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TO: Helen Pressley and Ann Wessel
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SUBJECT: Second Progress Report on Survey of Contaminants in Vactor Wastes

BACKGROUND

In 1991, the Department of Ecology (Ecology), in conjunction with *PTI Environmental* Services of Bellevue, Washington, began a survey to characterize contaminants in vactor truck wastes. The survey was conceived of by the Stormwater Unit (Water Quality Program) and the results will be used by Ecology to draft disposal guidelines for these wastes. The first round of sample collection from vactor trucks was completed in July 1991 and results were reported in February 1992 (PTI Environmental Services, 1991a; Serdar, 1992). The second and final round of sampling was completed in April 1992. Laboratory analyses of these samples have been completed and data have been reviewed. A description of the recent sampling effort is reported here along with analytical results. A final report, which will include results of all sampling, is slated for completion in October 1992.

METHODS AND MATERIALS

Sampling Locations

Sampling was conducted between March 23 and April 7, 1992. Sediment and decant water samples from each sampling event were collected from vactor trucks operating exclusively in one of the following areas:

- Residential areas of Snohomish County; specifically, the 21 Oaks and Cascade Heights housing developments; and

- Heavily industrialized area of Seattle; specifically, the Duwamish Plain area.

Samples originating from commercial and light-industrial areas were not collected in this round of sampling because previous results showed that they did not differ substantially from residential areas (Serdar, 1992).

Sampling Procedures

Vactor sediment and decant water samples from residential areas were collected as the trucks from the Snohomish County Public Works Department dumped them at the Monroe dump station. Seattle industrial samples were collected from Seattle Engineering Department trucks as they prepared to dump them at the West Seattle maintenance yard. Sediment samples from Snohomish County were collected from a pile after they had been dumped, while sediment samples from Seattle were collected directly from the back of the vactor truck. In both cases an effort was made to collect samples that were representative in terms of grain size and moisture content. Decant water samples were collected directly from the outlets of the vactor trucks. As with the previous sampling effort, the beginning, middle, and final portions of decant water were sampled and composited. Temperature and pH of decanted water were measured in the field.

Only stainless steel equipment was used for sampling sediment and water. All sampling equipment was decontaminated prior to use by scrubbing with Alconox, followed by sequential rinses with tap water, deionized water, 10% nitric acid, deionized water, and pesticide-grade acetone. Sampling equipment was primed with decant water prior to sampling in an attempt to eliminate residual chemicals used in the decontamination process. Sampling procedures are also described in PTI's document: *Characterization of Catch Basin Wastes: Sampling and Analysis Plan* (PTI Environmental Services, 1991b).

Laboratory Analysis and Data Quality

Table 1 summarizes the analytical methods for vactor sediment and decant water. The analyses chosen were generally consistent with the first round of sampling with the following exceptions:

- Specific conductance, fecal coliform, oil and grease, total dissolved solids, cyanide, mercury, nickel, silver, semi-volatile organics, and PCB analyses in decant water were dropped either because of previous low or non-detectable concentrations or the additional data would not provide any useful new information.

- Total petroleum hydrocarbon analysis was added in decant water because of previous high concentrations found in sediment. Settleable solids and dissolved metals analyses were also added to assess the distribution of metals in the dissolved and solid components. Total recoverable metals analyses were also conducted on several samples to determine the relationship of this fraction to total metals.

Table 1. Summary of Analytical Methods for Water and Sediment Samples Collected from Vactor Trucks, March – April, 1992

Parameter	Method/EPA No.	Reference	Laboratory
WATER			
Hardness	EPA 6010	EPA, 1987	Manchester Laboratory
Biological Oxgygen Demand	EPA 405.1	EPA, 1984	Manchester Laboratory
Chemical Oxygen Demand	EPA 410.1	EPA, 1984	Sound Analytical Services, Tacoma, WA
Total Organic Carbon	EPA 415.1	EPA, 1984	Manchester Laboratory
Total Solids	EPA 160.3	EPA, 1984	Manchester Laboratory
Total Suspended Solids	EPA 160.2	EPA, 1984	Manchester Laboratory
Settleable Solids	EPA 160.5	EPA, 1984	Manchester Laboratory
Turbidity	EPA 180.1	EPA, 1984	Manchester Laboratory
Total and Dissolved Metals			
As, Cd, Cu,			
Cr, Pb, Zn	ICP Scan/EPA 6010	EPA, 1987	Manchester Laboratory
Total Recoverable Metals			
As, Cd, Cu,			
Cr, Pb, Zn	ICP Scan/EPA 3005-6010	EPA, 1987	Manchester Laboratory
Total Petroleum Hydrocarbons	FTIR/EPA 418.1	EPA, 1984	Manchester Laboratory
Volatile Organic Compounds	GC-MS/EPA 8240	EPA, 1986a	Manchester Laboratory
SEDIMENT			
Percent Solids	EPA 160.3	EPA, 1984	Sound Analytical Services, Tacoma, WA
Total Organic Carbon	EPA 415.1	EPA, 1984	Sound Analytical Services, Tacoma, WA
Grain Size	Sieve-Pipet	Tetra Tech, 1986	Laucks Testing Laboratories, Seattle, WA
Metals			
As, Cd, Cu,			
Cr, Pb, Zn	ICP Scan	EPA, 1986a	Manchester Laboratory
Total Petroleum Hydrocarbons	FTIR/EPA 418.1	EPA, 1984	Manchester Laboratory
Volatile Organic Compounds	GC-MS/EPA 8240	EPA, 1986a	Manchester Laboratory
PAHs	GC-MS/EPA 8270-3630	EPA, 1986a	Manchester Laboratory

- Only six metals (As, Cd, Cr, Cu, Pb, and Zn) were analyzed in sediment compared to thirteen for the first round. Several classes of organic chemicals had no significant concentrations in the first round. These analyses were dropped in the second round: PCBs, Pesticides, and semi-volatiles except the PAHs.

Quality of the analytical data was reviewed by staff at Ecology's Manchester Laboratory. Reviewers evaluated initial and continuing instrument calibration, procedural (laboratory) blanks, matrix spike recoveries, analytical precision, ICP serial dilution analysis (metals only), and surrogate spike recoveries (organics only).

Much of the data are qualified as estimates. In most cases, the numbers are outside of the calibration range or matrix spike recoveries are not within specified limits. However, the reviewers concluded that all data are considered acceptable for use.

Quality assurance samples collected in the field included duplicates (replicate samples) to measure overall (sampling + analytical) precision, transfer blanks, and transport blanks. The precision, as measured by relative percent difference (RPD), was very good for most samples. Combined mean RPDs calculated for water and sediment analyses were 7% for conventionals, 26% for metals, and 24% for organics. No contaminants were detected in transfer blanks, and acetone, a common laboratory and equipment-cleaning solvent, was the only contaminant detected in the transport blank.

RESULTS AND DISCUSSION

Results of conventional, metals, and organics analyses in decant water and sediments from vactor trucks are presented below. In general, results are similar to those obtained from sampling conducted in July, 1991 (PTI Environmental Services, 1991a; Serdar, 1992). Aside from a few parameters, contaminant levels were higher in vactor truck wastes originating from industrial areas than those from residential areas.

Decanted Water

Results of conventional analysis of decant water are presented in Table 2. Turbidity, total solids and total suspended solids concentrations were one to two orders of magnitude higher in samples from industrial areas, while settleable solids concentrations were similar in samples from both land-use types. These differences may stem somewhat from the different practices, equipment, and amounts of water used by the Snohomish County and Seattle vactor crews. However, higher concentrations of fine materials are found in catch basins of the industrial areas. Biological and chemical oxygen demand were elevated in decant water from industrial areas, while pH, hardness, and total organic carbon content were more similar.

Concentrations of total arsenic, cadmium, chromium, copper, lead and zinc were slightly lower on average than those found in the July 1991 samples (Table 3). Concentrations of all

Table 2. Results of Conventional Analyses of Vactor Decant Water Sampled March - April, 1992

Land-Use:	Residential				Industrial				
Station:	21 Oaks	21 Oaks	Casc. Hts.	Casc. Hts.	Bailey St.	S. Brandon	S. Dawson	S. Dawson-Dupli.	Lucile St.
Date:	3/23 - AM	3/23 - PM	3/30 - AM	3/30 - PM	3/25	4/6	4/6	4/6	4/7
Lab Log#:	138105	138106	138108	138109	138107	158110	158111	158112	158113
pH	6.18	6.41	6.86	6.62	6.54	6.70	6.84	6.84	6.66
Hardness (mg/l CaCO3)	99	268	76	80	199	241 J	224 J	256 J	229 J
Biological Oxygen Demand (mg/l)	118 J	184 J	42	57	1,250 J	790	125	109	577
Chemical Oxygen Demand (mg/l)	420	400	230 *	300	1,400	4,500	2,300	2,200	1,200
Total Organic Carbon (mg/l)	106	112	50	49	141	169	132	133	118
Total Solids (mg/l)	820	821	750	586	32,600	70,400	17,900	18,800	3,030
Total Suspended Solids (mg/l)	578	309	556	371	31,800 J	74,900 J	18,800 J	18,500 J	3,180 J
Settleable Solids (ml/l/hr)	5	2	2	2	90 J	30	16	22	48 J
Turbidity (ntu)	500 J	200 J	280 J	270 J	1,400 J	2,200	1,900 J	2,100 J	1,200 J

J=Estimate

**=Result of duplicate laboratory analysis*

Table 3. Results of Metals Analyses of Vactor Decant Water Sampled March – April, 1992

Land-Use:	Residential				Industrial					
Station:	21 Oaks	21 Oaks	Casc. Hts.	Casc. Hts.	Bailey St.	S. Brandon	S. Dawson	S. Dawson-Dupli.	Lucile St.	Transfer Blk
Date:	3/23 - AM	3/23 - PM	3/30 - AM	3/30 - PM	3/25	4/6	4/6	4/6	4/7	3/30
Lab Log#:	138105	138106	138108	138109	138107	158110	158111	158112	158113	138114
Metals (ug/l)										
Arsenic	53 J	40 J	37 J	30 J	140	180	120 J	170	170	30 U
	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	
							150 J		180	
Cadmium	15	6.4 J	9.0 J	12 J	30.8	76	40	57	46	2.0 U
	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	
							48 J		36 J	
Chromium	37	13 J	26	19	227	407 J	170 J	266 J	256 J	5.0 U
	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ	
							247 J		205 J	
Copper	202	112	84	81	1,110	2,090	884	1,340	1,840	3.0 U
	17	5.9 J	12	3.0 U	3.0 U	5.6 J	16	11	9.0 J	
							1,250		1,520	
Lead	1,050	757	255	458	3,370	6,560	1,730	2,280	3,680	20 U
	48 J	20 U	20 U	20 U	20 U	20 U	40 J	20 U	20 U	
							2,050		3,240	
Zinc	1,090	522	401	421	5,200	8,540	3,930	4,650	5,020	4.0 U
	76	36.1	19 J	6.2 J	12 J	38	140	56	31	
							4,420		4460	

J=Estimate
U=Undetected

Total Metals
Dissolved Metals
Total Recoverable Metals

six metals were substantially higher in the industrial samples, possibly a reflection of high suspended solids concentrations. Arsenic, cadmium, and chromium were not detected as a dissolved component of any samples and dissolved copper, lead, and zinc concentrations were one to three orders of magnitude lower than total concentrations. This suggests that the solid component of the water samples accounts for the majority of metals concentrations.

Two of the industrial samples were also analyzed for total recoverable metals (S. Dawson St. and Lucile St.). "Total recoverable" defines the amount measured in an unfiltered sample treated with hot, dilute mineral acid and is the basis for EPA freshwater criteria for metals (EPA, 1986b). Total recoverable and total metals concentrations were similar for all samples analyzed.

Samples from S. Brandon St. (between 1st and 5th Aves.) in Seattle had the highest concentrations of all metals analyzed. Businesses in this area represent a potentially significant source of contamination; they include a radiator shop, machine fabricator, lamp manufacturer, and several car and truck repair shops.

Results of organics analyses of decanted vactor water are shown in Table 4. Concentrations of total petroleum hydrocarbons averaged 5.2 mg/l in the residential samples and 8.2 mg/l in the industrial samples. Total petroleum hydrocarbon analysis measures the quantity of petroleum hydrocarbons originating from gasoline, kerosene, jet fuel, diesel, and lubricating oil spills (Washington State Department of Ecology, 1991).

All samples were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations. These compounds are commonly detected gasoline and diesel fuel components and are also used in paints and thinners (PTI Environmental Services, 1991c). Toluene was the most frequently detected of these compounds, being present at all stations at concentrations ranging from 4 to 180 ug/l. Xylenes were detected at four stations, ethylbenzene at three stations, and benzene at only one station.

BTEX concentrations in one sample from 21 Oaks were two to five fold higher than all other samples. Ten additional volatile organic compounds were detected in this sample. Aside from 1,2,4-trimethylbenzene (125 ug/l), all were detected at concentrations less than 100 ug/l.

Sediments

Percent solids, total organic carbon, and grain size analyses of sediments are shown in Table 5. Vactor sediments were relatively consistent in terms of moisture content and grain size with sand being the predominant component.

Concentrations of arsenic, cadmium, chromium, copper, lead, and zinc are presented in Table 6. On average, zinc was found in the highest concentrations, while cadmium was present at the lowest concentrations. Mean metals concentrations were two to four times

Table 4. Results of Organics Analyses of Vactor Decant Water Sampled March – April, 1992

Land-Use:	Residential				Industrial					
Station:	21 Oaks	21 Oaks	Casc. Hts.	Casc. Hts.	Bailey St.	S. Brandon	S. Dawson	S. Dawson-Dupli.	Lucile St.	Transport Blk
Date:	3/23 - AM	3/23 - PM	3/30 - AM	3/30 - PM	3/25	4/6	4/6	4/6	4/7	4/6
Lab Log#:	138105	138106	138108	138109	138107	158110	158111	158112	158113	158114
Total Petroleum Hydrocarbons (mg/l)	8.2	2.6	4.0	6.1	1.9	9.2 *	12	10	9.7	-
Volatiles (ug/l)										
Benzene	1 U	4 J	1 U	1 U	1 U	1 U	5 U	5 U	5 U	1 U
Toluene	88 J*	180	47	4	84 *	49	71	70	77 J	1 U
Ethylbenzene	15 *	51	1 U	1 U	0.9 J*	1 U	5 U	5 U	5 U	1 U
Total Xylenes	92 *	360	1 U	1 U	4 J*	5	5 U	5 U	5 U	1 U
Acetone	-	-	-	-	-	B	B	B	B	140
Chloroform	-	0.2	-	-	-	1 U	5 U	5 U	5 U	1 U
Chloroethane	-	-	-	-	-	5 UJ	5 UJ	1 J	5 UJ	1 UJ
Vinyl Chloride	-	1.5	-	-	-	1 U	5 U	5 U	5 U	1 U
Naphthalene	-	57	-	-	-	11	1 J	5 U	6	1 U
1,2,4-Trimethylbenzene	-	125	-	-	-	3	5 U	5 U	5	1 U
Isopropylbenzene	-	3.4	-	-	-	1 U	5 U	5 U	5 U	1 U
p-Isopropyltoluene	-	1.6	-	-	-	1 U	5 U	5 U	5 U	1 U
Propylbenzene	-	12	-	-	-	1 U	5 U	5 U	5 U	1 U
4-Methyl-2-Pentanone	-	-	-	-	-	6	10	5 U	5 U	1 U
1,3,5-Trimethylbenzene	-	32	-	-	-	0.7 J	5 U	5 U	5 U	1 U
Tetrachloroethene	-	0.9	-	-	442 J*	0.8 J	5 U	5 U	5 U	1 U
Cis-1,2-Dichloroethane	-	5	-	-	-	1 U	5 U	5 U	5 U	1 U

**=Result of duplicate laboratory analysis*
U=Undetected
J=Estimate
B=Blank Contamination
Indicates compound was detected
-=Compound was not analyzed

Table 5. Results of Conventional Analysis of Vactor Sediments Sampled March – April, 1992

Land-Use:	Residential				Industrial				
Station:	21 Oaks	21 Oaks	Casc. Hts.	Casc. Hts.	Bailey St.	S. Brandon	S. Dawson	S. Dawson-Dupli.	Lucile St.
Date:	3/23 - AM	3/23 - PM	3/30 - AM	3/30 - PM	3/25	4/6	4/6	4/6	4/7
Lab Log#:	137000	137001	138120	138121	138107	158122	158123	158124	158125
Solids (%)	76	76	81	73	83	85	82	81	79
Total Organic Carbon (mg/kg, dry)	33,000	15,000	16,000	44,000 *	25,000	10,000	15,000	15,000	20,000
Grain Size (%)									
gravel (>2000um)	13	26	1	20 *	12	21	11	9	19
sand (2000-62um)	79	66	90	72 *	78	72	84	84	72
silt (62-2um)	7	8	7	8 *	10	4	5	5	6
clay (<2um)	1	0	2	0 *	0	3	0	2	3

**=Result of duplicate laboratory analysis*

Table 6. Results of Metals Analysis of Vactor Sediments Sampled March – April, 1992

Land-Use:	Residential				Industrial				
Station:	21 Oaks	21 Oaks	Casc. Hts.	Casc. Hts.	Bailey St.	S. Brandon	S. Dawson	S. Dawson-Dupli.	Lucile St.
Date:	3/23 - AM	3/23 - PM	3/30 - AM	3/30 - PM	3/25	4/6	4/6	4/6	4/7
Lab Log#:	137000	137001	138120	138121	138107	158122	158123	158124	158125
Metals (mg/kg, dry)									
Arsenic	4.1 *J*	3.0 *J*	3.0 *U*	4.0 *J*	3.0 *U*	17	25	22	19
Cadmium	0.8 *J*	0.8 *J*	0.5 *J*	0.7 *J*	1.1 *J*	0.9 *J*	1.0 *J*	1.0 *J*	0.9
Chromium	26 *J*	213 *J*	29 *J*	19 *J*	111 *J*	30	26	27	26
Copper	24	32	21	18	73	92 *J*	103 *J*	76 *J*	83 *J*
Lead	84 *J*	93	24 *J*	75 *J*	132 *J*	138 *J*	70 *J*	89 *J*	97 *J*
Zinc	121 *J*	114	80 *J*	109 *J*	246 *J*	199 *J*	203 *J*	196 *J*	227 *J*

J=Estimate

U=Undetected

higher in samples from the industrial areas with the exception of chromium whose mean concentration in the residential samples was higher because of elevated concentrations from the 21 Oaks sample (213 mg/kg). Samples from 21 Oaks, Bailey St. and S. Brandon potentially qualify as hazardous waste under Ch. 173-303 WAC because of elevated lead and/or chromium concentrations. However, toxicity characteristic leaching procedures (TCLP) must be conducted on the samples (presently archived at Manchester) to determine if they meet designation requirements.

Results of volatile organics analysis of sediments are shown in Table 7. In general, these results reflect the volatile organics concentrations in decant water. Toluene was the most frequently detected compound, followed by xylenes and ethylbenzene. As with decant water, the sample from the 21 Oaks site had much higher concentrations (at least an order of magnitude in this case) of BTEX compounds. This suggests that a point source or direct dumping of contaminants is occurring in certain catch basins. In addition to BTEX, ten volatile organic compounds were detected in one or more sediments, all at concentrations less than 100 ug/kg. Samples from the Lucile St. site were lost in a laboratory accident.

Total petroleum hydrocarbon (TPH) concentrations were elevated in both residential and industrial vactor sediments (Table 8). Mean TPH concentrations were 1300 mg/kg in residential sediments and 2200 in industrial sediments. Mean polycyclic aromatic hydrocarbon (PAH) concentrations for residential sediments were an order of magnitude lower and industrial sediment concentrations were approximately half of those from the previous sample collection. PAHs are formed during the incomplete combustion of organic material, especially fossil fuels (PTI Environmental Services, 1991c).

SUMMARY

1) Decanted water and sediment samples collected from vactor trucks in the summer and early spring have similar concentrations of conventional, metals, and organic contaminant concentrations. PAH concentrations, however, were substantially lower in the early spring samples.

2) In general, contaminant concentrations were higher in water and sediment samples originating in industrial areas than in samples from residential areas.

3) Dissolved metals in the water samples account for only a small fraction of the total metals concentrations.

4) Toxicity characteristic leaching procedures will be required to determine if samples with high lead and chromium concentrations meet hazardous waste designation criteria.

Table 7. Results of BTEX and other Volatile Organics Analysis of Vactor Sediments Sampled March – April, 1992

Land-Use:	Residential				Industrial				
Station:	21 Oaks	21 Oaks	Casc. Hts.	Casc. Hts.	Bailey St.	S. Brandon	S. Dawson	S. Dawson-Dupli.	Lucile St.
Date:	3/23 - AM	3/23 - PM	3/30 - AM	3/30 - PM	3/25	4/6	4/6	4/6	4/7
Lab Log#:	137000	137001	138120	138121	138107	158122	158123	158124	158125
Volatiles (ug/kg)									
Benzene	3 *U*	5	3 *U*	2 *J*	10 *U*	5 *U*	5 *U*	6 *U*	-
Toluene	220	470	97	660	160	2 *J*	8 *J*	6	-
Ethylbenzene	20 *	270	3 *U*	7	5 *J**	0.5 *J*	0.4 *J*	6 *U*	-
Total Xylenes	120 *	1675 *J**	3 *U*	40 *	17	1.8 *J*	1.4 *J*	0.4 *J*	-
Bromomethane	-	-	-	-	-	5 *U*	0.6 *J*	6 *U*	-
Carbon Disulfide	-	-	-	-	-	0.5 *J*	1 *J*	0.9 *J*	-
Trichlorofluoromethane	-	-	-	-	-	2 *J*	3 *J*	2 *J*	-
Dichlorodifluoromethane	-	-	-	-	-	64	85	60	-
Naphthalene	-	-	-	-	-	5 *J*	5 *UJ*	6 *U*	-
1,2,4-Trimethylbenzene	-	-	-	-	-	4 *J*	5 *UJ*	6 *U*	-
p-Isopropyltoluene	-	-	-	-	-	7	19 *J*	14	-
Propylbenzene	-	-	-	-	-	0.4 *J*	5 *UJ*	6 *U*	-
1,3,5-Trimethylbenzene	-	-	-	-	-	4 *J*	5 *UJ*	6 *U*	-
Tetrachloroethene	-	-	-	-	1950	5 *U*	0.7 *J*	6 *U*	-

U=Undetected
J=Estimated
**=Result of duplicate laboratory analysis*
Indicated compound was detected
-=Compound was not analyzed

Table 8. Results of Total Petroleum Hydrocarbon and PAH Analysis of Vactor Sediments Sampled March – April, 1992

Land-Use:	Residential				Industrial				
Station:	21 Oaks	21 Oaks	Casc. Hts.	Casc. Hts.	Bailey St.	S. Brandon	S. Dawson	S. Dawson-Dupli.	Lucile St.
Date:	3/23 - AM	3/23 - PM	3/30 - AM	3/30 - PM	3/25	4/6	4/6	4/6	4/7
Lab Log#:	137000	137001	138120	138121	138107	158122	158123	158124	158125
Total Petroleum Hydrocarbons (mg/kg, dry)	1850	1375 *	580	1370	200	2350 *	3350	3400	2890
PAHs (ug/kg, dry)									
Acenaphthene	150	61 J	10 J	43 J	130 J	230	72 J	51 J	42 J
Phenanthrene	3300	860	170 U	880 U	1900	1500	730 J	810	820
Fluorene	300	110	17 J	70 J	250 J	410	160 J	150 J	100 J
Naphthalene	96	610	20 J	590 U	84 J	200	62 J	45 J	63 J
Anthracene	600	140	160 U	590 U	340 J	180 J	88 J	91 J	110 J
Acenaphthylene	89 U	95 U	160 U	590 U	480 U	190 U	210 U	200 U	200 U
Pyrene	2700	1000	358	950 U	3000	710	680	800	1000
Benzo(g,h,i)perylene	280	120 U	160 U	590 U	480 U	190 U	130 J	200	250
Fluoranthene	3600 J	1400 J	487 J	890 J	3800 J	1800	670	860	1200
Indeno(1,2,3-cd)pyrene	710 J	170 J	160 UJ	590 UJ	750 J	190 U	170 J	240	280
Benzo(b)fluoranthene	1800	330	160 U	590 U	1500	570	400	540	730
Benzo(k)fluoranthene	460	140	160 U	590 U	630	190 U	210 UJ	160 UJ	200
Chrysene	1000	370	160 U	590 U	1500	360	310	410	500
Benzo(a)pyrene	640	250	160 U	590 U	1000	190 U	230	270	360
Dibenzo(a,h)anthracene	210 J	95 U	160 U	590 U	480 U	190 U	550 U	500 U	500 U
Benzo(a)anthracene	1800	290	160 U	590 U	1300	360	180 J	270	370
2-Methylnaphthalene	120	970	22 J	74 J	96 J	250	210 J	120 J	92 J
2-Chloronaphthalene	89 U	95 U	160 U	590 U	480 U	190 U	210 UJ	200 U	200 U
Dibenzofuran	140	52 J	11 J	41 J	110 J	210	74 J	67 J	42 J
1-Methylnaphthalene	130	930	21 J	88 J	120 J	260	250	150 J	97 J
Retene	560	110 U	160 U	740 U	480 U	190 U	210 U	200 U	110 J
Carbazole	460 UJ	95 UJ	830 UJ	3000 UJ	2500 UJ	960 UJ	1100 UJ	1000 UJ	1000 UJ

U=Undetected
J=Estimated
**=Result of duplicate laboratory analysis*
Indicates compound was detected

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