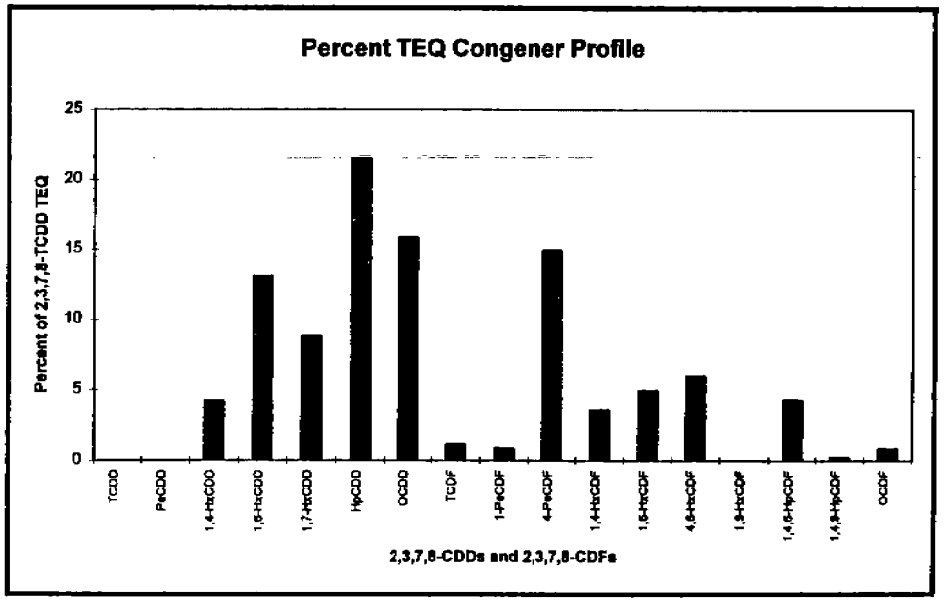


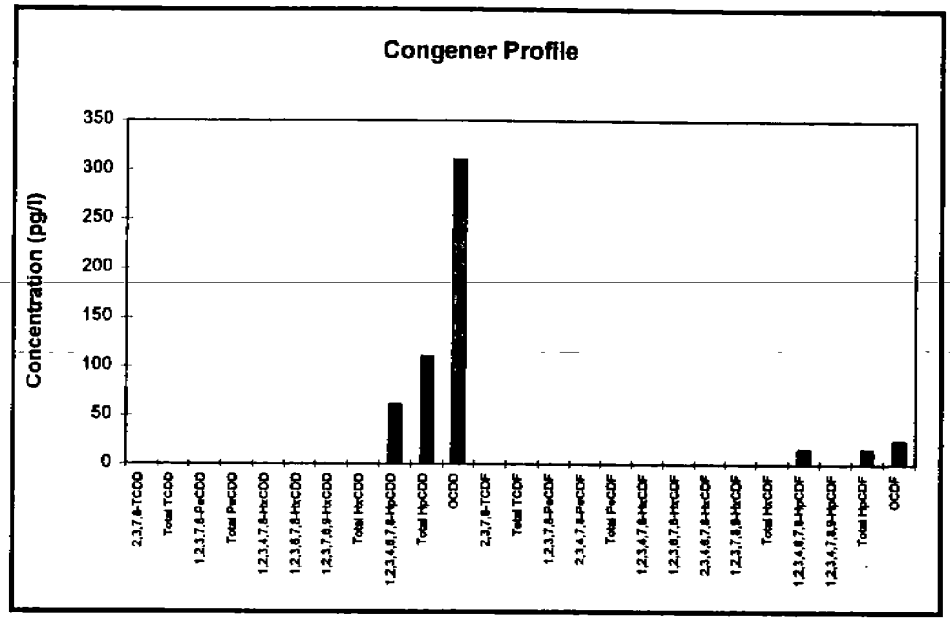
Table 4 Santa Clara County Sunnyvale East Channel Station SC-S2

Sample Date: April 1, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.9	0
Total TCDD		ND	3.9	
1,2,3,7,8-PeCDD	0.5	ND	5.8	0
Total PeCDD		ND	5.8	
1,2,3,4,7,8-HxCDD	0.1	ND	9.6	0
1,2,3,6,7,8-HxCDD	0.1	ND	10	0
1,2,3,7,8,9-HxCDD	0.1	ND	9.2	0
Total HxCDD		ND	10	
1,2,3,4,6,7,8-HpCDD	0.01	61		0.61
Total HpCDD		110		
OCDD	0.001	310		0.31
2,3,7,8-TCDF	0.1	ND	2.7	0
Total TCDF		ND	2.7	
1,2,3,7,8-PeCDF	0.05	ND	4.4	0
2,3,4,7,8-PeCDF	0.5	ND	4.2	0
Total PeCDF		ND	4.4	
1,2,3,4,7,8-HxCDF	0.1	ND	8.4	0
1,2,3,6,7,8-HxCDF	0.1	ND	8.1	0
2,3,4,6,7,8-HxCDF	0.1	ND	7.3	0
1,2,3,7,8,9-HxCDF	0.1	ND	7.8	0
Total HxCDF		ND	8.4	
1,2,3,4,6,7,8-HpCDF	0.01	15		0.15
1,2,3,4,7,8,9-HpCDF	0.01	ND	2.7	0
Total HpCDF		15		
OCDF	0.001	24		0.02
2,3,7,8-TCDD Toxicity Equivalents				1.1

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	55.8
OCDD	28.3
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	13.7
1,4,9-HpCDF	0
OCDF	2.2

Non-detect values considered to be zero.



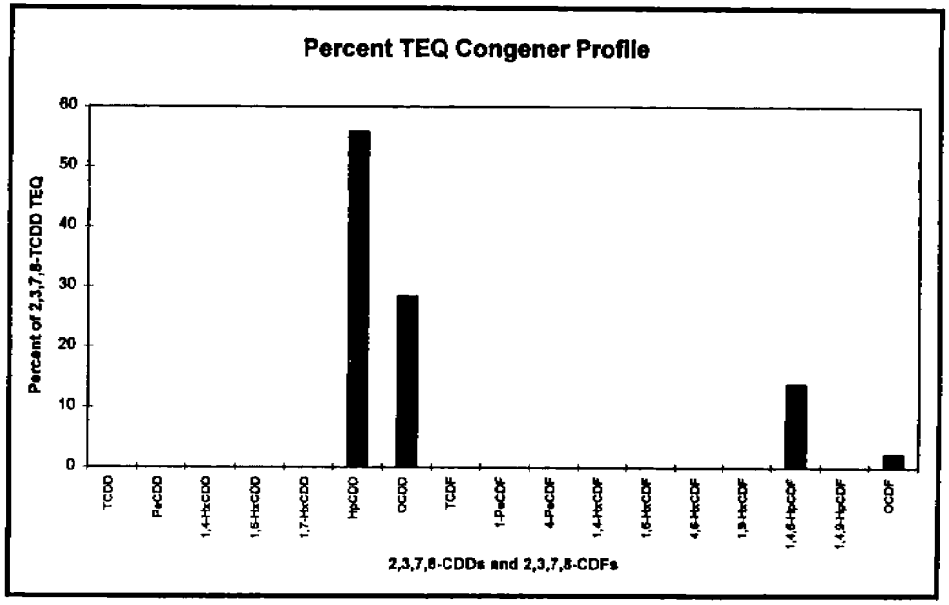


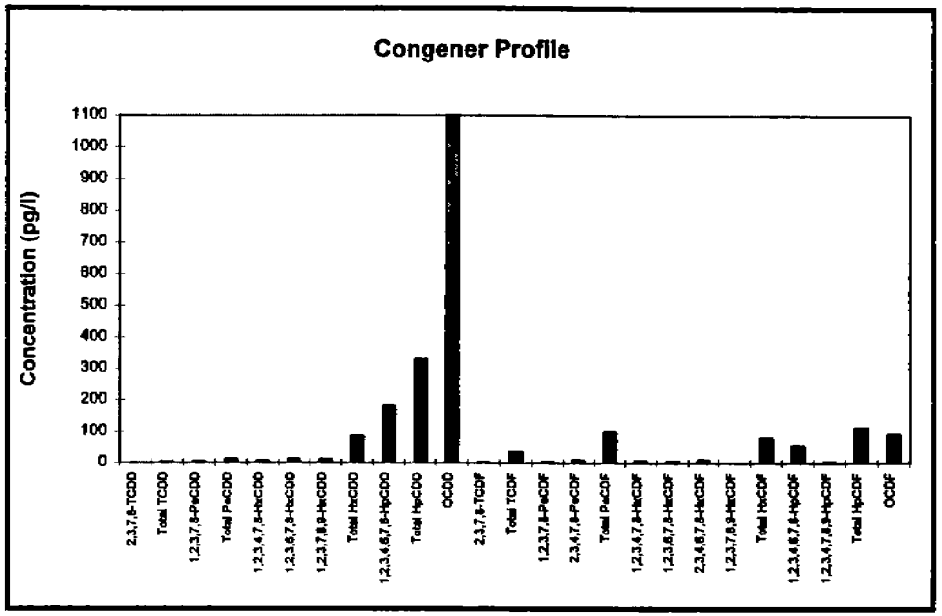
Table 5 Santa Clara County Guadalupe River Station SC-S3

Sample Date: December 14, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1.1	0
Total TCDD		3		
1,2,3,7,8-PeCDD	0.5	3.6		1.8
Total PeCDD		12		
1,2,3,4,7,8-HxCDD	0.1	5.6		0.56
1,2,3,6,7,8-HxCDD	0.1	12		1.2
1,2,3,7,8,9-HxCDD	0.1	11		1.1
Total HxCDD		65		
1,2,3,4,6,7,8-HpCDD	0.01	180		1.8
Total HpCDD		330		
OCDD	0.001	1100		1.1
2,3,7,8-TCDF	0.1	2.4		0.24
Total TCDF		36		
1,2,3,7,8-PeCDF	0.05	2.5		0.13
2,3,4,7,8-PeCDF	0.5	8.5		4.3
Total PeCDF		99		
1,2,3,4,7,8-HxCDF	0.1	5.4		0.54
1,2,3,6,7,8-HxCDF	0.1	5.1		0.51
2,3,4,6,7,8-HxCDF	0.1	9.2		0.92
1,2,3,7,8,9-HxCDF	0.1	ND	1.1	0
Total HxCDF		60		
1,2,3,4,6,7,8-HpCDF	0.01	54		0.54
1,2,3,4,7,8,9-HpCDF	0.01	4.2		0.04
Total HpCDF		110		
OCDF	0.001	92		0.09
2,3,7,8-TCDD Toxicity Equivalents				15

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	12.1
1,4-HxCDD	3.8
1,6-HxCDD	8.1
1,7-HxCDD	7.4
HpCDD	12.1
OCDD	7.4
TCDF	1.6
1-PeCDF	0.8
4-PeCDF	28.7
1,4-HxCDF	3.6
1,6-HxCDF	3.4
4,6-HxCDF	6.2
1,9-HxCDF	0
1,4,6-HpCDF	3.6
1,4,9-HpCDF	0.3
OCDF	0.6

Non-detect values considered to be zero.



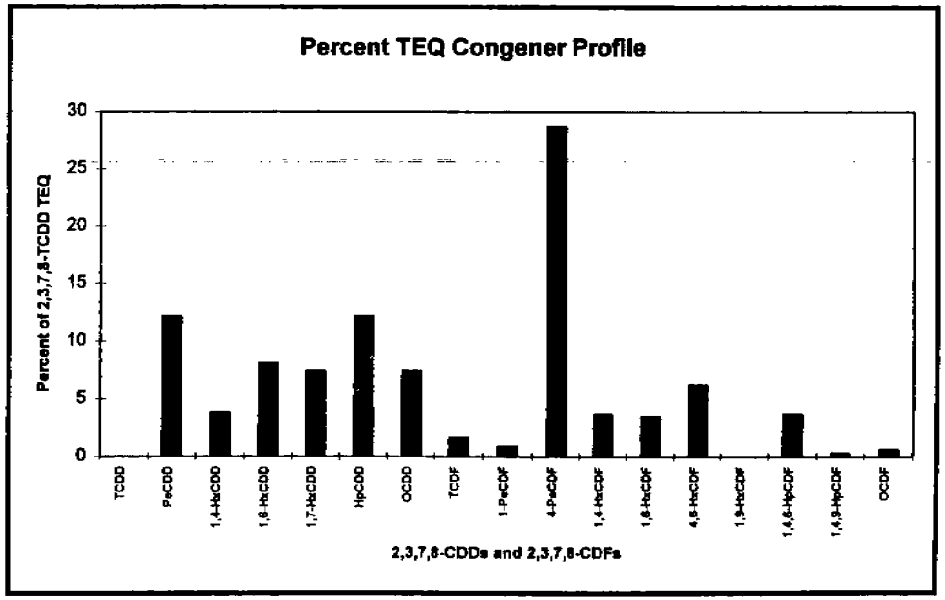


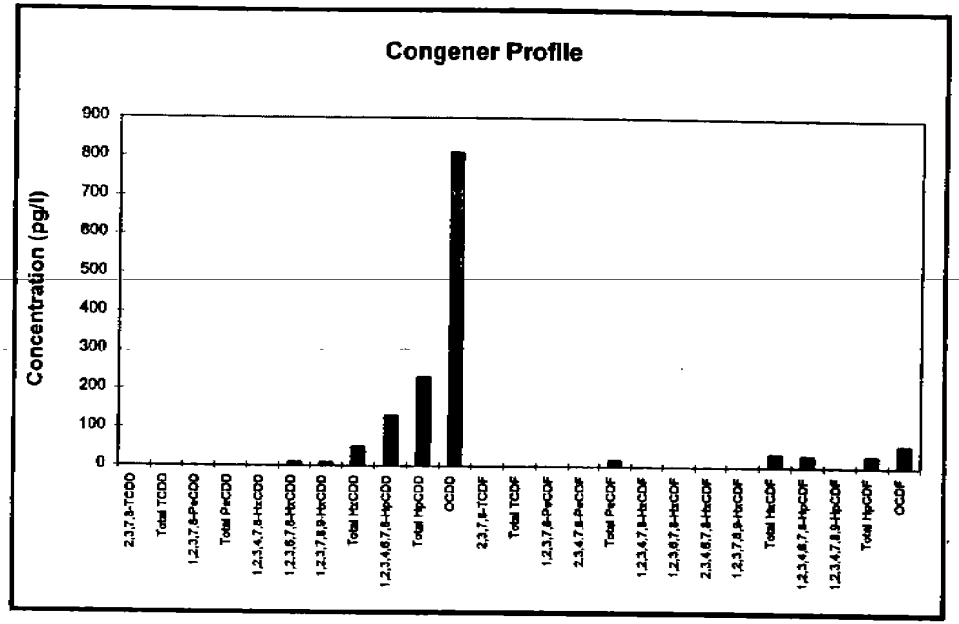
Table 6 Santa Clara County Guadalupe River Station SC-S3

Sample Date: April 1, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.5	0
Total TCDD		ND	3.5	
1,2,3,7,8-PeCDD	0.5	ND	2.5	0
Total PeCDD		ND	2.5	
1,2,3,4,7,8-HxCDD	0.1	ND	6.9	0
1,2,3,6,7,8-HxCDD	0.1	8.5		0.85
1,2,3,7,8,9-HxCDD	0.1	7.6		0.76
Total HxCDD		48		
1,2,3,4,6,7,8-HpCDD	0.01	130		1.30
Total HpCDD		230		
OCDD	0.001	810		0.81
2,3,7,8-TCDF	0.1	ND	2.8	0
Total TCDF		ND	2.8	
1,2,3,7,8-PeCDF	0.05	ND	3.3	0
2,3,4,7,8-PeCDF	0.5	ND	3.3	0
Total PeCDF		16		
1,2,3,4,7,8-HxCDF	0.1	ND	2.4	0
1,2,3,6,7,8-HxCDF	0.1	ND	2.2	0
2,3,4,6,7,8-HxCDF	0.1	ND	3.8	0
1,2,3,7,8,9-HxCDF	0.1	ND	2.6	0
Total HxCDF		34		
1,2,3,4,6,7,8-HpCDF	0.01	29		0.29
1,2,3,4,7,8,9-HpCDF	0.01	ND	2	0
Total HpCDF		29		
OCDF	0.001	56		0.06
2,3,7,8-TCDD Toxicity Equivalents				4.1

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	20.9
1,7-HxCDD	18.7
HpCDD	32.0
OCDD	19.9
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	7.1
1,4,9-HpCDF	0
OCDF	1.4

Non-detect values considered to be zero.



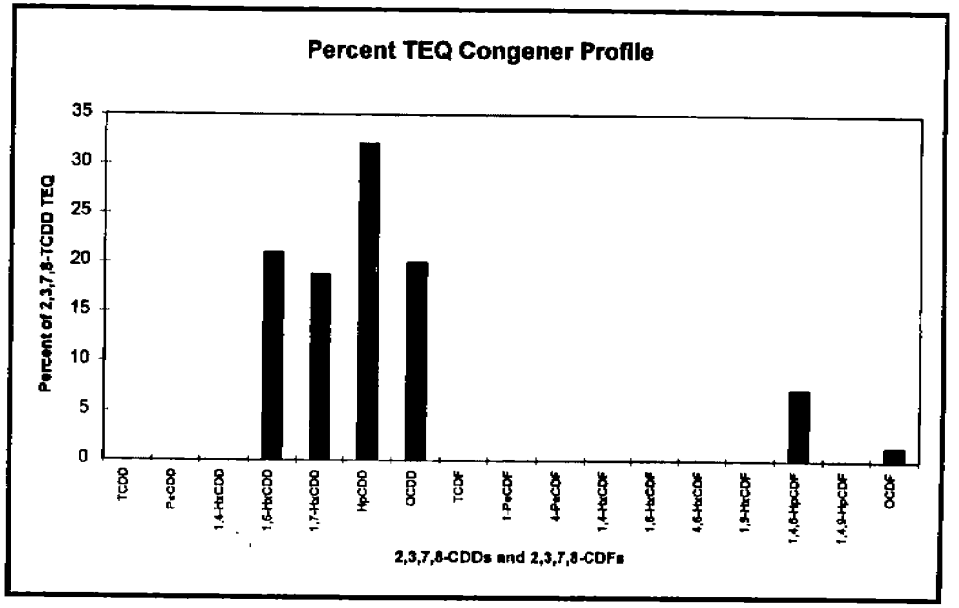


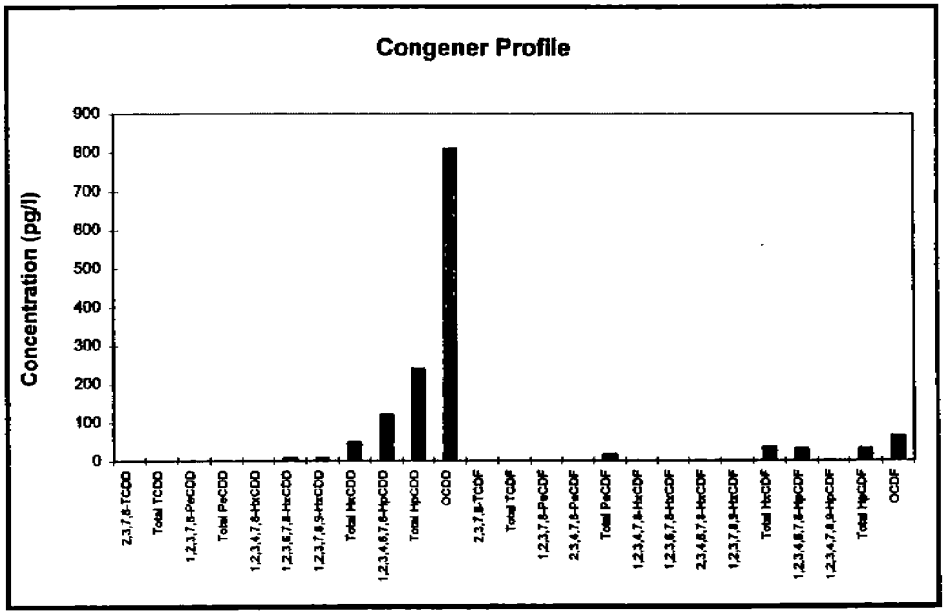
Table 7 Santa Clara County Guadalupe River Station SC-S3

Sample Date: April 1, 1996 (duplicate sample)

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3	0
Total TCDD		ND	3	
1,2,3,7,8-PeCDD	0.5	ND	2.6	0
Total PeCDD		ND	2.6	
1,2,3,4,7,8-HxCDD	0.1	ND	3.6	0
1,2,3,6,7,8-HxCDD	0.1	8.4		0.84
1,2,3,7,8,9-HxCDD	0.1	7.5		0.75
Total HxCDD		48		
1,2,3,4,6,7,8-HpCDD	0.01	120		1.20
Total HpCDD		240		
OCDD	0.001	810		0.81
2,3,7,8-TCDF	0.1	ND	3.3	0
Total TCDF		ND	3.3	
1,2,3,7,8-PeCDF	0.05	ND	3.3	0
2,3,4,7,8-PeCDF	0.5	ND	3.2	0
Total PeCDF		17		
1,2,3,4,7,8-HxCDF	0.1	ND	1.8	0
1,2,3,6,7,8-HxCDF	0.1	ND	1.7	0
2,3,4,6,7,8-HxCDF	0.1	ND	4.4	0
1,2,3,7,8,9-HxCDF	0.1	ND	1.9	0
Total HxCDF		34		
1,2,3,4,6,7,8-HpCDF	0.01	30		0.30
1,2,3,4,7,8,9-HpCDF	0.01	ND	2.7	0
Total HpCDF		30		
OCDF	0.001	84		0.08
2,3,7,8-TCDD Toxicity Equivalents				4.0

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	21.2
1,7-HxCDD	18.9
HpCDD	30.3
OCDD	20.4
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	7.6
1,4,9-HpCDF	0
OCDF	1.6

Non-detect values considered to be zero.



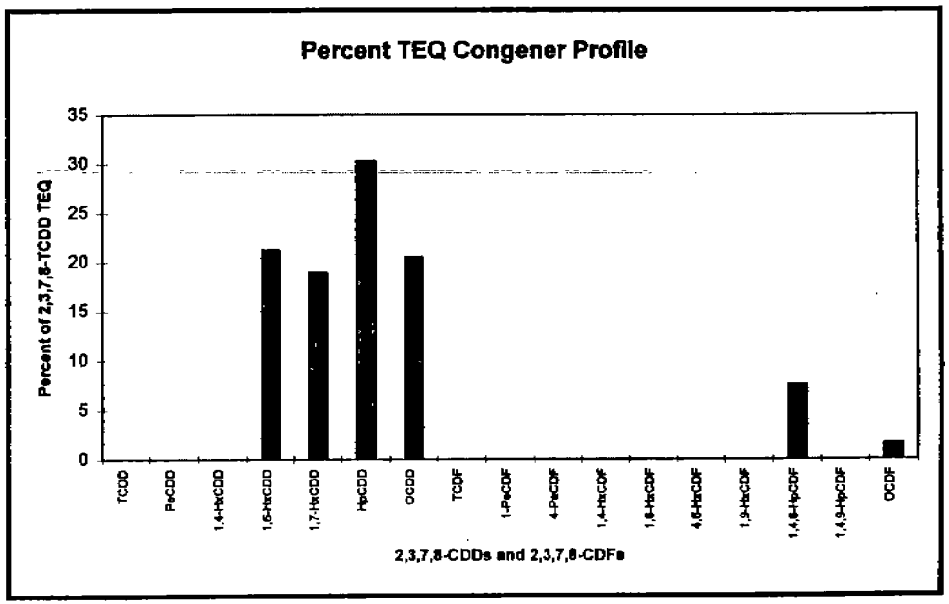


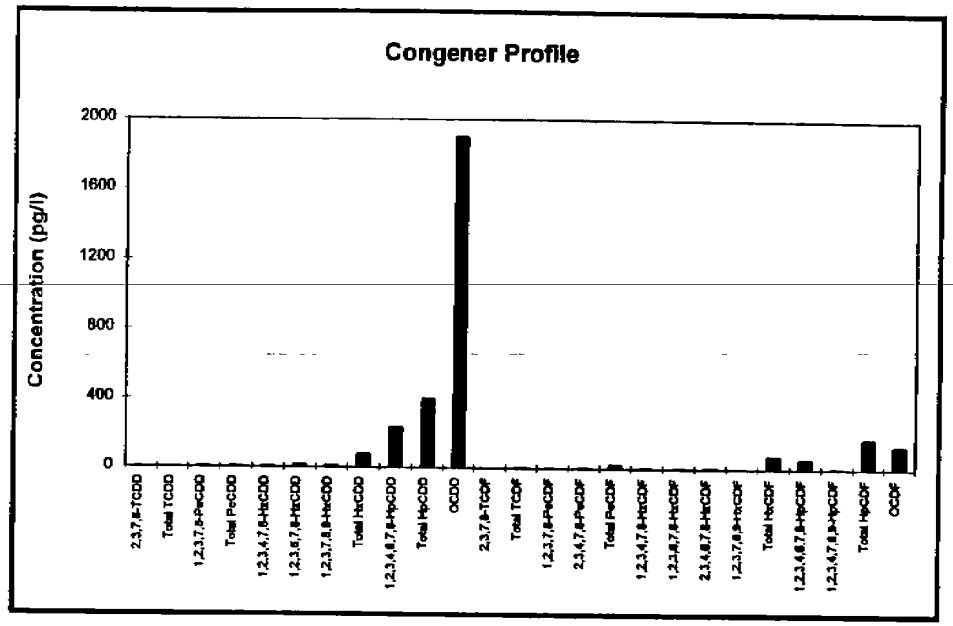
Table 8 Alameda County Castro Valley Creek Station S3

Sample Date: January 16, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	2	0
Total TCDD		ND	2	
1,2,3,7,8-PeCDD	0.5	2.7		1.4
Total PeCDD		2.7		
1,2,3,4,7,8-HxCDD	0.1	5.5		0.55
1,2,3,6,7,8-HxCDD	0.1	13		1.3
1,2,3,7,8,9-HxCDD	0.1	9.5		0.95
Total HxCDD		75		
1,2,3,4,6,7,8-HpCDD	0.01	230		2.3
Total HpCDD		400		
OCDD	0.001	1900		1.9
2,3,7,8-TCDF	0.1	ND	0.91	0
Total TCDF		2.8		
1,2,3,7,8-PeCDF	0.05	ND	0.82	0
2,3,4,7,8-PeCDF	0.5	1.8		0.90
Total PeCDF		20		
1,2,3,4,7,8-HxCDF	0.1	4.2		0.42
1,2,3,6,7,8-HxCDF	0.1	2.5		0.25
2,3,4,6,7,8-HxCDF	0.1	5.3		0.53
1,2,3,7,8,9-HxCDF	0.1	ND	1.2	0
Total HxCDF		72		
1,2,3,4,6,7,8-HpCDF	0.01	55		0.55
1,2,3,4,7,8,9-HpCDF	0.01	3.2		0.03
Total HpCDF		170		
OCDF	0.001	130		0.13
2,3,7,8-TCDD Toxicity Equivalents				11

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	12.1
1,4-HxCDD	4.9
1,6-HxCDD	11.6
1,7-HxCDD	8.5
HpCDD	20.6
OCDD	17.0
TCDF	0
1-PeCDF	0
4-PeCDF	8.1
1,4-HxCDF	3.8
1,6-HxCDF	2.2
4,6-HxCDF	4.7
1,9-HxCDF	0
1,4,6-HpCDF	4.9
1,4,9-HpCDF	0.3
OCDF	1.2

Non-detect values considered to be zero.



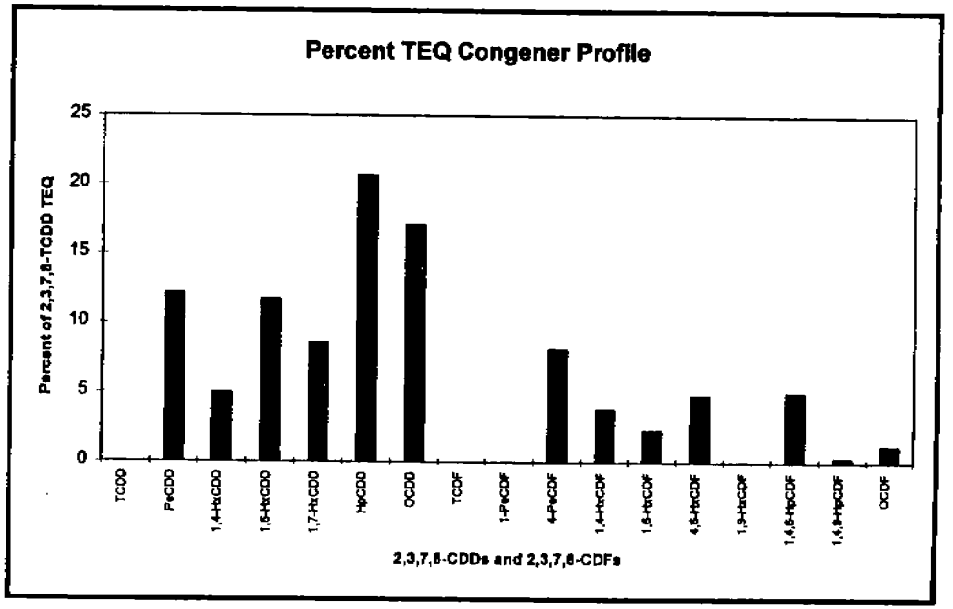


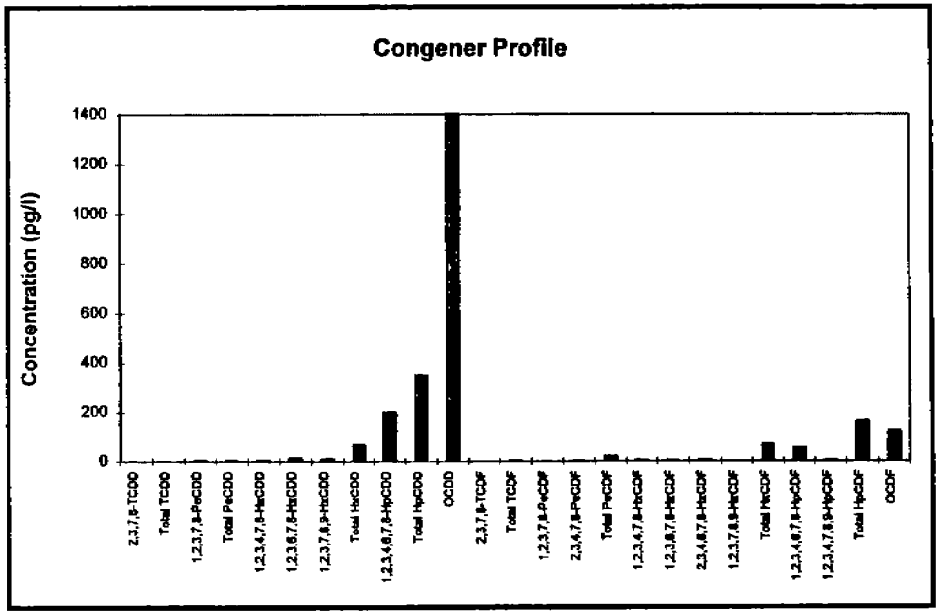
Table 9 Alameda County Castro Valley Creek Station S3

ample Date: January 16, 1996 (duplicate sample)

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1.6	0
Total TCDD		ND	1.6	
1,2,3,7,8-PeCDD	0.5	3.5		1.8
Total PeCDD		3.5		
1,2,3,4,7,8-HxCDD	0.1	4.6		0.46
1,2,3,6,7,8-HxCDD	0.1	13		1.3
1,2,3,7,8,9-HxCDD	0.1	9.4		0.94
Total HxCDD		68		
1,2,3,4,6,7,8-HpCDD	0.01	200		2.0
Total HpCDD		350		
OCDD	0.001	1400		1.4
2,3,7,8-TCDF	0.1	ND	0.44	0
Total TCDF		2.5		
1,2,3,7,8-PeCDF	0.05	ND	1.4	0
2,3,4,7,8-PeCDF	0.5	1.7		0.85
Total PeCDF		20		
1,2,3,4,7,8-HxCDF	0.1	3.5		0.35
1,2,3,6,7,8-HxCDF	0.1	2.4		0.24
2,3,4,6,7,8-HxCDF	0.1	4.9		0.49
1,2,3,7,8,9-HxCDF	0.1	ND	0.68	0
Total HxCDF		66		
1,2,3,4,6,7,8-HpCDF	0.01	53		0.53
1,2,3,4,7,8,9-HpCDF	0.01	3	2	0.03
Total HpCDF		160		
OCDF	0.001	120		0.12
2,3,7,8-TCDD Toxicity Equivalents				10

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	16.7
1,4-HxCDD	4.4
1,6-HxCDD	12.4
1,7-HxCDD	9.0
HpCDD	19.1
OCDD	13.4
TCDF	0
1-PeCDF	0
4-PeCDF	8.1
1,4-HxCDF	3.3
1,6-HxCDF	2.3
4,6-HxCDF	4.7
1,9-HxCDF	0
1,4,6-HpCDF	5.1
1,4,9-HpCDF	0
OCDF	1.1

Non-detect values considered to be zero.



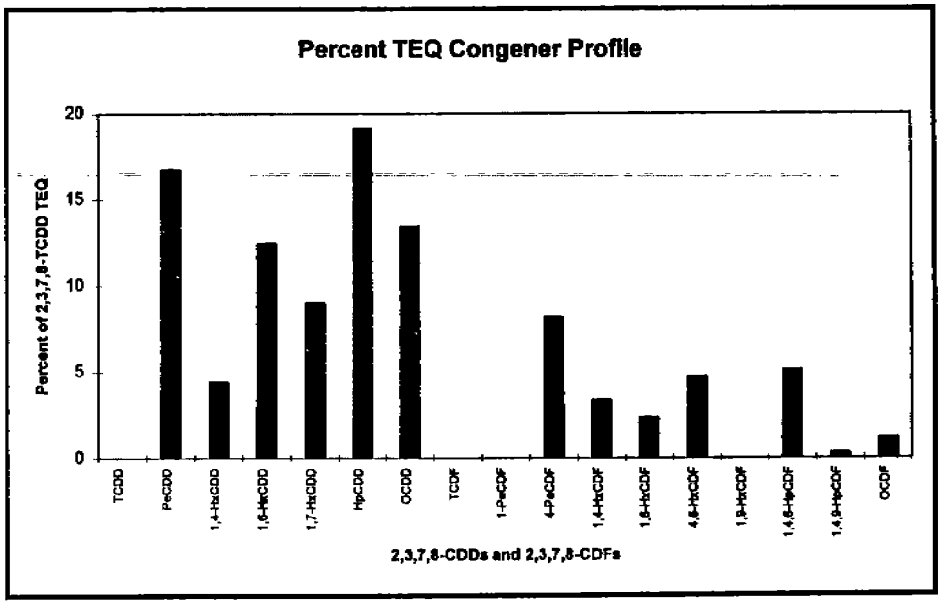


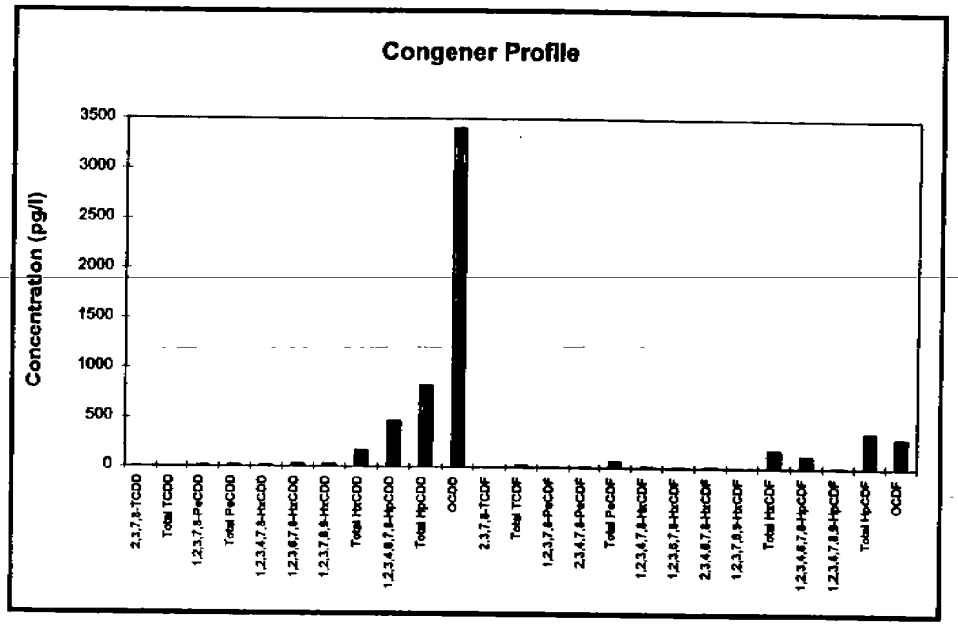
Table 10 Alameda County Castro Valley Creek Station S3

Sample Date: April 1, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	4.3	0
Total TCDD		ND	4.3	
1,2,3,7,8-PeCDD	0.5	7.7		3.9
Total PeCDD		13		
1,2,3,4,7,8-HxCDD	0.1	13		1.3
1,2,3,6,7,8-HxCDD	0.1	26		2.6
1,2,3,7,8,9-HxCDD	0.1	24		2.4
Total HxCDD		160		
1,2,3,4,6,7,8-HpCDD	0.01	460		4.6
Total HpCDD		820		
OCDD	0.001	3400		3.4
2,3,7,8-TCDF	0.1	1.7		0.17
Total TCDF		22		
1,2,3,7,8-PeCDF	0.05	2.2		0.11
2,3,4,7,8-PeCDF	0.5	5.5		2.8
Total PeCDF		83		
1,2,3,4,7,8-HxCDF	0.1	9.7		0.97
1,2,3,6,7,8-HxCDF	0.1	6.6		0.66
2,3,4,6,7,8-HxCDF	0.1	10		1.0
1,2,3,7,8,9-HxCDF	0.1	ND	3.4	0
Total HxCDF		160		
1,2,3,4,6,7,8-HpCDF	0.01	120		1.2
1,2,3,4,7,8,9-HpCDF	0.01	7.2	2.7	0.07
Total HpCDF		350		
OCDF	0.001	300		0.30
2,3,7,8-TCDD Toxicity Equivalents				26

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	15.0
1,4-HxCDD	5.1
1,6-HxCDD	10.9
1,7-HxCDD	9.4
HpCDD	18.0
OCDD	13.3
TCDF	0.7
1-PeCDF	0
4-PeCDF	10.7
1,4-HxCDF	3.8
1,6-HxCDF	2.6
4,6-HxCDF	3.9
1,9-HxCDF	0
1,4,6-HpCDF	4.7
1,4,9-HpCDF	0
OCDF	1.2

Non-detect values considered to be zero.



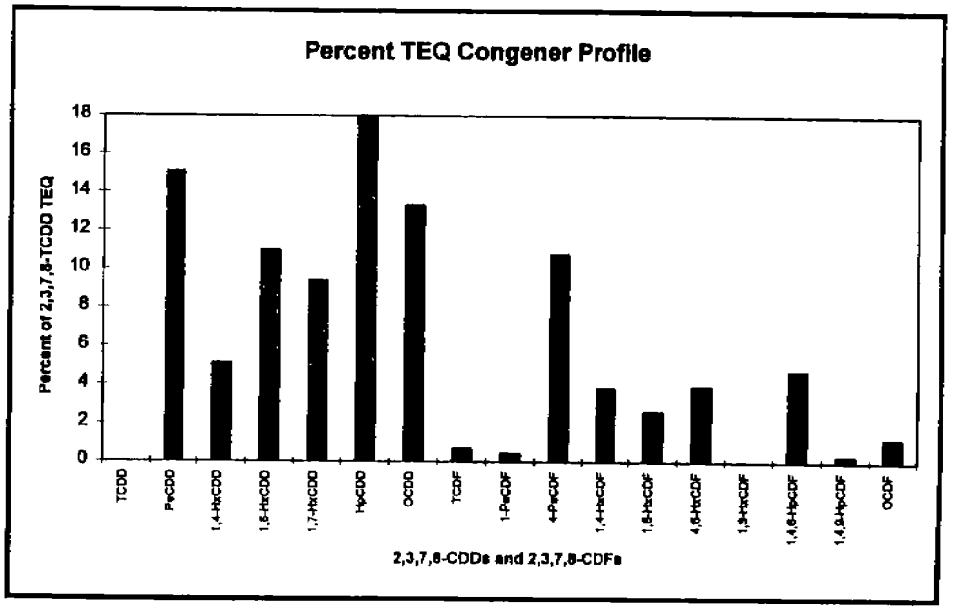


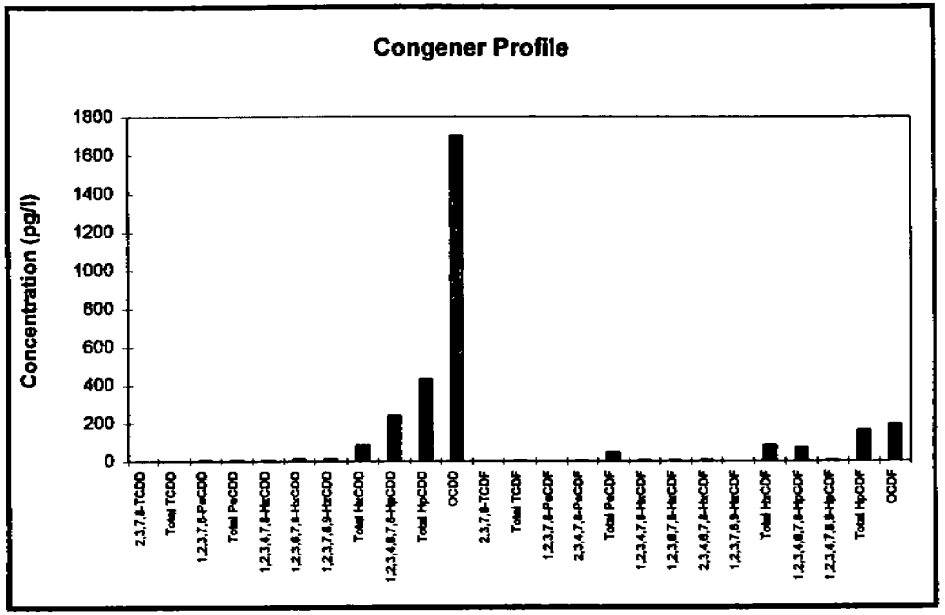
Table 11 Contra Costa County Rheem Creek Station CCS1

Sample Date: December 11, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1.8	0
Total TCDD		ND	1.8	
1,2,3,7,8-PeCDD	0.5	3.8		1.9
Total PeCDD		5.8		
1,2,3,4,7,8-HxCDD	0.1	6.1		0.61
1,2,3,6,7,8-HxCDD	0.1	15		1.5
1,2,3,7,8,9-HxCDD	0.1	15		1.5
Total HxCDD		85		
1,2,3,4,6,7,8-HpCDD	0.01	240		2.4
Total HpCDD		430		
OCDD	0.001	1700		1.7
2,3,7,8-TCDF	0.1	ND	1.4	0
Total TCDF		5.5		
1,2,3,7,8-PeCDF	0.05	ND	1.3	0
2,3,4,7,8-PeCDF	0.5	3.3		1.7
Total PeCDF		45		
1,2,3,4,7,8-HxCDF	0.1	4		0.40
1,2,3,6,7,8-HxCDF	0.1	4.2		0.42
2,3,4,6,7,8-HxCDF	0.1	7.1		0.71
1,2,3,7,8,9-HxCDF	0.1	ND	0.96	0
Total HxCDF		81		
1,2,3,4,6,7,8-HpCDF	0.01	69		0.69
1,2,3,4,7,8,9-HpCDF	0.01	4.3		0.04
Total HpCDF		160		
OCDF	0.001	190		0.19
2,3,7,8-TCDD Toxicity Equivalents				14

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	13.9
1,4-HxCDD	4.4
1,6-HxCDD	10.9
1,7-HxCDD	10.9
HpCDD	17.5
OCDD	12.4
TCDF	0
1-PeCDF	0
4-PeCDF	12.0
1,4-HxCDF	2.9
1,6-HxCDF	3.1
4,6-HxCDF	5.2
1,9-HxCDF	0
1,4,6-HpCDF	5.0
1,4,9-HpCDF	0.3
OCDF	1.4

Non-detect values considered to be zero.



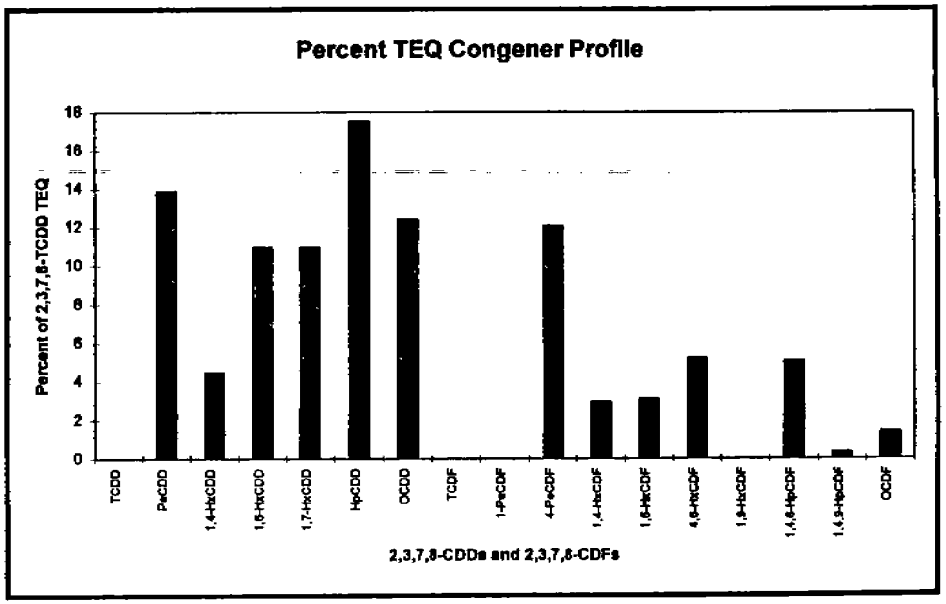


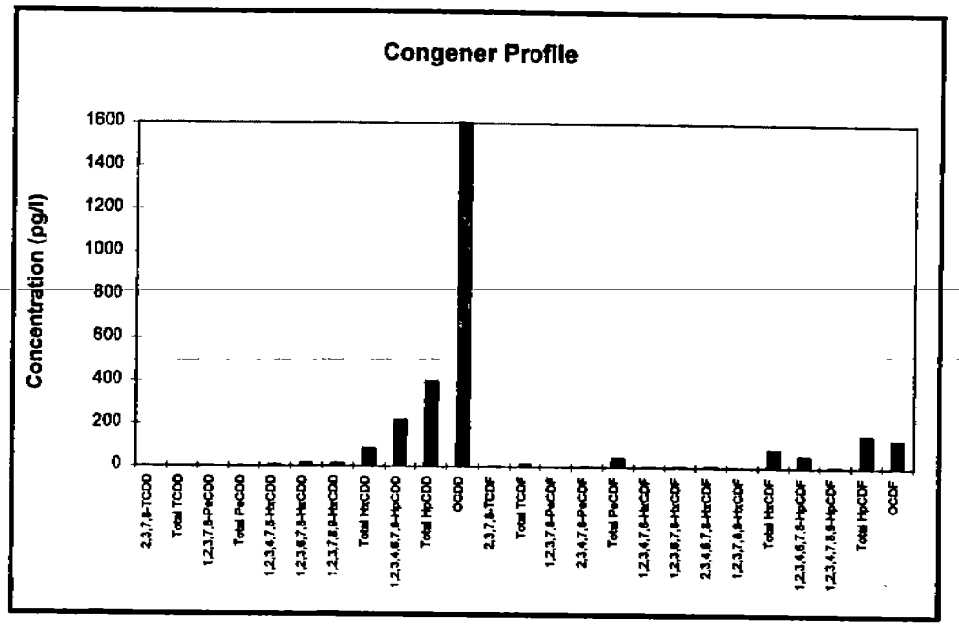
Table 12 Contra Costa County Rheem Creek Station CCS1

Sample Date: April 1, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	4.3	0
Total TCDD		ND	4.3	
1,2,3,7,8-PeCDD	0.5	ND	3.4	0
Total PeCDD		ND	3.4	0
1,2,3,4,7,8-HxCDD	0.1	5.5		0.55
1,2,3,6,7,8-HxCDD	0.1	13		1.3
1,2,3,7,8,9-HxCDD	0.1	11		1.1
Total HxCDD		81		
1,2,3,4,6,7,8-HpCDD	0.01	220		2.2
Total HpCDD		400		
OCDD	0.001	1600		1.6
2,3,7,8-TCDF	0.1	2.2		0.22
Total TCDF		12		
1,2,3,7,8-PeCDF	0.05	ND	2.3	0
2,3,4,7,8-PeCDF	0.5	3.2		1.6
Total PeCDF		41		
1,2,3,4,7,8-HxCDF	0.1	4.4		0.44
1,2,3,6,7,8-HxCDF	0.1	3.4		0.34
2,3,4,6,7,8-HxCDF	0.1	7.4		0.74
1,2,3,7,8,9-HxCDF	0.1	ND	1.1	0
Total HxCDF		83		
1,2,3,4,6,7,8-HpCDF	0.01	54		0.54
1,2,3,4,7,8,9-HpCDF	0.01	4.9		0.05
Total HpCDF		150		
OCDF	0.001	130		0.13
2,3,7,8-TCDD Toxicity Equivalents				11

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	5.1
1,6-HxCDD	12.0
1,7-HxCDD	10.2
HpCDD	20.4
OCDD	14.8
TCDF	2.0
1-PeCDF	0
4-PeCDF	14.8
1,4-HxCDF	4.1
1,6-HxCDF	3.1
4,6-HxCDF	6.8
1,9-HxCDF	0
1,4,6-HpCDF	5.0
1,4,9-HpCDF	0.5
OCDF	1.2

Non-detect values considered to be zero.



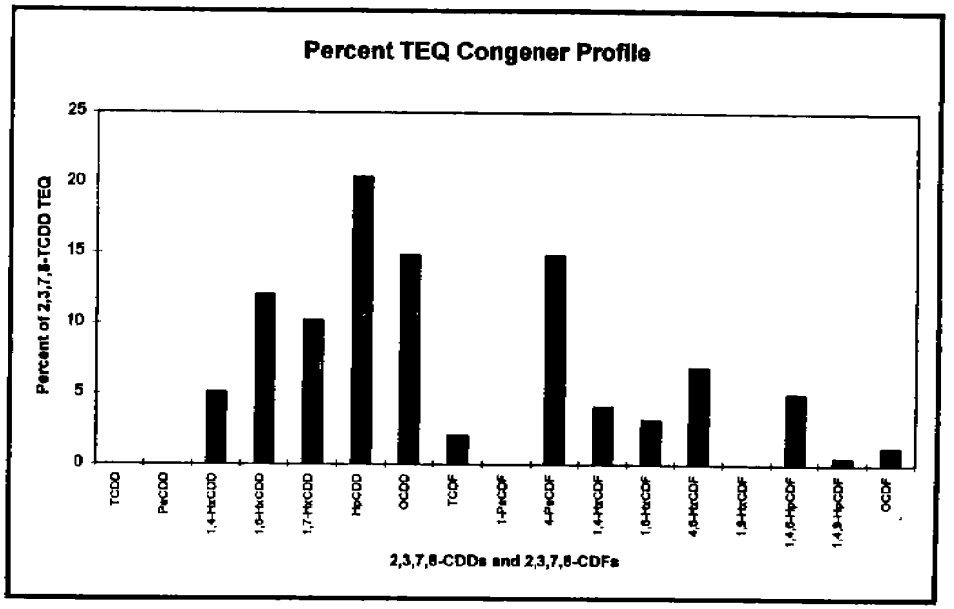


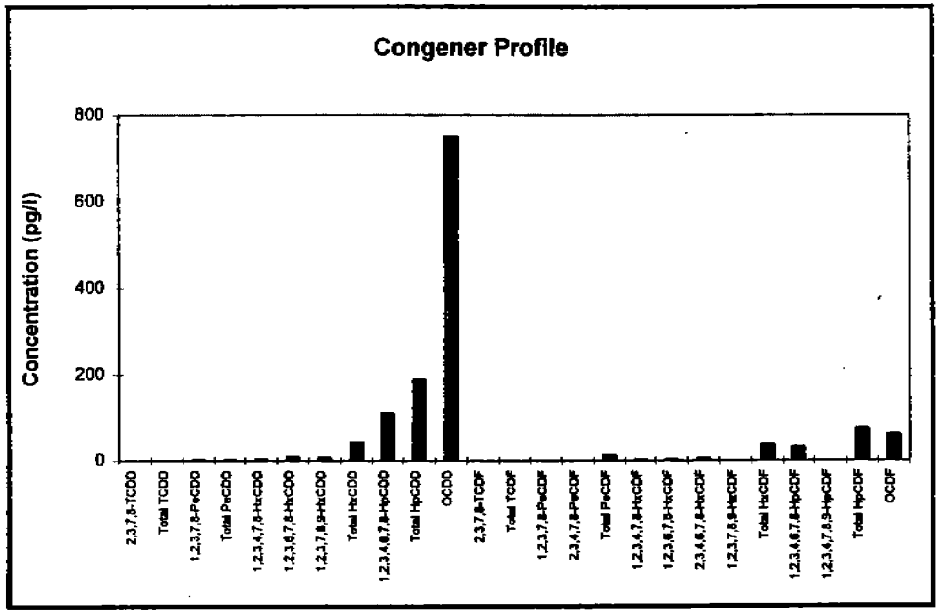
Table 13 Contra Costa County Walnut Creek Station CCS2

Sample Date: Dec. 13, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1	0
Total TCDD		ND	1	
1,2,3,7,8-PeCDD	0.5	2.2		1.10
Total PeCDD		2.2		
1,2,3,4,7,8-HxCDD	0.1	3.3		0.33
1,2,3,6,7,8-HxCDD	0.1	8.4		0.84
1,2,3,7,8,9-HxCDD	0.1	7.4		0.74
Total HxCDD		43		
1,2,3,4,6,7,8-HpCDD	0.01	110		1.10
Total HpCDD		190		
OCDD	0.001	750		0.75
2,3,7,8-TCDF	0.1	ND	0.86	0
Total TCDF		ND	1.2	
1,2,3,7,8-PeCDF	0.05	ND	1.6	0
2,3,4,7,8-PeCDF	0.5	ND	1.3	0
Total PeCDF		13		
1,2,3,4,7,8-HxCDF	0.1	1.9		0.19
1,2,3,6,7,8-HxCDF	0.1	2.1		0.21
2,3,4,6,7,8-HxCDF	0.1	5		0.50
1,2,3,7,8,9-HxCDF	0.1	ND	0.99	0
Total HxCDF		37		
1,2,3,4,6,7,8-HpCDF	0.01	31		0.31
1,2,3,4,7,8,9-HpCDF	0.01	ND	2	0
Total HpCDF		74		
OCDF	0.001	60		0.06
2,3,7,8-TCDD Toxicity Equivalents				6.1

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	17.9
1,4-HxCDD	5.4
1,6-HxCDD	13.7
1,7-HxCDD	12.1
HpCDD	17.9
OCDD	12.2
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	3.1
1,6-HxCDF	3.4
4,6-HxCDF	8.2
1,9-HxCDF	0.0
1,4,6-HpCDF	5.1
1,4,9-HpCDF	0
OCDF	1.0

Non-detect values considered to be zero.



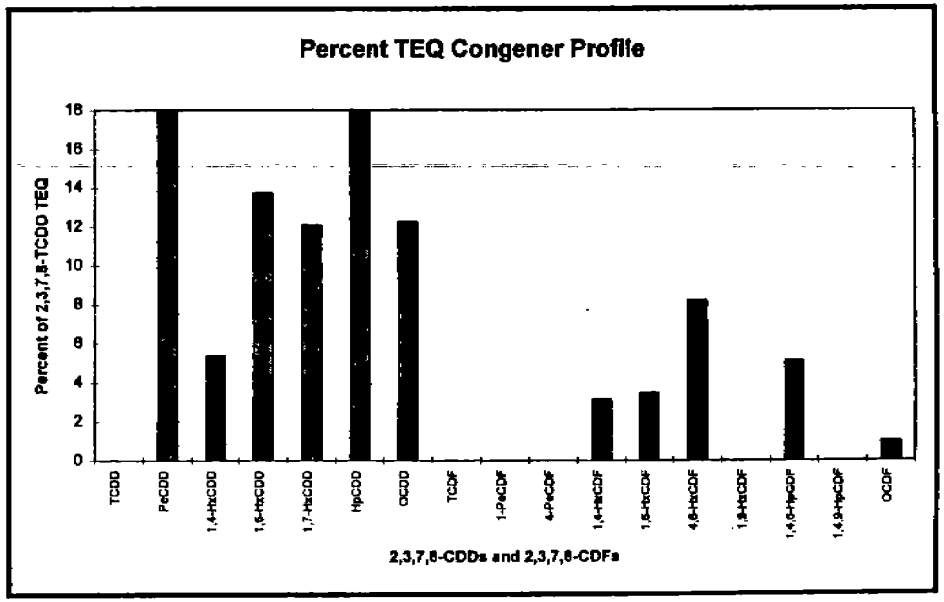


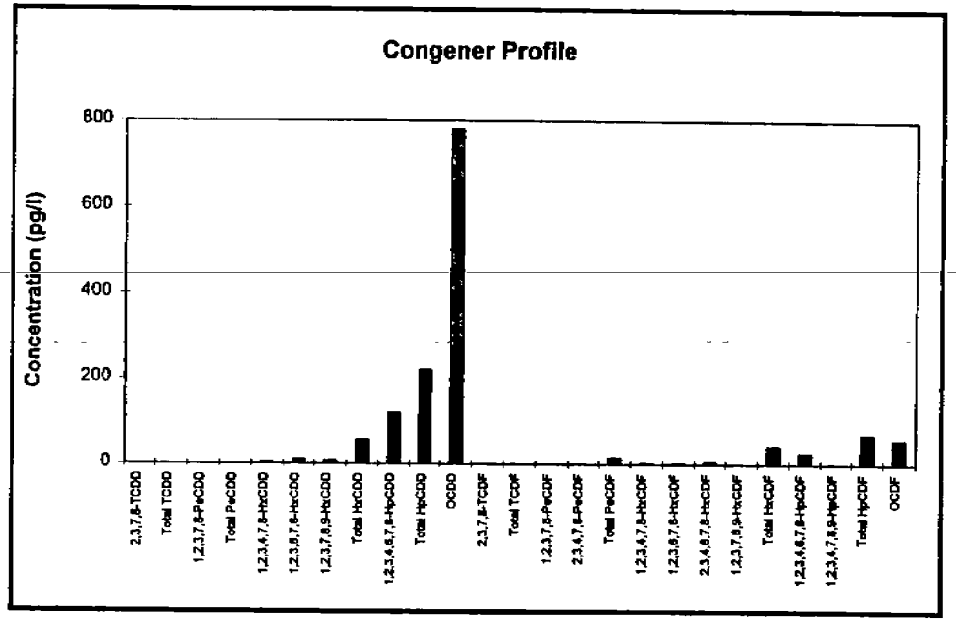
Table 14 Contra Costa County Walnut Creek Station CCS2

Sample Date: April 1, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	4.2	0
Total TCDD		ND	4.2	
1,2,3,7,8-PeCDD	0.5	ND	2.5	0
Total PeCDD		ND	2.5	
1,2,3,4,7,8-HxCDD	0.1	3.8		0.38
1,2,3,6,7,8-HxCDD	0.1	9.3		0.93
1,2,3,7,8,9-HxCDD	0.1	6.6		0.66
Total HxCDD		54		
1,2,3,4,6,7,8-HpCDD	0.01	120		1.20
Total HpCDD		220		
OCDD	0.001	780		0.78
2,3,7,8-TCDF	0.1	ND	3.4	0
Total TCDF		ND	4	
1,2,3,7,8-PeCDF	0.05	ND	1.5	0
2,3,4,7,8-PeCDF	0.5	ND	2.3	0
Total PeCDF		14		
1,2,3,4,7,8-HxCDF	0.1	2.1		0.21
1,2,3,6,7,8-HxCDF	0.1	2.1		0.21
2,3,4,6,7,8-HxCDF	0.1	4.7		0.47
1,2,3,7,8,9-HxCDF	0.1	ND	1.8	0
Total HxCDF		41		
1,2,3,4,6,7,8-HpCDF	0.01	24		0.24
1,2,3,4,7,8,9-HpCDF	0.01	ND	1.9	0
Total HpCDF		68		
OCDF	0.001	55		0.06
2,3,7,8-TCDD Toxicity Equivalents				5.1

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	7.4
1,6-HxCDD	18.1
1,7-HxCDD	12.9
HpCDD	23.4
OCDD	15.2
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	4.1
1,6-HxCDF	4.1
4,6-HxCDF	9.2
1,9-HxCDF	0
1,4,6-HpCDF	4.7
1,4,9-HpCDF	0
OCDF	1.1

Non-detect values considered to be zero.



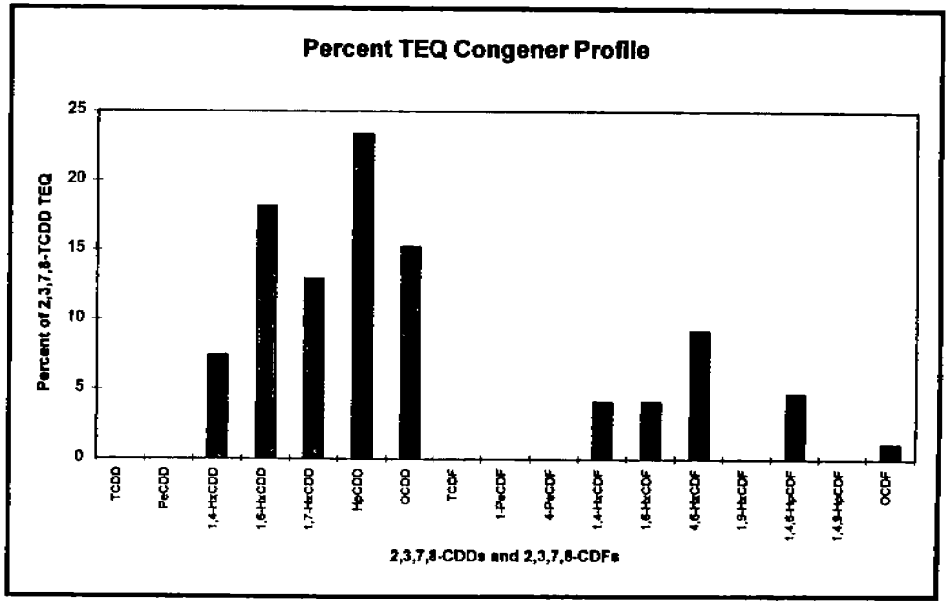


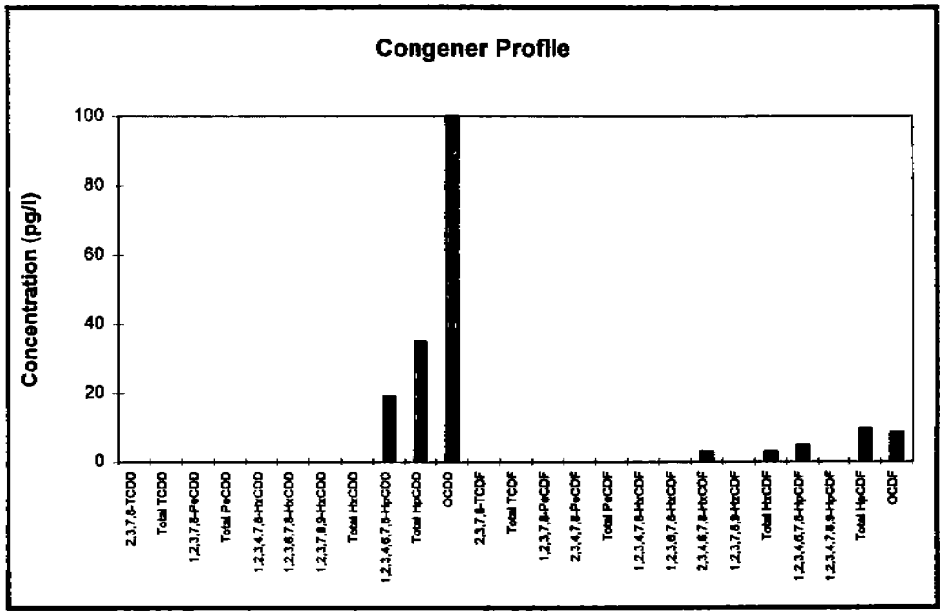
Table 15 Solano County Laurel Creek Station LB-0002

Sample Date: December 11, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	0.85	0
Total TCDD		ND	0.85	
1,2,3,7,8-PeCDD	0.5	ND	1.3	0
Total PeCDD		ND	1.3	
1,2,3,4,7,8-HxCDD	0.1	ND	1.5	0
1,2,3,6,7,8-HxCDD	0.1	ND	1.7	0
1,2,3,7,8,9-HxCDD	0.1	ND	1.6	0
Total HxCDD		ND	3.2	
1,2,3,4,6,7,8-HpCDD	0.01	19		0.19
Total HpCDD		35		
OCDD	0.001	100		0.10
2,3,7,8-TCDF	0.1	ND	0.89	0
Total TCDF		ND	0.89	
1,2,3,7,8-PeCDF	0.05	ND	1.9	0
2,3,4,7,8-PeCDF	0.5	ND	1.6	0
Total PeCDF		ND	1.9	
1,2,3,4,7,8-HxCDF	0.1	ND	1.5	0
1,2,3,6,7,8-HxCDF	0.1	ND	1.5	0
2,3,4,6,7,8-HxCDF	0.1	2.9		0.29
1,2,3,7,8,9-HxCDF	0.1	ND	1.1	0
Total HxCDF		2.9		
1,2,3,4,6,7,8-HpCDF	0.01	4.7		0.05
1,2,3,4,7,8,9-HpCDF	0.01	ND	0.83	0
Total HpCDF		9.5		
OCDF	0.001	8.4		0.008
2,3,7,8-TCDD Toxicity Equivalents				0.64

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	29.9
OCDD	15.7
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	45.6
1,9-HxCDF	0
1,4,6-HpCDF	7.4
1,4,9-HpCDF	0
OCDF	1.3

Non-detect values considered to be zero.



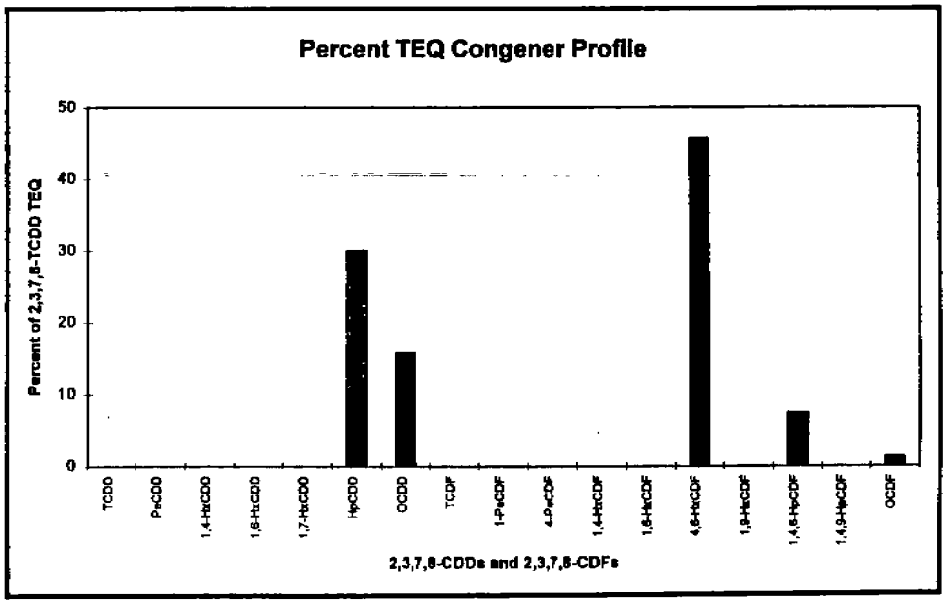


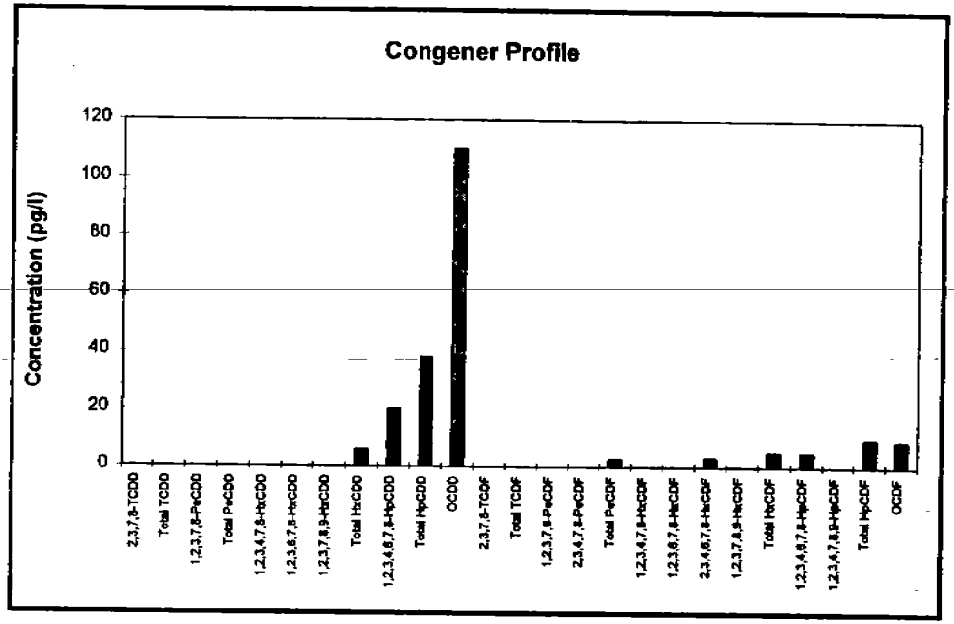
Table 16 Solano County Laurel Creek Station LB-0002

Sample Date: December 11, 1995 (duplicate)

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	0.85	0
Total TCDD		ND	0.85	
1,2,3,7,8-PeCDD	0.5	ND	1.5	0
Total PeCDD		ND	2	
1,2,3,4,7,8-HxCDD	0.1	ND	1.2	0
1,2,3,6,7,8-HxCDD	0.1	ND	1.4	0
1,2,3,7,8,9-HxCDD	0.1	ND	1.5	0
Total HxCDD		5.6		
1,2,3,4,6,7,8-HpCDD	0.01	20		0.20
Total HpCDD		38		
OCDD	0.001	110		0.11
2,3,7,8-TCDF	0.1	ND	0.8	0
Total TCDF		ND	0.8	
1,2,3,7,8-PeCDF	0.05	ND	1.6	0
2,3,4,7,8-PeCDF	0.5	ND	1.6	0
Total PeCDF		2.6		
1,2,3,4,7,8-HxCDF	0.1	ND	1.4	0
1,2,3,6,7,8-HxCDF	0.1	ND	1.5	0
2,3,4,6,7,8-HxCDF	0.1	3.1		0.31
1,2,3,7,8,9-HxCDF	0.1	ND	0.76	0
Total HxCDF		5.1		
1,2,3,4,6,7,8-HpCDF	0.01	4.8		0.05
1,2,3,4,7,8,9-HpCDF	0.01	ND	1.4	0
Total HpCDF		9.8		
OCDF	0.001	8.9		0.01
2,3,7,8-TCDD Toxicity Equivalents				0.68

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	29.5
OCDD	16.3
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	45.8
1,9-HxCDF	0
1,4,6-HpCDF	7.1
1,4,9-HpCDF	0
OCDF	1.3

Non-detect values considered to be zero.



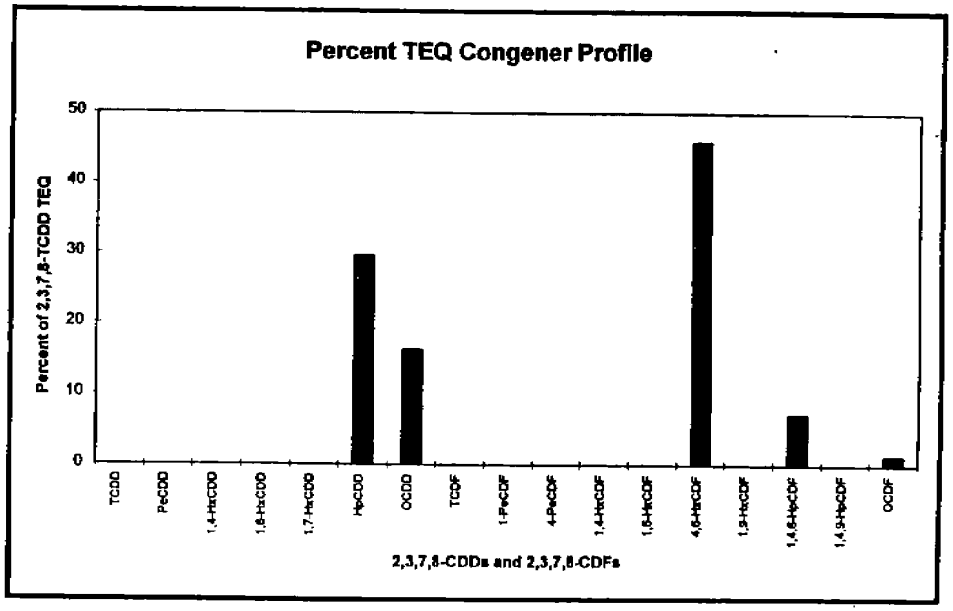


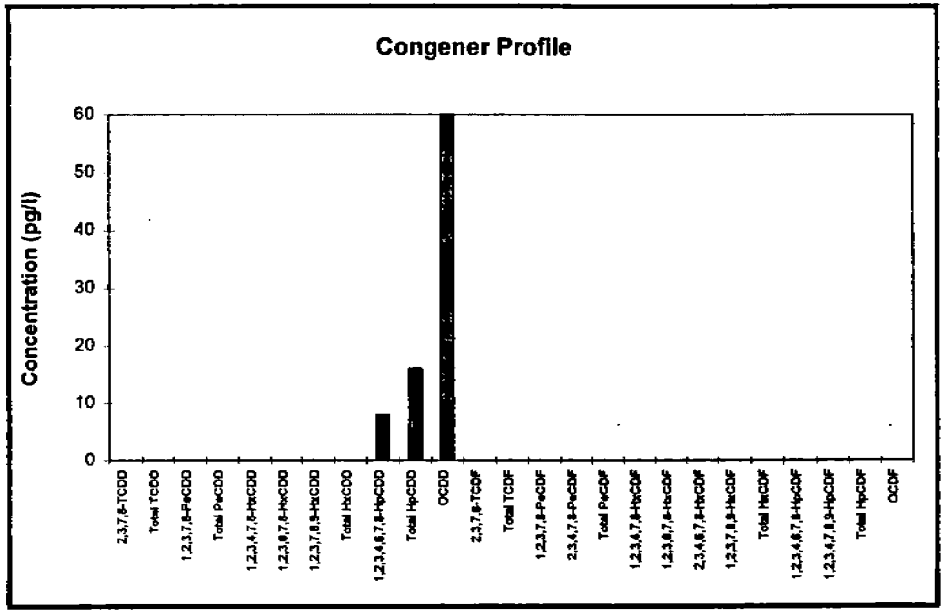
Table 17 Solano County Laurel Creek Station LB-0002

Sample Date: April 1, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.8	0
Total TCDD		ND	3.8	
1,2,3,7,8-PeCDD	0.5	ND	1.7	0
Total PeCDD		ND	1.7	
1,2,3,4,7,8-HxCDD	0.1	ND	3	0
1,2,3,6,7,8-HxCDD	0.1	ND	2.9	0
1,2,3,7,8,9-HxCDD	0.1	ND	2.6	0
Total HxCDD		ND	3	
1,2,3,4,6,7,8-HpCDD	0.01	7.9		0.08
Total HpCDD		16		
OCDD	0.001	60		0.06
2,3,7,8-TCDF	0.1	ND	1.5	0
Total TCDF		ND	1.5	
1,2,3,7,8-PeCDF	0.05	ND	2	0
2,3,4,7,8-PeCDF	0.5	ND	2	0
Total PeCDF		ND	2	
1,2,3,4,7,8-HxCDF	0.1	ND	1.5	0
1,2,3,6,7,8-HxCDF	0.1	ND	1.4	0
2,3,4,6,7,8-HxCDF	0.1	ND	2.7	0
1,2,3,7,8,9-HxCDF	0.1	ND	1.6	0
Total HxCDF		ND	2.7	
1,2,3,4,6,7,8-HpCDF	0.01	ND	1.9	0
1,2,3,4,7,8,9-HpCDF	0.01	ND	1.2	0
Total HpCDF		ND	1.9	
OCDF	0.001	ND	5.8	0
2,3,7,8-TCDD Toxicity Equivalents				0.14

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	56.8
OCDD	43.2
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	0
1,4,9-HpCDF	0
OCDF	0

Non-detect values considered to be zero.



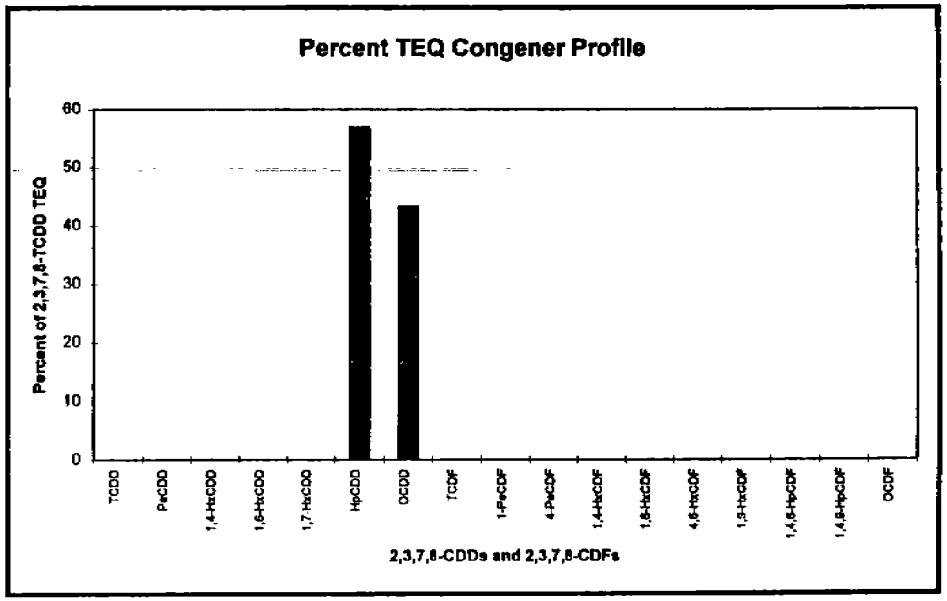


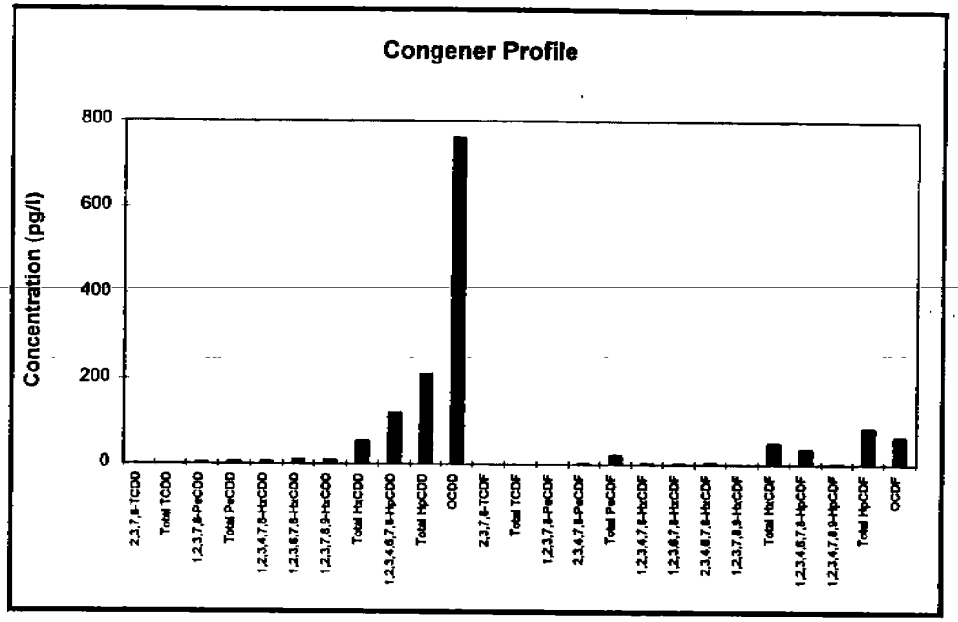
Table 18 Chevron U.S.A. Richmond, Station #1 Ox Pond

Sample Date: December 12, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1.1	0
Total TCDD		ND		
1,2,3,7,8-PeCDD	0.5	3		1.50
Total PeCDD		5		
1,2,3,4,7,8-HxCDD	0.1	4.8		0.48
1,2,3,6,7,8-HxCDD	0.1	9		0.90
1,2,3,7,8,9-HxCDD	0.1	8.3		0.83
Total HxCDD		54		
1,2,3,4,6,7,8-HpCDD	0.01	120		1.20
Total HpCDD		210		
OCDD	0.001	780		0.78
2,3,7,8-TCDF	0.1	ND		0
Total TCDF		ND		
1,2,3,7,8-PeCDF	0.05	ND		0
2,3,4,7,8-PeCDF	0.5	2		1.00
Total PeCDF		21		
1,2,3,4,7,8-HxCDF	0.1	3.7		0.37
1,2,3,6,7,8-HxCDF	0.1	2.8		0.28
2,3,4,6,7,8-HxCDF	0.1	5.1		0.51
1,2,3,7,8,9-HxCDF	0.1	ND	1.1	0
Total HxCDF		49		
1,2,3,4,6,7,8-HpCDF	0.01	38		0.38
1,2,3,4,7,8,9-HpCDF	0.01	3.2		0.03
Total HpCDF		84		
OCDF	0.001	65		0.07
2,3,7,8-TCDD Toxicity Equivalents				8.3

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	18.1
1,4-HxCDD	5.8
1,6-HxCDD	10.9
1,7-HxCDD	10.0
HpCDD	14.5
OCDD	9.2
TCDF	0
1-PeCDF	0
4-PeCDF	12.1
1,4-HxCDF	4.5
1,6-HxCDF	3.4
4,6-HxCDF	6.2
1,9-HxCDF	0
1,4,6-HpCDF	4.3
1,4,9-HpCDF	0.4
OCDF	0.8

Non-detect values considered to be zero.



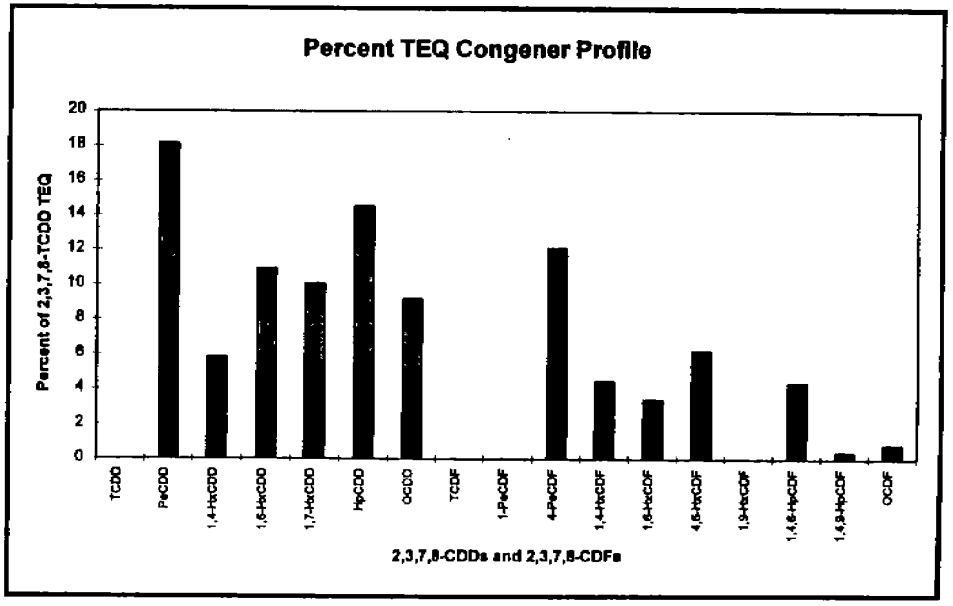


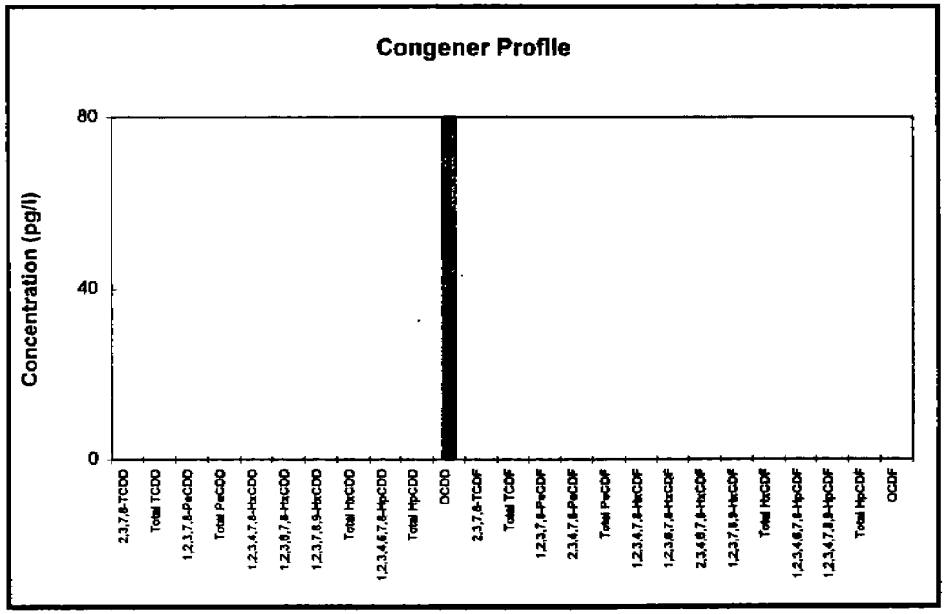
Table 19 Chevron U.S.A. Richmond, Station #1 Ox Pond

Sample Date: February 21, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	2.8	0
Total TCDD		ND	2.8	
1,2,3,7,8-PeCDD	0.5	ND	5.7	0
Total PeCDD		ND	18	
1,2,3,4,7,8-HxCDD	0.1	ND	5.4	0
1,2,3,6,7,8-HxCDD	0.1	ND	5.2	0
1,2,3,7,8,9-HxCDD	0.1	ND	4.7	0
Total HxCDD		ND	5.4	
1,2,3,4,6,7,8-HpCDD	0.01	ND	18	0
Total HpCDD		ND	18	
OCDD	0.001	80		0.08
2,3,7,8-TCDF	0.1	ND	1.5	0
Total TCDF		ND	1.5	
1,2,3,7,8-PeCDF	0.05	ND	3.4	0
2,3,4,7,8-PeCDF	0.5	ND	3.7	0
Total PeCDF		ND	3.7	
1,2,3,4,7,8-HxCDF	0.1	ND	2.4	0
1,2,3,6,7,8-HxCDF	0.1	ND	2.3	0
2,3,4,6,7,8-HxCDF	0.1	ND	2.5	0
1,2,3,7,8,9-HxCDF	0.1	ND	2.2	0
Total HxCDF		ND	2.5	
1,2,3,4,6,7,8-HpCDF	0.01	ND	4.5	0
1,2,3,4,7,8,9-HpCDF	0.01	ND	4	0
Total HpCDF		ND	4.5	
OCDF	0.001	ND	7.8	0

2,3,7,8-TCDD Toxicity Equivalents	0.08
	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	0
OCDD	100
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	0
1,4,9-HpCDF	0
OCDF	0

Non-detect values considered to be zero.



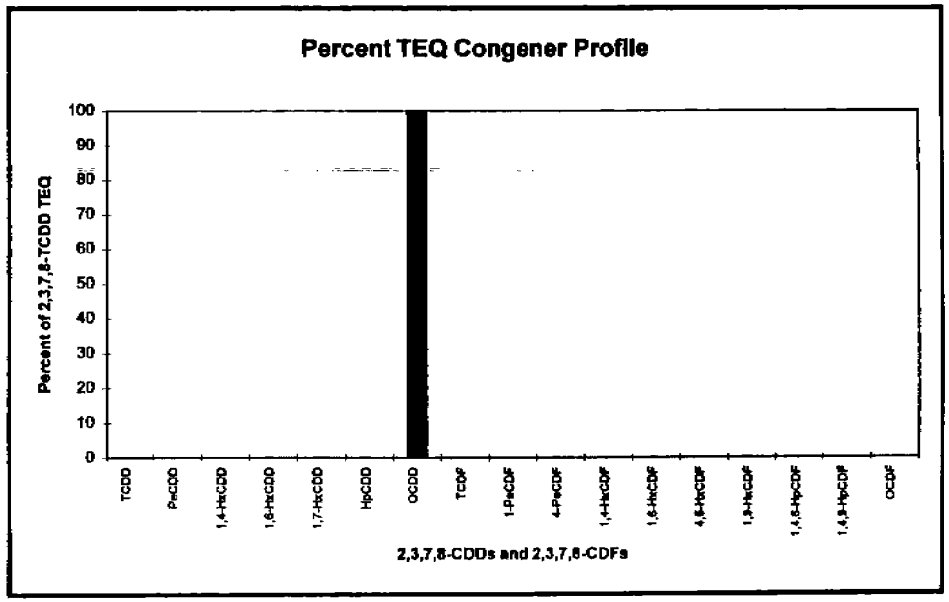


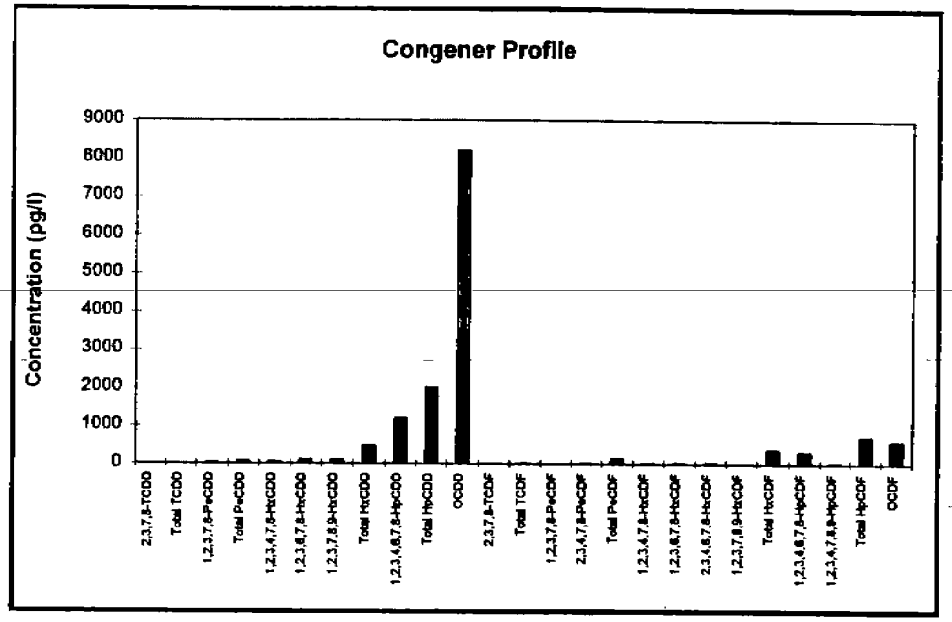
Table 20 Unocal Rodeo Refinery Station SW-1

Sample Date: December 11, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.7	0
Total TCDD		ND	3.7	
1,2,3,7,8-PeCDD	0.5	26		13
Total PeCDD		57		
1,2,3,4,7,8-HxCDD	0.1	43		4.3
1,2,3,6,7,8-HxCDD	0.1	86		8.6
1,2,3,7,8,9-HxCDD	0.1	83		8.3
Total HxCDD		460		
1,2,3,4,6,7,8-HpCDD	0.01	1200		12
Total HpCDD		2000		
OCDD	0.001	8200		8.2
2,3,7,8-TCDF	0.1	ND	1.8	0
Total TCDF		8.4		
1,2,3,7,8-PeCDF	0.05	3.8		0.19
2,3,4,7,8-PeCDF	0.5	7.7		3.9
Total PeCDF		130		
1,2,3,4,7,8-HxCDF	0.1	14		1.4
1,2,3,6,7,8-HxCDF	0.1	16		1.6
2,3,4,6,7,8-HxCDF	0.1	21		2.1
1,2,3,7,8,9-HxCDF	0.1	3.5		0.35
Total HxCDF		380		
1,2,3,4,6,7,8-HpCDF	0.01	300		3.0
1,2,3,4,7,8,9-HpCDF	0.01	16		0.16
Total HpCDF		700		
OCDF	0.001	590		0.59
2,3,7,8-TCDD Toxicity Equivalents				68

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	19.2
1,4-HxCDD	6.4
1,6-HxCDD	12.7
1,7-HxCDD	12.3
HpCDD	17.7
OCDD	12.1
TCDF	0
1-PeCDF	0.3
4-PeCDF	5.7
1,4-HxCDF	2.1
1,6-HxCDF	2.4
4,6-HxCDF	3.1
1,9-HxCDF	0.5
1,4,6-HpCDF	4.4
1,4,9-HpCDF	0.2
OCDF	0.9

Non-detect values considered to be zero.



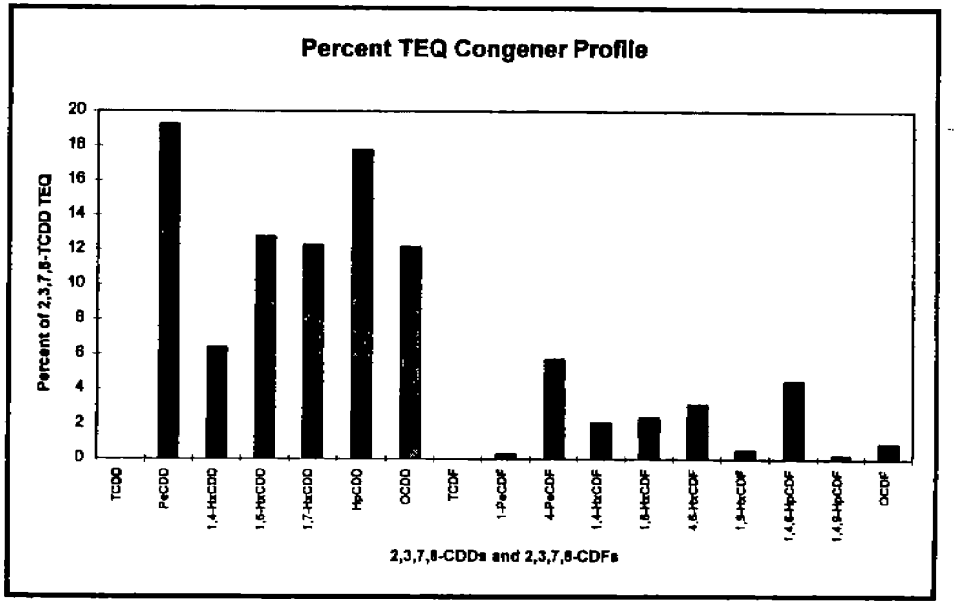


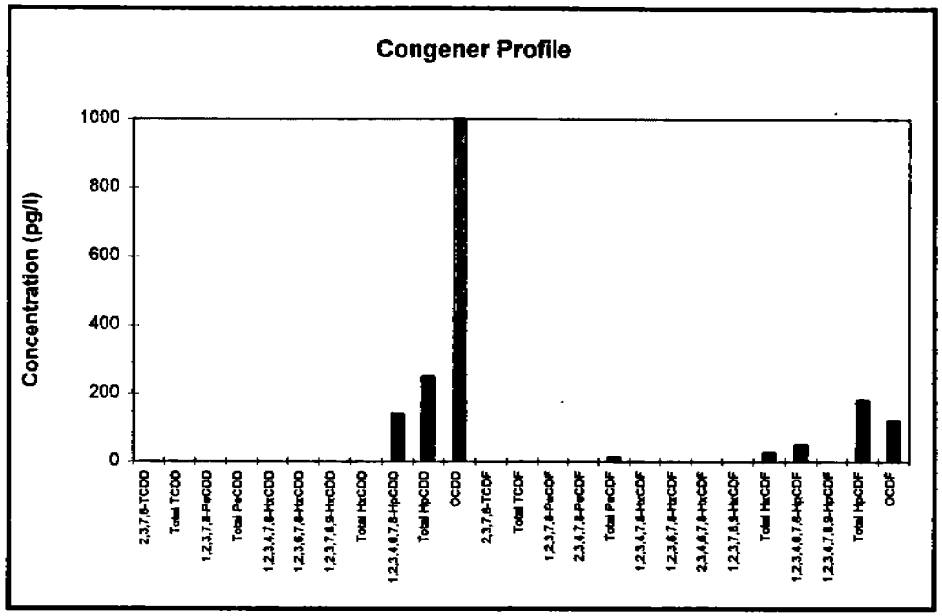
Table 21 Unocal Rodeo Refinery Station SW-1

Sample Date: February 15, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	4.5	0
Total TCDD		ND	4.5	
1,2,3,7,8-PeCDD	0.5	ND	8.5	0
Total PeCDD		ND	15	
1,2,3,4,7,8-HxCDD	0.1	ND	17	0
1,2,3,6,7,8-HxCDD	0.1	ND	17	0
1,2,3,7,8,9-HxCDD	0.1	ND	15	0
Total HxCDD		ND	17	
1,2,3,4,6,7,8-HpCDD	0.01	140		1.4
Total HpCDD		250		
OCDD	0.001	1000		1.0
2,3,7,8-TCDF	0.1	ND	2.7	0
Total TCDF		ND	2.7	
1,2,3,7,8-PeCDF	0.05	ND	5.2	0
2,3,4,7,8-PeCDF	0.5	ND	4.7	0
Total PeCDF		13		
1,2,3,4,7,8-HxCDF	0.1	ND	4.6	0
1,2,3,6,7,8-HxCDF	0.1	ND	4.4	0
2,3,4,6,7,8-HxCDF	0.1	ND	3.9	0
1,2,3,7,8,9-HxCDF	0.1	ND	3	0
Total HxCDF		28		
1,2,3,4,6,7,8-HpCDF	0.01	51		0.51
1,2,3,4,7,8,9-HpCDF	0.01	ND	7.2	0
Total HpCDF		160		
OCDF	0.001	120		0.12
2,3,7,8-TCDD Toxicity Equivalents				3.0

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	46.2
OCDD	33.0
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	16.8
1,4,9-HpCDF	0
OCDF	4.0

Non-detect values considered to be zero.



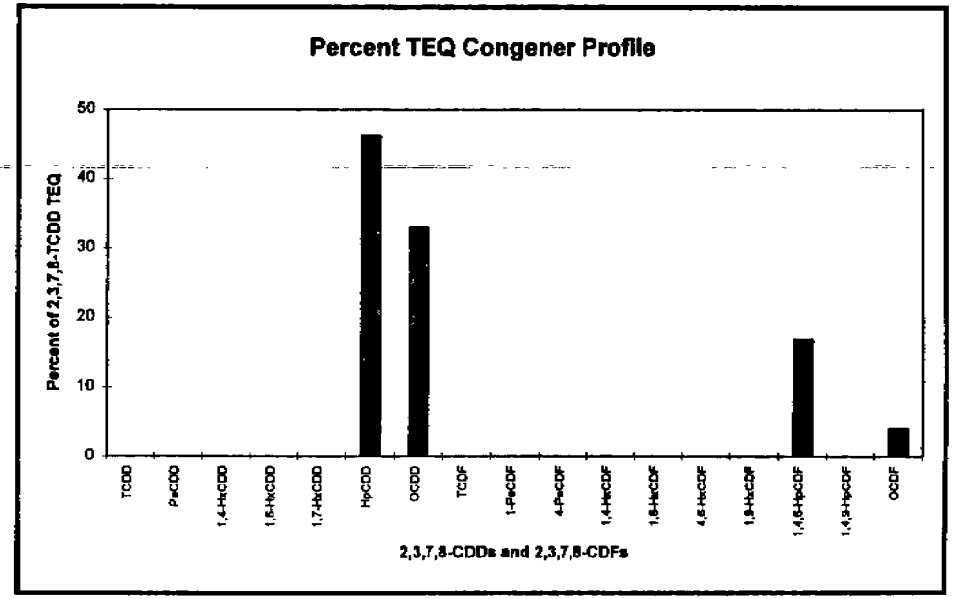


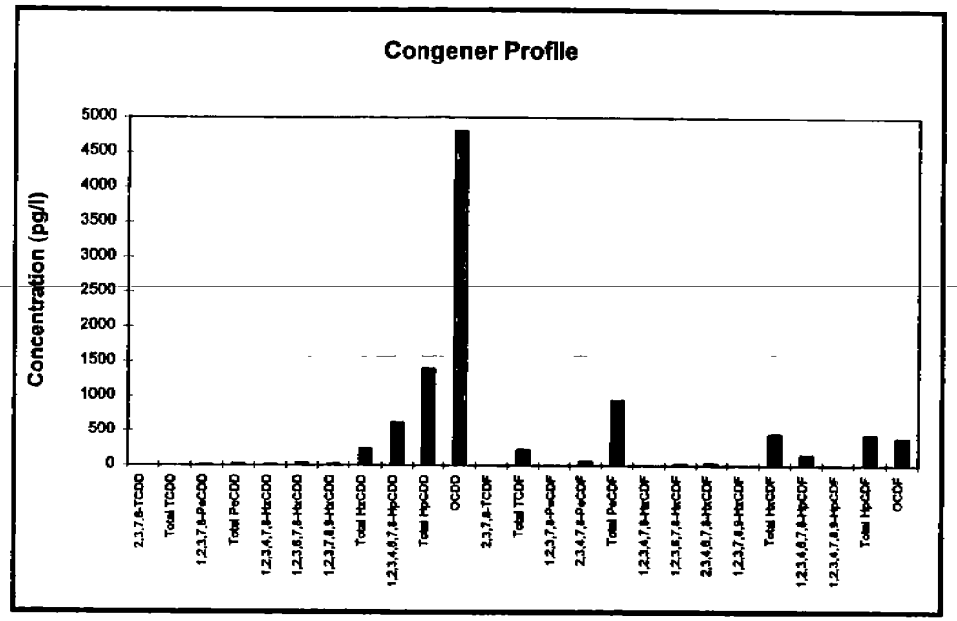
Table 22 Shell Martinez Refining Co. Station E002-Feed

Sample Date: December 11, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1.1	0
Total TCDD		ND		
1,2,3,7,8-PeCDD	0.5	8		4.0
Total PeCDD		21		
1,2,3,4,7,8-HxCDD	0.1	15		1.5
1,2,3,6,7,8-HxCDD	0.1	35		3.5
1,2,3,7,8,9-HxCDD	0.1	22		2.2
Total HxCDD		240		
1,2,3,4,6,7,8-HpCDD	0.01	620		6.2
Total HpCDD		1400		
OCDD	0.001	4800		4.8
2,3,7,8-TCDF	0.1	ND		0
Total TCDF		230		
1,2,3,7,8-PeCDF	0.05	ND		0
2,3,4,7,8-PeCDF	0.5	61		31
Total PeCDF		940		
1,2,3,4,7,8-HxCDF	0.1	ND		0
1,2,3,6,7,8-HxCDF	0.1	20		2.0
2,3,4,6,7,8-HxCDF	0.1	35		3.5
1,2,3,7,8,9-HxCDF	0.1	ND	1.1	0
Total HxCDF		450		
1,2,3,4,6,7,8-HpCDF	0.01	150		1.5
1,2,3,4,7,8,9-HpCDF	0.01	ND		0
Total HpCDF		440		
OCDF	0.001	390		0.39
2,3,7,8-TCDD Toxicity Equivalents				60

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	6.7
1,4-HxCDD	2.5
1,6-HxCDD	5.8
1,7-HxCDD	3.7
HpCDD	10.3
OCDD	8.0
TCDF	0
1-PeCDF	0
4-PeCDF	50.8
1,4-HxCDF	0
1,6-HxCDF	3.3
4,6-HxCDF	5.8
1,9-HxCDF	0
1,4,6-HpCDF	2.5
1,4,9-HpCDF	0
OCDF	0.6

Non-detect values considered to be zero.



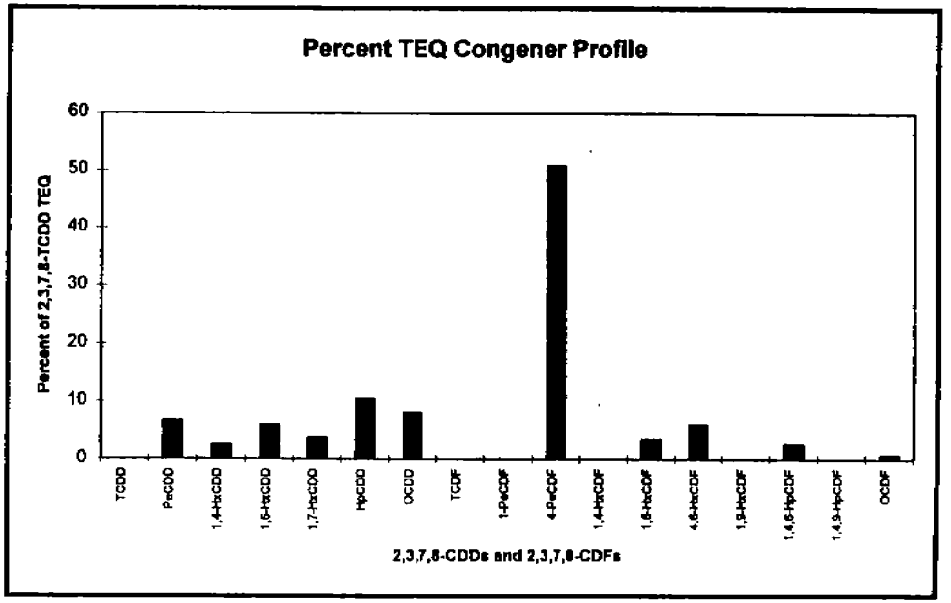


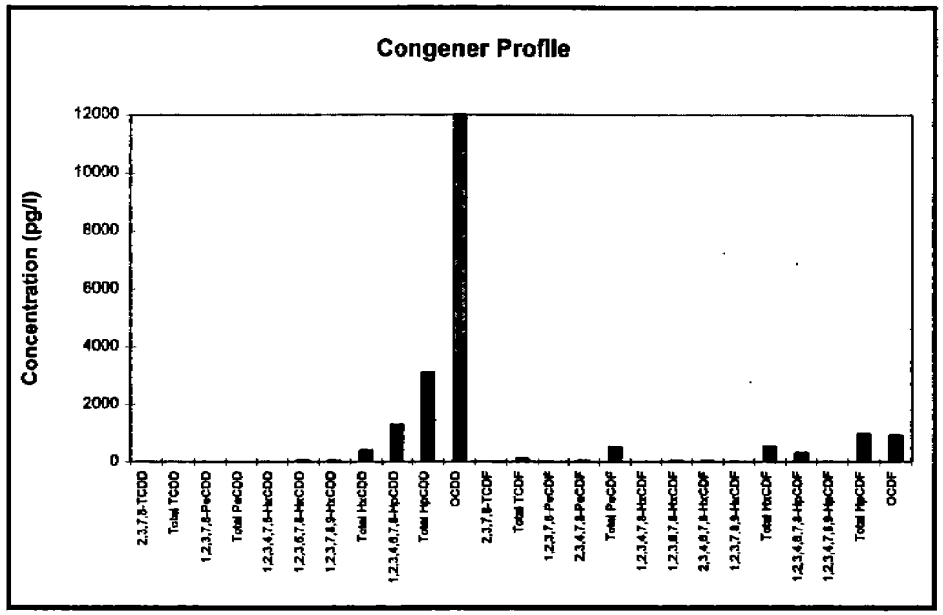
Table 23 Shell Martinez Refining Co. Station E002-Feed

Sample Date: February 15, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.5	0
Total TCDD		ND	3.5	
1,2,3,7,8-PeCDD	0.5	ND	2.5	0
Total PeCDD		ND	2.5	
1,2,3,4,7,8-HxCDD	0.1	ND	6.9	0
1,2,3,6,7,8-HxCDD	0.1	54		5.4
1,2,3,7,8,9-HxCDD	0.1	29		2.9
Total HxCDD		390		
1,2,3,4,6,7,8-HpCDD	0.01	1300		13
Total HpCDD		3100		
OCDD	0.001	12000		12
2,3,7,8-TCDF	0.1	ND	2.8	0
Total TCDF		120	2.8	
1,2,3,7,8-PeCDF	0.05	ND	3.3	0
2,3,4,7,8-PeCDF	0.5	27	3.3	14
Total PeCDF		520		
1,2,3,4,7,8-HxCDF	0.1	ND	2.4	0
1,2,3,6,7,8-HxCDF	0.1	28	2.2	2.8
2,3,4,6,7,8-HxCDF	0.1	27	3.8	2.7
1,2,3,7,8,9-HxCDF	0.1	ND	2.6	0
Total HxCDF		530		
1,2,3,4,6,7,8-HpCDF	0.01	310		3.1
1,2,3,4,7,8,9-HpCDF	0.01	ND	2	0
Total HpCDF		970		
OCDF	0.001	930		0.93

2,3,7,8-TCDD Toxicity Equivalents	56
	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	9.6
1,7-HxCDD	5.1
HpCDD	23.1
OCDD	21.3
TCDF	0
1-PeCDF	0
4-PeCDF	24.0
1,4-HxCDF	0
1,6-HxCDF	5.0
4,6-HxCDF	4.8
1,9-HxCDF	0
1,4,6-HpCDF	5.5
1,4,9-HpCDF	0
OCDF	1.7

Non-detect values considered to be zero.



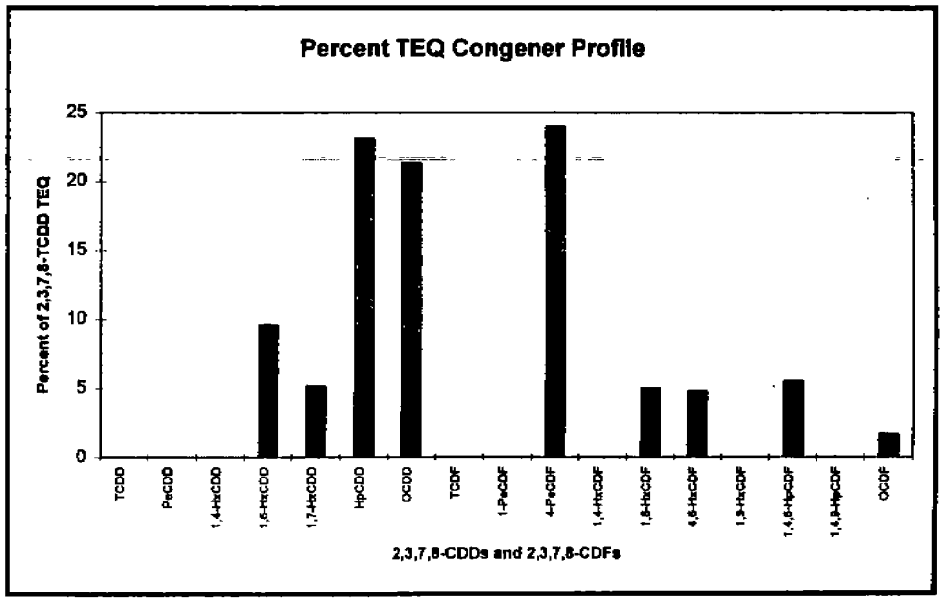


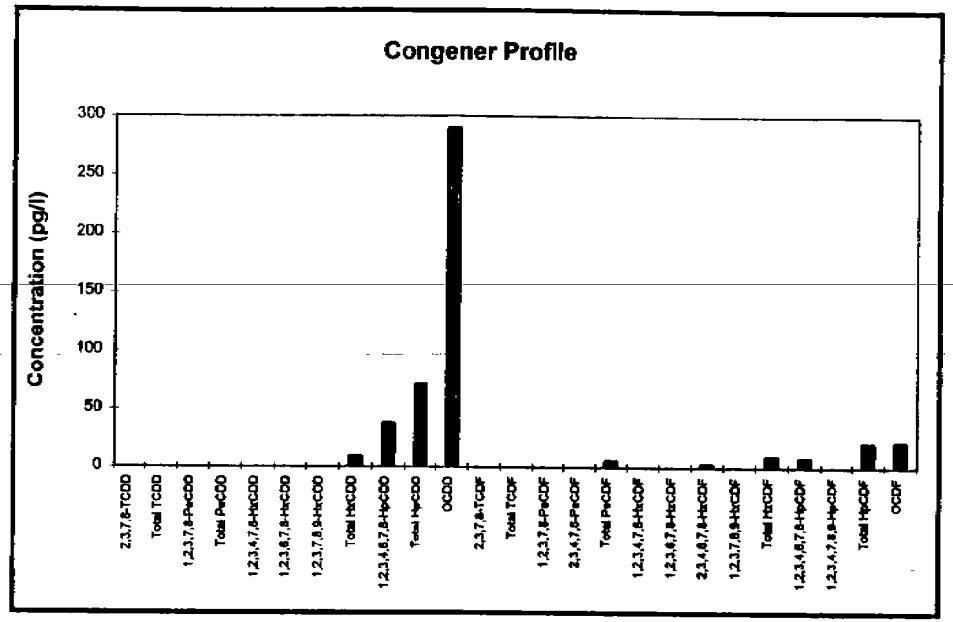
Table 24 Shell Martinez Refining Co. Station E002-Discharge

Sample Date: December 11, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1.2	0
Total TCDD		ND	1.2	
1,2,3,7,8-PeCDD	0.5	ND	1.3	0
Total PeCDD		ND	1.3	
1,2,3,4,7,8-HxCDD	0.1	ND	3	0
1,2,3,6,7,8-HxCDD	0.1	ND	3.3	0
1,2,3,7,8,9-HxCDD	0.1	ND	3	0
Total HxCDD		9.1		
1,2,3,4,6,7,8-HpCDD	0.01	38		0.38
Total HpCDD		71		
OCDD	0.001	290		0.29
2,3,7,8-TCDF	0.1	ND	0.89	0
Total TCDF		ND	0.89	
1,2,3,7,8-PeCDF	0.05	ND	1.2	0
2,3,4,7,8-PeCDF	0.5	ND	1.1	0
Total PeCDF		6.1		
1,2,3,4,7,8-HxCDF	0.1	ND	1.5	0
1,2,3,6,7,8-HxCDF	0.1	ND	1.5	0
2,3,4,6,7,8-HxCDF	0.1	3		0.3
1,2,3,7,8,9-HxCDF	0.1	ND	1.4	0
Total HxCDF		9.5		
1,2,3,4,6,7,8-HpCDF	0.01	8.1		0.08
1,2,3,4,7,8,9-HpCDF	0.01	ND	1.8	0
Total HpCDF		21		
OCDF	0.001	22		0.02
2,3,7,8-TCDD Toxicity Equivalents				1.1

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	35.4
OCDD	27.0
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	28.0
1,9-HxCDF	0
1,4,6-HpCDF	7.5
1,4,9-HpCDF	0
OCDF	2.1

Non-detect values considered to be zero.



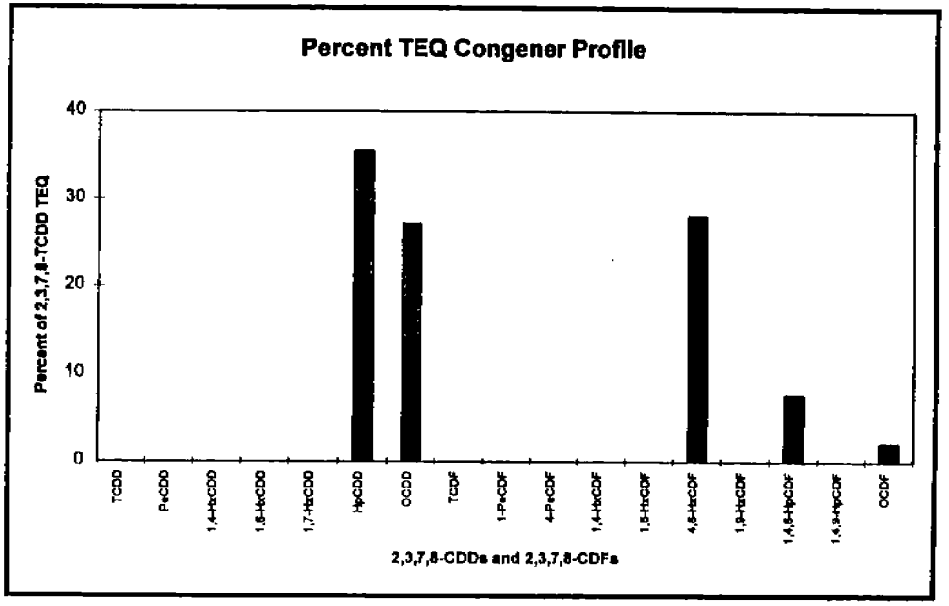


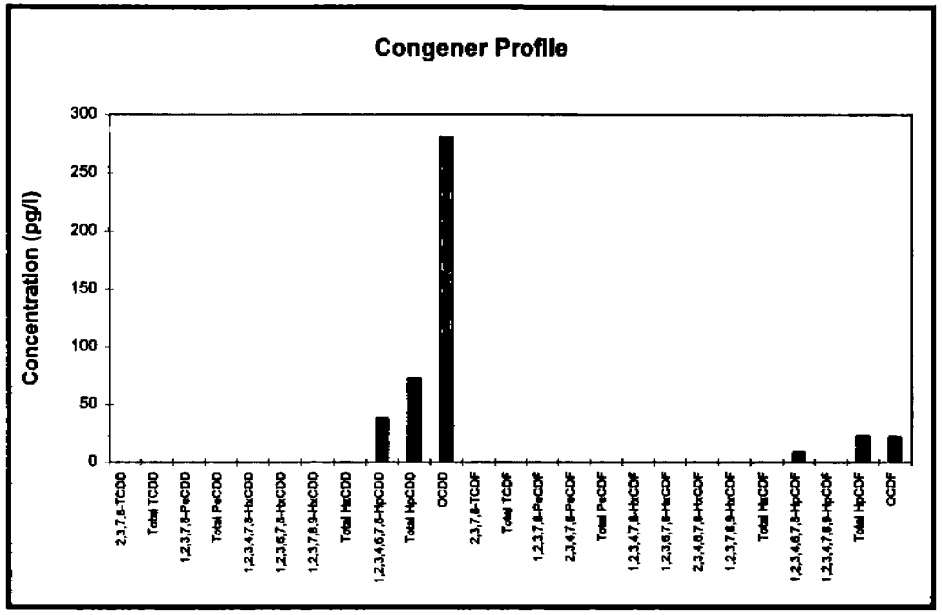
Table 25 Shell Martinez Refining Co. Station E002-Discharge

mple Date: December 11, 1995 (duplicate sample)

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	2.6	0
Total TCDD		ND	2.6	
1,2,3,7,8-PeCDD	0.5	ND	3.4	0
Total PeCDD		ND	3.4	
1,2,3,4,7,8-HxCDD	0.1	ND	3.6	0
1,2,3,6,7,8-HxCDD	0.1	ND	3.9	0
1,2,3,7,8,9-HxCDD	0.1	ND	3.7	0
Total HxCDD		ND	5.5	
1,2,3,4,6,7,8-HpCDD	0.01	38		0.38
Total HpCDD		73		
OCDD	0.001	280		0.28
2,3,7,8-TCDF	0.1	ND	2.2	0
Total TCDF		ND	2.2	
1,2,3,7,8-PeCDF	0.05	ND	3	0
2,3,4,7,8-PeCDF	0.5	ND	3	0
Total PeCDF		ND	3	
1,2,3,4,7,8-HxCDF	0.1	ND	3.2	0
1,2,3,6,7,8-HxCDF	0.1	ND	3	0
2,3,4,6,7,8-HxCDF	0.1	ND	3.2	0
1,2,3,7,8,9-HxCDF	0.1	ND	3.1	0
Total HxCDF		ND	3.1	
1,2,3,4,6,7,8-HpCDF	0.01	6.8		0.09
1,2,3,4,7,8,9-HpCDF	0.01	ND	3.9	0
Total HpCDF		23		
OCDF	0.001	22		0.02
2,3,7,8-TCDD Toxicity Equivalents				0.77

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	49.4
OCDD	36.4
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	11.4
1,4,9-HpCDF	0
OCDF	2.9

Non-detect values considered to be zero.



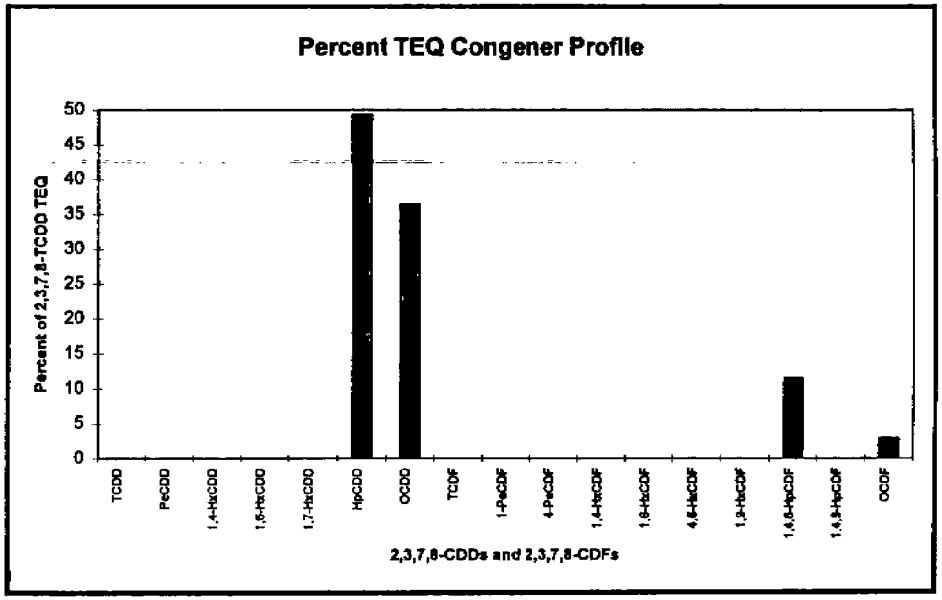


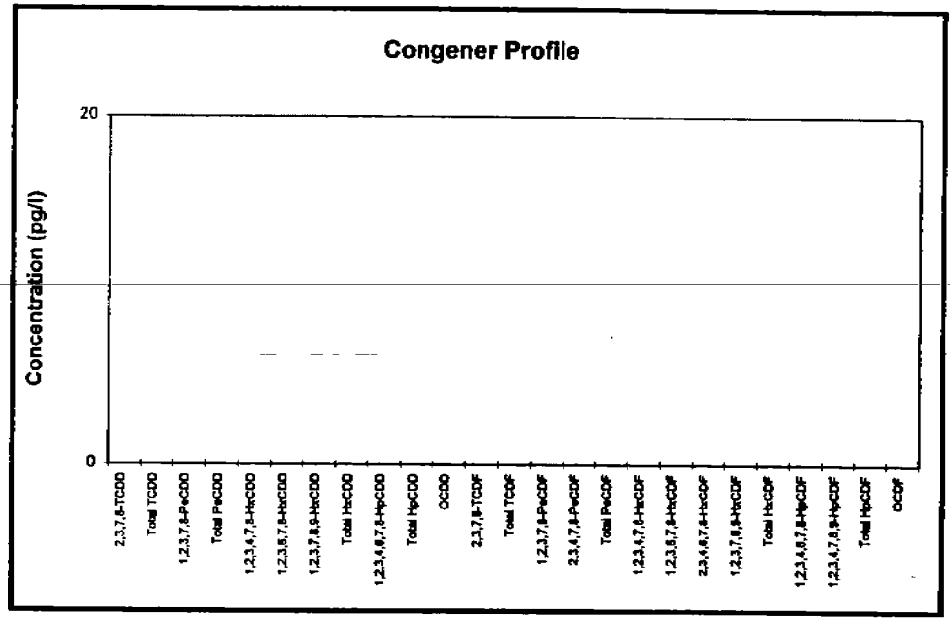
Table 26 Shell Martinez Refining Co. Station E002-Discharge

Sample Date: February 18, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.4	0
Total TCDD		ND	3.4	
1,2,3,7,8-PeCDD	0.5	ND	6	0
Total PeCDD		ND	15	
1,2,3,4,7,8-HxCDD	0.1	ND	6.8	0
1,2,3,6,7,8-HxCDD	0.1	ND	6.7	0
1,2,3,7,8,9-HxCDD	0.1	ND	6	0
Total HxCDD		ND	6.8	
1,2,3,4,6,7,8-HpCDD	0.01	ND	12	0
Total HpCDD		ND	12	
OCDD	0.001	ND	20	0
2,3,7,8-TCDF	0.1	ND	1.2	0
Total TCDF		ND	1.2	
1,2,3,7,8-PeCDF	0.05	ND	3.4	0
2,3,4,7,8-PeCDF	0.5	ND	3.7	0
Total PeCDF		ND	3.7	
1,2,3,4,7,8-HxCDF	0.1	ND	2.4	0
1,2,3,6,7,8-HxCDF	0.1	ND	2.3	0
2,3,4,6,7,8-HxCDF	0.1	ND	2.4	0
1,2,3,7,8,9-HxCDF	0.1	ND	2.3	0
Total HxCDF		ND	2.4	
1,2,3,4,6,7,8-HpCDF	0.01	ND	3.3	0
1,2,3,4,7,8,9-HpCDF	0.01	ND	4.2	0
Total HpCDF		ND	4.2	
OCDF	0.001	ND	1.3	0
2,3,7,8-TCDD Toxicity Equivalents				0

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	0
OCDD	0
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	0
1,4,9-HpCDF	0
OCDF	0

Non-detect values considered to be zero.



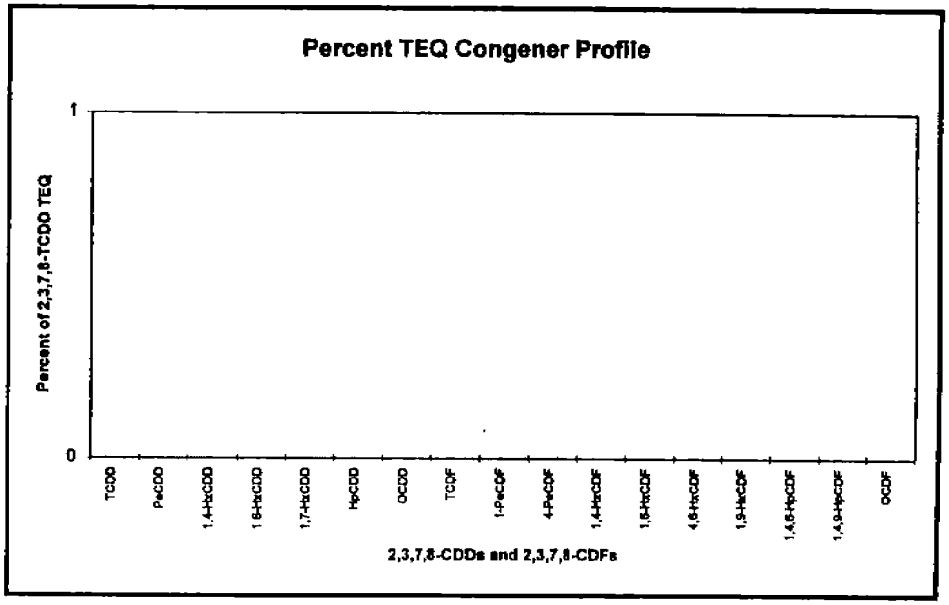


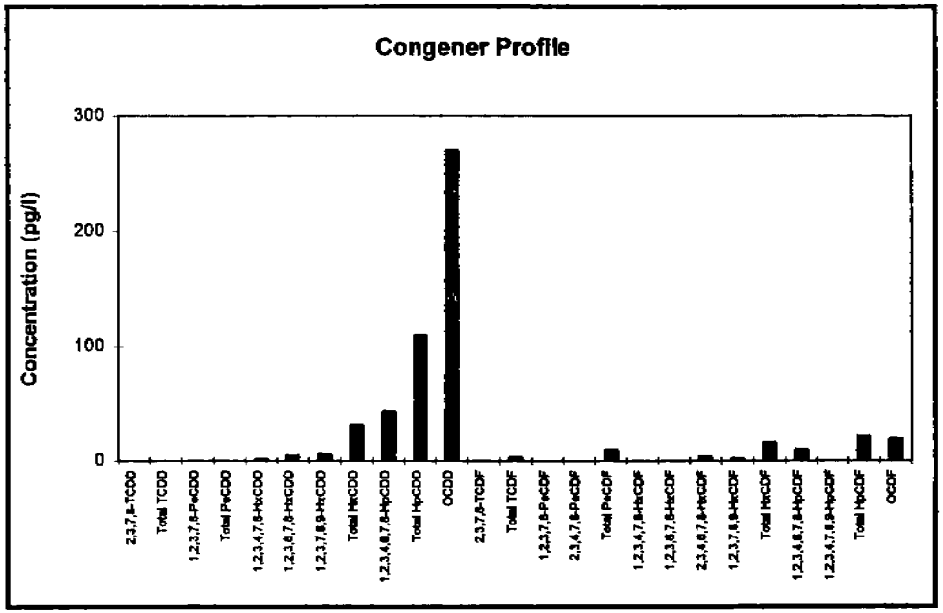
Table 27 Tosco Corp. Avon Refinery Station SW-E003-IN

Sample Date: December 11, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1	0
Total TCDD		ND	2.5	
1,2,3,7,8-PeCDD	0.5	ND	2	0
Total PeCDD		ND	2	
1,2,3,4,7,8-HxCDD	0.1	1.7		0.17
1,2,3,6,7,8-HxCDD	0.1	4.4		0.44
1,2,3,7,8,9-HxCDD	0.1	6.2		0.62
Total HxCDD		31		
1,2,3,4,6,7,8-HpCDD	0.01	43		0.43
Total HpCDD		110		
OCDD	0.001	270		0.27
2,3,7,8-TCDF	0.1	ND	1.1	0
Total TCDF		3.2		
1,2,3,7,8-PeCDF	0.05	ND	2.4	0
2,3,4,7,8-PeCDF	0.5	ND	1.4	0
Total PeCDF		9.5		
1,2,3,4,7,8-HxCDF	0.1	ND	1.8	0
1,2,3,6,7,8-HxCDF	0.1	ND	1.8	0
2,3,4,6,7,8-HxCDF	0.1	3.5		0.35
1,2,3,7,8,9-HxCDF	0.1	1.8		0.18
Total HxCDF		16		
1,2,3,4,6,7,8-HpCDF	0.01	9.3		0.09
1,2,3,4,7,8,9-HpCDF	0.01	ND		0
Total HpCDF		21		
OCDF	0.001	19		0.02
2,3,7,8-TCDD Toxicity Equivalents				2.6

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	6.6
1,6-HxCDD	17.1
1,7-HxCDD	24.1
HpCDD	16.7
OCDD	10.5
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	13.6
1,9-HxCDF	7.0
1,4,6-HpCDF	3.6
1,4,9-HpCDF	0
OCDF	0.7

Non-detect values considered to be zero.



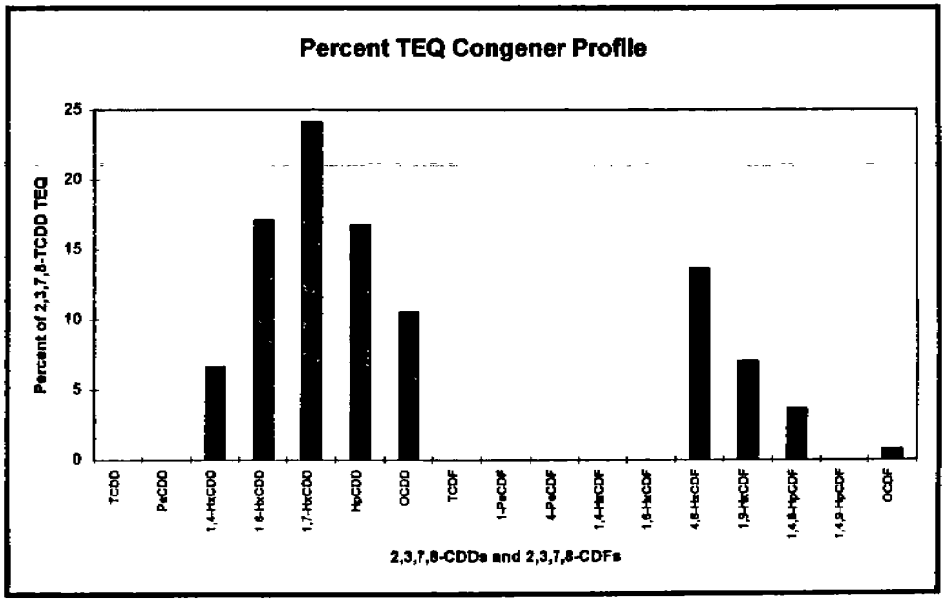


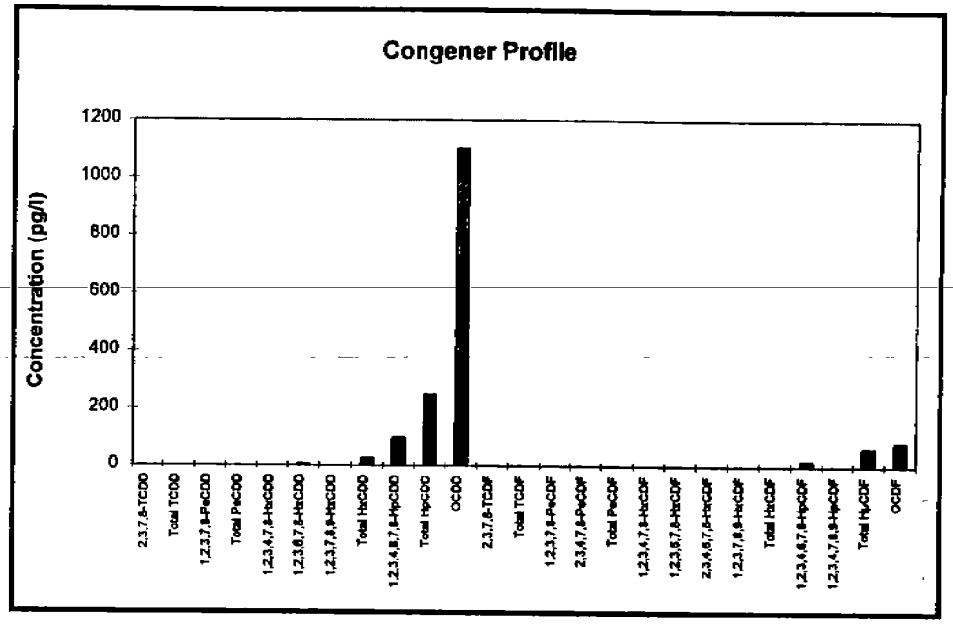
Table 28 Tosco Corp. Avon Refinery Station SW-E003-IN

Sample Date: February 21, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.5	0
Total TCDD		ND	3.5	
1,2,3,7,8-PeCDD	0.5	ND	5.1	0
Total PeCDD		ND	5.1	
1,2,3,4,7,8-HxCDD	0.1	ND	5	0
1,2,3,6,7,8-HxCDD	0.1	5.2		0.52
1,2,3,7,8,9-HxCDD	0.1	ND	5	0
Total HxCDD		26		
1,2,3,4,6,7,8-HpCDD	0.01	97		0.97
Total HpCDD		250		
OCDD	0.001	1100		1.1
2,3,7,8-TCDF	0.1	ND	3	0
Total TCDF		ND	3	
1,2,3,7,8-PeCDF	0.05	ND	3.6	0
2,3,4,7,8-PeCDF	0.5	ND	2.8	0
Total PeCDF		ND	3.8	
1,2,3,4,7,8-HxCDF	0.1	ND	5.2	0
1,2,3,6,7,8-HxCDF	0.1	ND	5	0
2,3,4,6,7,8-HxCDF	0.1	ND	5.5	0
1,2,3,7,8,9-HxCDF	0.1	ND	6.7	0
Total HxCDF		ND	6.7	
1,2,3,4,6,7,8-HpCDF	0.01	19		0.19
1,2,3,4,7,8,9-HpCDF	0.01	ND	5.4	0
Total HpCDF		64		
OCDF	0.001	83		0.08
2,3,7,8-TCDD Toxicity Equivalents				2.9

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	18.2
1,7-HxCDD	0
HpCDD	33.9
OCDD	38.4
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	6.6
1,4,9-HpCDF	0
OCDF	2.9

Non-detect values considered to be zero.



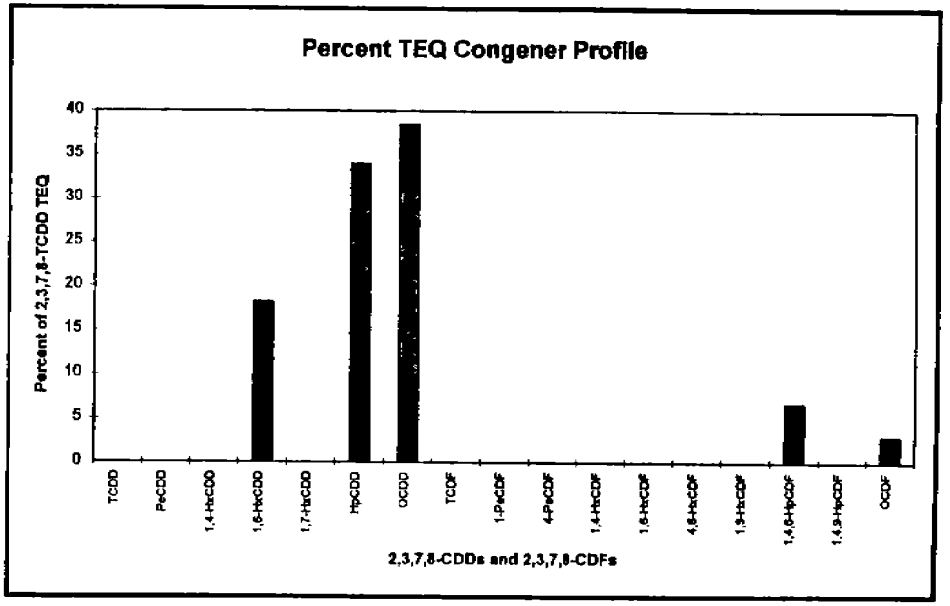


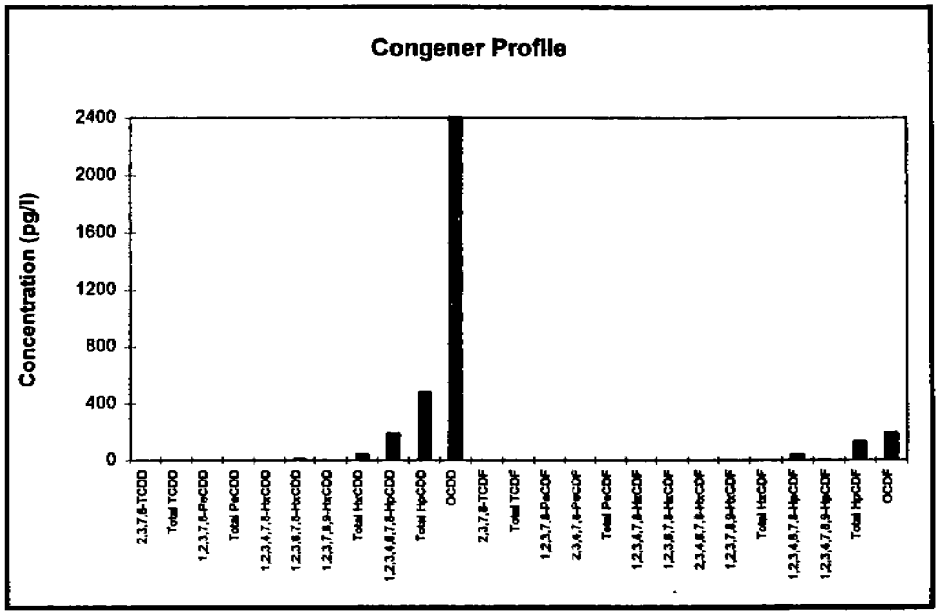
Table 29 Tosco Corp. Avon Refinery Station SW-E003-IN

mple Date: February 21, 1995 (duplicate sample)

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.4	0
Total TCDD		ND	3.4	
1,2,3,7,8-PeCDD	0.5	ND	4.5	0
Total PeCDD		ND	4.5	
1,2,3,4,7,8-HxCDD	0.1	ND	6.2	0
1,2,3,6,7,8-HxCDD	0.1	8.6		0.86
1,2,3,7,8,9-HxCDD	0.1	ND	7.8	0
Total HxCDD		42		
1,2,3,4,6,7,8-HpCDD	0.01	190		1.9
Total HpCDD		460		
OCDD	0.001	2400		2.4
2,3,7,8-TCDF	0.1	ND	2.9	0
Total TCDF		ND	2.9	
1,2,3,7,8-PeCDF	0.05	ND	4.7	0
2,3,4,7,8-PeCDF	0.5	ND	3.7	0
Total PeCDF		ND	4.7	
1,2,3,4,7,8-HxCDF	0.1	ND	7.2	0
1,2,3,6,7,8-HxCDF	0.1	ND	6.9	0
2,3,4,6,7,8-HxCDF	0.1	ND	7.1	0
1,2,3,7,8,9-HxCDF	0.1	ND	7.2	0
Total HxCDF		ND	7.3	
1,2,3,4,6,7,8-HpCDF	0.01	40		0.40
1,2,3,4,7,8,9-HpCDF	0.01	ND	4.7	0
Total HpCDF		130		
OCDF	0.001	190		0.19
2,3,7,8-TCDD Toxicity Equivalents				5.8

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	15.0
1,7-HxCDD	0
HpCDD	33.0
OCDD	41.7
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	7.0
1,4,9-HpCDF	0
OCDF	3.3

Non-detect values considered to be zero.



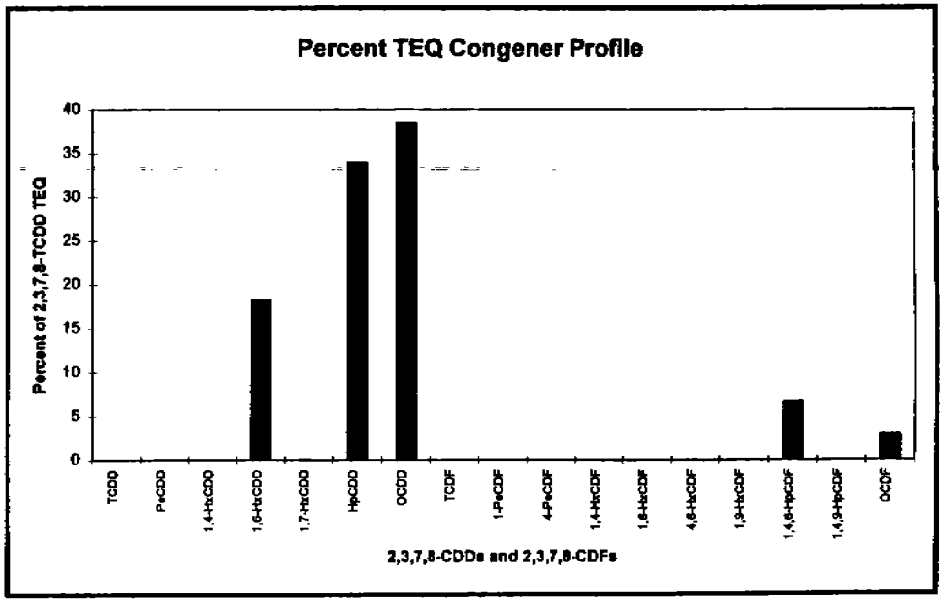


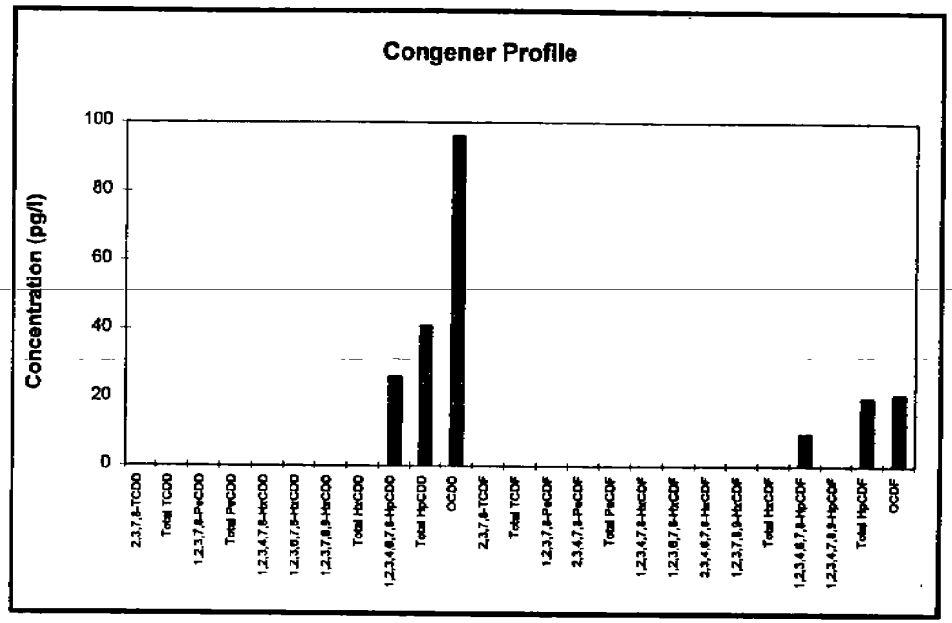
Table 30 Tosco Corp. Avon Refinery Station SW-E003 OUT

Sample Date: February 21, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	2.6	0
Total TCDD		ND	2.6	
1,2,3,7,8-PeCDD	0.5	ND	4.7	0
Total PeCDD		ND	4.7	
1,2,3,4,7,8-HxCDD	0.1	ND	8	0
1,2,3,6,7,8-HxCDD	0.1	ND	8.4	0
1,2,3,7,8,9-HxCDD	0.1	ND	7.6	0
Total HxCDD		ND	8.4	
1,2,3,4,6,7,8-HpCDD	0.01	26		0.26
Total HpCDD		41		
OCDD	0.001	96		0.10
2,3,7,8-TCDF	0.1	ND	2.6	0
Total TCDF		ND	2.6	
1,2,3,7,8-PeCDF	0.05	ND	4	0
2,3,4,7,8-PeCDF	0.5	ND	2.9	0
Total PeCDF		ND	4	
1,2,3,4,7,8-HxCDF	0.1	ND	3.9	0
1,2,3,6,7,8-HxCDF	0.1	ND	3.7	0
2,3,4,6,7,8-HxCDF	0.1	ND	4	0
1,2,3,7,8,9-HxCDF	0.1	ND	4.4	0
Total HxCDF		ND	4.4	
1,2,3,4,6,7,8-HpCDF	0.01	9.3		0.09
1,2,3,4,7,8,9-HpCDF	0.01	ND	3.9	0
Total HpCDF		20		
OCDF	0.001	21		0.02
2,3,7,8-TCDD Toxicity Equivalents				0.47

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	55.3
OCDD	20.4
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	19.8
1,4,9-HpCDF	0
OCDF	4.5

Non-detect values considered to be zero.



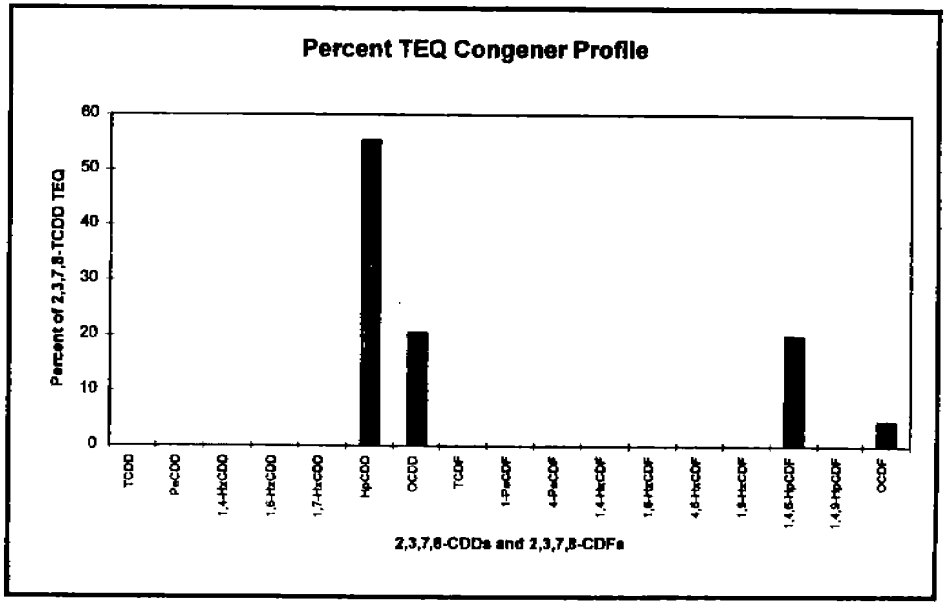


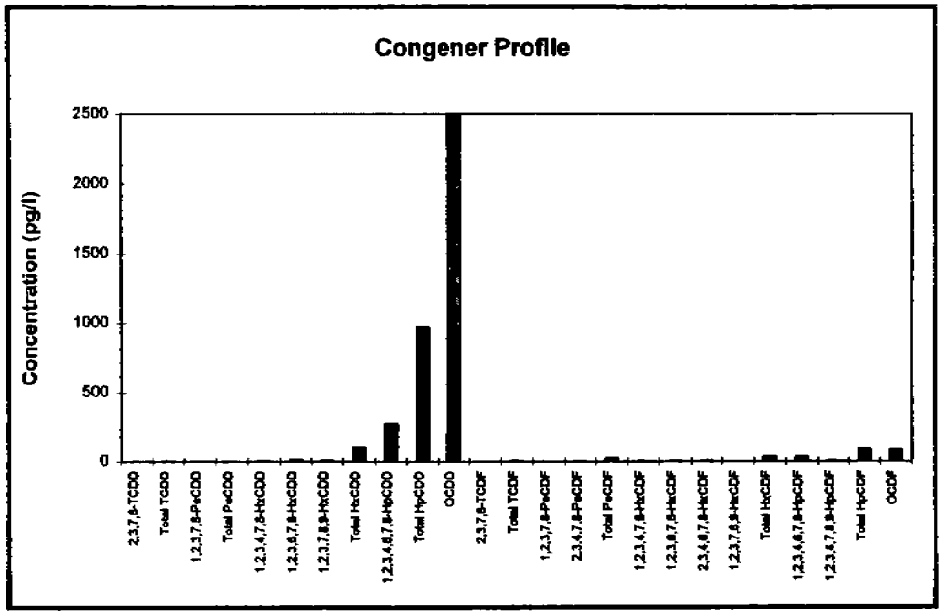
Table 31 Exxon Corp. Benicia Refinery Station Outfall 005

Sample Date: December 11, 1995

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	1.4	0
Total TCDD		2.4		
1,2,3,7,8-PeCDD	0.5	ND	3.1	0
Total PeCDD		ND	3.1	
1,2,3,4,7,8-HxCDD	0.1	4.1		0.41
1,2,3,6,7,8-HxCDD	0.1	9.9		0.99
1,2,3,7,8,9-HxCDD	0.1	7.1		0.71
Total HxCDD		100		
1,2,3,4,6,7,8-HpCDD	0.01	270		2.7
Total HpCDD		970		
OCDD	0.001	2500		2.5
2,3,7,8-TCDF	0.1	ND	1.3	0
Total TCDF		4.1		
1,2,3,7,8-PeCDF	0.05	ND	2.1	0
2,3,4,7,8-PeCDF	0.5	2.4		1.2
Total PeCDF		22		
1,2,3,4,7,8-HxCDF	0.1	2.4		0.24
1,2,3,6,7,8-HxCDF	0.1	2.3		0.23
2,3,4,6,7,8-HxCDF	0.1	4.7		0.47
1,2,3,7,8,9-HxCDF	0.1	ND	1.5	0
Total HxCDF		34		
1,2,3,4,6,7,8-HpCDF	0.01	30		0.30
1,2,3,4,7,8,9-HpCDF	0.01	2.7		0.03
Total HpCDF		87		
OCDF	0.001	82		0.08
2,3,7,8-TCDD Toxicity Equivalents				9.9

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	4.2
1,6-HxCDD	10.0
1,7-HxCDD	7.2
HpCDD	27.4
OCDD	25.4
TCDF	0
1-PeCDF	0
4-PeCDF	12.2
1,4-HxCDF	2.4
1,6-HxCDF	2.3
4,6-HxCDF	4.8
1,9-HxCDF	0
1,4,6-HpCDF	3.0
1,4,9-HpCDF	0.3
OCDF	0.8

Non-detect values considered to be zero.



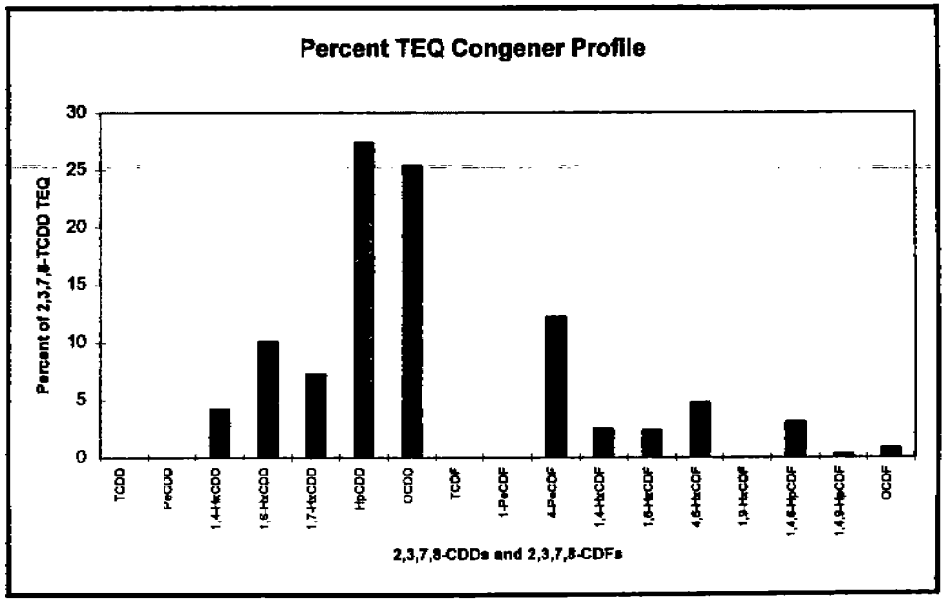


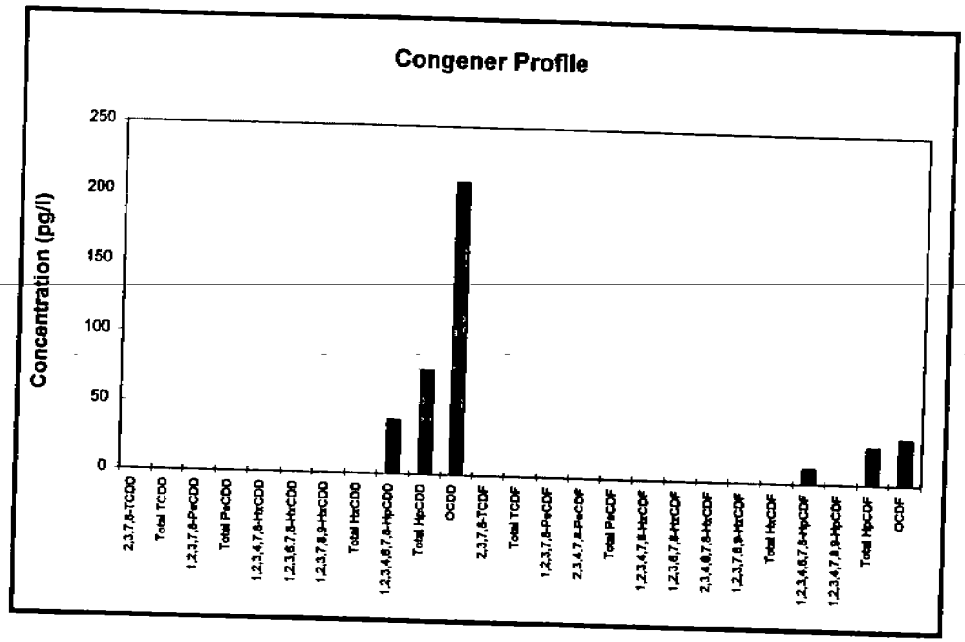
Table 32 Exxon Corp. Benicia Refinery Station Outfall 005

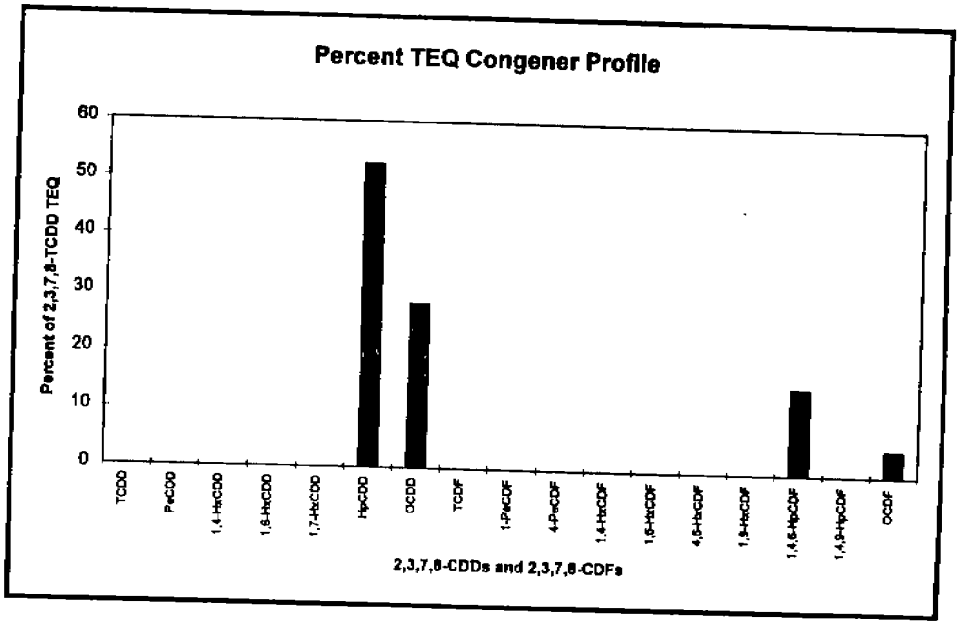
Sample Date: February 15, 1996

	Tox. Eq. Factor	Conc. (pg/l)	D.L.	TEQ
2,3,7,8-TCDD	1	ND	3.6	0
Total TCDD		ND	3.6	
1,2,3,7,8-PeCDD	0.5	ND	4	0
Total PeCDD		ND	4	
1,2,3,4,7,8-HxCDD	0.1	ND	5.5	0
1,2,3,6,7,8-HxCDD	0.1	ND	5.8	0
1,2,3,7,8,9-HxCDD	0.1	ND	5.2	0
Total HxCDD		ND	5.8	
1,2,3,4,6,7,8-HpCDD	0.01	39		0.39
Total HpCDD		75		
OCDD	0.001	210		0.21
2,3,7,8-TCDF	0.1	ND	3.6	0
Total TCDF		ND	4.7	
1,2,3,7,8-PeCDF	0.05	ND	3.2	0
2,3,4,7,8-PeCDF	0.5	ND	2.7	0
Total PeCDF		ND	3.2	
1,2,3,4,7,8-HxCDF	0.1	ND	3.4	0
1,2,3,6,7,8-HxCDF	0.1	ND	3.3	0
2,3,4,6,7,8-HxCDF	0.1	ND	3.6	0
1,2,3,7,8,9-HxCDF	0.1	ND	3.9	0
Total HxCDF		ND	3.9	
1,2,3,4,6,7,8-HpCDF	0.01	11		0.11
1,2,3,4,7,8,9-HpCDF	0.01	ND	2.2	0
Total HpCDF		27		
OCDF	0.001	33		0.03
2,3,7,8-TCDD Toxicity Equivalents				0.74

	Percent of 2,3,7,8-TCDD TEQ
TCDD	0
PeCDD	0
1,4-HxCDD	0
1,6-HxCDD	0
1,7-HxCDD	0
HpCDD	52.5
OCDD	28.3
TCDF	0
1-PeCDF	0
4-PeCDF	0
1,4-HxCDF	0
1,6-HxCDF	0
4,6-HxCDF	0
1,9-HxCDF	0
1,4,6-HpCDF	14.8
1,4,9-HpCDF	0
OCDF	4.4

Non-detect values considered to be zero.





APPENDIX A

Sample Collection Procedure