Algoma Slag Dump (St. Marys River) Nearshore Sediment Quality and Contaminant Bioavailability Study

April 2000



Ministry of the Environment



# Algoma Slag Dump (St. Marys River) Nearshore Sediment Quality and Contaminant Bioavailability Study

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## **EXECUTIVE SUMMARY**

The Algoma Slag Dump is an approximately 400 hectare Algoma Steel disposal site located above the St. Marys Falls, at Sault Ste. Marie, Ontario, partially on land reclaimed from the river. During August 16<sup>th</sup> - September 8<sup>th</sup>, 1989, the Ontario Ministry of the Environment (OMOE) conducted a sediment contamination and biological monitoring assessment of the Algoma Slag Dump nearshore. This study was a follow-up to sediment contamination and landfill leachate problems identified by previous Ministry studies in 1984 through 1987. Leachate infiltration from the dump to the river was identified in 1988.

The 1989 study involved the collection of sediment samples at 16 locations along the dump shoreline to determine sediment quality; an additional upstream station in Point aux Pins Bay served as upstream control. The samples were analyzed for persistent contaminants, including arsenic, cyanide, heavy metals and polycyclic aromatic hydrocarbons (PAHs). Also, unionid mussels (*Elliptio complanata*) in cages were exposed at these same stations for a period of three weeks to determine the biological availability of these inorganic and organic contaminants to aquatic organisms.

Sediments at many of the locations around the dump shoreline contained elevated concentrations of organic carbon, arsenic, cyanide, several heavy metals and PAHs. Concentrations of most contaminants were generally higher at stations located along the eastern half of the shoreline of the dump (i.e., closer to the Algoma Slip). Arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc and total organic carbon concentrations exceeded the respective Provincial Sediment Quality Guideline (PSQG) Lowest Effect Levels (LELs) at the majority of stations sampled. Arsenic, iron, manganese, zinc and total organic carbon also exceeded their respective PSQG-Severe Effect Levels (SELs) at a some stations. Levels of available cyanide were above the Provincial guideline for open water disposal of dredged material at most stations. Concentrations of Total PAHs as well as of 12 individual PAH compounds also exceeded their respective PSQG-LELs.

Although mean concentrations of arsenic and some metals in the mussels were higher at a few of the stations, these differences were not statistically significant from each other or from preexposure concentrations. The spatial pattern of PAH bioavailability and hence, accumulation by the mussels differed from that of metals, with accumulated concentrations being significantly higher at the most easterly stations (i.e., closer to the Algoma Slip). Mussel tissues tended to contain higher concentrations of the more water soluble PAHs (e.g., naphthalene), and very little if any of the lower solubility/higher molecular weight/higher octanol-water partition coefficient compounds (e.g., benzo(g,h,i)-perylene), which were nevertheless present in the sediments. This suggests that the more bioavailable PAHs are those which are more water soluble and present at higher concentrations. Of the 16 PAHs analyzed for, phenanthrene, naphthalene, fluoranthene and pyrene were on average, present at the highest concentrations. Based on preliminary data from this and other Ministry studies, the Cleanup and Restoration Task Team of the St. Marys River Remedial Action Plan identified and prioritized a number of areas of contaminated sediments and benthic invertebrate community impairment to be considered for remediation and monitoring. As a result of this process, the Algoma Slag Dump was ranked the third-highest in priority, just below the Algoma Slip and Bellevue Marine Park.

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#### 1.0 INTRODUCTION

The Algoma Slag Dump is a large (approximately 400 hectare) area adjacent to the upper St. Marys River that has been used since about 1910 for the disposal of slag from iron and steel making. Over the years, the original shoreline has been changed considerably due to infilling with slag and various wastes (Fig. 1). The disposal of waste materials including waste oil, pickling liquor, Terminal Basins dredged material, coke oven wastes, and the storage of PCBs has ocurred in specific areas of the dump (Fig. 2). The area immediately west of the Algoma Slip is used for the stockpiling of coal and calcium carbonate used in coke production and steel-making, respectively. Dust suppression on the dump roads has employed waste oil containing coal tar. In 1986, an area near the western end of the dump was modified to accommodate docking of vessels for the A.B. McLean sand and gravel operation (Fig 2).

Analysis of water samples from wells drilled on the Slag Dump during 1981-82 detected the presence of a number of contaminants in a groundwater mound located under the site. These included: chloride, sulphate, ammonia, phenol, mercury, solvent extractables, and the polycyclic aromatic hydrocarbons (PAHs) fluoranthene, perylene, benzo(k)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene and pyrene (Geocon, 1983)

Previous Ministry studies of sediment quality and benthic invertebrate communities (McKee et al., 1984; Burt et al., 1988) detected elevated concentrations of some metals and of PCBs along the slag dump nearshore. In 1987, surficial sediments collected in the river near the eastern end of the dump (OMOE, unpubl. 1987 data) contained elevated (above upstream background and Provincial open water dredged material disposal guidelines) concentrations of cadmium, iron, lead, magnesium, manganese, zinc, phenol, PAHs, solvent extractables and organic carbon (Appendix A). These concentrations were possibly related to a back-eddy effect (i.e., upstream flow) of the discharge of contaminants from the Algoma Slip, as well as to surface runoff and/or leachate from the site. Also, an oily material on the sediment surface and surface oil slicks were observed in Spring and Bennett Creeks in early 1987. (Bennett Creek discharges to the upper end of the Algoma Slip). Investigation and sediment core sampling in these creeks (see Appendix B, Fig. B-1) detected the presence of a fluid, oily substance, with a creosote-like smell on the surface of the sediments and oil- or tar-saturated deeper layers with a similar odour (Wager et al., 1987). Analysis of samples revealed the presence of numerous unsubstituted and substituted PAHs at elevated (high ppb to low ppm) concentrations in the oily layer and in subsurface core sections (Appendix B). Based on Fourier-transform infrared spectroscopy of some of the samples, the presence of coal tar was confirmed. These findings were followed up by localized clean-up by the industries (OMOE, 1987), involving the vacuum removal of about 3000 gallons of coal tar, and subsequent hydrogeologic studies (Conestoga-Rovers, 1988; Gartner Lee, 1988) and site remediation and the installation of collection systems.

Elevated concentrations of chromium, iron, magnesium, manganese, zinc, certain PAHs and solvent extractables were also found in sediment from the western end of the dump in 1987 (which is far removed from the influence of the Algoma Slip), suggesting losses from the site as





Waste disposal and storage areas on the Algoma Slag Dump. (Adapted from Geocon, 1983; Berry-Spark & Tossell, 1990). Figure 2.

the main source. Groundwater seepage had been identified as coming from some areas of riverbed or submerged slag adjacent to the site. However, the main constituents of this seepage were calcium, chloride and sulphate, while no PAHs were detected (Lee & Welch, 1988). Follow-up work was conducted during 1988-89 to determine (among other objectives) groundwater flow pathways, the quality of groundwater migrating off the slag dump, and the contribution of the slag dump inputs to contaminant levels in the St. Marys River and on-site creeks. This indicated that lateral groundwater flow was generally towards the St. Marys River and that discharge of groundwater contaminated by on-site wastes occurs along the St. Marys River shoreline, into the West Davignon Diversion Channel, the ditch along Baseline Road, Bennett Creek and Spring Creek (Fig. 2). Groundwater fluxes into the St. Marys River are upward through the river sediments and the shallow sediment water is chemically similar to shallow groundwater from nearby areas of the Slag Dump. Relative to point (effluent) and nonpoint (stormwater) source loadings (UGLCCS, 1989), the estimated mass fluxes from the dump site contributed: negligible amounts of the total load of phosphorus, cyanide, phenols, copper, iron and zinc; 3 % of the total chloride load; and 15 % and 32 %, respectively, of the BTX (benzene, toluene, xylenes) and PAH loads. Despite the low percentages, concentrations of numerous contaminants, including phenols, cyanide, cadmium, nickel, zinc, were above PWQOs in shoreline monitoring wells (Berry-Spark & Tossell, 1990).

#### 2.0 **OBJECTIVES**

The overall objectives of this study were to:

- (i) obtain more detailed information on the quality of river sediment adjacent to the Algoma Slag Dump and identify the most contaminated areas; and
- (ii) provide information regarding source areas of biologically available contaminants to the St. Marys River.

#### 3.0 METHODS

The 17 sampling locations were in part selected to update information from earlier studies. Also, additional "infill" stations were added to provide better spatial coverage of the dump shoreline. Descriptions and coordinates for the stations shown in Figure 3 are provided in Appendix C, Table C-1.

#### 3.1 Physical Measurements

Water temperature and conductivity were measured at each station at the beginning (August 16<sup>th</sup>) and end (Sepember 8<sup>th</sup>) of the three week mussel exposure period, using the appropriate

calibrated meters. Due to technical problems with the meter, dissolved oxygen could only be determined on August 16<sup>th</sup>. Current speed was also measured on August 16<sup>th</sup>, with a Marsh-McBirney meter, while the survey vessel was double-anchored.

#### 3.2 Sediment Sampling

Samples of surficial sediment were collected at the 17 stations on August 16, using a clean Shipek dredge of 0.05 m<sup>-2</sup> sampling area. The stainless steel bucket was hexane (glass-distilled)rinsed before sampling at each sation. At 13 of the stations, the top 3 cm of sediment from at least three grabs was composited in a clean (hexane-rinsed) Pyrex® glass tray, and thoroughly homogenized with a solvent-rinsed stainless steel spoon. Two additional replicate samples of sediment were collected at two randomly-selected stations to provide data on within-station variability (i.e., local heterogeneity). Also, sufficient sediment was collected at two other randomly-selected stations to permit the analysis of blind duplicate (split) samples and provide information on sample handling/preservation effects and analytical variability.

After a known volume of each sediment homogenate had been weighed and the field (wet) weight recorded, the remaining material was distributed among the prescribed sample jars and preserved as required (OMOE, 1989a)

#### 3.3 Mussel Biomonitoring

Mature *Elliptio complanata* (Lightfoot, 1786; Family Unionidae) specimens were collected from Balsam Lake on August 14, and placed in large (20 litre) food-grade bioassay bags containing lake water for transport to the study area. The mussels were of a restricted size/age class, i.e., long-axis shell length between 6.5 and 7.2 cm; age between 7 and 10 years. In previous Ministry studies, this species accumulated detectable concentrations of persistent environmnetal contaminants such as organochlorines (Kauss & Hamdy, 1985) and PAHs (Kauss & Hamdy, 1991) within a short exposure period (Kauss & Angelow, 1988).

On August 17, the day after sediment sampling, mussels were placed in the river. At each station, 12 clean mussels were placed in a clean (hexane-rinsed) galvanized wire cage (about 30 cm x 36 cm x 10 cm), which was then anchored to the bottom, using a rope tied to a concrete block. In addition, at three of the stations (121, 127 and 197) an extra cage of mussels was suspended at mid-depth using a submerged float.

Cages were recovered on September 8, after three weeks' exposure. Once on board, the mussels were immediately shucked, the soft tissues rinsed with clean water, the fresh (wet) weight recorded, and the soft tissues wrapped in the following materials and frozen on dry ice: for heavy metals - 3 replicates, each in a plastic (food grade) Whirl-Pak bag; for arsenic, cyanide and



mercury - 3 replicates, each in a Whirl-Pak bag; and for PAHs and lipids - 3 replicates, each in hexane-rinsed aluminum foil inside a Whirl-Pak bag. Additional mussels were wrapped as for PAHs and lipids and maintined in short-term archival storage (at about -15 degrees C), pending receipt of analytical data.

#### 3.4 Analytical Methods

Based on results from earlier Ministry studies, sediment samples were analyzed for a number of parmeters, including physical characteristics, oils and greases, arsenic, cyanide, heavy metals and PAHs. Mussel tissue samples were analyzed for arsenic, selected heavy metals and PAHs. Analysis for these parameters (see Table 1) was performed at the Ministry laboratories in Etobicoke, according to documented procedures (OMOE, 1983; OMOE, 1989b).

	Table 1	l.	Sample	analytical	tests.
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Parameter or Scan	Sediment	Mussel
Moisture	$\checkmark$	$\checkmark$
Lipids		$\checkmark$
Particle Size Distribution scan	$\checkmark$	
Residue, Loss on Ignition	$\checkmark$	
Carbon, total Organic	$\checkmark$	•
Arsenic	$\checkmark$	$\checkmark$
Cyanide, available & total	$\checkmark$	
Mercury (cold vapour flameless AAS)	$\checkmark$	$\checkmark$
Heavy Metals scan (Cd, Cr, Cu, Fe, Pb, Mg, Mn, Ni, Zn)/(Cd, Cu, Pb, Mg, Mn, Ni,	$\checkmark$	$\checkmark$
Solvent Extractables (Oils & Greases)	$\checkmark$	
Polycyclic Aromatic Hydrocarbons scan (16 compounds)	$\checkmark$	$\checkmark$

#### 3.5 Statistical Analysis

Correlation analysis (Pearson Product-Moment) on sediment and mussel data was performed on transformed (log x+1; arcsin/x for percentages) concentrations of selected parameters; correlations were deemed statistically significant at the 95 % confidence level (p < 0.05). Significant differences between contaminant concentrations in mussels were determined using Analysis of Variance (MANOVA) and the Tukey's HSD test at the 95 % confidence level (p < 0.05). Pairwise comparison of means was performed using a t-test and a 95 % confidence level.

In statistical calculations, values followed by "<W" were were deemed "not detected" (i.e., not present above the minimum reportable value of the analytical method) and assigned a value of zero, which provides aconservative estimate of the mean. Those values with a "<T" suffix were used as actual values. (The W value is 1.5 standard deviations of the mean for a series of low-level spiked samples; the Method Detection Limit (MDL) is 3 standard deviations. The T value is either 5 or 10 times the W value, depending on the analyte.) For convenience, the W value is

referred to as the Minimum Reportable Value or "MRV" in the following discussion of results. Between the MDL and the T value, there is a 99 % confidence that the value is not a false positive; however, confidence in the actual concentration may not be as high. Above the T value, there is a greater than 99 % confidence that the value is not a false positive and also a high degree of confidence that the analyte concentration is accurate.

#### 4.0 **RESULTS AND DISCUSSION**

Data for individual replicate or split sediment and mussel samples are provided in Appendix C tables.

#### 4.1 Physical and Chemical Characteristics of Water

At most stations, there was little difference between the surface or the mid-depth measurements of water temperature, dissolved oxygen or conductivity, and the values were within applicable Provincial Water Quality Objectives (PWQOs) for the protection of aquatic life (Table 2).

# Table 2.Water quality characteristics during 1989 study. Underlined value in shaded<br/>cell does not meet applicable Provincial Water Quality Objective.

Station	Metres	Water	Sample	Tempera	ture, °C	Dissolved Oxygen, mg.l <sup>-1</sup>	Conductivi µs.e	ty @25 °C, cm <sup>-1</sup>	Current Speed, m.s <sup>-1</sup>
Number	from shore	Depth, m.	Depth, m.	Aug. 16	Sept. 8	Aug. 16	Aug. 16	Sept. 8	Aug. 16
52	500	4.5	4.3	17.4		8.9	95		0
124	140	1.0	0.8	18.6		9.1	96		0
205	210	2.0	1.8	18.4	17.9	9.1	97	98	0.05
123	150	3.0	2.8	18.4	17.8	9.8	97	98	0.01
204	50	3.0	2.8	17.7	17.1	9.7	95	99	0.09
203	50	5.0	4.8	17.8	17.0	9.7	95	98	0.08
122	15	5.0	4.8	17.5	16.9	9.5	96	97	0.14
202	20	9.5	9.3	17.3		9.3	97	**	0.24
121	40	4.0	3.8	17.7	16.9	9.6	96	97	0.32
121-M	*	*	2.0		16.9	-		97	
201	50	4.0	3.8	17.5	16.9	9.8	96	97	0
200	80	3.0	2.8	17.6	16.8	10	96	97	0.09
199	60	8.5	8.3	17.7		9.4	97		
198	60	3.0	2.8	18.0	17.0	9.7	97	98	0
197	50	5.0	4.8	17.8	17.0	9.7	97	102	0.09
197-M	**	"	2.5		17.0			102	
196	50	5.0	4.8	17.6	17.0	<u>0.9</u>	97	100	0
195	70	5.0	4.8	17.3	16.9	9.6	97	97	0
127	70	5.0	4.8	17.7	17.0	9.7	96	97	0
127-M	"	**	2.5		17.0			97	

NOTES: "-" = no data available; "M" = mid-depth.

Over the three week mussel exposure period, water temperature was relatively constant, differing by less than a degree Celsius. At all but one of the stations, dissolved oxygen was quite high and supportive of a cold water fishery. However, on August 16, dissolved oxygen was 0.9 mg.l<sup>-1</sup> at Station 196 near the east end of the dump. This is far below the desired PWQOs of 4 mg.l<sup>-1</sup> for the protection of warm-water fish or the 5 mg.l<sup>-1</sup> for the protection of cold-water fish (OMOE, 1984; OMOEE, 1994). Conductivity was realtivley constant, only being slightly higher at Stations 204, 203, 197 and 196 on September 8 (Table 2).

There was no measurable current at many of the sampling stations on August 16<sup>th</sup> (Table 2). However, at Stations 205, 204, 203, 122, 200 and 197, current speed ranged from 0.05 to 0.14 m.s<sup>-1</sup>. These speeds are below the minimum required for the erosion of unconsolidated coarse silt (about 0.15 m.s<sup>-1</sup>). At Stations 202 and 121, the currents of 0.24 and 0.32 m.s<sup>-1</sup>, respectively, were close to or just above the minimum of ~0.30 m.s<sup>-1</sup> required for the erosion of consolidated coarse silt. (The coarse silt fraction is represented by particles ranging in diameter between 31 and 62  $\mu$ m.).

#### 4.2 Sediment Quality

#### 4.2.1 Physical Characteristics

Sediment at the Point aux Pins "control" Station 52 was silty-sand in nature, with abundant wood fibres (Table 3). The wood fibres are probably related to use of this area for log booming (OMNR archives). In contrast, sediments adjacent to the Algoma Slag Dump tended to be more sandy (gritty) in nature, at times also including stones, organic ooze, coke granules, iron ore and oil droplets. Laboratory analysis showed that sediments from stations along the dump shoreline consisted mostly of sand and "fines" (i.e., silt and clay - see Fig. 4).

#### 4.2.2 Contaminants

Overall, the mean concentrations of TOC (49 g.kg<sup>-1</sup>), LOI (43 g.kg<sup>-1</sup>) and solvent extractables (567 mg.kg<sup>-1</sup>) for the 16 slag dump stations were below the concentrations at the Point aux Pins Bay control station (66 g.kg<sup>-1</sup>, 140 g.kg<sup>-1</sup> and 1106 mg.kg<sup>-1</sup>, respectively). In contrast, the average slag dump sediment concentrations of arsenic (7.65 mg.kg<sup>-1</sup>), chromium (34 mg.kg<sup>-1</sup>), available cyanide (0.397 mg.kg<sup>-1</sup>), iron (34220 mg.kg<sup>-1</sup>), lead (35 mg.kg<sup>-1</sup>), magnesium (7642 mg.kg<sup>-1</sup>), manganese (1048 mg.kg<sup>-1</sup>), nickel (14 mg.kg<sup>-1</sup>), zinc (200 mg.kg<sup>-1</sup>) and of each of the 16 polycyclic aromatic hydrocarbon compounds (PAHs) as well as of Total PAHs (23.8 mg.kg<sup>-1</sup>) were considerably above the concentrations in Point aux Pins Bay, by factors ranging from two-fold for nickel to about 130-fold for benzo(a)anthracene (see Tables 3, 5 and 6).

Concentrations of sediment contaminants were compared to the Provincial Aquatic Sediment Quality Guidelines (PSQGs) (Persaud *et al.*, 1993). These guidelines replace the earlier Open Water Disposal Guidelines (OWDGs) (Persaud & Wilkins, 1976) which were used to assess the 
 Table 3. Sediment physical characteristics, organic carbon and solvent extractables concentrations.

 Concentration units as indicated.

		Very Coarse Sand	Sand	Silt & Clay	Moisture	Field	Residue, fotal loss	Organic Carbon,	Solvent
Station	Visual (Field) Description	2000-1000 µm %	1000.63 апі %	<63 am %	₿ <sup>6</sup>	Bensity g cm <sup>3</sup>	on Ignition g kg <sup>.t</sup>	total g kg <sup>1</sup>	Extractables mg kg <sup>1</sup>
Pointe aux P	Ins Bay-								
52	sity; abundant wood fibre	4.79	62.6	32.6	53	1.36	0FT	প্র	1106
Algoma Slag	Dump:								
124	silty sand; macrophytes	0.08 0.%	% I 6.98	131 3%	29 2 G.	1.79	5.0 18	щ, 52 8.97	398 315 %
205	sifty sand and clay; some stones	2 15	72.0	25.9	25	1 89	4.0	4.0	222
123	silty sand	2.02	916	6.37	23	1 96	5.0	101	405
204	organic ouze; macrophytes	131 134	546 1 4	32.2 7 47	52 1 %	1.34	2 83	<ol> <li>2.8 2.4.</li> </ol>	497 61 %
203	organic ouze; abundant macrophytes	157	51.3	33.1	58	1.25	<u>68</u>	π	274
122	silty sand: reddish surficial layer; oil droplets	3.31	68.5	28.2	3.4	1.71	32	22	206
202	sand; some stones; coke granules on surface	5.02	92 1	2.88	18	2.04	10	ส	264
121	silty sand; rust-coloured lumps	0.34	547	45 ()	29	62.1	5.0	न	380
201	sandy silt; some oil droplets	0.16	45.5	543	31	171	12	0T	FILE
2()()	sandy silt; rust-coloured lumps; macrophytes	3.19	39 h	57.2	43	1 4.1	21	म	321
661	sandy twize; quite only	0.86 25 %	42.6 9 %	40.5 6 %	38 5 %	69	46 3.	1 1 1 1 di	251
198	sandy ouze; very only	1.33	60.2	38.5	48	1 47	23	611	471
197	sandy coze; very oily	4 63	54.2	111	54	1 34	376	28	322
961	uily uuze, some fine sand	2 20	56.7	411	49	1.38	216	100	406
195	oily coze; some tine sand; plant and wood fibres	0.83 70 %	72.4 2.9%	267 7 %	46 9 %	142	22 13	7. 120 8 %	699 97 4
127	sandy coze; very oily	0.78	7.67	19.5	45	1.41	স্ল	130	692
Dump Mean.		3 48	63.9	31.6	39	09.1	13	ন	567
PSQG-LEL:			:	+	:	;	:	Ξ	:
PSQG-SEL:		;	:	:	;	;	:	11(1)	;
OWDMDG:		:	:	:	;	;	()9	:	15(8)

NOTES: "..." indicates that guidefine or CV is not available for this parameter.

underlined value in shaded cell exceeds PSQG-LEL or OWDMDG; holded value exceeds PSQG-SEL.

Percentages after concentrations are the Coefficient of Variation. For n = 3,  $CV = (Std.Dev'n/Mean) \times 188$ , or for n = 2,  $CV = (Square root of 2(max-min/min + max) \times 180)$ .

"S" after station number = split (same grab) sample; n = 2.

"R" after station number = replicate (discrete grab) sample; n = 3



Figure 4. Percent silt and clay, and total organic carbon and solvent extractables concentrations in sediments. Vertical lines on bars represent one standard deviation of replicates (n = 3) or range of split samples (n = 2).

<b>Contaminant Concentration</b>	Sediment Quality	Potential Impact
≤ No Effect Level (NEL)	clean	expect no impact on benthic organisms or biomagnification through the food chain; other water quality and use guidelines will be met
≥ No Effect Level (NEL)	clean to marginally polluted	potential to affect some sensitive water uses
≥ Lowest Effect Level (LEL)	marginally to significantly polluted	will affect sediment use by some (sensitive) benthic organisms
≥ Severe Effect Level (SEL)	grossly polluted	will significantly affect use of sediment by the majority of benthic organisms

Table 4.Provincial Sediment Quality Guidelines and their significance (Persaud et al.<br/>1993).

suitability of soils and dredged material for open-water disposal. In contrast, the PSQGs are specifically intended to protect aquatic biological resources by setting safe levels for metals, nutrients, and persistent organic compounds. These guidelines are based on three levels of ecotoxic effects: a No-Effect Level (NEL), a Lowest Effect Level (LEL), and a Severe Effect Level (SEL), the significance of which are summarized in Table 4.

Sediments from some of the slag dump stations were "marginally" or "grossly polluted" with respect to the concentrations of total organic carbon (TOC), loss on ignition (LOI), arsenic, heavy metals and various PAH compounds. Such concentrations would have the potential to affect use by the more sensitive sediment-dwelling organisms (marginally polluted) or significantly affect use by the majority of organisms (grossly polluted). Total organic carbon (TOC) exceeded the PSQG-LEL of 10 g.kg<sup>-1</sup> at the control (Station 52), and at 13 of the 16 stations around the perimeter of the dump. At the most easterly stations, (198, 197, 196, 195, 127), TOC levels exceeded the PSQG-SEL of 100 g.kg<sup>-1</sup> (Fig. 4; Table 3). Loss on ignition at the latter stations also exceed the old Open Water Dredged Material Disposal Guideline (OWDMDG) of 60 g.kg<sup>-1</sup> (Table 3). Concentrations of solvent extractables only exceeded the 1500 mg.kg<sup>-1</sup> OWDMDG at Station 201.

With the exception of mercury (no PSQG exceedences) and magnesium (with no PSQG), concentrations of all inorganics and heavy metals were higher than their respective PSQG-LELs or OWDMDGs at six or more of the stations around the perimeter of the dump (Table 5). Levels at control Station 52 only exceeded the PSQG-LELs for cadmium and copper. The highest concentrations of arsenic, copper, cyanide, iron, lead, nickel and zinc, were found at stations near the eastern end of the slag dump (i.e., Stations 199, 198, 197, 196, 195 and 127), with the peak concentration usually occurring at Station 199. Concentrations of magnesium and manganese were also high at these stations, but along with cadmium, chromium, copper and iron, they were also elevated and above the respective PSQG-LELs at a number of more westerly locations, including Stations 204, 203, 122, 202, 121 and 201 (Table 5). This may be due to

Table 5. Arsenic, cyanide and heavy metals concentrations in sediments.

Montonione         Annete         Annet         Anne	lation	Arsenic	Cadmium	5	romium	Copper	Cyanide		Iron	Lead	Magnesium,	Manganese	Mercury	z	lickel	Zinc
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Number         State         State <t< td=""><td></td><td>07 6</td><td>0.87</td><td></td><td><u>7</u></td><td>67</td><td>1 - 770 0</td><td></td><td>004/</td><td>17</td><td>1800</td><td>76</td><td>1 &gt; 10.0</td><td></td><td>1 1</td><td>40</td></t<>		07 6	0.87		<u>7</u>	67	1 - 770 0		004/	17	1800	76	1 > 10.0		1 1	40
	Slag Du	nıp.														
	s	1 25 6 %	014 <t< td=""><td>5 ° 6</td><td>11 0 %</td><td>\$ 25 4 %</td><td>0 040 <t< td=""><td>L 0 %</td><td>7350 3 %</td><td>60 0%</td><td>1650 4%</td><td>125 6 %</td><td>M&gt; 10.0</td><td>0 %</td><td>51 5%</td><td>27 0 %</td></t<></td></t<>	5 ° 6	11 0 %	\$ 25 4 %	0 040 <t< td=""><td>L 0 %</td><td>7350 3 %</td><td>60 0%</td><td>1650 4%</td><td>125 6 %</td><td>M&gt; 10.0</td><td>0 %</td><td>51 5%</td><td>27 0 %</td></t<>	L 0 %	7350 3 %	60 0%	1650 4%	125 6 %	M> 10.0	0 %	51 5%	27 0 %
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	~	5 70	0 30		29	<u>ଥ</u>	0 095		21000	17	16000	3600	0 03 <t< td=""><td></td><td>10</td><td>4.4</td></t<>		10	4.4
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fear         763         040         14         21         037         1420         15         4960         1048         04         14         200           EL         6         06         26         16         -         20000         31         -         460         02         16         12         200           EL         31         10         110         -         4000         250         -         460         02         16         120           DG         -         0100         -         -         0100         -         10         10         10         10         -         -         -         -         -         -         -         -         -         -         - <t< td=""><td>2</td><td>8 70</td><td>0 32</td><td></td><td><b>=</b>1</td><td>କ୍ଷା</td><td>1 300</td><td></td><td>34000</td><td><del>6</del>]</td><td>5000</td><td>760</td><td>0 04 <t< td=""><td></td><td>91</td><td>280</td></t<></td></t<>	2	8 70	0 32		<b>=</b> 1	କ୍ଷା	1 300		34000	<del>6</del> ]	5000	760	0 04 <t< td=""><td></td><td>91</td><td>280</td></t<>		91	280
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NOTES "..." indicates that guideline or CV is not available for this parameter

Percentages after concentrations are the Coefficient of Variation For n = 3, CV = (Std Devin Mean) x 100, or for n = 2, CV = [square root of 2(max-mn /mm + max ) x 100]

 $^{n} \leq T^{n} = a$  measurable trace amount interpret with caution

"<TE" = a measurable trace after extra dilution or concentration caution

"<W" = no measurable response (zero) less than reported value

" < WE" = no measurable response (dilution/concentration less than reported value

Underlined value in shaded cell exceeds PSQ-LEL Guideline or OWDMD guideline, bolded value exceeds PSQ-SEL Guideline

"S" after station number = split (same grab) sample, n = 2

"R" after station number = replicate (discrete grab) sample, n = 3



Figure 5. Concentrations of arsenic, cyanide, cadmium, chromium, copper and iron in sediments. Vertical lines on bars represent one standard deviation of replicates (n = 3) or range of split samples (n = 2).



Figure 6. Concentrations of lead, magnesium, manganese, mercury, nickel and zinc in sediments. Vertical lines on bars represent one standard deviation of replicates (n = 3) or range of split samples (n = 2).

Table 6. Polycyclic aromatic hydrocarbons concentrations in sediments.

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All concentrations in mg.kg<sup>-1</sup> (ppm), dry weight.

	Ace-	Ace-	A 164-10	Benzo(a)-	Benzo(b)-	Benzo(k)-	Benzo-	Doesdal	1	Dibenzo-	
Number	thene	thylene	Cene	cene cene	thene	there	gerylyne	Dyrene Dyrene	sene	(a,n)an- thracene	riuor- anthene
Pointe aux Pi	in Bay										
.,	0.04 /T	0.06 -11/	0.01 /T	0.00 /T	0.06 /T	T 0.00	0.04 /T	T. 100	0.04 /T	T. 100	T, 000
75	1 > +0 0	M> 000	1 100	1 20.0	1 - 00 0	15 70.0	1 1 4 10	1 > 100	0.04 <1	0.04 <1	1 > 20 0
Algoma Slag	Dump										
124-S	0.04 < T = 0.%	0 05 <w -<="" td=""><td>0.01 <t 0.%<="" td=""><td>0 02 <t %<="" 0="" td=""><td>0.06 <t 0.%<="" td=""><td>0 02 <t %<="" 0="" td=""><td>0.04 <t 0%<="" td=""><td>004 <t 0%<="" td=""><td>0.02 &lt; T = 0.%</td><td>0.04 <t 0%<="" td=""><td>003 <t 0<="" td=""></t></td></t></td></t></td></t></td></t></td></t></td></t></td></t></td></w>	0.01 <t 0.%<="" td=""><td>0 02 <t %<="" 0="" td=""><td>0.06 <t 0.%<="" td=""><td>0 02 <t %<="" 0="" td=""><td>0.04 <t 0%<="" td=""><td>004 <t 0%<="" td=""><td>0.02 &lt; T = 0.%</td><td>0.04 <t 0%<="" td=""><td>003 <t 0<="" td=""></t></td></t></td></t></td></t></td></t></td></t></td></t></td></t>	0 02 <t %<="" 0="" td=""><td>0.06 <t 0.%<="" td=""><td>0 02 <t %<="" 0="" td=""><td>0.04 <t 0%<="" td=""><td>004 <t 0%<="" td=""><td>0.02 &lt; T = 0.%</td><td>0.04 <t 0%<="" td=""><td>003 <t 0<="" td=""></t></td></t></td></t></td></t></td></t></td></t></td></t>	0.06 <t 0.%<="" td=""><td>0 02 <t %<="" 0="" td=""><td>0.04 <t 0%<="" td=""><td>004 <t 0%<="" td=""><td>0.02 &lt; T = 0.%</td><td>0.04 <t 0%<="" td=""><td>003 <t 0<="" td=""></t></td></t></td></t></td></t></td></t></td></t>	0 02 <t %<="" 0="" td=""><td>0.04 <t 0%<="" td=""><td>004 <t 0%<="" td=""><td>0.02 &lt; T = 0.%</td><td>0.04 <t 0%<="" td=""><td>003 <t 0<="" td=""></t></td></t></td></t></td></t></td></t>	0.04 <t 0%<="" td=""><td>004 <t 0%<="" td=""><td>0.02 &lt; T = 0.%</td><td>0.04 <t 0%<="" td=""><td>003 <t 0<="" td=""></t></td></t></td></t></td></t>	004 <t 0%<="" td=""><td>0.02 &lt; T = 0.%</td><td>0.04 <t 0%<="" td=""><td>003 <t 0<="" td=""></t></td></t></td></t>	0.02 < T = 0.%	0.04 <t 0%<="" td=""><td>003 <t 0<="" td=""></t></td></t>	003 <t 0<="" td=""></t>
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123	0.04 <t< td=""><td>0 05 <w< td=""><td>001 <t< td=""><td>0 02 <t< td=""><td>0 06 <t< td=""><td>0 02 <t< td=""><td>0.04 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></w<></td></t<>	0 05 <w< td=""><td>001 <t< td=""><td>0 02 <t< td=""><td>0 06 <t< td=""><td>0 02 <t< td=""><td>0.04 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></w<>	001 <t< td=""><td>0 02 <t< td=""><td>0 06 <t< td=""><td>0 02 <t< td=""><td>0.04 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0 02 <t< td=""><td>0 06 <t< td=""><td>0 02 <t< td=""><td>0.04 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0 06 <t< td=""><td>0 02 <t< td=""><td>0.04 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0 02 <t< td=""><td>0.04 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<></td></t<></td></t<>	0 04 <t< td=""><td>0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<></td></t<>	0 02 <t< td=""><td>0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<></td></t<>	0 04 <t< td=""><td>0 02 <t< td=""></t<></td></t<>	0 02 <t< td=""></t<>
204-R	0.04 <t %<="" 0="" td=""><td>0 05 <w -<="" td=""><td>0.03 <t %<="" 33="" td=""><td>0 I0 <t %<="" 20="" td=""><td>016 <t 6%<="" td=""><td>0.07 <t %<="" 14="" td=""><td>006 <t 35%<="" td=""><td>011 <t 18%<="" td=""><td>014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t></td></t></td></t></td></t></td></t></td></t></td></t></td></w></td></t>	0 05 <w -<="" td=""><td>0.03 <t %<="" 33="" td=""><td>0 I0 <t %<="" 20="" td=""><td>016 <t 6%<="" td=""><td>0.07 <t %<="" 14="" td=""><td>006 <t 35%<="" td=""><td>011 <t 18%<="" td=""><td>014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t></td></t></td></t></td></t></td></t></td></t></td></t></td></w>	0.03 <t %<="" 33="" td=""><td>0 I0 <t %<="" 20="" td=""><td>016 <t 6%<="" td=""><td>0.07 <t %<="" 14="" td=""><td>006 <t 35%<="" td=""><td>011 <t 18%<="" td=""><td>014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t></td></t></td></t></td></t></td></t></td></t></td></t>	0 I0 <t %<="" 20="" td=""><td>016 <t 6%<="" td=""><td>0.07 <t %<="" 14="" td=""><td>006 <t 35%<="" td=""><td>011 <t 18%<="" td=""><td>014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t></td></t></td></t></td></t></td></t></td></t>	016 <t 6%<="" td=""><td>0.07 <t %<="" 14="" td=""><td>006 <t 35%<="" td=""><td>011 <t 18%<="" td=""><td>014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t></td></t></td></t></td></t></td></t>	0.07 <t %<="" 14="" td=""><td>006 <t 35%<="" td=""><td>011 <t 18%<="" td=""><td>014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t></td></t></td></t></td></t>	006 <t 35%<="" td=""><td>011 <t 18%<="" td=""><td>014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t></td></t></td></t>	011 <t 18%<="" td=""><td>014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t></td></t>	014 <t 14%<="" td=""><td>0.04 <t 0%<="" td=""><td>0.25 16</td></t></td></t>	0.04 <t 0%<="" td=""><td>0.25 16</td></t>	0.25 16
203	0.04 <t< td=""><td>0 05 <w< td=""><td>0.05 <t< td=""><td>0.29</td><td>0 44 <t< td=""><td>0.21</td><td>022 <t< td=""><td>10 11</td><td>0.37</td><td>0.06 <t< td=""><td>0 66</td></t<></td></t<></td></t<></td></t<></td></w<></td></t<>	0 05 <w< td=""><td>0.05 <t< td=""><td>0.29</td><td>0 44 <t< td=""><td>0.21</td><td>022 <t< td=""><td>10 11</td><td>0.37</td><td>0.06 <t< td=""><td>0 66</td></t<></td></t<></td></t<></td></t<></td></w<>	0.05 <t< td=""><td>0.29</td><td>0 44 <t< td=""><td>0.21</td><td>022 <t< td=""><td>10 11</td><td>0.37</td><td>0.06 <t< td=""><td>0 66</td></t<></td></t<></td></t<></td></t<>	0.29	0 44 <t< td=""><td>0.21</td><td>022 <t< td=""><td>10 11</td><td>0.37</td><td>0.06 <t< td=""><td>0 66</td></t<></td></t<></td></t<>	0.21	022 <t< td=""><td>10 11</td><td>0.37</td><td>0.06 <t< td=""><td>0 66</td></t<></td></t<>	10 11	0.37	0.06 <t< td=""><td>0 66</td></t<>	0 66
122	0 22 <t< td=""><td>0 29 <t< td=""><td>1.22</td><td>2.56</td><td>2 90</td><td>136</td><td>121</td><td>2 60</td><td>2 64</td><td>032 <t< td=""><td>11-5</td></t<></td></t<></td></t<>	0 29 <t< td=""><td>1.22</td><td>2.56</td><td>2 90</td><td>136</td><td>121</td><td>2 60</td><td>2 64</td><td>032 <t< td=""><td>11-5</td></t<></td></t<>	1.22	2.56	2 90	136	121	2 60	2 64	032 <t< td=""><td>11-5</td></t<>	11-5
202	0.04 <t< td=""><td>0 05 ×W</td><td>0 09 <t< td=""><td>0.32</td><td>0 42 <t< td=""><td>0 18 <t< td=""><td>0.19 <t< td=""><td>037 <t< td=""><td>0.16</td><td>0.05 <t< td=""><td>0.61</td></t<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0 05 ×W	0 09 <t< td=""><td>0.32</td><td>0 42 <t< td=""><td>0 18 <t< td=""><td>0.19 <t< td=""><td>037 <t< td=""><td>0.16</td><td>0.05 <t< td=""><td>0.61</td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	0.32	0 42 <t< td=""><td>0 18 <t< td=""><td>0.19 <t< td=""><td>037 <t< td=""><td>0.16</td><td>0.05 <t< td=""><td>0.61</td></t<></td></t<></td></t<></td></t<></td></t<>	0 18 <t< td=""><td>0.19 <t< td=""><td>037 <t< td=""><td>0.16</td><td>0.05 <t< td=""><td>0.61</td></t<></td></t<></td></t<></td></t<>	0.19 <t< td=""><td>037 <t< td=""><td>0.16</td><td>0.05 <t< td=""><td>0.61</td></t<></td></t<></td></t<>	037 <t< td=""><td>0.16</td><td>0.05 <t< td=""><td>0.61</td></t<></td></t<>	0.16	0.05 <t< td=""><td>0.61</td></t<>	0.61
121	0 04 <t< td=""><td>0 05 <w< td=""><td>0.15</td><td>0.68</td><td>1 00</td><td>0.47</td><td>049</td><td>0.92</td><td>0.79</td><td>013 <t< td=""><td>1 22</td></t<></td></w<></td></t<>	0 05 <w< td=""><td>0.15</td><td>0.68</td><td>1 00</td><td>0.47</td><td>049</td><td>0.92</td><td>0.79</td><td>013 <t< td=""><td>1 22</td></t<></td></w<>	0.15	0.68	1 00	0.47	049	0.92	0.79	013 <t< td=""><td>1 22</td></t<>	1 22
201	0.04 <t< td=""><td>W&gt; 30.0</td><td>0 08 <t< td=""><td>0.36</td><td>0 50 <t< td=""><td>0 23</td><td>0.25 <t< td=""><td>10</td><td>041</td><td>006 <t< td=""><td>0 65</td></t<></td></t<></td></t<></td></t<></td></t<>	W> 30.0	0 08 <t< td=""><td>0.36</td><td>0 50 <t< td=""><td>0 23</td><td>0.25 <t< td=""><td>10</td><td>041</td><td>006 <t< td=""><td>0 65</td></t<></td></t<></td></t<></td></t<>	0.36	0 50 <t< td=""><td>0 23</td><td>0.25 <t< td=""><td>10</td><td>041</td><td>006 <t< td=""><td>0 65</td></t<></td></t<></td></t<>	0 23	0.25 <t< td=""><td>10</td><td>041</td><td>006 <t< td=""><td>0 65</td></t<></td></t<>	10	041	006 <t< td=""><td>0 65</td></t<>	0 65
200	0 04 <t< td=""><td>0 05 <w< td=""><td>0.08 <t< td=""><td>0 25</td><td>037 <t< td=""><td>017 <t< td=""><td>018 AT</td><td>032 <t< td=""><td>0 30</td><td>0.05 <t< td=""><td>047</td></t<></td></t<></td></t<></td></t<></td></t<></td></w<></td></t<>	0 05 <w< td=""><td>0.08 <t< td=""><td>0 25</td><td>037 <t< td=""><td>017 <t< td=""><td>018 AT</td><td>032 <t< td=""><td>0 30</td><td>0.05 <t< td=""><td>047</td></t<></td></t<></td></t<></td></t<></td></t<></td></w<>	0.08 <t< td=""><td>0 25</td><td>037 <t< td=""><td>017 <t< td=""><td>018 AT</td><td>032 <t< td=""><td>0 30</td><td>0.05 <t< td=""><td>047</td></t<></td></t<></td></t<></td></t<></td></t<>	0 25	037 <t< td=""><td>017 <t< td=""><td>018 AT</td><td>032 <t< td=""><td>0 30</td><td>0.05 <t< td=""><td>047</td></t<></td></t<></td></t<></td></t<>	017 <t< td=""><td>018 AT</td><td>032 <t< td=""><td>0 30</td><td>0.05 <t< td=""><td>047</td></t<></td></t<></td></t<>	018 AT	032 <t< td=""><td>0 30</td><td>0.05 <t< td=""><td>047</td></t<></td></t<>	0 30	0.05 <t< td=""><td>047</td></t<>	047
199.S	$0.04 < \Gamma = 0.\%$	0 05 <w -<="" td=""><td>0 23 15 %</td><td>0.73 29 %</td><td>0% 6 L0 1</td><td>0.38 5 %</td><td>0.41 17 %</td><td>0.78 11 %</td><td>0.79 3 %</td><td>0.12 <t %<="" 28="" td=""><td>141 8 %</td></t></td></w>	0 23 15 %	0.73 29 %	0% 6 L0 1	0.38 5 %	0.41 17 %	0.78 11 %	0.79 3 %	0.12 <t %<="" 28="" td=""><td>141 8 %</td></t>	141 8 %
198	0.81	024 <t< td=""><td>1.20</td><td>3.55</td><td>4 97</td><td>101</td><td>2.46</td><td>4 28</td><td>3.40</td><td>0.71</td><td>5.86</td></t<>	1.20	3.55	4 97	101	2.46	4 28	3.40	0.71	5.86
197	0.52	0 25 <t< td=""><td>139</td><td>5.25</td><td>7 51</td><td>2.59</td><td>281.</td><td>5.81</td><td>537</td><td>0.93</td><td>8 77</td></t<>	139	5.25	7 51	2.59	281.	5.81	537	0.93	8 77
196	0.54	021 <t< td=""><td>1.48</td><td>501</td><td>6.81</td><td>2 48</td><td>2 47</td><td>5 31</td><td>4.97</td><td>0.78</td><td>8.75</td></t<>	1.48	501	6.81	2 48	2 47	5 31	4.97	0.78	8.75
195-R	0 78 18 %	0 35 14 %	2 10 18 %	630 6%	8 07 4 %	3.13 5 %	3.40 5 %	<u>6.55</u> 5 %	636 4%	1 06 10 %	11 77 13
127	1 05	038 <t< td=""><td>2.23</td><td>6.29</td><td>7 52</td><td>2 89</td><td>115</td><td>617</td><td>629</td><td>1 05</td><td>13.09 &gt;A</td></t<>	2.23	6.29	7 52	2 89	115	617	629	1 05	13.09 >A
Dump Mean	0 27	011 <t< td=""><td>0.65</td><td>1 98</td><td>2 62</td><td>0 660</td><td><del>1</del>00</td><td>213</td><td>2.02</td><td>034</td><td>3 69</td></t<>	0.65	1 98	2 62	0 660	<del>1</del> 00	213	2.02	034	3 69
PSQG-LEL	:		0 22	0.32	:	0 24	017	037	0.34	0.06	0.75
PSQG-SEL	:	;	370	1480	:	1340	320	1440	460	130	1020
DOMDMDG	1	:	;		:	:	:	;	:	:	1

NOTES "---" indicates that guideline or CV is not available for this parameter

I

 ${}^{\omega} < T^{*} = a$  measurable trace amount interpret with caution

 $^{\prime\prime} < W^{*} =$  no measurable response (zero) ~ less than reported value

">A" = approximate result exceeded normal range limit

Underlined value in shaded cell exceeds PSQ-LEL Guideline

Percentages after concentrations are the Coefficient of Variation For n = 3, CV = (Std Dev'n/Mtan) x 100, or for n = 2, CV = (square root of 2(max min /min + max ) x 100)

"S" after station number = split (same grab) sample,  $n \approx 2$ 

"R" after station number  $\approx$  replicate (discrete grab) sample, n = 3

# Table 6. continued.

All concentrations in mg kg<sup>-1</sup> (ppm), dry weight.

											E	
			Indeno-				i				10131	
Station	Fluor-		(1.2,3-		Naph-		Phen-				91 10	
Number	ene		cd)pyrene		thalene		anthrene		Pyrene		PAHs	
Pointe aux P	my Bay-											
52	0.04 <	Ţ	0.04	~T>	0.04	۲×	0.07	Ť	0.06	<t></t>	0.69	
Algoma Slag	Dump											
124-S	> 100	21 0 %	0.04	<t %<="" 0="" td=""><td>0.04</td><td><t %<="" 0="" td=""><td>0.07</td><td><t %<="" ()="" td=""><td>0.06</td><td><t %<="" 0="" td=""><td>0.57</td><td>% 0</td></t></td></t></td></t></td></t>	0.04	<t %<="" 0="" td=""><td>0.07</td><td><t %<="" ()="" td=""><td>0.06</td><td><t %<="" 0="" td=""><td>0.57</td><td>% 0</td></t></td></t></td></t>	0.07	<t %<="" ()="" td=""><td>0.06</td><td><t %<="" 0="" td=""><td>0.57</td><td>% 0</td></t></td></t>	0.06	<t %<="" 0="" td=""><td>0.57</td><td>% 0</td></t>	0.57	% 0
205	0.04 <	Ţ	0.04	∠T >	0.04	≺T	0.07	<t< td=""><td>0.06</td><td><t></t></td><td>0.56</td><td></td></t<>	0.06	<t></t>	0.56	
123	0.04 <	Ę	0.04	T>	0.04	Υ	0.07	<t< td=""><td>0.06</td><td><t< td=""><td>0.56</td><td></td></t<></td></t<>	0.06	<t< td=""><td>0.56</td><td></td></t<>	0.56	
204-R	0 (04 <	×1 0 %	0.07	<t %<="" 14="" td=""><td>0.13</td><td><t %<="" 45="" td=""><td>0.13</td><td><t %<="" 22="" td=""><td>61.0</td><td><t %<="" 15="" td=""><td>1.58</td><td>11 %</td></t></td></t></td></t></td></t>	0.13	<t %<="" 45="" td=""><td>0.13</td><td><t %<="" 22="" td=""><td>61.0</td><td><t %<="" 15="" td=""><td>1.58</td><td>11 %</td></t></td></t></td></t>	0.13	<t %<="" 22="" td=""><td>61.0</td><td><t %<="" 15="" td=""><td>1.58</td><td>11 %</td></t></td></t>	61.0	<t %<="" 15="" td=""><td>1.58</td><td>11 %</td></t>	1.58	11 %
203	0.04	Ę	0.27	<t></t>	0.04	<t></t>	0.23	<t< td=""><td>92.0</td><td>τ</td><td>3 85</td><td></td></t<>	92.0	τ	3 85	
122	05-0		0F.L		0.50		2.1		124		. 30.82	
202	0.04 <	Ţ	0.24	<t< td=""><td>0.04</td><td>×T</td><td>0.26</td><td><t< td=""><td>2420</td><td>Υ</td><td>3.70</td><td></td></t<></td></t<>	0.04	×T	0.26	<t< td=""><td>2420</td><td>Υ</td><td>3.70</td><td></td></t<>	2420	Υ	3.70	
121	0.05 <	Ę	0.60		0.06	<t></t>	0.51	≺T	100		11.8	
201	> 10.04	Đ	0.29	<t></t>	0.05	Υ	0.23	T^	50	τ×	<b>112</b>	
200	0.04 <	Đ	120	<t< td=""><td>0.04</td><td><t< td=""><td>0.19</td><td><t< td=""><td>0.39</td><td><t< td=""><td>3.12</td><td></td></t<></td></t<></td></t<></td></t<>	0.04	<t< td=""><td>0.19</td><td><t< td=""><td>0.39</td><td><t< td=""><td>3.12</td><td></td></t<></td></t<></td></t<>	0.19	<t< td=""><td>0.39</td><td><t< td=""><td>3.12</td><td></td></t<></td></t<>	0.39	<t< td=""><td>3.12</td><td></td></t<>	3.12	
2-991	010 <	1 7%	. 0.55	19 %	0.17	<t %<="" 8="" td=""><td>0.72</td><td>13 %</td><td>ILL</td><td>25 L</td><td>8.86</td><td>1 %</td></t>	0.72	13 %	ILL	25 L	8.86	1 %
198	110		UK.E		3.56		3.64		गुर		45.88	
197	0.80		3.90		1 64		4.92		197		10.03	
196	0.85		3.40		1.72		5.16		133		12.12	
195-R	1.24	18 %	4.53	6 %	2.39	15 %	173	13 %	8.99	25 11	<u>14.76</u>	7 %
127	1691		0K.F		3.40		18.8	>A	5.9	>A	31.15	
Dump Mean:	TFT		<u>SF1</u>		0.87		2.26		297		23.65	
PSOG-LEL:	0.19		0.20		:		0.56		0.49		-7	
PSQG-SEL:	091		320		:		950		850		10	6222
OWDMDG	:		:		:		:		1		;	

groundwater or runoff input(s) from the dump. The 1988-89 sampling of shallow perimeter monitoring wells on the dump (reflecting potential discharge to the St. Marys River) found the highest concentrations of cyanide near Station 203, with somewhat lower levels in wells near Stations 121, 197, 196, 195 and 127. Concentrations of cadmium in well samples were highest near Station 121, whereas iron and zinc were highest near Station 124 (Berry-Spark & Tossell, 1990).

Sediment Total PAH concentrations exceeded the PSQG-LEL of 4 mg.kg<sup>-1</sup> at nine of the 16 dump stations, with concentrations ranging from 4.17 mg.kg<sup>-1</sup> to 81.2 mg.kg<sup>-1</sup> in samples (Table 6). Also, concentrations of all 12 of the individual PAH compounds for which guidelines are currently available were above their respective PSQG-LELs. These compounds included: anthracene, benzo(a)anthracene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene. (None of the individual PAH compound or total PAH concentrations exceeded their respective PSQG-SELs at any of the stations sampled during this study.) As with many of the metals, concentrations of PAHs were highest near the eastern end of the slag dump (i.e., Stations 198, 197, 196, 195 and 127, with concentrations peaking at 127 - see Fig. 6). During 1988-89, monitoring of shallow monitoring wells installed around the perimeter of the dump detected parts Total PAHs at parts per billion ( $\mu$ g.l<sup>-1</sup>) concentrations (Berry-Spark & Tossell, 1990). The highest concentrations were found at wells in the vicinity of Station 203, with somewhat lower levels in wells near Stations 205, 196, 195 and 127 (see Fig. 3).

Of the 16 unsubstituted PAHs analyzed for in the present study, fluoranthene, pyrene, benzo(b)fluoranthene and phenanthrene were, on average, present at the highest concentrations (see Fig. 10). This pattern in sediments is consistent with that observed during a 1985 study (Kauss & Hamdy, 1991). It was suggested that high-temperature combustion, which occurs during the burning of coal and production of coke, was the major source of these compounds.

#### 4.2.3 Relationships Between Contaminants

Correlation analysis (Appendix Table C-5) indicated that the proportion of silt and clay (i.e., "fines") in sediments only correlated significantly with copper concentrations, and iron concentrations were not significantly correlated with those of other analytes. Magnesium, chromium and Total PAHs concentrations correlated significantly (p < 0.05) with each other. Levels of all 16 of the PAH compounds were significantly correlated (p < 0.05) with each other (r = 0.91 to 1.0) in the sediments, as well as with arsenic, copper, cyanide, lead, mercury, nickel and zinc levels (r = 0.49 to 0.75), and with TOC content (r = 0.72 to 0.77). Consequently, concentrations of these analytes were TOC-normalized, assuming that the contaminants were only associated with the organic carbon particles in the sediments. The resultant concentration patterns (Fig. 11) are somewhat different from those of non-normalized data (Figs. 5 and 6). The highest arsenic, copper, cyanide, lead, mercury, nickel and zinc concentrations in sediment organic carbon would seem to be at the southeastern end of Leigh Bay (Stations 205 and/or 123) and at the middle of the south shore (Station 199). In contrast, the pattern for PAHs changed



Figure 7. Concentrations of total polycyclic aromatic hydrocarbons (PAHs), benzo(a)anthracene, benzo(a)pyrene, fluoranthene, naphthalene and phenanthrene in sediments. Vertical lines on bars represent one standard deviation of replicates (n = 3) or range of split samples (n = 2).







Figure 9. TOC-normalized concentrations of arsenic, cyanide, copper, lead, mercury, nickel, zinc and Total PAHs in sediments.

Table 7:Comparison of 1987 and 1989 polycyclic aromatic hydrocarbons<br/>concentrations in surficial sediments from the Algoma Slag Dump and Point<br/>aux Pins Bay.Concentrations in mg.kg<sup>-1</sup> (ppm), dry weight.

Sta	ation:	5	2	1	24	1	21	1	27
Compound	Year:	<u>1987</u>	1989	1987	1989	1987	1989	1987	1989
тос		28	66	22	5.50	17.5	<u>14</u>	144	130
Cadmium		0.50	0.87	0.44	0.13 <t< td=""><td>0.58</td><td>0.23<t< td=""><td>1.04</td><td>0.32</td></t<></td></t<>	0.58	0.23 <t< td=""><td>1.04</td><td>0.32</td></t<>	1.04	0.32
Chromium		9.60	14	<u>28</u>	11	<u>70</u>	<u>43</u>	31	31
Copper		12	<u>24</u>	<u>16</u>	5.2	<u>19</u>	<u>16</u>	33	<u>29</u>
Iron		5400	7400	18000	7 350	21444	16000	47400	34000
Magnesium		970	1800	4100	1650	9 925	4200	5520	5000
Manganese		55	94	350	125	3 156	1 600	<u>940</u>	760
Nickel		4.20	7.10	12	5.10	9.40	8.60	15.4	<u>16</u>
Zinc		24	40	73	27	49	38	283	280
Solvent Extractables		1260	1106	651	326	3 474	380	3517	692
Acenaphthene		0.04 <t< td=""><td>0.04<t< td=""><td>0.04</td><td>0.04<t< td=""><td>0.12</td><td>0.04<t< td=""><td>0.68</td><td>1.05</td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04</td><td>0.04<t< td=""><td>0.12</td><td>0.04<t< td=""><td>0.68</td><td>1.05</td></t<></td></t<></td></t<>	0.04	0.04 <t< td=""><td>0.12</td><td>0.04<t< td=""><td>0.68</td><td>1.05</td></t<></td></t<>	0.12	0.04 <t< td=""><td>0.68</td><td>1.05</td></t<>	0.68	1.05
Acenaphthylene		0.04 <t< td=""><td>0.05<w< td=""><td>0.04</td><td>0.05<w< td=""><td>0.11</td><td>0.05<w< td=""><td>0.36</td><td>0.38<t< td=""></t<></td></w<></td></w<></td></w<></td></t<>	0.05 <w< td=""><td>0.04</td><td>0.05<w< td=""><td>0.11</td><td>0.05<w< td=""><td>0.36</td><td>0.38<t< td=""></t<></td></w<></td></w<></td></w<>	0.04	0.05 <w< td=""><td>0.11</td><td>0.05<w< td=""><td>0.36</td><td>0.38<t< td=""></t<></td></w<></td></w<>	0.11	0.05 <w< td=""><td>0.36</td><td>0.38<t< td=""></t<></td></w<>	0.36	0.38 <t< td=""></t<>
Anthracene		0.01 <t< td=""><td>0.01<t< td=""><td>0.01</td><td>0.01&lt;<b>T</b></td><td>0.31</td><td>0.15</td><td>2.01</td><td>2.23</td></t<></td></t<>	0.01 <t< td=""><td>0.01</td><td>0.01&lt;<b>T</b></td><td>0.31</td><td>0.15</td><td>2.01</td><td>2.23</td></t<>	0.01	0.01< <b>T</b>	0.31	0.15	2.01	2.23
Benzo(a)anthracene		0.02 <t< td=""><td>0.02<t< td=""><td>0.04</td><td>0.02<t< td=""><td>1.21</td><td>0.68</td><td>4.26</td><td>6.29</td></t<></td></t<></td></t<>	0.02 <t< td=""><td>0.04</td><td>0.02<t< td=""><td>1.21</td><td>0.68</td><td>4.26</td><td>6.29</td></t<></td></t<>	0.04	0.02 <t< td=""><td>1.21</td><td>0.68</td><td>4.26</td><td>6.29</td></t<>	1.21	0.68	4.26	6.29
Benzo((b)fluoranthene		0.06 <t< td=""><td>0.06<t< td=""><td>0.06</td><td>0.06<t< td=""><td>1.60</td><td>1.00</td><td>3.48</td><td>7.52</td></t<></td></t<></td></t<>	0.06 <t< td=""><td>0.06</td><td>0.06<t< td=""><td>1.60</td><td>1.00</td><td>3.48</td><td>7.52</td></t<></td></t<>	0.06	0.06 <t< td=""><td>1.60</td><td>1.00</td><td>3.48</td><td>7.52</td></t<>	1.60	1.00	3.48	7.52
Benzo(k)fluoranthene		0.02 <t< td=""><td>0.02<t< td=""><td>0.02</td><td>0.02<t< td=""><td><u>1.56</u></td><td>0.47</td><td>2.24</td><td>2.89</td></t<></td></t<></td></t<>	0.02 <t< td=""><td>0.02</td><td>0.02<t< td=""><td><u>1.56</u></td><td>0.47</td><td>2.24</td><td>2.89</td></t<></td></t<>	0.02	0.02 <t< td=""><td><u>1.56</u></td><td>0.47</td><td>2.24</td><td>2.89</td></t<>	<u>1.56</u>	0.47	2.24	2.89
Benzo(g,h,i)perylene		0.02 <t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>1.45</td><td>0.49</td><td><u>1.44</u></td><td>3.17</td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>1.45</td><td>0.49</td><td><u>1.44</u></td><td>3.17</td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04<t< td=""><td>1.45</td><td>0.49</td><td><u>1.44</u></td><td>3.17</td></t<></td></t<>	0.04 <t< td=""><td>1.45</td><td>0.49</td><td><u>1.44</u></td><td>3.17</td></t<>	1.45	0.49	<u>1.44</u>	3.17
Benzo(a)pyrene		0.04 <t< td=""><td>0.04<t< td=""><td>0.04</td><td>0.04<t< td=""><td><u>1.64</u></td><td>0.92</td><td>2.77</td><td><u>6.17</u></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04</td><td>0.04<t< td=""><td><u>1.64</u></td><td>0.92</td><td>2.77</td><td><u>6.17</u></td></t<></td></t<>	0.04	0.04 <t< td=""><td><u>1.64</u></td><td>0.92</td><td>2.77</td><td><u>6.17</u></td></t<>	<u>1.64</u>	0.92	2.77	<u>6.17</u>
Chrysene		0.02 <t< td=""><td>0.04<t< td=""><td>0.03</td><td>0.02<t< td=""><td><u>1.58</u></td><td>0.79</td><td>4.47</td><td><u>6.29</u></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.03</td><td>0.02<t< td=""><td><u>1.58</u></td><td>0.79</td><td>4.47</td><td><u>6.29</u></td></t<></td></t<>	0.03	0.02 <t< td=""><td><u>1.58</u></td><td>0.79</td><td>4.47</td><td><u>6.29</u></td></t<>	<u>1.58</u>	0.79	4.47	<u>6.29</u>
Dibenzo(a,h)anthracene		0.04 <t< td=""><td>0.04<t< td=""><td>0.04</td><td>0.04<t< td=""><td>0.26</td><td><u>0.13<t< u=""></t<></u></td><td>0.33</td><td>1.05</td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04</td><td>0.04<t< td=""><td>0.26</td><td><u>0.13<t< u=""></t<></u></td><td>0.33</td><td>1.05</td></t<></td></t<>	0.04	0.04 <t< td=""><td>0.26</td><td><u>0.13<t< u=""></t<></u></td><td>0.33</td><td>1.05</td></t<>	0.26	<u>0.13<t< u=""></t<></u>	0.33	1.05
Fluoranthene		0.04	0.08 <t< td=""><td>0.09</td><td>0.03<t< td=""><td>· <u>2.25</u></td><td>1.22</td><td><u>8.74</u></td><td><u>13.09&gt;A</u></td></t<></td></t<>	0.09	0.03 <t< td=""><td>· <u>2.25</u></td><td>1.22</td><td><u>8.74</u></td><td><u>13.09&gt;A</u></td></t<>	· <u>2.25</u>	1.22	<u>8.74</u>	<u>13.09&gt;A</u>
Fluorene		0.04 <t< td=""><td>0.04<t< td=""><td>0.04</td><td>0.04<t< td=""><td>0.11</td><td>0.05<t< td=""><td><u>1.11</u></td><td>1.60</td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04</td><td>0.04<t< td=""><td>0.11</td><td>0.05<t< td=""><td><u>1.11</u></td><td>1.60</td></t<></td></t<></td></t<>	0.04	0.04 <t< td=""><td>0.11</td><td>0.05<t< td=""><td><u>1.11</u></td><td>1.60</td></t<></td></t<>	0.11	0.05 <t< td=""><td><u>1.11</u></td><td>1.60</td></t<>	<u>1.11</u>	1.60
Indeno(1,2,3-cd)pyrene		0.04 <t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>1.56</td><td>0.60</td><td>1.42</td><td>4.30</td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>1.56</td><td>0.60</td><td>1.42</td><td>4.30</td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04<t< td=""><td>1.56</td><td>0.60</td><td>1.42</td><td>4.30</td></t<></td></t<>	0.04 <t< td=""><td>1.56</td><td>0.60</td><td>1.42</td><td>4.30</td></t<>	1.56	0.60	1.42	4.30
Naphthalene		0.04 <t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0.23</td><td>0.06<t< td=""><td>2.27</td><td>3.40</td></t<></td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04<t< td=""><td>0.04<t< td=""><td>0.23</td><td>0.06<t< td=""><td>2.27</td><td>3.40</td></t<></td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.04<t< td=""><td>0.23</td><td>0.06<t< td=""><td>2.27</td><td>3.40</td></t<></td></t<></td></t<>	0.04 <t< td=""><td>0.23</td><td>0.06<t< td=""><td>2.27</td><td>3.40</td></t<></td></t<>	0.23	0.06 <t< td=""><td>2.27</td><td>3.40</td></t<>	2.27	3.40
Phenanthrene		0.07< <b>T</b>	0.07 <t< td=""><td>0.07<t< td=""><td>0.07<t< td=""><td>0.98</td><td>0.51<t< td=""><td><u>6.11</u></td><td><u>8.81&gt;A</u></td></t<></td></t<></td></t<></td></t<>	0.07 <t< td=""><td>0.07<t< td=""><td>0.98</td><td>0.51<t< td=""><td><u>6.11</u></td><td><u>8.81&gt;A</u></td></t<></td></t<></td></t<>	0.07 <t< td=""><td>0.98</td><td>0.51<t< td=""><td><u>6.11</u></td><td><u>8.81&gt;A</u></td></t<></td></t<>	0.98	0.51 <t< td=""><td><u>6.11</u></td><td><u>8.81&gt;A</u></td></t<>	<u>6.11</u>	<u>8.81&gt;A</u>
Pyrene		0.06< <b>T</b>	0.06 <t< td=""><td>0.06<t< td=""><td>0.06<t< td=""><td>2.05</td><td><u>1.00</u></td><td><u>6.81</u></td><td><u>9.54&gt;A</u></td></t<></td></t<></td></t<>	0.06 <t< td=""><td>0.06<t< td=""><td>2.05</td><td><u>1.00</u></td><td><u>6.81</u></td><td><u>9.54&gt;A</u></td></t<></td></t<>	0.06 <t< td=""><td>2.05</td><td><u>1.00</u></td><td><u>6.81</u></td><td><u>9.54&gt;A</u></td></t<>	2.05	<u>1.00</u>	<u>6.81</u>	<u>9.54&gt;A</u>
Total of 16 PAHs		0.60	0.64	0.67	0.57	14.97	<u>8.11</u>	48.5	77.78

NOTES: Values in shaded cells and underlined exceed PSQG-LEL or OWDMDG; those in **bold** type exceed PSQG-SEL (see Table 6). "<T" = a measurable trace amount; interpret with caution.

"<W" = no measurable response (zero): less than reported value.

Comparison of contaminants concentrations in sediments from other priority Table 8. areas in the St. Marys River. Shaded cells contain the maximum value of the six areas. All concentrations are in mg.kg<sup>-1</sup> (dry weight).

Parameter	Algoma Slag Dump <sup>-1</sup>	Algoma Slip <sup>2</sup>	Belleview Marine Park <sup>3</sup>	Lake George Channel-East End WWTP <sup>4</sup>	Lake George Channel-Bells Point <sup>5</sup>	Little Lake George <sup>6</sup>	Lake George
Arsenic	1.2 - 40	5.1 - 11	(14 - 17)	1.6 - 11	20	3.6 - 6.2	1.3 - 15
Cyanide	0.01 <w -="" 2.20<="" td=""><td>0.01 - 1.60</td><td>(1.70 - 2.30)</td><td>0.014<t -="" 0.590<="" td=""><td>2.80</td><td>0.310 - 0.470</td><td>0.300 - 0.550</td></t></td></w>	0.01 - 1.60	(1.70 - 2.30)	0.014 <t -="" 0.590<="" td=""><td>2.80</td><td>0.310 - 0.470</td><td>0.300 - 0.550</td></t>	2.80	0.310 - 0.470	0.300 - 0.550
Cadmium	0.13 <t -="" 1.40<="" td=""><td>0.05 - 0.95</td><td>0.73 - 2.60</td><td>0.24<t -="" 1.20<="" td=""><td>1.80 - 2.40</td><td>0.24<t -="" 0.69<t<="" td=""><td>0.20 - 1.10</td></t></td></t></td></t>	0.05 - 0.95	0.73 - 2.60	0.24 <t -="" 1.20<="" td=""><td>1.80 - 2.40</td><td>0.24<t -="" 0.69<t<="" td=""><td>0.20 - 1.10</td></t></td></t>	1.80 - 2.40	0.24 <t -="" 0.69<t<="" td=""><td>0.20 - 1.10</td></t>	0.20 - 1.10
Chromium	9.7 - 74	21 - 58	42 - 330	22 - 98	75 - 110	38 - 49	11 - 55
Copper	5.1 - 35	15 - 43	29 - 110	14 - 87	97 - 100	36 - 43	7.3 - 59
Iron	7200 - 170000	24000 - 60000	32000 - 115000	8900 - 61000	58000 - 81000	15000 - 21000	8600 - 42000
Lead	5.9 - 160	16 - 46	42 - 310	15 - 90	130 - 160	28 - 36	3.8 - 68
Magnesium	1400 - 16000	3067 - 14000	2500 - 7100	1600 - 3887	4700 - 5400	2800 - 3800	
Manganese	96 - 3600	533 - 2000	380 - 7100	110 - 700	780 - 830	200 - 280	100 - 640
Mercury	0.01 <w -="" 0.09<="" td=""><td>0.02 - 0.18</td><td>(0.14 - 0.16)</td><td>0.02<t -="" 0.34<="" td=""><td>0.24</td><td>0.01<w -="" 0.07<="" td=""><td>0.01<t -="" 0.21<="" td=""></t></td></w></td></t></td></w>	0.02 - 0.18	(0.14 - 0.16)	0.02 <t -="" 0.34<="" td=""><td>0.24</td><td>0.01<w -="" 0.07<="" td=""><td>0.01<t -="" 0.21<="" td=""></t></td></w></td></t>	0.24	0.01 <w -="" 0.07<="" td=""><td>0.01<t -="" 0.21<="" td=""></t></td></w>	0.01 <t -="" 0.21<="" td=""></t>
Nickel	4.9 - 43	13 - 38	15 - 54	7.2 - 27	37 - 47	13 - 18	3.6 - 25
Zinc	14 - 1300	65 - 250	75 - 630	54 - 300	380 -450	86 - 140	21 - 260
Solvent Extractables	222 - 3264	588 - 10870	695 - 19200	194 - 3814	280 - 989	2233 - 2340	2850 - 3165
Acenaphthene	0.04 <t -="" 1.05<="" td=""><td>0.10 - 32.0</td><td>0.05&lt;<b>T</b> - 0.80</td><td>0.04<t -="" 0.11<="" td=""><td>0.08 - 0.10</td><td>0.02<w-0.04<t< td=""><td>0.02<w< td=""></w<></td></w-0.04<t<></td></t></td></t>	0.10 - 32.0	0.05< <b>T</b> - 0.80	0.04 <t -="" 0.11<="" td=""><td>0.08 - 0.10</td><td>0.02<w-0.04<t< td=""><td>0.02<w< td=""></w<></td></w-0.04<t<></td></t>	0.08 - 0.10	0.02 <w-0.04<t< td=""><td>0.02<w< td=""></w<></td></w-0.04<t<>	0.02 <w< td=""></w<>
Acenaphthylene	0.05 <w -="" 0.40<t<="" td=""><td>0.07 - 6.55</td><td>0.10 - 0.88</td><td>0.05<t -="" 0.18<="" td=""><td>0.13 - 0.15</td><td>.0.05<t-0.024<t< td=""><td>0.07</td></t-0.024<t<></td></t></td></w>	0.07 - 6.55	0.10 - 0.88	0.05 <t -="" 0.18<="" td=""><td>0.13 - 0.15</td><td>.0.05<t-0.024<t< td=""><td>0.07</td></t-0.024<t<></td></t>	0.13 - 0.15	.0.05 <t-0.024<t< td=""><td>0.07</td></t-0.024<t<>	0.07
Anthracene	0.01 <t -="" 2.53<="" td=""><td>0.18 - 90.8</td><td>0.23 - 2.23</td><td>0.02<t -="" 0.39<="" td=""><td>0.24 - 0.36</td><td>0.039<t -="" 0.06<="" td=""><td>0.07</td></t></td></t></td></t>	0.18 - 90.8	0.23 - 2.23	0.02 <t -="" 0.39<="" td=""><td>0.24 - 0.36</td><td>0.039<t -="" 0.06<="" td=""><td>0.07</td></t></td></t>	0.24 - 0.36	0.039 <t -="" 0.06<="" td=""><td>0.07</td></t>	0.07
Benzo(a)anthracene	0.02 <t -="" 6.64<="" td=""><td>0.76 - 90.0</td><td>0.92 - 3.04</td><td>0.15 - 1.34</td><td>0.74 - 1.50</td><td>0.02<w 0.31<="" td="" ~=""><td>0.28</td></w></td></t>	0.76 - 90.0	0.92 - 3.04	0.15 - 1.34	0.74 - 1.50	0.02 <w 0.31<="" td="" ~=""><td>0.28</td></w>	0.28
Benzo(b)fluoranthene	0.06 <t -="" 8.30<="" td=""><td>1.00 - 56.6</td><td>0.91 - 3.66</td><td>0.17 - 2.20</td><td>0.89 - 2.30</td><td>0.028<t -="" 0.43<="" td=""><td>0.33</td></t></td></t>	1.00 - 56.6	0.91 - 3.66	0.17 - 2.20	0.89 - 2.30	0.028 <t -="" 0.43<="" td=""><td>0.33</td></t>	0.33
Benzo(k)fluoranthene	0.02 <t -="" 3.26<="" td=""><td>0.38 - 30.0</td><td>0.91 - 3.66</td><td>0.10<t -="" 1.02<="" td=""><td>0.89 - 1.00</td><td>0.024<t -="" 0.32<="" td=""><td></td></t></td></t></td></t>	0.38 - 30.0	0.91 - 3.66	0.10 <t -="" 1.02<="" td=""><td>0.89 - 1.00</td><td>0.024<t -="" 0.32<="" td=""><td></td></t></td></t>	0.89 - 1.00	0.024 <t -="" 0.32<="" td=""><td></td></t>	
Benzo(g,h,i)perylene	0.04 <t -="" 3.52<="" td=""><td>0.43 - 21.9</td><td>0.25 - 2.55</td><td>0.07 - 0.95</td><td>0.65 - 0.89</td><td>0.04<w-0.26<t< td=""><td>0.07</td></w-0.26<t<></td></t>	0.43 - 21.9	0.25 - 2.55	0.07 - 0.95	0.65 - 0.89	0.04 <w-0.26<t< td=""><td>0.07</td></w-0.26<t<>	0.07
Benzo(a)pyrene	0.04 <t -="" 6.75<="" td=""><td>0.77 - 50.0</td><td>0.55 - 3.08</td><td>0.14 - 1.71</td><td>0.77 - 1.70</td><td>0.024<t -="" 0.38<="" td=""><td>0.21</td></t></td></t>	0.77 - 50.0	0.55 - 3.08	0.14 - 1.71	0.77 - 1.70	0.024 <t -="" 0.38<="" td=""><td>0.21</td></t>	0.21
Chrysene	0.02 <t -="" 6.59<="" td=""><td>0.83 - 90.7</td><td>0.84 - 4.67</td><td>0.21 - 1.88</td><td>0.78 - 2.00</td><td>0.021<t -="" 0.40<="" td=""><td>0.06</td></t></td></t>	0.83 - 90.7	0.84 - 4.67	0.21 - 1.88	0.78 - 2.00	0.021 <t -="" 0.40<="" td=""><td>0.06</td></t>	0.06
Dibenzo(a,h)anthracene	0.04 <t -="" 1.15<="" td=""><td>0.13 - 6.19</td><td>0.14 - 0.78</td><td>0.04<t -="" 0.35<="" td=""><td>0.14 - 0.30</td><td>0.04<w-0.09<t< td=""><td>0.03</td></w-0.09<t<></td></t></td></t>	0.13 - 6.19	0.14 - 0.78	0.04 <t -="" 0.35<="" td=""><td>0.14 - 0.30</td><td>0.04<w-0.09<t< td=""><td>0.03</td></w-0.09<t<></td></t>	0.14 - 0.30	0.04 <w-0.09<t< td=""><td>0.03</td></w-0.09<t<>	0.03
Fluoranthene	0.03 <t -="" 13.6<="" td=""><td>1.50 - 490</td><td>1.80 - 10.5</td><td>0.31 - 2.78</td><td>1.58 - 3.60</td><td>0.027<t -="" 0.61<="" td=""><td>0.43</td></t></td></t>	1.50 - 490	1.80 - 10.5	0.31 - 2.78	1.58 - 3.60	0.027 <t -="" 0.61<="" td=""><td>0.43</td></t>	0.43
Fluorene	0.04 <t -="" 1.60<="" td=""><td>0.11 - 140</td><td>0.10 - 1.23</td><td>0.04<t -="" 0.13<="" td=""><td>0.11 - 0.11</td><td>0.02<w-0.04<t< td=""><td>0.03</td></w-0.04<t<></td></t></td></t>	0.11 - 140	0.10 - 1.23	0.04 <t -="" 0.13<="" td=""><td>0.11 - 0.11</td><td>0.02<w-0.04<t< td=""><td>0.03</td></w-0.04<t<></td></t>	0.11 - 0.11	0.02 <w-0.04<t< td=""><td>0.03</td></w-0.04<t<>	0.03
Indeno(1,2,3-cd)pyrene	0.04 <t -="" 4.70<="" td=""><td>0.62 - 26.3</td><td>0.33 - 2.01</td><td>0.08 - 1.15</td><td>0.66 - 0.96</td><td>0.04<w-0.37<t< td=""><td>0.07</td></w-0.37<t<></td></t>	0.62 - 26.3	0.33 - 2.01	0.08 - 1.15	0.66 - 0.96	0.04 <w-0.37<t< td=""><td>0.07</td></w-0.37<t<>	0.07
Naphthalene	0.04 <t -="" 3.56<="" td=""><td>0.31 - 340</td><td>0.04 - 6.98</td><td>0.04<t -="" 1.20<="" td=""><td>0.20 - 0.58</td><td>0.07 - 0.17<t< td=""><td>013</td></t<></td></t></td></t>	0.31 - 340	0.04 - 6.98	0.04 <t -="" 1.20<="" td=""><td>0.20 - 0.58</td><td>0.07 - 0.17<t< td=""><td>013</td></t<></td></t>	0.20 - 0.58	0.07 - 0.17 <t< td=""><td>013</td></t<>	013
Phenanthrene	0.07 <t -="" 8.81<="" td=""><td>0.88 - 720</td><td>0.80 ~ 8.85</td><td>0.10 - 1.30</td><td>0.89 - 1.30</td><td>0.02<w -="" 0.23<="" td=""><td>0.25</td></w></td></t>	0.88 - 720	0.80 ~ 8.85	0.10 - 1.30	0.89 - 1.30	0.02 <w -="" 0.23<="" td=""><td>0.25</td></w>	0.25
Pyrene	0.06 <t -="" 10.1="">A</t>	1.20 - 340	1.89 - 7.84	0.27 - 2.38	1.34 - 3.10	0.023 <t -="" 0.52<="" td=""><td>0.27</td></t>	0.27
Total of 16 PAHs	0.56 - 81.2	18.5 - 2389	12.2 - 61.5	0.86 - 7.95	9.16 - 10.4	0.19 - 3.46	2.30

NOTES: "--" = no data available.

"nd" = not detected.

"<T" = a measurable trace amount: interpret with caution

"<W" = no measurable response (zero): less than reported value. Data Sources:

1 - data from this study, excluding results for Station 52.

2 - data from 16 stations sampled in 1990 (Pope & Kauss, 1995).

3 - data from 7 stations sampled in 1987 (unpublished OMOE data) & 1 station in 1992 for data in brackets (Arthur & Kauss, 1999).

- 4 data from 12 stations sampled downstream of East End WWTP discharge in 1989 (Kauss & Nettleton, 1995).
- 5 range of data from 1 station sampled in 1987 (OMOE, unpubl. data) & in 1989 (Kauss & Nettleton, 1995).

6 - range of data from 1 station sampled in 1989 (Kauss & Nettleton, 1995) & in 1992 (Arthur & Kauss, 1999).

7 - data from 22 stations sampled in 1985 for metals (Burt et al., 1988) & 1 station sampled for PAHs (Kauss & Hamdy, 1991).

only slightly from the non-normalized concentrations.

#### 4.2.4 Contaminants Temporal Trends

Arsenic, heavy metals and PAH concentrations in sediments sampled in 1989 as well as in 1987 at Stations 52, 124, 121 and 127 are summarized in Table 7. Changes in contaminant levels over the two years were variable, with regards to both station location and contaminant. For example, TOC and a number of the metals increased in concentration between 1987 and 1989 at Station 52, but decreased at the slagb dump stations. Sediment PAH levels in Point aux Pins Bay (Station 52) and Leigh Bay (Station 124) were close to or below the MRVs in 1987 and 1989. and concentrations (e.g., Total PAHs) have not changed at these two sites over the two years between surveys. In contrast, concentrations decreased about four-fold at Station 121 and increased two-fold at Station 127 over the same period. This may be due to the natural heterogeneity of sediments in this area. In this regard, the coefficients of variation for concentrations in 1989 replicate grab samples were usually similar to or higher than the CVs for split samples (see Tables 3, 5 and 6), suggesting that this variability was related to local spatial heterogeneity of the sediments, and not to sample handling and/or analytical variability. Periodic disturbance or movement of the sediments can occur from physical factors such as wind-induced currents (storms), wakes, prop wash or dragging of anchors by large vessels using the nearby Algoma Slip, ice scour. As shown by the sediment data summarized in Appendix A, there were marked within-year differences in some sediment quality parameters at stations sampled along the Slag Dump shore in 1987. Finally, the periodic addition of slag to the shoreline and construction of the A.B. MacLean docking facilty has undoubtedly changed the nature and distribution of sediments adjacent to some sections of the dump.

#### 4.2.5 Comparison of Concentrations With Other Areas

Sediment contamination associated with discharges from the Sault Ste. Marie area has been monitored at other locations or areas in the St. Marys River. Table 8 compares inorganic and organic contaminant concentrations in sediments with six other downstream areas. With few exceptions, all of the maximum arsenic and heavy metal concentrations in sediments from this group of locations exceeded the respective PSQG-LELs, and in some areas, also exceeded the applicable PSQG-SELs (cf. Tables 5 and 8). The maximum concentrations of Total PAHs and of many individual PAH compounds in all areas also exceeded their respective PSQG-LELs, particularly in the Slag Dump, Algoma Slip, Belleview Marine Park and Lake George Channel areas (cf. Tables 6 and 8). Overall, the group maximum concentrations of cyanide, a number of heavy metals and solvent extractables were found in Belleview Marine Park sediments, whereas Algoma Slip sediments contained the highest maximum levels of all a6 of the PAHs analyzed for. In contrast, only the arsenic, iron, magnesium and zinc maxima were found within the 1989 Algoma Slag Dump sediment data.
Table 9. Arsenic and heavy metals concentrations in mussel tissues.All concentrations in mg.kg<sup>-1</sup> (ppm), wet weight.

			030 A					A ()6()	()3() A	090 A	A (88)	A 000		030) A	A ()())	A (XO)	030) A		A 000	030 A	030 A	030 A	050 A	030 A	160 A	960
			()-/+ (					()-/+	()-/+	+/-().	()-/+	()-/+		.()-/+	+/-()	+/-()-/+	()-/+		·()-/+	0-/+	()-/+	+/-()-/+	+/-()-/+	+()-/+	0-/+	()-/+
Nickel			0 180		:		:	0.470	0.220	0.470	0.200	0.250	:	0.220	0 200	0.200	0.230	:	() 200	0.220	0.220	0.220	0.200	0.230	0.370	0 256
			A H					× I	ĸ	۲ ا	I A	< _		۲	1 A	٨	۲ ۲		ΙV	V	۷	2 2	۲	A 2	2 2	_
			()-/+					() ()-/+	W>	() ()-/+	0 ()-/+	0 ()-/+		W>	0 ()-/+	~ M>	4/-()-(+		() ()-/+	W>	~W>	+/-0.1	~W>	+/-0 0	() ()-/+	() ()-/+
Mercury			0.01		:		;	0.01	0.01	0.01	0.03	10'0	;	0.01	10.0	0.01	0.01	;	0.01	10.0	10.0	0.07	10.0	0.01	0.02	0.01
			×					×	Y	V	×	<		A	۲	A	A		×	<	A	A	V	۷	<	
			+/-526					+/-338	+/-306	+/-161	+/-470	+/-498		+/-722	+/-675	+/-703	+/-173		+/-311	+/-693	+/-295	+/-166	+/-340	+/-543	+/-153	+/-328
Manganese			193		:		;	913	467	480	622	760	:	667	1030	1043	1300	:	617	X51	1140	1123	006	1589	1733	ж72
			AB					AB	AB	AB	AB	AB		V	AB	AB	AB		AB	AB	AB	AB	AB	AB	8	
			+/-58					+/-22	\$1-15	+/-38	*/-68	()9-/+		12-/+	+/-4()	+/-82	+/-15		£1-/+	+/-72	+/-45	01-/+	+/-49	+/-82	+/-87	+/-33
Magnesium			233		:		}	262	183	187	231	208	:	181	264	239	231	:	226	226	284	247	252	295	352	228
			AB					AB	в	ЛΒ	AB	۲		<	<	۲	۲		AB	AB	۲	٨B	AB	V	۲	
			+/-030					+/-0 26	+/-0 32	+/-0.22	+/-0 20	()()-/+		+/-() ()3	+/-() ()2	()()()-/+	+/-0-03		+/-0 15	+/-0.20	+/-0.10	+/-0.28	+/-() 2]	+/-0.05	()()()-/+	81.0-/+
Lead			09 (0		:		:	0.65	16 0	0.61	() 11	0.35	:	0.32	0.30	0.30	0.33	1	0.47	0.44	0.38	0.46	0.59	0.35	0.30	0 48
			۲					V	۲	۲	۲	٨		<	۲	¥	<		V	<	ĸ	۲	<	۲	۲	
			+/-0.15					+/-0.55	16 0-/4	+/-0.32	19 ()-/4	00 1-/4		+/-0.56	-/-()-12	90.0-/-	-/-0 26		-/-0.84	-/-0-/-	-/-0.35	-/-0.35	+0.10	90.0-/-	/-0.56	/-0.3)(
Copper			1.33		:		ł	1 97	2 27 4	143 +	2.13	2.77 +	;	1 70 4	1 73 +	1.93 +	1.30 +	;	1 63 +	1 93 +	2 40 +	1.87 +	1.60 +	183 +	2 20 +	1.87 +
			۲					۲	<	۲	<	۲		<	۲	<	<		×	×	٨	۲	۲	۲	<	
-			+/-0.360					+/-().55()	+/-().33()	+/-0 240	+/-0.420	+/-0.380		+/-0.480	11 ()-/+	061 0-/+	+/-0 270		+/-()-/+	+/-() 25()	+/-() 48()	+/-0.170	+/-0.350	+/-0.190	+/-().26()	+/-0.132
Cadmiur			1.40		;		1.	0,)(40	0.670	0.580	0.820	0.580	;	0.670	0.860	0.930	0.560	;	0.710	0.770	0.780	0.670	0.970	0.010	1.300	0.737
			۲ 					<	۲ ۲	×	V (	× ×		×	A	×	× ~		×	<	۲	~	۲	<	<	
			<del>1</del> .()-/+					1 ()-/+	00-/+	0 0-/+	+-/0.19	() ()-/+		-1 ()-/+	+/-010	\$[ ()-/+	21 ()-/+		21 ()-/+	51 ()-/+	10 0-/+	51 0-/+	+/-0.25	10-/+	10 0-/+	(0.0-/+
Arsenic			0.63		:		:	0.33	19-0	0170	0.49	0.46	;	0.48	0.38	0.46	0.36	:	0.40	0.46	0.31	0140	0.54	0.37	110	0.44
Sample	Date		89/08/15	Pins Bay.	NA	Dump-	VN	80/60/68	-	:		-	VN	X()/60/68	z	I		VN	80/60/68		;	:	-	=	5	& S D :
Station	Laoman	Balsam Lak	-	Pointe aux F	52	Algoma Slag	124	205	123	204	203	122	202	121	121-M	201	2())	661	198	197	IN-701	196	195	127	127-M	Dump Mean

NOTES: station values are anthmetic mean and standard deviation (n = 3).  $^{n,+,+}$  indicates that data is not available for this parameter or sample

"M" = mid-depth exposure; all others on bottom.

"NA" = not available; cages lost

"<W" = uu measurable response (zero): less than reported value

means tollowed by different letters are significantly different (MANOVA and Tukeys HSD test, p < 0.05).

Table 9. continued.All concentrations in mg.kg<sup>-1</sup> (ppm), wet weight.

		ABC					ABCD	Q	CD	BCD	ABCD		ABC	ABCD	AB	ABCD		ABC	A	AB	ABC	ABC	ABCD	ABCD	
		9 ()-/+					+/-1 ()	+/-1.5	+/-1.1	01-/+	+/-2.1		+/-() 58	+/-2.0	9 ()-/+	4/-{).6		+/-1.5	4/-1) 6	+/-1 ()	() ()-/+	+/-1 5	9 ()-/+	1.1-/+	+/-16
Joisture %		82.7					84.0	86.7	857	85.0	83.3	:	823	84.0	81.7	83.3	:	827	813	82.0	83.0	827	8.4.7	83.7	83.6
2		A					۲	A	<	<	×		V	A	×	٨		۲	۲	۲	۲	<	۲	V	
		(8).6-/+					+/-7.(X)	+/-4 40	+/-1() 8	+/-11 5	+/-8 20		+/-13()	+/-2 5()	+/-13.6	+/-1.70		+/-2.60	+/-142	()6 6-/+	+/-7 4()	01.6-/+	+/-180	+/-102	+/-6 1
Zinc		36.7		:		:	33.7	24()	32.0	31.3	29()	:	26.0	33.3	37.7	40.0	;	31.0	38.3	41.3	37.7	377	45.7	51.3	34.2
Sample Date		89/08/15	A Bay	AN.	ump.	NA	80/60/68	z	÷	:	z	NA	80/64)/68	x	;	5	NA	80/60/68	I	Ŧ	×			÷	s D :
Station Number	Balsum Lake	-	Pointe aux Pin	52	Algoma Slag L	124	205	123	204	203	122	202	121	121-M	201	2(K)	661	198	197	197-M	961	195	127	127-M	Dump Mean é

.



Figure 10. Concentrations of arsenic, copper, magnesium and zinc in mussels. Vertical lines on bars represent one standard deviation (n = 3).

Table 10. Polycyclic aromatic hydrocarbons concentrations in mussel tissues.

	weight.
	, wet
	(dqq)
•	ug.kg <sup>-1</sup>
	.≘
	concentrations
9	Ξ
	<

		Ace-		Ace-				Benzo(	÷		Benzo(b)-		Benzo(k)-		Benzo-						Dibe	-024
Station	Sample	naph-		aaph-	•	Anthra-		anthra			fluoran-		fluoran-		(g,h,i)-	B	enzo(a)-		Chry-		( <b>A</b> , <b>h</b> )	36-
Numher	Date	thene	-	thylene		cene		cene			theae		thene		perylyne		yrene		sene		thrac	ene
Balsam Lak	41																					
-	89/08/15	12 +/-3	ABCD	5 <w< td=""><td>۲</td><td>/+ 11</td><td>-0 A</td><td>BC</td><td>3 +/-4</td><td>٨</td><td>7 <w< td=""><td>×</td><td>8 +/</td><td>-7 A</td><td>9</td><td><w a<="" td=""><td>8 <w< td=""><td>&lt;</td><td>6</td><td>-1-2 4</td><td>_</td><td>7 <w a<="" td=""></w></td></w<></td></w></td></w<></td></w<>	۲	/+ 11	-0 A	BC	3 +/-4	٨	7 <w< td=""><td>×</td><td>8 +/</td><td>-7 A</td><td>9</td><td><w a<="" td=""><td>8 <w< td=""><td>&lt;</td><td>6</td><td>-1-2 4</td><td>_</td><td>7 <w a<="" td=""></w></td></w<></td></w></td></w<>	×	8 +/	-7 A	9	<w a<="" td=""><td>8 <w< td=""><td>&lt;</td><td>6</td><td>-1-2 4</td><td>_</td><td>7 <w a<="" td=""></w></td></w<></td></w>	8 <w< td=""><td>&lt;</td><td>6</td><td>-1-2 4</td><td>_</td><td>7 <w a<="" td=""></w></td></w<>	<	6	-1-2 4	_	7 <w a<="" td=""></w>
pame aux l	my Bay.																					
52	NA	:		:		;					:		1		4.0		:		;			:
Algoma Slay	dunG :																					
124	NA	:		;		ł					ţ		:		1		;		;			;
205	80/60/68	9-/+ 2	AB	5 <w< td=""><td>×</td><td>/+ L</td><td>-7 AJ</td><td>8</td><td>2 +/-3</td><td>¥</td><td>7 <w< td=""><td>۲</td><td>6 &lt;1</td><td>×</td><td>9</td><td>&lt; W A</td><td>8 <w< td=""><td>&lt;</td><td>80</td><td>√ I-/-</td><td></td><td>7 <w a<="" td=""></w></td></w<></td></w<></td></w<>	×	/+ L	-7 AJ	8	2 +/-3	¥	7 <w< td=""><td>۲</td><td>6 &lt;1</td><td>×</td><td>9</td><td>&lt; W A</td><td>8 <w< td=""><td>&lt;</td><td>80</td><td>√ I-/-</td><td></td><td>7 <w a<="" td=""></w></td></w<></td></w<>	۲	6 <1	×	9	< W A	8 <w< td=""><td>&lt;</td><td>80</td><td>√ I-/-</td><td></td><td>7 <w a<="" td=""></w></td></w<>	<	80	√ I-/-		7 <w a<="" td=""></w>
123	z	12 +/-6	ABCD	5 <w< td=""><td>&lt;</td><td>14 +/</td><td>-3 AJ</td><td>BC</td><td>t-/+ €</td><td>×</td><td>7 <w< td=""><td>۲</td><td>1+ 6</td><td>-12 A</td><td>6</td><td>&lt; W &gt;</td><td>8 <w< td=""><td>&lt;</td><td>1</td><td>4 Z-J-</td><td></td><td>7 <w a<="" td=""></w></td></w<></td></w<></td></w<>	<	14 +/	-3 AJ	BC	t-/+ €	×	7 <w< td=""><td>۲</td><td>1+ 6</td><td>-12 A</td><td>6</td><td>&lt; W &gt;</td><td>8 <w< td=""><td>&lt;</td><td>1</td><td>4 Z-J-</td><td></td><td>7 <w a<="" td=""></w></td></w<></td></w<>	۲	1+ 6	-12 A	6	< W >	8 <w< td=""><td>&lt;</td><td>1</td><td>4 Z-J-</td><td></td><td>7 <w a<="" td=""></w></td></w<>	<	1	4 Z-J-		7 <w a<="" td=""></w>
204	£	14 +/-5	ABCD	5 <w< td=""><td>×</td><td>12 +/</td><td>-3 AJ</td><td>BC</td><td>2 +/-3</td><td>×</td><td>7 <w< td=""><td>A</td><td>9 ≤</td><td>×</td><td>6</td><td>&lt; W A</td><td>8 <w< td=""><td>۲</td><td></td><td>V 2-1-</td><td></td><td>7 <w a<="" td=""></w></td></w<></td></w<></td></w<>	×	12 +/	-3 AJ	BC	2 +/-3	×	7 <w< td=""><td>A</td><td>9 ≤</td><td>×</td><td>6</td><td>&lt; W A</td><td>8 <w< td=""><td>۲</td><td></td><td>V 2-1-</td><td></td><td>7 <w a<="" td=""></w></td></w<></td></w<>	A	9 ≤	×	6	< W A	8 <w< td=""><td>۲</td><td></td><td>V 2-1-</td><td></td><td>7 <w a<="" td=""></w></td></w<>	۲		V 2-1-		7 <w a<="" td=""></w>
203	2	11 +/-10	ABCD	5 <w< td=""><td>×</td><td>13 +/</td><td>-6 A</td><td>BC</td><td>3 +/-6</td><td>&lt;</td><td>7 <w< td=""><td>A</td><td>1+ 41</td><td>-6 A</td><td>6</td><td><w a<="" td=""><td>3 77</td><td>۲</td><td>6</td><td>√ £-/-</td><td></td><td>V W&gt; 7</td></w></td></w<></td></w<>	×	13 +/	-6 A	BC	3 +/-6	<	7 <w< td=""><td>A</td><td>1+ 41</td><td>-6 A</td><td>6</td><td><w a<="" td=""><td>3 77</td><td>۲</td><td>6</td><td>√ £-/-</td><td></td><td>V W&gt; 7</td></w></td></w<>	A	1+ 41	-6 A	6	<w a<="" td=""><td>3 77</td><td>۲</td><td>6</td><td>√ £-/-</td><td></td><td>V W&gt; 7</td></w>	3 77	۲	6	√ £-/-		V W> 7
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198	80/60/68	39 +/-10	ABCD	4 +/-3	AB	15 +/	-2 AI	BC 2	2 +/-8	AB	27 +/-7	AB	12 +/	-12 A	6	≺W A	8 <w< td=""><td>&lt;</td><td>47 -</td><td>-/-18 /-</td><td>B</td><td>2 77 A</td></w<>	<	47 -	-/-18 /-	B	2 77 A
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961	=	174 +/-24	Ŀ	18 +/-2	ш	65 +/	-9 E	10	3 +/-37	J	130 +/-4	ш	6 <1	۸ ۲	6	<w a<="" td=""><td>49 +/-23</td><td>B</td><td>136</td><td>-/-38 E</td><td></td><td>7 <w a<="" td=""></w></td></w>	49 +/-23	B	136	-/-38 E		7 <w a<="" td=""></w>
195	r	157 +/-14	<u>د.</u>	15 +/-1	DE	57 +/	-9 -	5	1 +/-16	В	62 +/-2	BCD	/+ 81	-31 A	6	< M >	01	<	72	-/-20 B	CD	7 <w a<="" td=""></w>
127	z	104 +/-46	щ	1 +/-4	CD	36 +/	-18 D	4	6-/+ 6	В	53 +/+1	BC	27 +/	-23 A	6	< W A	11-/+ 01	< >	64	H 9-/-	ų	7 <w a<="" td=""></w>
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Dump Mean	& S D	43 +/-56		4 +/-6		18 +/-	-20	1	₹-/+ ¢		31 +/-4.	-	/+ 9	-15	Q	M>	6 +/-15		41	-/-45		7 <w< td=""></w<>

NOTES values are arithmetic mean and standard deviation (n = 3)

"--" indicates that data is not available for this parameter or sample

"M" after station number indicates mid-depth exposure, all others on bottom

"NA" = not available, cages lost

A " וועו מעמוומטוני, ניוקנים ועסו

"<W" = no measurable response (zero) less than reported value

means followed by different letters are significantly different (MANOVA and Tukeys HSD test, p < 0.05)

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All concentrations in ug.kg<sup>-1</sup> (ppb), wet weight.

						Indeno-											Totał					
Station	Sample Date	Fluor- anthene		Fluor- ene	5	(1,2,3- d)pyrene		Naph- thalene		d	Phen- inthrene		2	's rene		-	of 16 2AHs			Lipids %		
Balsam La	te l																					
-	\$1/80/68	20 +/-1	A	26 +/-4	AB	6 <1	N A	54	y-/+	AB	118	+/-3	ABC	15	1-/-	V	275	+/-5	¥	0.33	01 0./+	AB
Pointe aux	Punx Bay:																					
52	NA	:		4		:		:			:			:			:	;				
Algoma Sla	S Dump:																					
124	NA	:		:		:		:			:			:			;	:				
205	80/60/68	21 +/-2	<	21 +/-5	AB	l < l	V A	15	+/-13	ĸ	98	+/-25	ABC	16 +	L-1-	A	861	+/-55	<	0.31	+/-0.10	۲
123	1	26 +/-3	<	30 +/-8	AB	6 +1	-II A	26	++	V	137	+/-34	ABC	16 +	1.2	A	288	+/-51	<	() 4()	+/-()-()-	AB
204	e	24 +/-5	<	31 +/-7	AB	/+ 6	-16 A	28	5-/+	V	133	+/-32	ABC	15 +	-1-3	4	276	£9-/+	<	0.41	+/-().14	AB
203	I	27 +/-6	A	26 +/-10	AB	/+ 61	-23 A	25	8-/+	۲	123	+/-56	ABC	+ 61	1.5	A	277	+/-86	<	0.33	+/-() ()8	AB
122		20 +/-10	<	18 +/-16	AB	4> 4	< >	28	4-1+	×	86	+/-51	AB	15 +	01-/-	A	188	+/-115	<	0.38	6() ()-/+	АΒ
202	NA	ł		:		:		:			;			;			;			:		
121	80/641/68	1 -1-6	<	7 +/-13	A	46 +/-	-25 A	29	+/-11	A	39	+/-18	<	+	1-5	A	127	+/-20	×	0.50	+/-0.07	AB
121-M		16 +/-2	V	16 <w< td=""><td>×</td><td>36 +1</td><td>37 A</td><td>61</td><td>-/+</td><td>V</td><td>29</td><td>+/-2</td><td>A</td><td>+</td><td>I-/-</td><td>A</td><td>306</td><td>+/-34</td><td>¥</td><td>0.36</td><td>+/-0.05</td><td>AB</td></w<>	×	36 +1	37 A	61	-/+	V	29	+/-2	A	+	I-/-	A	306	+/-34	¥	0.36	+/-0.05	AB
201	p	18 +/-6	V	16 <w< td=""><td>¥</td><td>6 <v< td=""><td>V A</td><td>29</td><td>+/-t</td><td>×</td><td>7</td><td>8.1+</td><td>V</td><td>12 +</td><td>1-4</td><td></td><td>105</td><td>+/-16</td><td>٨</td><td>0.53</td><td>+/-()-13</td><td>AB</td></v<></td></w<>	¥	6 <v< td=""><td>V A</td><td>29</td><td>+/-t</td><td>×</td><td>7</td><td>8.1+</td><td>V</td><td>12 +</td><td>1-4</td><td></td><td>105</td><td>+/-16</td><td>٨</td><td>0.53</td><td>+/-()-13</td><td>AB</td></v<>	V A	29	+/-t	×	7	8.1+	V	12 +	1-4		105	+/-16	٨	0.53	+/-()-13	AB
2(K)	:	, 4 +/-K	A	lń <w< td=""><td>¥</td><td>6 <v< td=""><td>V A</td><td>7</td><td>+/-12</td><td>¥</td><td>20</td><td>€./+</td><td>A</td><td>+</td><td>1-5</td><td>~</td><td>41</td><td>+/-15</td><td>A</td><td>().34)</td><td>+/-0 ()2</td><td>&lt;</td></v<></td></w<>	¥	6 <v< td=""><td>V A</td><td>7</td><td>+/-12</td><td>¥</td><td>20</td><td>€./+</td><td>A</td><td>+</td><td>1-5</td><td>~</td><td>41</td><td>+/-15</td><td>A</td><td>().34)</td><td>+/-0 ()2</td><td>&lt;</td></v<>	V A	7	+/-12	¥	20	€./+	A	+	1-5	~	41	+/-15	A	().34)	+/-0 ()2	<
661	NA	:		:		;		:			:			;			;			:		
861	80/60/68	136 +/-47	8	401-/+ 61	AB	6 <v< td=""><td>V A</td><td>186</td><td>+/-22</td><td>BC</td><td>681</td><td>+/-21</td><td>ABC</td><td>+ 101</td><td>1-39</td><td>æ</td><td>к21</td><td>+/-177</td><td>в</td><td>0.62</td><td>+/-(} 22</td><td>в</td></v<>	V A	186	+/-22	BC	681	+/-21	ABC	+ 101	1-39	æ	к21	+/-177	в	0.62	+/-(} 22	в
261		228 +/-10	CD	7() +/-12	в	14 11	25 A	241	+/-52	J	261	+/-53	BCD	+ 781	1-4	D	1349	\$6-/+	CD	0.57	60 ()-/+	AB
M-791	:	3094 +/-77 1	DE	74 +/-10	B	6 <4	V A	229	+/-34	J	286	+/-41	CD	231 +	/-51	DE	1464	+/-85	۵	(1,60)	+/-0.12	AB
196	:	320 +/-29	ω	228 +/-30	D	6 <v< td=""><td>V A</td><td>681</td><td>101-/+</td><td>ш</td><td>728</td><td>()6-/+</td><td>ш</td><td>254 +</td><td>/-26</td><td>112</td><td>2698</td><td>+/-146</td><td>ш</td><td>0.62</td><td>6() ()-/+</td><td>8</td></v<>	V A	681	101-/+	ш	728	()6-/+	ш	254 +	/-26	112	2698	+/-146	ш	0.62	6() ()-/+	8
195	:	265 +/-47 1	DE	203 +/-18	D	6 <v< td=""><td>V A</td><td>(418)</td><td>+/-36</td><td>ш</td><td>673</td><td>[9-/+</td><td>ш</td><td>2(K) +</td><td>1-35</td><td>ЭE</td><td>2361</td><td>+/- 149</td><td>ш</td><td>() 46</td><td>4/-0.07</td><td>AB</td></v<>	V A	(418)	+/-36	ш	673	[9-/+	ш	2(K) +	1-35	ЭE	2361	+/- 149	ш	() 46	4/-0.07	AB
127	-	1 02-/+ 021	BC	141 +/-62	J	6 <v< td=""><td>V A</td><td>417</td><td>+/-145</td><td>Q</td><td>420</td><td>+/-208</td><td>D</td><td>138 +</td><td>1-22</td><td>3C</td><td>1618</td><td>+/-509</td><td>C</td><td>0.34</td><td>+/-().[4</td><td>AB</td></v<>	V A	417	+/-145	Q	420	+/-208	D	138 +	1-22	3C	1618	+/-509	C	0.34	+/-().[4	AB
127-M	2	11.1.4 811	8	68 +/-12	в	4> y	V A	260	+/-54	C	186	+/-24	ABC	+ 16	6-/	e	936	+/-136	BC	0.42	+/-0.08	AB
Dump Mea	и & SD:	108 +/-115		12-/* (19		8 +/-	21	176	+/-218		215	+/-22()		×3 +	-190		806	+/-9846		0.45	+/-0.14	



Figure 11. Concentrations of total polycyclic aromatic hydrocarbons (PAHs), benzo(a)anthracenc, benzo(a)pyrene, fluoranthene, naphthalene and phenanthrene in mussels. Vertical lines on bars represent one standard deviation (n = 3).





### 4.3 Mussel Contaminant Accumulation

### 4.3.1 Contaminants Spatial Pattern

Tables 9 and 10 summarize concentrations of arsenic, metals and PAHs in musssel tissues after their three week exposure to water and sediment along the Slag Dump shoreline. Unfortunately, cages could not be recovered at three of the locations, including the upstream control in Point aux Pins Bay. Therefore, comparisons are made to the pre-exposure (Balsam Lake) concentrations in the mussels.

Although mean concentrations of arsenic and some metals in *E. complanata* were higher after exposure at a few of the stations (e.g., Fig. 8), the majority of differences were not statistically significant (p > 0.05) from each other or from pre-exposure concentrations. Only the concentrations of lead at Station 123 (0.94 mg.kg<sup>-1</sup>) and magnesium at Station 127-M (352 mg.kg<sup>-1</sup>) were significantly higher (p < 0.05) than concentrations in mussels at the other stations (Table 9).

The spatial pattern of PAH bioavailability and hence, accumulation by the mussels differed from that of metals, with accumulated concentrations often being significantly higher (p < 0.05) than pre-exposure at the most easterly stations (i.e., beginning at Stations 198, 197 or 196 - see Table 10 and Fig. 9). For example, the mean Total PAHs content of Stations 196 (2698  $\mu$ g.kg-1) and 195 (2361  $\mu$ g.kg-1) mussels were significantly higher than at all other stations (see Table 10).

There was no significant difference (t-test and MANOVA-Tukeys HSD test; p > 0.05) between the mean concentrations of Total PAHs or individual compounds accumulated by mussels exposed only to water (at mid-depth) or to both sediment and water (on the bottom) at Stations 121 and 197 (Table 10 and Fig. 11). This indicates that, at least at these two stations, the primary exposure route of for filter-feeding aquatic organisms is aqueous. There was however, a significantly higher (p < 0.05) concentration of Total PAHs as well as the more water soluble PAHs (acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene and phenanthrene - see Fig. 12) in mussels exposed to the sediment at Station 127, near the Algoma Slip entrance (Fig. 3). The reason(s) for this difference are presently unknown.

Mussel tissues tended to contain higher concentrations of the more water soluble and lower molecular weight PAHs (e.g., naphthalene), and very little if any of the lower solubility/higher molecular weight/higher K<sub>ow</sub> compounds (e.g., benzo(g,h,i)perylene and dibenzo(a,h)anthracene), which were nevertheless present in the sediments (see Table 6). Of the 16 PAHs analyzed for, phenanthrene, naphthalene, fluoranthene and pyrene were, on average, the dominant compounds in mussel tissues (Fig. 10). This PAH abundance profile is similar to that observed during a 1985 biomonitoring study in the river (Kauss & Hamdy, 1991).

PAH accumulation by mussels may well be related to discrete inputs from the Slag Dump. During 1988-89, Total PAHs concentrations in shallow perimeter groundwater monitoring wells

caged mussels exposed along the Algoma Slag Dump shoreline. Concentrations in  $\mu g.kg^{-1}$  (ppb), dry weight. Comparison of 1985, 1987 and 1989 polycyclic aromatic hydrocarbons concentrations in Table 11.

	Station:		124		1	23		121		12	7
Compound	Year:	58,	28,	68,	58,	68,	\$8,	.84	68,	48,	68,
Acenaphthene		1 <w< td=""><td>34</td><td>:</td><td>6.0</td><td>15<t< td=""><td>1<w< td=""><td>36<t< td=""><td>8<w< td=""><td>188</td><td>104</td></w<></td></t<></td></w<></td></t<></td></w<>	34	:	6.0	15 <t< td=""><td>1<w< td=""><td>36<t< td=""><td>8<w< td=""><td>188</td><td>104</td></w<></td></t<></td></w<></td></t<>	1 <w< td=""><td>36<t< td=""><td>8<w< td=""><td>188</td><td>104</td></w<></td></t<></td></w<>	36 <t< td=""><td>8<w< td=""><td>188</td><td>104</td></w<></td></t<>	8 <w< td=""><td>188</td><td>104</td></w<>	188	104
Acenaphthylene		0.4 ·	20	:	1 <w< td=""><td>5<w< td=""><td>1<w< td=""><td>18<t< td=""><td>5<w< td=""><td>52<t< td=""><td>11<t< td=""></t<></td></t<></td></w<></td></t<></td></w<></td></w<></td></w<>	5 <w< td=""><td>1<w< td=""><td>18<t< td=""><td>5<w< td=""><td>52<t< td=""><td>11<t< td=""></t<></td></t<></td></w<></td></t<></td></w<></td></w<>	1 <w< td=""><td>18<t< td=""><td>5<w< td=""><td>52<t< td=""><td>11<t< td=""></t<></td></t<></td></w<></td></t<></td></w<>	18 <t< td=""><td>5<w< td=""><td>52<t< td=""><td>11<t< td=""></t<></td></t<></td></w<></td></t<>	5 <w< td=""><td>52<t< td=""><td>11<t< td=""></t<></td></t<></td></w<>	52 <t< td=""><td>11<t< td=""></t<></td></t<>	11 <t< td=""></t<>
Anthracene		0.8	13	1	-	14 <t< td=""><td>6</td><td>7<t< td=""><td>W&gt;6</td><td>74<t< td=""><td>36</td></t<></td></t<></td></t<>	6	7 <t< td=""><td>W&gt;6</td><td>74<t< td=""><td>36</td></t<></td></t<>	W>6	74 <t< td=""><td>36</td></t<>	36
Benzo(a)anthracene		;	5 <w< td=""><td>;</td><td>;</td><td>4<t< td=""><td>;</td><td>12<t< td=""><td>4<t< td=""><td>416</td><td>49</td></t<></td></t<></td></t<></td></w<>	;	;	4 <t< td=""><td>;</td><td>12<t< td=""><td>4<t< td=""><td>416</td><td>49</td></t<></td></t<></td></t<>	;	12 <t< td=""><td>4<t< td=""><td>416</td><td>49</td></t<></td></t<>	4 <t< td=""><td>416</td><td>49</td></t<>	416	49
Benzo((b)fluoranthene		2 <w< td=""><td>7<w< td=""><td>;</td><td>2<w< td=""><td>7<w< td=""><td>2<w< td=""><td>16<t< td=""><td>7<w< td=""><td>473</td><td>50</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<>	7 <w< td=""><td>;</td><td>2<w< td=""><td>7<w< td=""><td>2<w< td=""><td>16<t< td=""><td>7<w< td=""><td>473</td><td>50</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<>	;	2 <w< td=""><td>7<w< td=""><td>2<w< td=""><td>16<t< td=""><td>7<w< td=""><td>473</td><td>50</td></w<></td></t<></td></w<></td></w<></td></w<>	7 <w< td=""><td>2<w< td=""><td>16<t< td=""><td>7<w< td=""><td>473</td><td>50</td></w<></td></t<></td></w<></td></w<>	2 <w< td=""><td>16<t< td=""><td>7<w< td=""><td>473</td><td>50</td></w<></td></t<></td></w<>	16 <t< td=""><td>7<w< td=""><td>473</td><td>50</td></w<></td></t<>	7 <w< td=""><td>473</td><td>50</td></w<>	473	50
Benzo(k)fluoranthene		;	W>0	*	1	7 <t< td=""><td>:</td><td>6<w< td=""><td>6<w< td=""><td>6<w< td=""><td>27</td></w<></td></w<></td></w<></td></t<>	:	6 <w< td=""><td>6<w< td=""><td>6<w< td=""><td>27</td></w<></td></w<></td></w<>	6 <w< td=""><td>6<w< td=""><td>27</td></w<></td></w<>	6 <w< td=""><td>27</td></w<>	27
Benzo(g,h,i)perylene		1 <w< td=""><td>6<w< td=""><td>;</td><td>I<w< td=""><td>0<w< td=""><td>1<w< td=""><td>W&gt;6</td><td>6<w< td=""><td>10<t< td=""><td>6<w< td=""></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	6 <w< td=""><td>;</td><td>I<w< td=""><td>0<w< td=""><td>1<w< td=""><td>W&gt;6</td><td>6<w< td=""><td>10<t< td=""><td>6<w< td=""></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<>	;	I <w< td=""><td>0<w< td=""><td>1<w< td=""><td>W&gt;6</td><td>6<w< td=""><td>10<t< td=""><td>6<w< td=""></w<></td></t<></td></w<></td></w<></td></w<></td></w<>	0 <w< td=""><td>1<w< td=""><td>W&gt;6</td><td>6<w< td=""><td>10<t< td=""><td>6<w< td=""></w<></td></t<></td></w<></td></w<></td></w<>	1 <w< td=""><td>W&gt;6</td><td>6<w< td=""><td>10<t< td=""><td>6<w< td=""></w<></td></t<></td></w<></td></w<>	W>6	6 <w< td=""><td>10<t< td=""><td>6<w< td=""></w<></td></t<></td></w<>	10 <t< td=""><td>6<w< td=""></w<></td></t<>	6 <w< td=""></w<>
Benzo(a)pyrene		1 <w< td=""><td>8<w< td=""><td>;</td><td>1<w< td=""><td>8<w< td=""><td>1<w< td=""><td>8<w< td=""><td>8<w< td=""><td>123</td><td>10<t< td=""></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	8 <w< td=""><td>;</td><td>1<w< td=""><td>8<w< td=""><td>1<w< td=""><td>8<w< td=""><td>8<w< td=""><td>123</td><td>10<t< td=""></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	;	1 <w< td=""><td>8<w< td=""><td>1<w< td=""><td>8<w< td=""><td>8<w< td=""><td>123</td><td>10<t< td=""></t<></td></w<></td></w<></td></w<></td></w<></td></w<>	8 <w< td=""><td>1<w< td=""><td>8<w< td=""><td>8<w< td=""><td>123</td><td>10<t< td=""></t<></td></w<></td></w<></td></w<></td></w<>	1 <w< td=""><td>8<w< td=""><td>8<w< td=""><td>123</td><td>10<t< td=""></t<></td></w<></td></w<></td></w<>	8 <w< td=""><td>8<w< td=""><td>123</td><td>10<t< td=""></t<></td></w<></td></w<>	8 <w< td=""><td>123</td><td>10<t< td=""></t<></td></w<>	123	10 <t< td=""></t<>
Chrysene		2 <w< td=""><td>7<t< td=""><td>;</td><td>2<w< td=""><td>11<t< td=""><td>2<w< td=""><td>17<t< td=""><td>11<t< td=""><td>346</td><td>64</td></t<></td></t<></td></w<></td></t<></td></w<></td></t<></td></w<>	7 <t< td=""><td>;</td><td>2<w< td=""><td>11<t< td=""><td>2<w< td=""><td>17<t< td=""><td>11<t< td=""><td>346</td><td>64</td></t<></td></t<></td></w<></td></t<></td></w<></td></t<>	;	2 <w< td=""><td>11<t< td=""><td>2<w< td=""><td>17<t< td=""><td>11<t< td=""><td>346</td><td>64</td></t<></td></t<></td></w<></td></t<></td></w<>	11 <t< td=""><td>2<w< td=""><td>17<t< td=""><td>11<t< td=""><td>346</td><td>64</td></t<></td></t<></td></w<></td></t<>	2 <w< td=""><td>17<t< td=""><td>11<t< td=""><td>346</td><td>64</td></t<></td></t<></td></w<>	17 <t< td=""><td>11<t< td=""><td>346</td><td>64</td></t<></td></t<>	11 <t< td=""><td>346</td><td>64</td></t<>	346	64
Dibenzo(a,h)anthracene		1 <w< td=""><td>7<w< td=""><td>;</td><td>I<w< td=""><td>7<w< td=""><td>I<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	7 <w< td=""><td>;</td><td>I<w< td=""><td>7<w< td=""><td>I<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	;	I <w< td=""><td>7<w< td=""><td>I<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""></w<></td></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	7 <w< td=""><td>I<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""></w<></td></w<></td></w<></td></w<></td></w<></td></w<>	I <w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""></w<></td></w<></td></w<></td></w<></td></w<>	7 <w< td=""><td>7<w< td=""><td>7<w< td=""><td>7<w< td=""></w<></td></w<></td></w<></td></w<>	7 <w< td=""><td>7<w< td=""><td>7<w< td=""></w<></td></w<></td></w<>	7 <w< td=""><td>7<w< td=""></w<></td></w<>	7 <w< td=""></w<>
Fluoranthene		13	39 <t< td=""><td>:</td><td>21</td><td>26<t< td=""><td>5</td><td>46<t< td=""><td>19<t< td=""><td>230</td><td>170</td></t<></td></t<></td></t<></td></t<>	:	21	26 <t< td=""><td>5</td><td>46<t< td=""><td>19<t< td=""><td>230</td><td>170</td></t<></td></t<></td></t<>	5	46 <t< td=""><td>19<t< td=""><td>230</td><td>170</td></t<></td></t<>	19 <t< td=""><td>230</td><td>170</td></t<>	230	170
Fluorene		0.4	87 <t< td=""><td>;</td><td>12</td><td>30<t< td=""><td>1<w< td=""><td>87<t< td=""><td>7<t< td=""><td>256</td><td>141</td></t<></td></t<></td></w<></td></t<></td></t<>	;	12	30 <t< td=""><td>1<w< td=""><td>87<t< td=""><td>7<t< td=""><td>256</td><td>141</td></t<></td></t<></td></w<></td></t<>	1 <w< td=""><td>87<t< td=""><td>7<t< td=""><td>256</td><td>141</td></t<></td></t<></td></w<>	87 <t< td=""><td>7<t< td=""><td>256</td><td>141</td></t<></td></t<>	7 <t< td=""><td>256</td><td>141</td></t<>	256	141
Indeno(1,2,3-cd)pyrene		1 <w< td=""><td>6<w< td=""><td>;</td><td>1<w< td=""><td>6<t< td=""><td>1<w< td=""><td>6<w< td=""><td>18<t< td=""><td>9<t< td=""><td>6<w< td=""></w<></td></t<></td></t<></td></w<></td></w<></td></t<></td></w<></td></w<></td></w<>	6 <w< td=""><td>;</td><td>1<w< td=""><td>6<t< td=""><td>1<w< td=""><td>6<w< td=""><td>18<t< td=""><td>9<t< td=""><td>6<w< td=""></w<></td></t<></td></t<></td></w<></td></w<></td></t<></td></w<></td></w<>	;	1 <w< td=""><td>6<t< td=""><td>1<w< td=""><td>6<w< td=""><td>18<t< td=""><td>9<t< td=""><td>6<w< td=""></w<></td></t<></td></t<></td></w<></td></w<></td></t<></td></w<>	6 <t< td=""><td>1<w< td=""><td>6<w< td=""><td>18<t< td=""><td>9<t< td=""><td>6<w< td=""></w<></td></t<></td></t<></td></w<></td></w<></td></t<>	1 <w< td=""><td>6<w< td=""><td>18<t< td=""><td>9<t< td=""><td>6<w< td=""></w<></td></t<></td></t<></td></w<></td></w<>	6 <w< td=""><td>18<t< td=""><td>9<t< td=""><td>6<w< td=""></w<></td></t<></td></t<></td></w<>	18 <t< td=""><td>9<t< td=""><td>6<w< td=""></w<></td></t<></td></t<>	9 <t< td=""><td>6<w< td=""></w<></td></t<>	6 <w< td=""></w<>
Naphthalene		45	105 <t< td=""><td>;</td><td>17</td><td>26<t< td=""><td>86</td><td>95<t< td=""><td>29<t< td=""><td>444</td><td>417</td></t<></td></t<></td></t<></td></t<>	;	17	26 <t< td=""><td>86</td><td>95<t< td=""><td>29<t< td=""><td>444</td><td>417</td></t<></td></t<></td></t<>	86	95 <t< td=""><td>29<t< td=""><td>444</td><td>417</td></t<></td></t<>	29 <t< td=""><td>444</td><td>417</td></t<>	444	417
Phenanthrene		2	133	;	80	137	0.8	95	39 <t< td=""><td>161</td><td>420</td></t<>	161	420
Pyrene		6	31 <t< td=""><td>;</td><td>12</td><td>16<t< td=""><td>3</td><td>53<t< td=""><td>14<t< td=""><td>202</td><td>138</td></t<></td></t<></td></t<></td></t<>	;	12	16 <t< td=""><td>3</td><td>53<t< td=""><td>14<t< td=""><td>202</td><td>138</td></t<></td></t<></td></t<>	3	53 <t< td=""><td>14<t< td=""><td>202</td><td>138</td></t<></td></t<>	14 <t< td=""><td>202</td><td>138</td></t<>	202	138
Total of 16 PAHs		71	469	1	72	288	76	482	127	2984	1618

<sup>&</sup>quot;<T" = a measurable trace amount; interpret with caution. NOTES:

"<W" = no measurable response (zero): less than reported value. "-" = no data available: cases not recovered.

= no data available; cages not recovered.

on the slag dump ranged between 0.7 and 61  $\mu$ g.l<sup>-1</sup> (Berry-Spark & Tossell, 1990). The highest concentrations were found at wells in the vicinity of Station 203, with somewhat lower levels in wells near Stations 205, 196, 195 and 127 (see Fig. 3).

Correlation analysis on log-transformed replicate data showed that concentrations of most individual PAH compounds in mussels were significantly correlated (r = 0.58 to 1.00; p < 0.05) with each other and occasionally with lipid content, but only rarely with mercury levels (Appendix Tables C-8 to C10). Indeno(1,2,3-cd)pyrene concentrations did not correlate significantly with those of other PAHs, probably due to the high frequency of non-detects for this compound. Of the heavy metals, cadmium, magnesium, manganese and zinc concentrations were significantly correlated with each other (r = 0.58 to 0.83; p < 0.05). Tissue arsenic levels were not significantly correlated with any of the other contaminants analyzed for.

## 4.3.2 Contaminants Temporal Trends

Ministry biomonitoring studies for PAHs were also conducted in 1985 and 1987, using the same mussel species and methodology. PAH compound concentrations accumulated by with *Elliptio complanata* at Stations 124, 123, 121 and 127 in 1985, 1987 and 1989 are summarized in Table 11. Trends in PAH concentrations over the two or four year period were variable with regards to station location. For example, levels of Total PAHs at Leigh Bay stations (124 and 123) increased four- to nearly seven-fold between 1985 and 1987 and 1985 and 1989, respectively. At Station 121, concentrations were five-fold higher in 1987 than 1985, but were four-fold lower in 1989 than 1987. For all years, the greatest Total PAHs accumulation occurred at Station 127, although 1989 concentrations were about half those in 1987. These year-to-year fluctuations were also evident in the concentrations of individual PAHs (Table 11), and may be related to temporally varying concentrations of these PAHs (particularly the more water-soluble compounds) in the water filtered by the mussels. Such concentration differences may be related to changes in the magnitude of loadings (i.e., groundwater inflow, surface runoff) from the Slag Dump.

# 4.4 Mussel-Sediment Contaminant Relationships

There was a significant correlation between Total PAHs in mussels and their lipid content (although there was considerable scatter), but not between lipid-normalized concentrations in mussels and TOC-normalized sediment levels (Fig. 13). The average PAH compound profile in mussels also differed somewhat from that in sediments (cf. Figs. 7 and 10). This suggested that the mussel PAH concentrations are not directly related to the filtering out and ingestion of contaminated sediment particles. Rather, they are related to PAH concentrations in the water, which are perhaps also responsible for the elevated sediment PAH concentrations. An earlier biomonitoring study found no significant correlation between the concentrations of individual PAHs in mussels and in sediments (Kauss & Hamdy, 1991).

Concentrations of Total PAHs in the mussels were compared with those in the corresponding





Mussel-sediment PAH accumulation factors.	(BSAFs are on dry weight basis)
Table 12.	

	A60-	Ace-		Benzo(a)-	Benzo(b)-	Benzo(k)-					Indeno-				Total
Station	-hqan	naph-	Anthra-	anthra-	fluoran-	Auoran-	Benzo(a)-	Chry-	Fluor-	Fluor-	(1,2,3-	Naph-	Phen-		of 16
Number	thene	thylene	сепе	cene	thene	thene	pyrene	sene	anthene	ene	cd)pyrene	thalene	anthrene	Pyrene	PAHs
														1	
205	1 10	*	4 40	0 65	0 00	0 00	0 00	2 50	6 55	3 28	0 00	235	8 76	1 67	2 54
123	2 83	;	10 50	1 50	0 00	2 65	0 00	4 15	08.6	5 65	1 13	4 90	14 71	2 00	451
204	2 45	;	2 80	0 14	0 00	0 00	0 00	010	0 67	5 43	06 0	151	7.15	0.55	1 32
203	1 83	1	1 74	0 07	0 00	0 13	0 00	0 16	0 27	4 33	0 47	4 18	3 57	0 23	0 52
122	0 27	0 00	0 03	0 00	0 00	0 00	0 00	0.01	0 02	0 22	0 03	034	0 15	0 02	0 04
121	0 00	1	0 00	0 03	0 00	0 00	0 00	0 08	0 0	080	0 17	2 73	0.43	0 08	010
201	0 00	;	0 00	0 00	0 00	0 00	0 00	0 07	0.15	0 00	0 00	3 16	0 97	0 12	0 17
200	0 00	;	0 00	0 00	0 00	0 00	0 00	0 14	0 05	00 0	0.00	1 05	0 63	0 05	0 0
198	0 28	0 10	0 07	0.04	0 03	0.04	0 00	0.08	0 13	0 26	0 00	030	0 29	0 11	0 11
197	0 50	0 15	0 0	0 06	0 07	0 05	0.02	010	0.14	0 47	0 02	0 79	0 28	0 13	0.13
961	1 89	0 50	0.26	0 12	0 11	0 00	0 05	0 16	0 22	1 58	0 00	2 33	0 83	0 20	0 29
195	1 16	0 25	910	0 05	0.04	0.03	10 0	0 07	0 13	0.95	0 00	1 45	0 50	0 13	0 19
261	0.45	0.10	110	0.05	0.04	0.06	0.01	0.07	0 08	0.58	0 00	080	031	0 0	0 14

NOTE ".-" indicates PAH not detected in either mussel or sediment, BCF could therefore not be calculated

sediments at each station to determine if there was any significant relationship. As shown by Figure 13, this relationship was equally positive and strong ( $r^2 = 0.75$ ; p = 0.0001) whether the mussel concentrations were expressed on a wet weight, or a dry weight basis (using concentrations in mussels converted to a dry weight basis using the moisture content data in Table 9). Consequently, biota-sediment accumulation factors (BSAFs) were calculated on a dry weight basis (Table 12). The BSAFs were often less than 1 (indicating no bioaccumulation from sediments), particularly for PAHs of lower water solubility and greater tendency to partition onto organic carbon in the sediments, such as benzo(b&k)fluoranthenes, benzo(a)pyrene and indeno(1,2,3-cd)pyrene (Table 12). Bioavailability was, however suggested by the BSAFs (range: 1.1 to 14.7) for the more water soluble PAHs (i.e., acenaphthene, anthracene, fluoranthene, fluorene, naphthalene, phenanthrene and pyrene) at some of the Leigh Bay/west end of slag dump stations (numbers 205, 123, 204, 203). The maximum of this BSAF range is somewhat greater than the range (< 0.0001 to 8.96) reported from a 1985 study (Kauss & Hamdy, 1991).

### 5.0 CONCLUSIONS AND RECOMMENDATIONS

(i) Sediments at many of the 16 locations sampled around the Algoma Slag Dump shoreline contained concentrations of persistent contaminants - including arsenic, cyanide, heavy metals and polycyclic aromatic hydrocarbons (PAHs) - above levels at the upstream control station in Point aux Pins Bay. Concentrations of most contaminants were generally highest at stations located along the eastern half of the dump, adjacent to the St. Marys River and close to the Algoma Slip (i.e., Stations 199, 198, 197, 196, 195, 127), with the peak concentrations usually occurring at Station 199. This may be related to groundwater or runoff input(s) from the dump.

Concentrations of all 16 individual PAH compounds were significantly correlated with each other in the sediments, with TOC content, and with arsenic, copper, cyanide, lead, mercury, nickel and zinc levels. This suggests common source(s) of these contaminants. When normalized to TOC content, the highest arsenic, copper, cyanide, lead, mercury, nickel and zinc concentrations in sediments were at the southeastern end of Leigh Bay (Stations 205 and/or 123) and at the middle of the south shore (Station 199). The pattern for PAHs changed only slightly from the non-normalized concentrations (i.e., highest at the eastern end of the dump shoreline).

<u>Recommendation</u>: Based on information from this study, inputs from the dump should be identified and controlled to prevent continuing adverse impacts on the St. Marys River.

(ii) Arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc and organic carbon (TOC) concentrations exceeded the respective Provincial Sediment Quality Guideline (PSQG) Lowest Effect Levels (LELs) at the majority of stations sampled. Arsenic, iron, manganese, zinc and TOC also exceeded their respective PSQG-Severe

Effect Levels (SELs) at some stations. Levels of cyanide were above the Provincial guideline for open water disposal of dredged material at most stations. Total PAH concentrations exceeded the PSQG-LEL of 4 mg.kg<sup>-1</sup> at nine of the 16 dump stations, with levels ranging from 4.2 mg.kg<sup>-1</sup> to 81.2 mg.kg<sup>-1</sup> in samples. Also, concentrations of all 12 of the individual PAH compounds for which guidelines are currently available were above their respective PSQG-LELs. Based on PSQG exceedences, sediments from some of the slag dump stations were "marginally" or "grossly polluted". Such sediments would have the potential to affect use by the more sensitive sediment-dwelling organisms (marginally polluted) or significantly affect use by the majority of organisms (grossly polluted).

<u>Recommendation:</u> Future surficial sediment quality surveys around the Algoma Slag Dump should incorporate assessment of the status of associated benthic invertebrate communities and sediment bioassays utilizing laboratory test species.

(iii) Trends in sediment contaminant concentrations at four stations sampled in both 1989 and an in 1987 were variable, depending both on station location and the specific contaminant. This may be due to the natural heterogeneity of sediments in this area or to changes in sediment quality due to physical factors, such as wind-induced currents, wakes or prop wash from large vessels approaching the nearby Algoma Slip, and ice scour.

<u>Recommendation:</u> To obtain statistically valid information for the evaluation of long term contaminant trends in the sediments and hence, the efficacy of any remediation efforts, a subset of the stations sampled in 1989 should be periodically re-sampled (e.g., every 5 years or so), with replication.

(iv) Although mean concentrations of arsenic and some heavy metals in mussels were higher at a few of the stations, these differences were in most instances not statistically significant from each other or from pre-exposure concentrations, indicating either that these elements are not biologically available to filter-feeding aquatic organisms or that the exposure period was not long enough.

<u>Recommendation:</u> Future biological monitoring with caged mussels in this area should incorporate longer exposure periods (e.g., 3 months or longer) to determine if arsenic and heavy metals are biologically available to aquatic organisms.

(v) Concentrations of PAHs were significantly higher at the most easterly stations (i.e., closer to the Algoma Slip), indicating greater biological availability and higher concentrations of PAHs in this area. Mussel tissues tended to contain higher concentrations of the more water soluble PAHs (e.g., naphthalene), and very little if any of the lower solubility and higher molecular weight/higher octanol-water partition coefficient compounds (e.g.,

benzo(g,h,i)-perylene), which were nevertheless present in the sediments. This suggests that the more bioavailable PAHs are those which are more water soluble and present at higher concentrations. Of the 16 PAHs analyzed for, phenanthrene, naphthalene, fluoranthene and pyrene were on average, present at the highest concentrations in mussels. Concentrations of most individual PAH compounds were significantly and positively correlated with each other in the mussels and occasionally with lipid content, but only rarely with mercury levels and not at all with arsenic or the other heavy metals. This suggests a common source of the PAHs.

<u>Recommendation:</u> At locations with significantly higher PAH concentrations in mussels inputs from the dump should be identified and controlled to prevent continuing impacts on the St. Marys River.

- (vi) Comparison to results for four of the 1989 stations also used in 1987 and 1985 indicated year-to-year fluctuations in the concentrations of individual PAHs. These may be related to temporally varying concentrations of these compounds (particularly the more watersoluble compounds) in the water filtered by the mussels. Such concentration differences may be related to temporal variability in the magnitude of inputs (i.e., loadings) from the Slag Dump.
- (vi) Concentrations of Total PAHs in the mussels correlated positively with those in the corresponding sediments at the sampling/biomonitoring stations. Calculated mussel-sediment bioaccumulation factors (BSAFs) for individual PAHs and stations were often less than 1 (indicating no bioaccumulation from sediments), particularly for compounds of lower water solubility, such as benzo(b&k)fluoranthenes, benzo(a)pyrene and indeno(1,2,3-cd)pyrene. Bioaccumulation was, however suggested by the BSAFs (range: 1.1 to 14.7) for the more water soluble PAHs (i.e., acenaphthene, anthracene, fluoranthene, fluorene, naphthalene, phenanthrene and pyrene) at some of the Leigh Bay/west end of slag dump stations. There was no significant difference between PAH levels in mussels exposed only to water (mid-depth) or to both sediment and water (on the bottom) at Stations 121, 197 and 127.

There was a significant correlation between Total PAHs in mussels and their lipid content, but not between lipid-normalized concentrations in mussels and TOC-normalized sediment levels. This suggests that the mussel PAH concentrations are not directly related to the filtering out and ingestion of sediment particles. Rather, they are related to PAH concentrations in the water, which are perhaps also responsible for the elevated sediment PAH concentrations.

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# APPENDIX A

# 1987 Algoma Slag Dump Sediment Quality Data





Intract but andSand but<				Very Coarse					Residue,	Organic	
Station         Station <t< th=""><th></th><th>Distance</th><th></th><th>Sand</th><th>Sand</th><th>Silt &amp; Clay</th><th>Moisture</th><th>Field</th><th>total loss</th><th>Carbon,</th><th>Solvent</th></t<>		Distance		Sand	Sand	Silt & Clay	Moisture	Field	total loss	Carbon,	Solvent
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NOTE: underlaned value in shaded cell exceeds PSQ-LEL guideline or OWDMD guideline; holded value exceeds PSQ-SEL guideline.

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All concentrations in mg.kg<sup>-1</sup> (ppm), dry weight

Station Number	Distance from CDN shore, m	Sample Date	Cadmium	Chromium	Соррег	Iron	Lead	Magnesium	Manganese	Nickel	Zinc
Pointe aux P	ins Bay:			i							
52	5(K)	87/05/15	0.50	10	12	5400	24.0	026	55	4	24
Algoma Slag	Dump.										
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		87/(9/25	0.41	17	1	10040	11.0	2060	109	6.1	25
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ę	50	87/05/17	1.25	<u>3</u> 2	40	51333	87.0	5833	975	8	420
		61/60//28	735	55	89	47600	81.0	5420	862	14	394
127	70	71/30/18	BLLL	TE	35	53000	<u>65.0</u>	6000	1040	हा	314
:	:	61/60/28	19.0	R	TR.	41800	46.0	5040	840	12	252
PSQG-LEL:			0.6	26	16	2(XXX)	31	1	460	16	120
PSQG-SEL:			10	011	110	(KXKIt	25()	1	11(X)	75	820
OWDMDG:			-	25	25	(()))	50		1	25	(K)

NOTES: hhank or "--" indicates that data is not available for this parameter or sample. underhined value in shaded cell exceeds PSQ-LEL guideline; holded value exceeds PSQ-SEL guideline

Table A-3. Polycyclic aromatic hydrocarbon concentrations in 1987 surficial sediments.

All concentrations in mg.kg<sup>-1</sup> (ppm), dry weight.

$0.04 \ < T$ $0.06 \ < T$ $0.07 \ < T$ $0.06 \ < T$ $0.07 \ < T$	Distance Ace Ace Benzola)- Benzolk)- Benzolk)- Benzolk)- Benzolk)- Benzolk)- Benzol fram CDN Sample naph- naph- Anthra- anthra- Nuoran- Nuoran- (g,h,i)- Benzola)- Chry- ( shore,m Date thene thytene cene cene thene thene perylyne pyrene sene t	Ace- Ace- Benzola)- Benzolk)- Benzolk)- Benzol- Sample naph- naph- Anthra- anthra- Nuoran- Nuoran- (g,h.i)- Benzola)- Chry- ( Date thene thylene cene cene thene thene perylyne pyrene sene t	Acc- Acc- Benzola)- Benzolk)- Benzolk)- Benzolk)- Benzol naph- naph- Anthra- anthra- Auoran- Auoran- (g.h.i)- Benzola)- Chry- ( thene thylene cene cene thene thene perylyne pyrene sene ti	Ace- Benzo(a)- Benzo(b)- Benzo(k)- Benzo- naph- Anthra- anthra- Muoran- Muoran- (g.h.i)- Benzo(a)- Chry- ( thytene cene crne thene thene perylyne pyrene sene ti	Benzo(a)- Benzo(b)- Benzo(k)- Benzo- Anthra- anthra- Nuoran- Nuoran- (g,h,i)- Benzo(a)- Chry- ( cene cene thene perylyne pyrene sene t	Renzo(a)- Benzo(b)- Benzo(k)- Benzo- Anthra- anthra- Auoran- Auoran- (g,h,i)- Benzo(a)- Chry- ( cene cene thene thene perylyne pyrene sene th	Benzo(a)- Benzo(b)- Benzo(k)- Benzo- anthra- Auoran- Auoran- (g,h,i)- Benzo(a)- Chry- ( cene thene thene perylyne pyrene sene t	Benzold). Benzolk). Benzo. Auoran. (g.h.i). Benzola). Chry. ( Alene thene perylyne pyrene sene ti	Benzo(k)- Benzo. Auoran- (g,h,i)- Benzo(a)- Chry- ( thene perylyne pyrene sene t	Benzo. (g.h.i). Benzola). Chry. ( perylyne pyrene sene tl	Benzo(a). Chry. ( pyrene sene ()	Chry- ( sene ti		Dibenzo- a,h)an- hracene	Fluor- anthene	Fluor- ene	Indeno- (1,2,3- cd)pyrene	Naph- thalene	Phen- anthrene	Pyrene	Total of 16 PAHs
0.04 < t $0.04 < t$ $0.04$	Prix Bay: 5181 - 827066/15 - 6444 ×T - 6404 ×T - 6407 ×T - 6406 ×T - 6405 ×	יי מיס די וויס די טיוס די מיס די מיס בי מיס בי וויס די וויס די וויס די מיס בי מיס בי מיס בי מיס בי מיס בי מיס בי	, 000 T, 000	T 0.01 J 0.00 J 0.00 J 0.00 J 0.00 J 0.00 J 0.00 J	- 100 - 1 - 100 - 1 - 100 - 1 - 100 - 1 - 1	- 100 T, 100 T, 100 T, 200 T, 100	, 2010 T, 2010 T, 2010 T, 2010	0.06 J. T. 0.00 T. 0.00 T. 0.00 J.	, 000 F, 000 F, 000	→ MA → MA → MA	- 500 T, 500	50 00		10 PU	4 4 4 F				i.	2	:
0.04 < T $0.06 < T$ $0.06$												4						/			
0.04 - 51 $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.04 - 51$ $0.06 - 51$	8 Dump 3180 X20046117 0104 ×T 0104 ×T 0.013 ×T 0.013 0.014 0.003	83///6/12 0/04 /T 0/04 /T 0/04 /T 0/04	0.04 - T 0.04 - T 0.04 - 0.04 0.06 0.07 0.07 0.04	T 014 /T 0.01 /T 0.03 0.06 0.03 0.04 0.04	-T 0.01 /T 0.03 0.06 0.00 0.00	0.01 /T 0.03 0.06 0.00 0.01	1000 1000 1000 1000 1000	0.06 0.00 0.00	0.07 0.04 0.04	101	0.04	10.01		T	211.11	E. MON	310.10			:	
					10/0 N/01 N/01 10/01 10/01 10/01 10 10/01 10	40YA 40YA 60YA 60YA 75 DA	50YA 60YA 60YA 60YA 60YA 60YA			40°0 40°0	40°0	40°D		12 60/0	80.0		C0 0	> 100	> /// 0	× 900 1	~
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0.04         T         0.21         0.04         CT         0.08         CT         0.08         CT         0.09         D           015 <b>1.86</b> 0.46 <b>0.29</b> 114 <b>1.27 2.25 2.1 1.2</b>	40 87/05/17 0.23 0.1K 0.55 2.560 3.40 3.40 3.10 1.242	2FT 6 23 0 18 0700 3 40 3 40 3 40 3 10 12 0 2 10 1 1 1 1 1 1 1 1 1 1 1 1 1	0 23 0 1K 0.65 2.60 3.40 3.40 3.10 2.5	2FT FST 8TT 0FT 0FT 10 1 10	244 244 346 346 346 346 347 347	0FG 5FG 3-40 3740 31E 3FG 3FG	2.60 3.40 3.40 3.18 3.54 3.42	3.40 3.40 3.18 3.40 A.4	तन्त सर आर अन्त	तन्त हर आर	रनर हर	3.42		0.52	4.BO	0.20	3.39	0.46	2.11	177	স
015         1366         046         0.29         114         2.57         2.98         1           018         2.26         018         0.46         0.31         1.22         1.77         1           024         6.35         103         1.13         1.14         5.34         4.91         1           0.24         6.35         103         1.13         1.14         5.34         4.91         2           0.43         11.20         1.20         1.20         1.21         1         1         1         2	" K7/09/19 0.04 <t 0.02="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td>87/09/19 0.04 <t 0.02="" 0.05="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" <t="" td=""><td>0.04 <t 0.02="" 0.05="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" <t="" td=""><td>F 0.05 <t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td><t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td>0.02 0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.16 0.08 0.07 0.12 0.10</td><td>0.08 0.07 0.12 0.10</td><td>0.07 0.12 0.10</td><td>0.12 0.10</td><td>01.0</td><td></td><td>0.04 <t< td=""><td>0.21</td><td>0.04 <t< td=""><td>60.0</td><td>&gt; 10.04</td><td>T 0.08</td><td>61.0</td><td></td></t<></td></t<></td></t></td></t></td></t></td></t></td></t>	87/09/19 0.04 <t 0.02="" 0.05="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" <t="" td=""><td>0.04 <t 0.02="" 0.05="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" <t="" td=""><td>F 0.05 <t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td><t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td>0.02 0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.16 0.08 0.07 0.12 0.10</td><td>0.08 0.07 0.12 0.10</td><td>0.07 0.12 0.10</td><td>0.12 0.10</td><td>01.0</td><td></td><td>0.04 <t< td=""><td>0.21</td><td>0.04 <t< td=""><td>60.0</td><td>&gt; 10.04</td><td>T 0.08</td><td>61.0</td><td></td></t<></td></t<></td></t></td></t></td></t></td></t>	0.04 <t 0.02="" 0.05="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" <t="" td=""><td>F 0.05 <t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td><t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td>0.02 0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.16 0.08 0.07 0.12 0.10</td><td>0.08 0.07 0.12 0.10</td><td>0.07 0.12 0.10</td><td>0.12 0.10</td><td>01.0</td><td></td><td>0.04 <t< td=""><td>0.21</td><td>0.04 <t< td=""><td>60.0</td><td>&gt; 10.04</td><td>T 0.08</td><td>61.0</td><td></td></t<></td></t<></td></t></td></t></td></t>	F 0.05 <t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td><t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td>0.02 0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.16 0.08 0.07 0.12 0.10</td><td>0.08 0.07 0.12 0.10</td><td>0.07 0.12 0.10</td><td>0.12 0.10</td><td>01.0</td><td></td><td>0.04 <t< td=""><td>0.21</td><td>0.04 <t< td=""><td>60.0</td><td>&gt; 10.04</td><td>T 0.08</td><td>61.0</td><td></td></t<></td></t<></td></t></td></t>	<t 0.02="" 0.07="" 0.08="" 0.09="" 0.10<="" 0.12="" 0.16="" td=""><td>0.02 0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.09 0.16 0.08 0.07 0.12 0.10</td><td>0.16 0.08 0.07 0.12 0.10</td><td>0.08 0.07 0.12 0.10</td><td>0.07 0.12 0.10</td><td>0.12 0.10</td><td>01.0</td><td></td><td>0.04 <t< td=""><td>0.21</td><td>0.04 <t< td=""><td>60.0</td><td>&gt; 10.04</td><td>T 0.08</td><td>61.0</td><td></td></t<></td></t<></td></t>	0.02 0.09 0.16 0.08 0.07 0.12 0.10	0.09 0.16 0.08 0.07 0.12 0.10	0.16 0.08 0.07 0.12 0.10	0.08 0.07 0.12 0.10	0.07 0.12 0.10	0.12 0.10	01.0		0.04 <t< td=""><td>0.21</td><td>0.04 <t< td=""><td>60.0</td><td>&gt; 10.04</td><td>T 0.08</td><td>61.0</td><td></td></t<></td></t<>	0.21	0.04 <t< td=""><td>60.0</td><td>&gt; 10.04</td><td>T 0.08</td><td>61.0</td><td></td></t<>	60.0	> 10.04	T 0.08	61.0	
018         2.26         0.18         0.46         0.31         1.22         1.21           0.24         6.35         1.03         1.13         1.14         5.34         4.91           0.43         11.22         1.20         1.24         1.4         5.34         4.91	50 87/05/17 0.31 0.15 0.52 2.12 1.62 1.62 1.62 1.26 1.75	87/05/17 0.31 0.15 0.52 2.12 1.62 1.62 1.62 0.69 1.26 1.75	0.31 0.15 0.53 2.12 1.62 1.62 1.62 1.26 1.75	015 0.82 2.12 1.62 1.62 0.69 1.26 1.75	9.82 2.12 1.62 1.62 0.69 1.26 1.73	9.52 2.12 1.62 1.62 1.62 1.73	212 1.62 1.62 0.69 1.26 1.75	1.62 L62 0.69 L26 L75	172 0765 1730	0.69 1.26 1.75	527 927	172		0.15	3.86	046	0.59	Fi	12.5	2.95	
0.24 6.25 103 1.13 1.14 5.14 4.91 5. 0.43 11.22 1.20 1.80 1.80 2.02 6.62 5	" K7/H9/H9 012 0.09 0.32 1.05 1.09 0.42 0.43 0.22 1.33	87/14/19 012 0.09 0.32 1.05 1.09 0.42 0.43 0.27 1.33	012 0.09 0.32 1.05 1.09 0.42 0.43 0.27 1.33	0.09 0.32 1.05 1.09 0.42 0.43 0.12 1.33	0.12 1.05 1.09 0.42 0.43 0.13	0.32 1.05 1.09 0.42 0.43 0.77 1.33	1.05 1.09 0.42 0.43 0.77 1.33	1.09 0.42 0.43 0.77 1.33	0.42 0.43 0.77 1.33	0.43 0.77 1.3	0.72 1.3	13	a	0 18	2.26	0.18	2.46	0.31	1.22	777	-
0.43 11.72 1.20 1.80 1.80 2.07 6.61 2	70 87/05/17 0.65 0.31 <b>1.42 3.49 2.43 2.43 1.19 2.11 3.1</b>	87/05/17 0.65 0.31 1.42 3.49 2.43 2.43 1.19 2.11 3.11	0.65 0.31 1.42 3.49 2.43 2.43 1.19 2.11 3.11	0.31 LAI 3.49 2.43 2.43 LL9 2.LL 3.1	1.47 3.49 2.43 2.43 1.19 2.11 3.11	1.42 3.49 2.43 2.43 1.19 2.11 1.1	349 2.43 2.43 1.19 2.11 M	177 177 177 177 177 177 177 177 177 177	177 JTT 571 JTT 571	गर गाउ हाग	חד חד	11		0.24	52.3	1 03	112	1 14	FTS	161	F
	" K7/19/19 071 043 245 522 487 200 125 340 611	K7/19/19 071 043 245 522 487 200 125 3.60 6.11	071 043 245 222 487 2.00 1.75 2.60 6.11	043 245 222 487 2.00 1.75 2.60 6.11	2.45 2.22 487 2.00 1.25 2.60 6.11	2.45 2.22 4.87 2.00 1.25 3.69 6.11	<b>5.22</b> 4 87 2.00 1.75 3.60 6.11	4 K7 2.00 1.75 3.60 6.11	2.00 1.75 2.60 6.17	173 337 571	11.0 02.5	<u>f</u> ug	~	0.43	11.72	1.20	0371	1 80	101	<u>6.61</u>	513
	370 1480 1340 320 1440 460	370 1480 1340 320 1440 460	370 1480 1340 320 1440 460	370 1480 1340 320 1440 460	370 1480 1340 320 1440 460	370 1480 1340 320 1440 460	1480 1340 320 1440 460	1340 320 1440 460	[340 320 [440 460	320 1440 460	1440 460	460		130	1020	()91	320	;	950	850	10000
130 1020 160 320 950 850 10XX											:	i		:	ŧ	:	;	-	;	:	;

NOTES. Mank or "--" indicates that data is not available for this parameter or sample

"< T" = a measurable trace amount: interpret with caution

underlined value in shaded cell exceeds PSQ-LEL guideline

PSQG-SEL isd TOC-hased.

# Table A-4. Phenolic compound concentrations in 1987 surficial sediments.

All concentrations in ug.kg<sup>-1</sup> (ppb), dry weight.

	Distance								
Station	from CDN shore, m	Sample Date	Phenol		m-Cresol	9-0	Cresol	Ь	-Cresol
Pointe aux P	ins Bay								
52	500	87/05/15	5	M> (	5()	/M>	()9	NIN	I(KK)
Algoma Slag	Dump								
4()-2())	200	87/05/17	35	.W> ()	50	W>	50	M>	365
40-13(8)	1300	87/05/15	20	M> (	50	W>	50	W>	225
40-1830	1830	87/05/15	36	M> (	50	<w></w>	50	<w></w>	383
I		87/09/25			1		;		:
124	140	87/05/17	5(	<pre>M&gt; (</pre>	50	W>	50	W>	140
121	40	87/05/17	7(	_	20	~W>	()9		2()
÷		81/60/28			1		1		;
ų	50	87/05/17	<u>,</u>	5	50	W>	50	W>	1050
I	•	61/60/7X	•		1		:		;
127	70	87/05/17	160	~	50	W>	5()	W>	850
z	•	61/60/28	,	,	:		:		1
PSQG-LEL:					1		;		\$
PSQG-SEL:					:		:		:
OWDMDG-					1		:		

NOTES: blank or "--" indicates that data is not available for this parameter or sample.

"<W" = no measurable response (zero): less than reported value.



# **APPENDIX B**

# 1987 Bennett Creek Sediment Core Data



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Figure B-1.

Concentrations of contaminants in Bennett Creek and Spring Creek sediment cores relative to coal tar and creosote, 1987. PAH concentrations are approximate, relative to the d<sub>10</sub>-phenanthrene external standard. Table B-1.

							Sampling	Location					
						2						4	
		Algoma	Domtar Inc.	Bennett C	r. at pipe	Bennett C	r. at pipe	Spring Cr.,	15 m. west (	of Bennett Cr.	., 4 metres	Spring Cr	, next to
	Units	steel Corp. coal tar	creosote	crossing, 3 n south	netres from shore	crossing,6 n north.	tetres from shore		from	shore		Domtar	tanks
	(dry weight)			surface "oil"	10-30 cm	0-12.5 cm	12.5-22.5	0-12.5 cm	12.5-22.5	22.5-33 cm	22.5-58 cm	0-7.5 cm	7.5-35 cm
Contaminant				layer	core section	core section	cm core section	core section	cm core section	core section	core section	core section	core section
	Sample No.	16285	16286	50681	50683	50684	50685	50689	50690	50691	50692	50693	50694
Cadmium	mg.kg <sup>.1</sup>	-	;	;	:	0.98	:					; ;	
Chromium	:	;	:	;	;	31	;		:	:		{	
Iron		;	:	:	:	1400	;	:		:		;	;
Lead		-	:	:	:	28	-	:	:	:		:	
Magnesium	:	;	:	;	1	3700	:	:			:	:	;
Manganese	1	-	-	1	;	960	:		:	:		;	;
Nickel	11	;	;	:	-	10	;	:		;	;	;	;
Zinc	11	;	;	;	1	320	;			:	: 1		
Total Organic Carbon	g.kg <sup>-1</sup>	1	-	:	: -	45	; 1			;			
Solvent Extractables	mg.kg <sup>.1</sup>	-		:	91300	4800	23400	28900	69700	:	71000	4040	30600
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	mg.kg <sup>.1</sup>	0.1	13	3.7	0.62	:	0.14	1.3	8.2	12	2.9	0.25	4
Acenaphthylene	ų	2.8	0.06	11	0.014	:	pu	pu	0.2	0.2	pu	pu	0.055
Anthracene	:	;	-,	pu	0.34	:	0.051	0.74	6.7	15	2.1	0.62	2.9
Benzo(a)anthracene	11	_	1.4	6.8	0.2	:	0.063	0.32	2.5	3.1	0.85	0.15	0.43
Benzo Fluorenes	1	0.7	1.76	3.80 <sup>2</sup>	$0.24^{2}$	1	0.92 2	$0.50^{2}$ .	2.40 <sup>2</sup>	3.80 <sup>2</sup>	0.89 2	0.14 <sup>2</sup>	1.60 <sup>2</sup>
Benzo(b/k)fluoranthene	:	1.7	0.83	8.2	0.21	;	0.032	0.5	2.9	4.8	1.7	0.18	0.89
Benzo(j)fluoranthene	44	pu	pu	1.1	pu	ł	pu	pu	0.2	0.32	0.11	0.006	pu
Benzo(g,h,i)fluoranthene	4	pu	0.15	0.76	0.034	:	pu	pu	0.22	0.72	0.27	0.054	pu
Benzo(a)pyrene	mg.kg <sup>.t</sup>	0.78	0.32	4.8	0.079	:	0.049	0.37	1.4	2	0.87	0.09	0.64
Benzo(e)pyrene	a.	0.4	0.18	ę	0.076	:	0.027	0.18	0.9	1.2	0.47	0.05	0.14

							Sampling	Location					
				I		5					Γ	4	
	Units	Algoma Steel Corp. coal tar	Domtar Inc. creosote	Bennett C crossing, 3 1 south	r. at pipe netres from shore	Bennett C crossing.6 n north :	r. at pipe vetres from shore	Spring Cr.	.15 m. west from	of Bennett Cr shore	., 4 metres	Spring C Domta	r, next to r tanks
Contaminant	(dry weight)			surface "oil" layer	10-30 cm core section	0-12.5 cm core section	12.5-22.5 cm core section	0-12.5 cm core section	12.5-22.5 cm core section	22.5-33 cm core section	22.5-58 cm core section	0-7.5 cm core section	7.5-35 cm core section
	Sample No.	16285	16286	50681	50683	50684	50685	50689	50690	50691	50692	50693	50694
Chrysene	ng kg <sup>-1</sup>	-	1.4	5.4	0.38	:	0.12	0.35	2.4	5.9	1.9	0.21	2.7
4H-Cyclopenta(d,e,f)phenanthrene	, T	0.68	2.5	4.1	0.34	:	0.1		2.5	2.1	—	0.26	1.8
Benzo(g,h,i)perylene/Dibenzo(a,h)anthra	:	0.5	0.11	2.7	pu	:	pu	pu	0.76	1.2	0.35	0.017	0.11
Fluoranthene	:	3.2	13.1	24	1.6	-	0.66	2.6	12	15	4.6	1.5	6.6
Fluorene	1	1.5	7	8.8	0.66	;	0.12	0.98	7.1	11	2.4	0.26	2.9
Indane	1	pu	0.96	nd	pu	;	pu	pu	pu	0.94	0.2	pu	pu
Indene		0.6	0.86	1.6	nd	:	pu	pu	pu	0.3	pu	pu	pu
Indeno(1,2,3-cd)pyrene		0.44	0.06	2.7	pu		pu	pu	0.72	0.86	0.29	nd	0.13
Naphthalene	11	15	32.2	75	1.2	:	pu	1.9	32	28	6.6	0.16	8.2
Perylene		0.17	0.07	1.6	0.092	:	pu	pu	0.43	0.38	0.39	pu	pu
Phenanthrene/Anthracene	11	6.1	27.9	38	3	1	0.87	3.9	23	29	6.6	2.6	
Pyrene	11	2.3	Π	17	1.3	;	0.54	2.2	11	13	4.2	1.1	5.8
Triphenylene/Naphthacene	11	0.25	0.33	pu	pu	:	nd	pu	nd	pu	pu	pu	pu
Alkylated PAHs:													
C <sub>1</sub> (methyl)-Benz(a)anthracene	mg.kg <sup>.t</sup>	0.6	0.2	nd	pu	:	pu	pu	0.36	5.90 2	0.13	pu	pu
C2-(alkyl)-Fluoranthene/C2-(alkyl) Pyrene	11	pu	0.1	pu	pu	;	pu	pu	0.12	0.67 2	0.33 2	pu	0.12
C <sub>1</sub> (methyl)-Fluoranthenes/C <sub>1</sub> -(methyl)	**	nd	1.1	1.30 2	0.10 2	:	pu	0.29 2	1.40 <sup>2</sup>	0.54 2	0.77 2	0.094	0.29 2
C <sub>i</sub> (methyl)-Fluorenes	11	pu	0.66	pu	0.041	:	0.092 2	pu	0.6	1 20.0	0.15	pu	0.56 4
C <sub>1</sub> (methyl)-Naphthalenes	1	2.2	6.1	7.30 2	0.26 2		pu	0.61	9.3	10	1.6	0.14	3.20 2
C <sub>2</sub> (alkyl)-Naphthalene	-	0.2	1.8	1.00 2	0.05 2		pu	0.24 4	2.70 '	3.50 %	0.6	pu	1.00 4
C <sub>1</sub> (alkyl)-Naphthalene	:	pu	1.36	pu	pu	:	pu	pu	0.15 <sup>2</sup>	0.40 <sup>2</sup>	pu	pu	0.066
C <sub>3</sub> (phenyl)-Naphthalene	1	pu	-	0.37	0.058	:	0.051	pu	0.70 2	0.79	0.15	0.061	0.44 <sup>2</sup>
C <sub>1</sub> (methyl)-Phenanthrencs/C <sub>1</sub> (methyl)-	2	0.32	27.2	1.70 2	0,15 2	-	0.0821	0.30 2	1.90	4.40 1	0.70 1	0.20 3	1.1
4H-cyclopenta(d,e,f)Phenanthrene	mg.kg <sup>.1</sup>	0.68	2.5		0.34	:	0.1	0.64	2.5	2.1		0.26	1.8

							Sampling	Location					
						2						4	
	Units	Algoma Steel Corp. coal tar	Domtar Inc. creosote	Bennett C crossing, 3 n south	r. at pipe netres from shore	Bennett C crossing,6 n north s	r. at pipe tetres from thore	Spring Cr.	J5 m. west of from :	of Bennett Cr. shore	. 4 metres	Spring Cr. Domtar	, next to tanks
Contaminant	(dry weight)			surface "oil" layer	10-30 cm core section	0-12.5 cm core section	12.5-22.5 cm core section	0-12.5 cm core section	12.5-22.5 cm core section	22.5-33 cm core section	22.5-58 cm core section	0-7.5 cm core section (	7.5-35 cm core section
	Sample No.	16285	16286	50681	50683	50684	50685	50689	50690	50691	50692	50693	50694
Nitrogen-containing PAHs:													
Acridine	mg.kg <sup>.t</sup>	pu	0.35	pu	pu	:	pu	pu	0.15	0.24	0.075	pu	pu
Carbazole	;	0.03	4.1	1.2	0.092		pu	0.099	1.8	5.3	0.53	0.031	0.34
C <sub>1</sub> (methyl)-Carbonitrile		nd	0.1	pu	pu		pu	pu	nd	pu	pu	pu	pu
Fluoranthene amine		pu	0.07	pu	pu	:	pu	pu	0.36 2	0.89	0.15	pu	0.081
Anthracene Carbonitriles		pu	0.5	pu	pu	1	pu	pu	nd	pu	pu	pu	pu
Naphthalene Carbonitriles		pu	0.26	pu	0.01	4	pu	0.029	0.18	0.24	0.056	pu	pu
9H-Fluorene-9-Carbonitrile		pu	0.1	pu	pu	;	pu	pu	pu	pu	pu	pu	pu
Quinoline/Isoquinoline		pu	0.88	pu	pu	1	pu	pu	pu	pu	pu	pu	pu
C <sub>1</sub> (methyl)-Quiniline/C <sub>1</sub> (methyl)-	1	pu	0.08	pu	pu	1	pu	pu	pu	pu	pu	pu	pu
Oxygen-containing PAHs:													
C <sub>1</sub> (methyl)-Benzofuran	mg.kg <sup>.1</sup>	0.05	pu	pu	pu	;	pu	pu	pu	pu	pu	pu	pu
Dibenzofuran		0.9	5	3.8	0.3		0.024	0.45	4.5	5.7	1.1	0.14	1.6
C <sub>1</sub> (methyl)-Dibenzofuran		0.26	1.2	1.00 2	0.058 2	ł	0.019	0.063	1.30 2	1.90 <sup>2</sup>	0.30 2	0.084	0.34 <sup>2</sup>
Benzo(b)naphtho(2,3-d)furan		0.07	0.24	0.26	pu	:	pu	pu	0.24	0.32	0.082	pu	0.089
Dihydro Phenanthrene/Dihydro	:	pu	1.1	pu	pu	:	pu	pu	pu	pu	pu	pu	pu
Tetrahydro Phenanthrcnc/Tetrahydro		pu	0.3	pu	pu	:	pu	pu	pu	pu	pu	pu	pu
Sulphur-containing PAHs:													
Benzo(b)naphtho(1,2-d)thiophene	mg.kg <sup>.1</sup>	pu	0.75	pu	0.05	:	pu	0.11	0.36	0.84	0.1	pu	pu
Benzothiophene		pu	-	pu	pu	:	pu	pu	0.33	0.64	pu	pu	pu
C <sub>1</sub> (methyl)-Benzo(b)thiophene		pu	0.75	pu	pu	:	pu	pu	pu	pu	pu	pu	pu
Dibenzothiophene	:	0.2	1.4	-	0.13	:	0.022	0.16	0.59	1.6	0.25	0.054	0.4

							Sampling	Location					
						5				-		4	
	Units	Algoma Steel Corp. coal tar	Domtar Inc. creosote	Bennett C crossing, 3 1 south	r. at pipe netres from shore	Bennett C crossing,6 n north :	r. at pipe tetres from thore	Spring Cr.	J5 m. west of from .	of Bennett Cr shore	., 4 metres	Spring Cr Domtar	, next to tanks
	(dry weight)			surface "oil" laver	10-30 cm	0-12.5 cm	12.5-22.5 cm core	0-12.5 cm core section	12.5-22.5 cm core	22.5-33 cm core section	22.5-58 cm core section	0-7.5 cm	7.5-35 cm
Contaminant				ומאנו	section		section		section				
	Sample No.	16285	16286	50681	50683	50684	50685	50689	50690	50691	50692	50693	50694
Miscellaneous:													
Phenols	mg.kg <sup>-1</sup>	pu	0.13	pu	pu	1	pu	pu	pu	pu	pu	pu	pu
Cresols	               	0.12	pu	pu	pu	1	pu	pu	nd	pu	pu	pu	pu
Xylenols		pu	0.06	pu	pu	:	pu	pu	pu	pu	pu	pu	pu
Biphenyl		0.16	1.1	0.57	0.066	-	pu	0.088	1,1	1.6	0.23	pu	0.5
C <sub>1</sub> (methyl)-Biphenyls	:	pu	0.13	pu	pu	I	pu	pu	pu	pu	pu	pu	pu
C <sub>2</sub> (alkyl)-Biphenyls		pu	0.18	pu	pu	-	pu	pu	pu	pu	pu	pu	pu
Polychlormated Dibenzo-p-dioxins & Dibenzofurans:													
2,3,7,8-TetraCDD	ng.kg <sup>-1</sup>		1	nd (30)	-	:	nd (40)	:	:	nd (50)	;		;
TetraCDD				nd (30)	:	1	nd (40)	-	:	nd (50)		;	
PentaCDD	L             		;	nd (40)	;	;	nd (40)	1	:	nd (80)	:	1	;
HexaCDD				nd (70)	1	:	nd (10)	:	:	nd (100)	;	-	;
HeptaCDD	1	:	;	nd (40)	:	:	98 2	-	;	(09) pu	: 1	-	
OctaCDD	:	!	1	nd (70)	1	1	300	-	;	nd (100)	-	;	1
TctraCDF			;	nd (30)	;	-	nd (30)	-		nd (40)	;	;	;
PentaCDF	:	1	1	nd (30)	:	1	nd (40)	:		nd (40)		;	;
HexaCDF	:		1	nd (30)	:	:	nd (7)	-		(09) pu	;	:	:
HeptaCDF	1:	:	;	nd (40)	:	:	nd (10)	;		nd (70)	:	:	;
OctaCDF	:	-	:	nd (60)	;	-	37	;	:	nd (100)	:	:	:

NOTES:

"-" = not available. "nd" = not detected. "na" = not available. Number in superscripts after concentration indicates the number of distinct isomers or compounds identified. Values in parentheses for PCDDs and PCDFs are detection limits.



# **APPENDIX C**

# 1989 Station Descriptions, Replicate Data and Statistical Analysis


Station Number	Location	Distance from CDN. shore, m.	Water Depth, m.	Latitude (N)	Longitude (W)
1	Balsam Lake, at Rosedale		1.5	44°34'36"	78°47'28''
52	Point aux Pins Bay	500	4.5	46°29'49"	84°28'06"
124	Leigh Bay (northeast)	140	1.0	46°30'41"	84°24'45"
205	Leigh Bay (east)	210	3.0	46°30'32"	84°24'44"
123	Leigh Bay (east)	150	2.5	46°30'23"	84°24'46"
204	Leigh Bay (south)	50	4.5	46°30'13"	84°24'42''
203	Old Vessel Point	40	5.0	46°30'11"	84°24'30"
122	Old Vessel Point	15	6.5	46°30'09"	84°24'21''
202	Old Vessel Point	20	9.5	46°30'05"	84°24'08"
121	Old Vessel Point	40	6.0	46°30'11"	84°23'57"
201	2370 metres west of Algoma Slip entrance	50	5.5	46°30'14"	84°23'47"
200	2100 metres west of Algoma Slip entrance	80	5.0	46°30'19"	84°23'39"
199	1700 metres west of Algoma Slip entrance	60	8.5	46°30'23"	84°23'30"
198	1400 metres west of Algoma Slip entrance	60	6.0	46°30'29"	84°23'23''
197	1150 metres west of Algoma Slip entrance	50	7.0	46°30'36"	84°23'12"
196	900 metres west of Algoma Slip entrance	50	8.0	46°30'41"	84°23'05"
195	650 metres west of Algoma Slip entrance	70	7.0	46°30'46"	84°22'55"
127	500 metres west of Algoma Slip entrance	70	7.0	46°30'50"	84°22'50"

### Table C-1. Station locations and descriptions for 1989 study.

NOTES: Coordinates are in NAD27 Datum; distances from shore were determined by radar.

Solvent ctractables mg.kg <sup>-1</sup>	398	254	848	295	349	:	251	1481	312	305
Organic Carbon, total E5 g.kg <sup>-1</sup>	5.2	5.8	28	28	29	72	71	120	110	130
Residue, total loss on Ignition g.kg <sup>-1</sup>	5.0	3.0	50	53	57	47	45	76	67	87
Field Density e g.cm <sup>-3</sup>	1.79	÷	1.34	=	=	1.69	-	1.42	=	=
Moisture %	29	28	53	52	52	37	40	43	44	51
Silt & Clay <63 um %	13.1	12.3	31.2	35.0	30.6	42.2	38.8	28.8	26.4	25.0
Sand 1000-63 um %	86.9	87.6	54.7	53.9	55.1	45.5	39.6	70.9	72.9	73.5
Very Coarse Sand 2000-1000 um %	0.08	0.08	14.0	1.11	14.3	0.49	1.22	0.33	0.71	1.46
Visual (Field) Description	silty sand, macrophytes	-	organic ooze; macrophytes	-	2	sandy ooze; quite oily	-	oily ooze; some fine sand; plant and wood fibres	. =	2
Field Sample Number	68202-S	68203-S	68206-R	68207-R	68208-R	68215-S	68216-S	68220-R	68221-R	68222-R
Station Number	124	-	204		:	199	÷	195	z	2

 Table C-2. Sediment replicate physical characteristics, organic carbon and solvent extractables concentrations.

 Concentration units as indicated.

NOTE: "S" = split (same grab) sample. "R" = replicate (discrete grab) sample.

Table C-3. Arsenic, cyanide and heavy metals concentrations in sediment replicates.

All concentrations in mg.kg<sup>-1</sup> (ppm), dry weight.

	-to	Field	A second o	Codadinan	Chronolous	Conser	Cranida	Cvanide	lron	hed 1	Magnosium	Mandanece	Mercury	Nickol	Zinc
Number	Date	Sampre Number	Arsenic			copper	available	free			'mneon@eng	actual de la company	6		
124	89/08/16	6K202-S	1 30	0.14 <t< td=""><td>=</td><td>51</td><td>0.040 <t< td=""><td>0.010 <w< td=""><td>72(0)</td><td>6.0</td><td>16(8)</td><td>120</td><td>W&gt; 10.0</td><td>5.3</td><td>27</td></w<></td></t<></td></t<>	=	51	0.040 <t< td=""><td>0.010 <w< td=""><td>72(0)</td><td>6.0</td><td>16(8)</td><td>120</td><td>W&gt; 10.0</td><td>5.3</td><td>27</td></w<></td></t<>	0.010 <w< td=""><td>72(0)</td><td>6.0</td><td>16(8)</td><td>120</td><td>W&gt; 10.0</td><td>5.3</td><td>27</td></w<>	72(0)	6.0	16(8)	120	W> 10.0	5.3	27
2	2	68203-S	1 20	0.13 <t< td=""><td>11</td><td>54</td><td>0.040 <t< td=""><td>M&gt; 010.0</td><td>75(X)</td><td>6.0</td><td>17(0)</td><td>13(1</td><td>W&gt; 10.0</td><td>4 6</td><td>27</td></t<></td></t<>	11	54	0.040 <t< td=""><td>M&gt; 010.0</td><td>75(X)</td><td>6.0</td><td>17(0)</td><td>13(1</td><td>W&gt; 10.0</td><td>4 6</td><td>27</td></t<>	M> 010.0	75(X)	6.0	17(0)	13(1	W> 10.0	4 6	27
204	:	68206-R	3.10	0.68	30	26	0.020 <t< td=""><td>W&gt; (010)</td><td>I S(NX)</td><td>20</td><td>4(NN)</td><td>220</td><td>0.03 <t< td=""><td>15</td><td>02</td></t<></td></t<>	W> (010)	I S(NX)	20	4(NN)	220	0.03 <t< td=""><td>15</td><td>02</td></t<>	15	02
	-	6K207-R	3.50	0.79	32	28	T> ()4()()	0.010 <w< td=""><td>10000</td><td>28</td><td>47(K)</td><td>280</td><td>0.04 <t< td=""><td>15</td><td>78</td></t<></td></w<>	10000	28	47(K)	280	0.04 <t< td=""><td>15</td><td>78</td></t<>	15	78
Ŧ	=	6K208-R	4,00	0.70	30	27	W> 010.0	0.010 <w< td=""><td>16(83)</td><td>19</td><td>42(8)</td><td>260</td><td>0.02 <t< td=""><td>15</td><td>74</td></t<></td></w<>	16(83)	19	42(8)	260	0.02 <t< td=""><td>15</td><td>74</td></t<>	15	74
199	÷	6K215-S	40.0	1.40	72	32	2 2(M)	0.010 <w< td=""><td>17(жжи)</td><td>160</td><td>5100</td><td>35(K)</td><td>:</td><td>11</td><td>1300</td></w<>	17(жжи)	160	5100	35(K)	:	11	1300
:	-	6.K216-S	39.0	1.20 <te< td=""><td>74</td><td>31</td><td>1 6(8)</td><td>0.010 <w< td=""><td>17(XXX)</td><td>150</td><td>S(NN)</td><td>34(K)</td><td>60.0</td><td>43</td><td>13(8)</td></w<></td></te<>	74	31	1 6(8)	0.010 <w< td=""><td>17(XXX)</td><td>150</td><td>S(NN)</td><td>34(K)</td><td>60.0</td><td>43</td><td>13(8)</td></w<>	17(XXX)	150	S(NN)	34(K)	60.0	43	13(8)
195	2	68220-R	K.10	0.38	32	30	O HKO	M> 010.0	35680	43	47(H)	740	0.08	16	220
-		68221-R	01 X	0.62	33	29	0.580	0.010 <w< td=""><td>37(88)</td><td>42</td><td>48(8)</td><td>027</td><td>0.08</td><td>17</td><td>210</td></w<>	37(88)	42	48(8)	027	0.08	17	210
÷	:	6K222-R	9.60	0.38	31	30)	1.100	0.010 <w< td=""><td>34000</td><td>46</td><td>4)H(H)</td><td>720</td><td>0.05 <t< td=""><td>91</td><td>220</td></t<></td></w<>	34000	46	4)H(H)	720	0.05 <t< td=""><td>91</td><td>220</td></t<>	91	220

NOTES: blank or "..." indicates that data is not available for this sample.

 $^{0}$  <T<sup>0</sup> = a measurable trace amount: interpret with caution

" <TE" = a measurable trace after extra dilution or concentration.

"<br/><W"  $\approx$  no measurable response (zero): less than reported value.

"S" = split (same grab) sample

"R" = replicate (discrete grab) sample

Table C-4. Polycyclic aromatic hydrocarbon concentrations in sediment replicates.

All concentrations in mg.kg<sup>-1</sup> (ppm), dry weight.

T	PAIIs	0.57	1 64 1 72 1 37	8.92 8.81	71.13 71.95 v 81.19
	Pyrene	0.06 <t 0.06 <t< td=""><td>0.20 <t 0.22 <t 0.16 <t< td=""><td>1.25</td><td>8.56 8.26 10.14 &gt;/</td></t<></t </t </td></t<></t 	0.20 <t 0.22 <t 0.16 <t< td=""><td>1.25</td><td>8.56 8.26 10.14 &gt;/</td></t<></t </t 	1.25	8.56 8.26 10.14 >/
2	Phen- nthrene	0.07 <t 0.07 <t< td=""><td>0.15 <t 0.15 <t 0.10 <t< td=""><td>0.66 <t 0.79</t </td><td>7.65 6.73 8.80</td></t<></t </t </td></t<></t 	0.15 <t 0.15 <t 0.10 <t< td=""><td>0.66 <t 0.79</t </td><td>7.65 6.73 8.80</td></t<></t </t 	0.66 <t 0.79</t 	7.65 6.73 8.80
	Naph- halene a	0.04 <t 0.04 <t< td=""><td>0.20 <t 0.10 <t 0.10 <t< td=""><td>0.18 <t 0.16 <t< td=""><td>2.42 2.03 2.73</td></t<></t </td></t<></t </t </td></t<></t 	0.20 <t 0.10 <t 0.10 <t< td=""><td>0.18 <t 0.16 <t< td=""><td>2.42 2.03 2.73</td></t<></t </td></t<></t </t 	0.18 <t 0.16 <t< td=""><td>2.42 2.03 2.73</td></t<></t 	2.42 2.03 2.73
ndeno-	1,2,3- pyrene ti	0.04 <t 0.04 <t< td=""><td>0.07 <t 0.08 <t 0.07 <t< td=""><td>0.63 0.48</td><td>4 20 4 70 4.70</td></t<></t </t </td></t<></t 	0.07 <t 0.08 <t 0.07 <t< td=""><td>0.63 0.48</td><td>4 20 4 70 4.70</td></t<></t </t 	0.63 0.48	4 20 4 70 4.70
<u>بة</u>	huor- () ene cd)	0.04 <t 0.04 <t< td=""><td>0.04 <t 0.04 <t 0.04 <t< td=""><td>0.10 <t 0.11 <t< td=""><td>1 14 1 08 1.51</td></t<></t </td></t<></t </t </td></t<></t 	0.04 <t 0.04 <t 0.04 <t< td=""><td>0.10 <t 0.11 <t< td=""><td>1 14 1 08 1.51</td></t<></t </td></t<></t </t 	0.10 <t 0.11 <t< td=""><td>1 14 1 08 1.51</td></t<></t 	1 14 1 08 1.51
	fluor- F nthene	0.03 <t 0.03 <t< td=""><td>0.26 0.28 0.21</td><td>1.33</td><td>11.16 10.58 13.56 &gt;A</td></t<></t 	0.26 0.28 0.21	1.33	11.16 10.58 13.56 >A
vibenzo-	a,h)an- I racene al	0.04 <t 0.04 <t< td=""><td>0.04 <t 0.04 <t 0.04 <t< td=""><td>0.15 <t 0.10 <t< td=""><td>6.94 1-10 1.15</td></t<></t </td></t<></t </t </td></t<></t 	0.04 <t 0.04 <t 0.04 <t< td=""><td>0.15 <t 0.10 <t< td=""><td>6.94 1-10 1.15</td></t<></t </td></t<></t </t 	0.15 <t 0.10 <t< td=""><td>6.94 1-10 1.15</td></t<></t 	6.94 1-10 1.15
0	Chry- (2 sene th	0.02 <t 0.02 <t &lt;</t </t 	0.14 <t 0.16 <t 0.13 <t< td=""><td>0.78 0.81</td><td>6.13 6.59 6.36</td></t<></t </t 	0.78 0.81	6.13 6.59 6.36
	Benzo(a)- pyrene	0.04 <t 0.04 <t< td=""><td>010 <t 013 <t 009 <t< td=""><td>0.84 0.72</td><td>6.16 6.75 6.74</td></t<></t </t </td></t<></t 	010 <t 013 <t 009 <t< td=""><td>0.84 0.72</td><td>6.16 6.75 6.74</td></t<></t </t 	0.84 0.72	6.16 6.75 6.74
Benzo-	(g,h,i)- erylyne	0.04 <t 0.04 <t< td=""><td>0.04 <t 0.07 <t 0.06 <t< td=""><td>0.46 0.36 <t< td=""><td>3 22 3 46 3.52</td></t<></td></t<></t </t </td></t<></t 	0.04 <t 0.07 <t 0.06 <t< td=""><td>0.46 0.36 <t< td=""><td>3 22 3 46 3.52</td></t<></td></t<></t </t 	0.46 0.36 <t< td=""><td>3 22 3 46 3.52</td></t<>	3 22 3 46 3.52
Senzo(k)-	fluoran- thene p	0.02 <t 0.02 <t< td=""><td>0.07 <t 0.08 <t 0.07 <t< td=""><td>0.40</td><td>2.97 3.26 3.17</td></t<></t </t </td></t<></t 	0.07 <t 0.08 <t 0.07 <t< td=""><td>0.40</td><td>2.97 3.26 3.17</td></t<></t </t 	0.40	2.97 3.26 3.17
lenzo(b)-	horan- thene	0.06 <t 0.06 <t< td=""><td>0.15 <t 0.17 <t 0.15 <t< td=""><td>1.14</td><td>7.66 8.25 8.30</td></t<></t </t </td></t<></t 	0.15 <t 0.17 <t 0.15 <t< td=""><td>1.14</td><td>7.66 8.25 8.30</td></t<></t </t 	1.14	7.66 8.25 8.30
3enzo(a)- B	anthra- f	0.02 <t 0.02 <t< td=""><td>0.10 <t 0.12 <t 0.09 <t< td=""><td>0.75 0.72</td><td>5.90 6.37 6.64</td></t<></t </t </td></t<></t 	0.10 <t 0.12 <t 0.09 <t< td=""><td>0.75 0.72</td><td>5.90 6.37 6.64</td></t<></t </t 	0.75 0.72	5.90 6.37 6.64
-	Anthra-	0.01 <t 0.01 <t< td=""><td>0.04 <t 0.04 <t 0.02 <t< td=""><td>0 21 0 26</td><td>1.95 1.81 2.53</td></t<></t </t </td></t<></t 	0.04 <t 0.04 <t 0.02 <t< td=""><td>0 21 0 26</td><td>1.95 1.81 2.53</td></t<></t </t 	0 21 0 26	1.95 1.81 2.53
Ace-	hulane A	0.05 <w 0.05 <w< td=""><td>0.05 <w 0.05 <w 0.05 <w< td=""><td>0.05 <w 0.05 <w< td=""><td>0.36 <t 0.30 <t 0.40 <t< td=""></t<></t </t </td></w<></w </td></w<></w </w </td></w<></w 	0.05 <w 0.05 <w 0.05 <w< td=""><td>0.05 <w 0.05 <w< td=""><td>0.36 <t 0.30 <t 0.40 <t< td=""></t<></t </t </td></w<></w </td></w<></w </w 	0.05 <w 0.05 <w< td=""><td>0.36 <t 0.30 <t 0.40 <t< td=""></t<></t </t </td></w<></w 	0.36 <t 0.30 <t 0.40 <t< td=""></t<></t </t 
Ace-	naph-	0.04 <t 0.04 <t< td=""><td>0.04 <t 0.04 <t 0.04 <t< td=""><td>0.04 <t 0.04 <t< td=""><td>0.71 0.68 0.94</td></t<></t </td></t<></t </t </td></t<></t 	0.04 <t 0.04 <t 0.04 <t< td=""><td>0.04 <t 0.04 <t< td=""><td>0.71 0.68 0.94</td></t<></t </td></t<></t </t 	0.04 <t 0.04 <t< td=""><td>0.71 0.68 0.94</td></t<></t 	0.71 0.68 0.94
Field	Sample	68202-S 68203-S	682()6-R 682()7-R 682()8-R	68215-S 68216-S	6822()-R 68221-R 68222-R
	Sample	89/()8/16		z :	
	Station	Number 124 "	204	" 661	

NOTES: blank or "--" indicates that data is not available for this sample.

 $^{u}$  <T<sup>*u*</sup> = a measurable trace amount: interpret with caution.

"<W" = no measurable response (zero): less than reported value.

">A" = approximate result: exceeded normal range limit.

"S" = split (same grab) sample.

"R" = replicate (discrete grab) sample

Table C-5.	Sediment parameter correlation coefficients. Pearson Product-Moment analysis on log (x+1)-transformed
	concentration data; percentages were arc sin/x-transformed. Significant correlations at $p < 0.05$ are underlined
	Pearson Product-Moment $(n = 17)$ .

Table C-5. continued

	BkF	BghiPer	BaP	Chry	DahAnth	Flan	Fluor	IPyr	Naph	Phen	Pyr
Fines	0.16	0.16	0.18	0.17	0.11	0.17	0.05	0.17	0.08	01.0	0.17
Molst	0.41	0.42	0.41	110	0.43	()+()	017 ()	0.42	0.43	0.39	041
TOC	27.0	0.76	0.76	0.76	0.75	0.77	0.73	12.0	0.74	0.75	0.77
SOLEXT	0.06	0.08	() ()?	0.05	01.10	0.03	0.12	0.07	0.13	0.04	0.02
As	0.64	0.66	0.62	0.62	0.61	0.68	65.0	0.62	0.62	0.64	0.69
Cd	011	0.07	60.0	0.12	0.08	0.13	0.01	0.08	-0.02	0.10	0.13
٦,	0.48	0.46	0.51	0.52	0.36	0.55	0.34	110	0.32	0.47	0.54
Cu	0.63	0.62	0.63	164	0.59	0.65	0.56	0.63	0.57	1970	0.65
N	0.64	0.65	0.64	0.65	0.65	0.66	0.62	0.66	1971	0.65	0.66
Fe	() 41	0.41	0.39	0.42	0.45	0.43	0.54	041	61.0	0.47	0.42
ЪЪ	0.65	0.67	0.67	0.67	0.65	0.68	2970	0.68	0.66	0.65	0.69
Mg	0.46	0.42	0.47	0.49	0.33	0.53	0.34	0.42	0.27	0.47	0.52
Mn	0) 46	() 44	61-10	0.50	0.33	0.54	0.32	() 45	0.28	51 ()	0.53
Hg	0.72	0.72	0.73	0.72	0.72	12.0	0.63	0.74	0.66	0.69	0.73
ź	0.53	0.54	0.55	0.55	12.0	0.57	() 4)(	0.55	0.51	0.52	0.57
Zn	0.66	11.68	0.68	0.68	0.66	0.68	0.63	0.69	0.67	<u>0.66</u>	07.0
TPAHS	0.97	79.0	0.98	0.98	0.93	661	160	<u>197</u>	0.88	<u>96'0</u>	66.0
Ace	0.93	39.11	56.0	26.0	19.1	0.92	<u>99</u> .0	<u>195</u>	66.0	0.94	0.92
Anth	66.0	32.0	0.98	0.99	74.0	0.99	0.98	0.98	5610	1.00	660
BaA	101	001	001	<u>1.00</u>	0.98	1.00	0.96	<u> 44.()</u>	56.0	66.0	1.00
BbF	100T	1.00	1.00	1.00	0.98	66.0	26.0	001	6.03	<u>66 ()</u>	1.00
BkF	1.00	99.99	001	1.00	0.98	66.0	0.96	<u>999</u>	0.92	66.0	<u>1.00</u>
BghiPer	66.0	1.00	1.00	66-0	0.99	66.0	<u>7670</u>	<u>T (X)</u>	0.95	66.0	0.99
BaP	1.())	100	1.00	1.00	0.98	<u>99 ()</u>	0.96	1.00	1.93	0.99	001
Chry	<u>1.00</u>	<u>44.()</u>	( <del>)) T</del>	1.00	0.98	1.00	<u>96 ()</u>	<u>99.11</u>	0.92	<u>99 0</u>	( <u>)()</u> T
DahAnth	<u>86 ()</u>	66.0	0.98	0.98	I.00	0.96	0.98	<u>99</u> 0	<u>(1.96</u>	0.98	0.97
Flan	<u>99.0</u>	66.0	<u>99.0</u>	100 T	96.11	1.00	22.0	<u> 99 ()</u>	0.91	0.99	<u>1.00</u>
Fluor	0.96	76.0	0.96	0.96	0.98	0.45	(307)	<u>1.97</u>	98-0	197	26.0
IPyr	0.99	1.00	1.18)	0.99	0.99	0.99	197	00.0	0.95	0.98	0.99
Naph	192	36.0	0.93	0.92	0.96	16.0	39.0	20.0	1 ()()	193	0.92
Phen	66.0	66.0	66.0	6611	0.98	0.99	197	36.0	640	1.00	<u>46 ()</u>
Pyr	1.(N)	66.0	()() <sup>+</sup> T	001	197	1.00	0.95	<u>44.0</u>	0.92	66.0	1.00

Table C-6. Arsenic, heavy metals concentrations and moisture and lipid content in caged mussel replicates.All concentrations in mg.kg<sup>-1</sup> (ppm), wet weight.

		Field											
Station	Sample	Sample	Arsenic	Cadmium	Copper	Lead	Magnesium	Manganese	Mercury	Nickel	Zinc	Moisture	Lipids
Number	Date	Number										%	%
	89/08/15	62385	0.47	(8)5-1	1.50	0.59	226	860	0.112 <t< td=""><td>0.300 &lt;</td><td>32.0</td><td>83</td><td>0.22</td></t<>	0.300 <	32.0	83	0.22
:	-	62386	1.10	0001	1 20	06.0	17X	920	W> 10.0	< ()()() <	31.0	83	017 ()
:	:	62387	0.33	1.700	1.30	(),6() <	294	18(8)	W> 10.0	> ()())) <	47.0	82	0.38
52	NA	:	:	;	:	ł	;	;	:	:	:	:	:
124	NA	:	:	:	:	;	:	;	;	:	:	1	:
205	80/64/68	62388	0.21	0.210	1.40	0.70 <	247	1000	M> 10.0	() 5()() <	330	K3	0.32
-	-	62389	0.35	1 2(8) -	2.50	0.78	252	540	0.02 <t< td=""><td>() 500 &lt;</td><td>27.0</td><td>88</td><td>0.29</td></t<>	() 500 <	27.0	88	0.29
z	2	62390	0.43	0.100	2 ()()	0.81	287	1200	W> 10.0	<ul><li>()()() &lt;</li></ul>	41.0	84	0.32
123	x	62391	0.51	0.820	2 20	06.1	161	280	W> 10.0	().5(8) <	: 22.0	85	0.36
-		62392	0.67	0.300	2 ()()	0.69	153	300	M> 10.0	> ()()7()	21.0	жк	0.45
		62393	0.65	()(6()	2 60	0.83	235	820	W> 10.0	0.400 <	29.0	87	0.38
2014		62394	0.40	0.510	()(*)1	0.71	155	330	0.02 <t< td=""><td>&lt; () 4()() &lt;</td><td>20.0</td><td>87</td><td>0.57</td></t<>	< () 4()() <	20.0	87	0.57
=		62395	0.47	0 830	())( [	0.70 <	229	460	0.02 <t< td=""><td>0.500 &lt;</td><td>41.0</td><td>85</td><td>0.30</td></t<>	0.500 <	41.0	85	0.30
	-	62396	0.32	0.380	1.20	0.76	178	(12)	0.01 <w< td=""><td>0.500 &lt;</td><td>: 35.0</td><td>85</td><td>0.36</td></w<>	0.500 <	: 35.0	85	0.36
203	÷	62397	0.71	0.520	1 60	> ()9()	261	077	0.03 <t< td=""><td>() 4(X) &lt;</td><td>31.0</td><td>X6</td><td>0.29</td></t<>	() 4(X) <	31.0	X6	0.29
2	;	62398	0.36	0.630	2 ()()	0.64	153	95	0.03 <t< td=""><td>() 4()() &lt;</td><td>20 0</td><td>88</td><td>0.29</td></t<>	() 4()() <	20 0	88	0.29
:	I	62399	0.41	1.3(X)	2.80	> ()9()	280	1(XX)	0.02 <t< td=""><td>(),400 &lt;</td><td>43.0</td><td>84</td><td>0.42</td></t<>	(),400 <	43.0	84	0.42
122	:	68557	() 45	1.000	2.40	0.70 <	151	220	0.01 <w< td=""><td>0.500 &lt;</td><td>22.0</td><td>85</td><td>0.43</td></w<>	0.500 <	22.0	85	0.43
z	2	68558	0.54	0.460	3.90	0.70 <	203	K60	0.02 <t< td=""><td>0.508) &lt;</td><td>27.0</td><td>8.4</td><td>0.43</td></t<>	0.508) <	27.0	8.4	0.43
:	-	68559	0.40	0.270	2 ()()	0.70 <	270	12(x)	W> 10.0	() 508) <	38.01	81	0.28
202	NA	:	;	1	:	:	:	;	:	:	:	:	:
121	X0/60/6X	68560	0.63	0.260	1.20	> ()9 ()	011	44()	W> 10.0	0.400 <	0.61 2	82	0.50
	Ŧ	68561	0.46	0.560	2.30	0.60 <	139	120	W> 10.0	() 4()() <	0.81 5	83	0.43
	Ŧ	68562	0.36	1.200	1.60	0.70 <	263	1500	W> 10.0	0.500 <	41.0	K2	0.56
121-M	÷	68563	0.55	0.900	09.1	0.70 <	303	13081	W> 10.0	0.500 <	36.0	84	0.38
:	÷	68564	0.36	0.730	1.40	().5() <	266	750	W> 10.0	0.300 <	: 31.0	X6	0.40
		68565	0.24	0.940	2.20	> 090	223	540	0.02 <t< td=""><td>&lt; () (0) &lt;</td><td>: 33.0</td><td>82</td><td>0.31</td></t<>	< () (0) <	: 33.0	82	0.31
201	-	68566	0.30	1.100	2 ()()	> 09.0	324	(K)X [	W> 10.0	< () 4()) <	: 53.0	81	0.66
	z	68567	0.44	0.970	06.1	> ()9()	161	410	W> 10.0	() 4(8) <	33.0	ж2	0.51
:	:	68568	0.65	0.720	061	> (191)	232	026	W> 10.0	< ()(†())	27.0	Ж2	0.45
2()()	:	68569	0.30	0.500	1.20	0.70 <	222	1400	W> 10.0	() 500 <	39.0	КЗ	0.31
	:	68570	0.56	0.850	1 60	0.5% <	2.4K	14()()	W> 10.0	().400 <	39.0	КЗ	0.2%
-	÷	68571	0.21	0.320	1.10	0.70 <	222	11001	0.02 <t< td=""><td>0.500 &lt;</td><td>42.0</td><td>84</td><td>0.31</td></t<>	0.500 <	42.0	84	0.31
661	NA	;	;			;	:	:	:	:	:	;	1
198	80/69/68	68572	0.38	0011	1 10	1 10 <	226	650	M> 10.0	() 4()() <	32.0	83	0.63
2	:	68573	0.53	().55()	2.60	1 10 <	213	29()	W> 10.0	> ()()†())	28.0	K1	() 4()
*	12	6X574	0.30	() 4)()	1 20	0.57 <	24()	016	0.02 <t< td=""><td>&lt; () () () &lt;</td><td>33.0</td><td>84</td><td>0.84</td></t<>	< () () () <	33.0	84	0.84

### Table C-6. continued.

All concentrations in mg.kg<sup>-1</sup> (ppm), wet weight.

		Field			-								
Station	Sample	Sample	Arsenic	Cadmium	Capper	Lead	Magnesium	Manganese	Mercury	Nkckel	Zinc	Malsture	Lipids
Number	Date	Number										2%	0%
197	80/60/68	68575	0.34	0.790	2 30	0 66	289	12(8)	W> 10.0	0.4003 <	45 (1	81	0.58
÷	:	68576	0.68	0.510	1.40	0.70 <	Xt1	53	0.01 <w< td=""><td>(0.500) &lt;</td><td>22.0</td><td>82</td><td>0.66</td></w<>	(0.500) <	22.0	82	0.66
ε	:	68577	0.35	1.083	2 10	> () (() <	2.4()	CKIE .	0.01 <w< td=""><td>&gt; ()()† ()</td><td>48.0</td><td>H</td><td>0.48</td></w<>	> ()()† ()	48.0	H	0.48
197-M		68578	0.32	0.370	2 20	0.70 <	232	820	0.01 <w< td=""><td>() 5()() &lt;</td><td>31.0</td><td>81</td><td>0.47</td></w<>	() 5()() <	31.0	81	0.47
	1	68579	0.31	1 3001	2.80	0.50	306	I 4(X)	0.01 <w< td=""><td>&lt; ()()() &lt;</td><td>10.65</td><td>Ю.</td><td>0.69</td></w<>	< ()()() <	10.65	Ю.	0.69
-	1	6858()	0.30	0.660	2.20	> () ()	314	12(0)	0.01 <w< td=""><td>&lt; ()()() &lt;</td><td>44 ()</td><td>Н2</td><td>0.64</td></w<>	< ()()() <	44 ()	Н2	0.64
196	I	68581	0.26	0.500	1 50	0.70 <	240	070	W> 10.0	() 5()() <	35.0	83	() ()
:	z	68582	0.55	0.680	2.20	0.78	259	1300	0.20 <t< td=""><td>&lt; ()()() &lt;)</td><td>46()</td><td>83</td><td>0.72</td></t<>	< ()()() <)	46()	83	0.72
\$	r	68583	0.38	0.)(30	06.1	(15() <	243	1100	0.01 <w< td=""><td>&lt;0.400 &lt;</td><td>32.0</td><td>69</td><td>0.54</td></w<>	<0.400 <	32.0	69	0.54
195	÷	68584	0.51	1.300	1 60	0.70 <	263	070	W> 10.0	() 5()() <	46.0	81	0.42
-	:	68585	0.81	0.610	1.70	0.73	861	530	W> 10.0	0.300 <	2)(.()	84	0.55
\$		68586	0.31	0.990	1 50	0.68	294	12(0)	M> 10.0	0.400 <	39.0	83	0.51
127	:	68587	(146	0 6(8)	1 80	0.70 <	210	960	W> 10.0	() 500 <	25.0	ж	0.19
2	*	6MSH8	(); ()	0.850	1.90	(1.8(1) <	302	0061	W> 10.0	() 500 <	58 ()	85	0.46
	1	68589	0.26	0.970	1 80	> ()9()	374	0061	0.03 <t< td=""><td>&lt; ()()†())</td><td>54.0</td><td>¥4</td><td>0.38</td></t<>	< ()()†())	54.0	¥4	0.38
127-N	:	68590	0.34	1.100	2 10	> ()9()	140	0061	0.03 <t< td=""><td>0.390</td><td>63.0</td><td>83</td><td>0.51</td></t<>	0.390	63.0	83	0.51
Ŧ	*	68591	0.48	1 2(8)	1 70	> ()9()	266	1600	0.01 <w< td=""><td>&gt; 1000 &gt;</td><td>47 ()</td><td>83</td><td>0.38</td></w<>	> 1000 >	47 ()	83	0.38
:	I	68592	070	1 6(8)	2 80	0.60 <	350	1700	0.02 <t< td=""><td>0.520</td><td>44.0</td><td>85</td><td>0.38</td></t<>	0.520	44.0	85	0.38

NOTES: "--" indicates that data is not available for this parameter or sample.

"M" = mud-depth exposure; all others on bottom. "NA" = not available; cages lost. " <T" = a measurable trace amount: interpret with caution.

"< W" = no measurable response (zero): less than reported value.

"<" = less than reported value.

Table C-7. Polycyclic aromatic hydrocarbons concentrations in caged mussesl replicates.

weight.
wet
(qdd)
ug.kg <sup>-1</sup>
.u
All concentrations
1

	5	ald Aco.	Aca		Ro	nzula)-	tenzn(h)-	Ber	Tzofk)-	Benzo-			Dihenzo-			Indeno-					Total
Station	Sample Sar	mole naph-	naph-	Anthr	an an	uhra-	fluoran-	Ē	oran-	(g,h,i)-	Benzo(a)-	Chry-	-ns(n,s)	Fluor-	Fluor.	(1,2,3-	le N	-4d	Phen-		of 16
Number	Date Nut	mber thene	thylene	cene	5	sene	thene	-	hene	perylyne	pyrene	sene	thracene	anthene	ene	cd)pyren	e that	ene an	nthrene	Pyrene	PAHs
-	0/08/15 62	385 15	<t 5<="" td=""><td><w 1<="" td=""><td>T <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>W</td><td>H <t< td=""><td>₩&gt; Y</td><td>8 <w< td=""><td>× 6</td><td><t 7="" <<="" td=""><td>W 20 &lt;</td><td>Т 22</td><td><t <<="" td=""><td>W&gt; S</td><td>59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></t<></td></v<></td></t<></td></w></td></t>	<w 1<="" td=""><td>T <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>W</td><td>H <t< td=""><td>₩&gt; Y</td><td>8 <w< td=""><td>× 6</td><td><t 7="" <<="" td=""><td>W 20 &lt;</td><td>Т 22</td><td><t <<="" td=""><td>W&gt; S</td><td>59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></t<></td></v<></td></t<></td></w>	T <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>W</td><td>H <t< td=""><td>₩&gt; Y</td><td>8 <w< td=""><td>× 6</td><td><t 7="" <<="" td=""><td>W 20 &lt;</td><td>Т 22</td><td><t <<="" td=""><td>W&gt; S</td><td>59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></t<></td></v<></td></t<>	5 <v< td=""><td>7 &lt;</td><td>W</td><td>H <t< td=""><td>₩&gt; Y</td><td>8 <w< td=""><td>× 6</td><td><t 7="" <<="" td=""><td>W 20 &lt;</td><td>Т 22</td><td><t <<="" td=""><td>W&gt; S</td><td>59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></t<></td></v<>	7 <	W	H <t< td=""><td>₩&gt; Y</td><td>8 <w< td=""><td>× 6</td><td><t 7="" <<="" td=""><td>W 20 &lt;</td><td>Т 22</td><td><t <<="" td=""><td>W&gt; S</td><td>59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></t<>	₩> Y	8 <w< td=""><td>× 6</td><td><t 7="" <<="" td=""><td>W 20 &lt;</td><td>Т 22</td><td><t <<="" td=""><td>W&gt; S</td><td>59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<>	× 6	<t 7="" <<="" td=""><td>W 20 &lt;</td><td>Т 22</td><td><t <<="" td=""><td>W&gt; S</td><td>59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t>	W 20 <	Т 22	<t <<="" td=""><td>W&gt; S</td><td>59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t>	W> S	59 <t< td=""><td>115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<>	115 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<>	15 <t< td=""><td>280</td></t<>	280
2	" 62	386 13	<t 5<="" td=""><td><w td=""  <=""><td>l <t< td=""><td>T&gt; 7</td><td>&gt; 1</td><td>W</td><td>6 <w< td=""><td>h <w< td=""><td>8 <w< td=""><td>10</td><td><t 7="" <<="" td=""><td>W 21 &lt;</td><td>T 29</td><td><t (<="" td=""><td>√&gt; 3</td><td>56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></w<></td></w<></td></t<></td></w></td></t>	<w td=""  <=""><td>l <t< td=""><td>T&gt; 7</td><td>&gt; 1</td><td>W</td><td>6 <w< td=""><td>h <w< td=""><td>8 <w< td=""><td>10</td><td><t 7="" <<="" td=""><td>W 21 &lt;</td><td>T 29</td><td><t (<="" td=""><td>√&gt; 3</td><td>56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></w<></td></w<></td></t<></td></w>	l <t< td=""><td>T&gt; 7</td><td>&gt; 1</td><td>W</td><td>6 <w< td=""><td>h <w< td=""><td>8 <w< td=""><td>10</td><td><t 7="" <<="" td=""><td>W 21 &lt;</td><td>T 29</td><td><t (<="" td=""><td>√&gt; 3</td><td>56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></w<></td></w<></td></t<>	T> 7	> 1	W	6 <w< td=""><td>h <w< td=""><td>8 <w< td=""><td>10</td><td><t 7="" <<="" td=""><td>W 21 &lt;</td><td>T 29</td><td><t (<="" td=""><td>√&gt; 3</td><td>56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></w<></td></w<>	h <w< td=""><td>8 <w< td=""><td>10</td><td><t 7="" <<="" td=""><td>W 21 &lt;</td><td>T 29</td><td><t (<="" td=""><td>√&gt; 3</td><td>56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<></td></w<>	8 <w< td=""><td>10</td><td><t 7="" <<="" td=""><td>W 21 &lt;</td><td>T 29</td><td><t (<="" td=""><td>√&gt; 3</td><td>56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t></td></w<>	10	<t 7="" <<="" td=""><td>W 21 &lt;</td><td>T 29</td><td><t (<="" td=""><td>√&gt; 3</td><td>56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t></td></t>	W 21 <	T 29	<t (<="" td=""><td>√&gt; 3</td><td>56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<></td></t>	√> 3	56 <t< td=""><td>118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<></td></t<>	118 <t< td=""><td>15 <t< td=""><td>280</td></t<></td></t<>	15 <t< td=""><td>280</td></t<>	280
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z	62	389 11	<t 5<="" td=""><td><w 1.<="" td=""><td>3 <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2</td><td><li>1 7 </li></td><td>W 22 &lt;</td><td>T 27</td><td><t (<="" td=""><td>W&gt; 3</td><td>25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<></td></w></td></t>	<w 1.<="" td=""><td>3 <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2</td><td><li>1 7 </li></td><td>W 22 &lt;</td><td>T 27</td><td><t (<="" td=""><td>W&gt; 3</td><td>25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<></td></w>	3 <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2</td><td><li>1 7 </li></td><td>W 22 &lt;</td><td>T 27</td><td><t (<="" td=""><td>W&gt; 3</td><td>25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<>	5 <v< td=""><td>7 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2</td><td><li>1 7 </li></td><td>W 22 &lt;</td><td>T 27</td><td><t (<="" td=""><td>W&gt; 3</td><td>25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></v<>	7 <	W	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2</td><td><li>1 7 </li></td><td>W 22 &lt;</td><td>T 27</td><td><t (<="" td=""><td>W&gt; 3</td><td>25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>2</td><td><li>1 7 </li></td><td>W 22 &lt;</td><td>T 27</td><td><t (<="" td=""><td>W&gt; 3</td><td>25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<></td></t></td></w<></td></w<>	8 <w< td=""><td>2</td><td><li>1 7 </li></td><td>W 22 &lt;</td><td>T 27</td><td><t (<="" td=""><td>W&gt; 3</td><td>25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<></td></t></td></w<>	2	<li>1 7 </li>	W 22 <	T 27	<t (<="" td=""><td>W&gt; 3</td><td>25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<></td></t>	W> 3	25 <t< td=""><td>126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<></td></t<>	126 <t< td=""><td>24 <t< td=""><td>255</td></t<></td></t<>	24 <t< td=""><td>255</td></t<>	255
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123	" 62	391 185	<t 5<="" td=""><td><w 10<="" td=""><td>5 <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>Ś</td><td>ĥ <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>° 6</td><td><li>7 &lt;</li></td><td>W 27 &lt;</td><td>T 35</td><td><t (<="" td=""><td>X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<></td></w></td></t>	<w 10<="" td=""><td>5 <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>Ś</td><td>ĥ <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>° 6</td><td><li>7 &lt;</li></td><td>W 27 &lt;</td><td>T 35</td><td><t (<="" td=""><td>X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<></td></w>	5 <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>Ś</td><td>ĥ <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>° 6</td><td><li>7 &lt;</li></td><td>W 27 &lt;</td><td>T 35</td><td><t (<="" td=""><td>X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<>	5 <v< td=""><td>2 &lt;</td><td>Ś</td><td>ĥ <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>° 6</td><td><li>7 &lt;</li></td><td>W 27 &lt;</td><td>T 35</td><td><t (<="" td=""><td>X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<></td></v<>	2 <	Ś	ĥ <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>° 6</td><td><li>7 &lt;</li></td><td>W 27 &lt;</td><td>T 35</td><td><t (<="" td=""><td>X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>° 6</td><td><li>7 &lt;</li></td><td>W 27 &lt;</td><td>T 35</td><td><t (<="" td=""><td>X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<></td></t></td></w<></td></w<>	8 <w< td=""><td>° 6</td><td><li>7 &lt;</li></td><td>W 27 &lt;</td><td>T 35</td><td><t (<="" td=""><td>X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<></td></t></td></w<>	° 6	<li>7 &lt;</li>	W 27 <	T 35	<t (<="" td=""><td>X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<></td></t>	X <w< td=""><td>26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<></td></w<>	26 <t< td=""><td>159</td><td>16 <t< td=""><td>306</td></t<></td></t<>	159	16 <t< td=""><td>306</td></t<>	306
	. 62	392 8	<w 5<="" td=""><td><w ii<="" td=""><td>0 <t< td=""><td>8 <t< td=""><td>7 &lt;</td><td>W</td><td>21 <t< td=""><td>h ⊲W</td><td>8 <w< td=""><td>13 &lt;</td><td><li>1 &lt;</li></td><td>W 23 &lt;</td><td>T 21</td><td><t (<="" td=""><td>% <w< td=""><td>23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></t<></td></t<></td></t<></td></w></td></w>	<w ii<="" td=""><td>0 <t< td=""><td>8 <t< td=""><td>7 &lt;</td><td>W</td><td>21 <t< td=""><td>h ⊲W</td><td>8 <w< td=""><td>13 &lt;</td><td><li>1 &lt;</li></td><td>W 23 &lt;</td><td>T 21</td><td><t (<="" td=""><td>% <w< td=""><td>23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></t<></td></t<></td></t<></td></w>	0 <t< td=""><td>8 <t< td=""><td>7 &lt;</td><td>W</td><td>21 <t< td=""><td>h ⊲W</td><td>8 <w< td=""><td>13 &lt;</td><td><li>1 &lt;</li></td><td>W 23 &lt;</td><td>T 21</td><td><t (<="" td=""><td>% <w< td=""><td>23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></t<></td></t<></td></t<>	8 <t< td=""><td>7 &lt;</td><td>W</td><td>21 <t< td=""><td>h ⊲W</td><td>8 <w< td=""><td>13 &lt;</td><td><li>1 &lt;</li></td><td>W 23 &lt;</td><td>T 21</td><td><t (<="" td=""><td>% <w< td=""><td>23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></t<></td></t<>	7 <	W	21 <t< td=""><td>h ⊲W</td><td>8 <w< td=""><td>13 &lt;</td><td><li>1 &lt;</li></td><td>W 23 &lt;</td><td>T 21</td><td><t (<="" td=""><td>% <w< td=""><td>23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></t<>	h ⊲W	8 <w< td=""><td>13 &lt;</td><td><li>1 &lt;</li></td><td>W 23 &lt;</td><td>T 21</td><td><t (<="" td=""><td>% <w< td=""><td>23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<></td></w<></td></t></td></w<>	13 <	<li>1 &lt;</li>	W 23 <	T 21	<t (<="" td=""><td>% <w< td=""><td>23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<></td></w<></td></t>	% <w< td=""><td>23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<></td></w<>	23 <t< td=""><td>98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<></td></t<>	98 <t< td=""><td>14 <t< td=""><td>231</td></t<></td></t<>	14 <t< td=""><td>231</td></t<>	231
		393 18	<t 5<="" td=""><td><w it<="" td=""><td>s <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>12 &lt;</td><td>- 1 - L</td><td>W 28 &lt;</td><td>T 34</td><td><t iv<="" td=""><td>€ <t< td=""><td>30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></v<></td></t<></td></w></td></t>	<w it<="" td=""><td>s <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>12 &lt;</td><td>- 1 - L</td><td>W 28 &lt;</td><td>T 34</td><td><t iv<="" td=""><td>€ <t< td=""><td>30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></v<></td></t<></td></w>	s <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>12 &lt;</td><td>- 1 - L</td><td>W 28 &lt;</td><td>T 34</td><td><t iv<="" td=""><td>€ <t< td=""><td>30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></v<></td></t<>	5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>12 &lt;</td><td>- 1 - L</td><td>W 28 &lt;</td><td>T 34</td><td><t iv<="" td=""><td>€ <t< td=""><td>30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></v<>	2 <	W	6 <w< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>12 &lt;</td><td>- 1 - L</td><td>W 28 &lt;</td><td>T 34</td><td><t iv<="" td=""><td>€ <t< td=""><td>30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<></td></t<></td></t></td></w<></td></w<>	W> 9	8 <w< td=""><td>12 &lt;</td><td>- 1 - L</td><td>W 28 &lt;</td><td>T 34</td><td><t iv<="" td=""><td>€ <t< td=""><td>30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<></td></t<></td></t></td></w<>	12 <	- 1 - L	W 28 <	T 34	<t iv<="" td=""><td>€ <t< td=""><td>30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<></td></t<></td></t>	€ <t< td=""><td>30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<></td></t<>	30 <t< td=""><td>154</td><td>17 <t< td=""><td>328</td></t<></td></t<>	154	17 <t< td=""><td>328</td></t<>	328
204	" 62	394 13	<t 5<="" td=""><td><w 1.<="" td=""><td>4 <t< td=""><td>6 <t< td=""><td>7 &lt;</td><td>Ś</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>10</td><td>CT 7 &lt;</td><td>W 26 &lt;</td><td>T 31</td><td><t 2.<="" td=""><td>7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></t<></td></t<></td></w></td></t>	<w 1.<="" td=""><td>4 <t< td=""><td>6 <t< td=""><td>7 &lt;</td><td>Ś</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>10</td><td>CT 7 &lt;</td><td>W 26 &lt;</td><td>T 31</td><td><t 2.<="" td=""><td>7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></t<></td></t<></td></w>	4 <t< td=""><td>6 <t< td=""><td>7 &lt;</td><td>Ś</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>10</td><td>CT 7 &lt;</td><td>W 26 &lt;</td><td>T 31</td><td><t 2.<="" td=""><td>7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></t<></td></t<>	6 <t< td=""><td>7 &lt;</td><td>Ś</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>10</td><td>CT 7 &lt;</td><td>W 26 &lt;</td><td>T 31</td><td><t 2.<="" td=""><td>7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></t<>	7 <	Ś	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>10</td><td>CT 7 &lt;</td><td>W 26 &lt;</td><td>T 31</td><td><t 2.<="" td=""><td>7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>10</td><td>CT 7 &lt;</td><td>W 26 &lt;</td><td>T 31</td><td><t 2.<="" td=""><td>7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<></td></t></td></w<></td></w<>	8 <w< td=""><td>10</td><td>CT 7 &lt;</td><td>W 26 &lt;</td><td>T 31</td><td><t 2.<="" td=""><td>7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<></td></t></td></w<>	10	CT 7 <	W 26 <	T 31	<t 2.<="" td=""><td>7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<></td></t>	7 <t< td=""><td>33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<></td></t<>	33 <t< td=""><td>144</td><td>16 <t< td=""><td>320</td></t<></td></t<>	144	16 <t< td=""><td>320</td></t<>	320
	fr2	395 20	<t 5<="" td=""><td><w 1.<="" td=""><td>3 <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>Ŵ</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>oc</td><td><li>7 &lt;</li></td><td>W 28 &lt;</td><td>T 38</td><td><t (<="" td=""><td>W&gt; 3</td><td>23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<></td></w></td></t>	<w 1.<="" td=""><td>3 <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>Ŵ</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>oc</td><td><li>7 &lt;</li></td><td>W 28 &lt;</td><td>T 38</td><td><t (<="" td=""><td>W&gt; 3</td><td>23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<></td></w>	3 <t< td=""><td>5 <v< td=""><td>7 &lt;</td><td>Ŵ</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>oc</td><td><li>7 &lt;</li></td><td>W 28 &lt;</td><td>T 38</td><td><t (<="" td=""><td>W&gt; 3</td><td>23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<>	5 <v< td=""><td>7 &lt;</td><td>Ŵ</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>oc</td><td><li>7 &lt;</li></td><td>W 28 &lt;</td><td>T 38</td><td><t (<="" td=""><td>W&gt; 3</td><td>23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<></td></t></td></w<></td></w<></td></w<></td></v<>	7 <	Ŵ	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>oc</td><td><li>7 &lt;</li></td><td>W 28 &lt;</td><td>T 38</td><td><t (<="" td=""><td>W&gt; 3</td><td>23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<></td></t></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>oc</td><td><li>7 &lt;</li></td><td>W 28 &lt;</td><td>T 38</td><td><t (<="" td=""><td>W&gt; 3</td><td>23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<></td></t></td></w<></td></w<>	8 <w< td=""><td>oc</td><td><li>7 &lt;</li></td><td>W 28 &lt;</td><td>T 38</td><td><t (<="" td=""><td>W&gt; 3</td><td>23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<></td></t></td></w<>	oc	<li>7 &lt;</li>	W 28 <	T 38	<t (<="" td=""><td>W&gt; 3</td><td>23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<></td></t>	W> 3	23 <t< td=""><td>157</td><td>17 <t< td=""><td>304</td></t<></td></t<>	157	17 <t< td=""><td>304</td></t<>	304
=	" 62	396 10	<t 5<="" td=""><td>W&gt;</td><td>9 <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>y y</td><td><li>7 &lt;</li></td><td>W 18 &lt;</td><td>T 24</td><td><t (<="" td=""><td>5 <w< td=""><td>29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<></td></t>	W>	9 <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>y y</td><td><li>7 &lt;</li></td><td>W 18 &lt;</td><td>T 24</td><td><t (<="" td=""><td>5 <w< td=""><td>29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<></td></v<></td></t<>	5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>y y</td><td><li>7 &lt;</li></td><td>W 18 &lt;</td><td>T 24</td><td><t (<="" td=""><td>5 <w< td=""><td>29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<></td></v<>	2 <	W	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>y y</td><td><li>7 &lt;</li></td><td>W 18 &lt;</td><td>T 24</td><td><t (<="" td=""><td>5 <w< td=""><td>29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>y y</td><td><li>7 &lt;</li></td><td>W 18 &lt;</td><td>T 24</td><td><t (<="" td=""><td>5 <w< td=""><td>29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<></td></w<></td></t></td></w<></td></w<>	8 <w< td=""><td>y y</td><td><li>7 &lt;</li></td><td>W 18 &lt;</td><td>T 24</td><td><t (<="" td=""><td>5 <w< td=""><td>29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<></td></w<></td></t></td></w<>	y y	<li>7 &lt;</li>	W 18 <	T 24	<t (<="" td=""><td>5 <w< td=""><td>29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<></td></w<></td></t>	5 <w< td=""><td>29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<></td></w<>	29 <t< td=""><td>97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<></td></t<>	97 <t< td=""><td>II <t< td=""><td>204</td></t<></td></t<>	II <t< td=""><td>204</td></t<>	204
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٤		398 12	<t 5<="" td=""><td><w 1<="" td=""><td>T <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>11 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2 6</td><td>7 7 &lt;</td><td>W 26 &lt;</td><td>T 23</td><td><t i.<="" td=""><td>3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></t<></td></v<></td></t<></td></w></td></t>	<w 1<="" td=""><td>T <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>11 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2 6</td><td>7 7 &lt;</td><td>W 26 &lt;</td><td>T 23</td><td><t i.<="" td=""><td>3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></t<></td></v<></td></t<></td></w>	T <t< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>11 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2 6</td><td>7 7 &lt;</td><td>W 26 &lt;</td><td>T 23</td><td><t i.<="" td=""><td>3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></t<></td></v<></td></t<>	5 <v< td=""><td>2 &lt;</td><td>W</td><td>11 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2 6</td><td>7 7 &lt;</td><td>W 26 &lt;</td><td>T 23</td><td><t i.<="" td=""><td>3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></t<></td></v<>	2 <	W	11 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>2 6</td><td>7 7 &lt;</td><td>W 26 &lt;</td><td>T 23</td><td><t i.<="" td=""><td>3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<></td></t></td></w<></td></w<></td></t<>	6 <w< td=""><td>8 <w< td=""><td>2 6</td><td>7 7 &lt;</td><td>W 26 &lt;</td><td>T 23</td><td><t i.<="" td=""><td>3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<></td></t></td></w<></td></w<>	8 <w< td=""><td>2 6</td><td>7 7 &lt;</td><td>W 26 &lt;</td><td>T 23</td><td><t i.<="" td=""><td>3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<></td></t></td></w<>	2 6	7 7 <	W 26 <	T 23	<t i.<="" td=""><td>3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<></td></t>	3 <t< td=""><td>22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<></td></t<>	22 <t< td=""><td>105</td><td>19 <t< td=""><td>249</td></t<></td></t<>	105	19 <t< td=""><td>249</td></t<>	249
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z		568 8	<w 5<="" td=""><td>W&gt;</td><td>9 <w< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>ų</td><td>V 7 &lt;</td><td>W 14 &lt;</td><td>T 16</td><td><w <<="" td=""><td>W&gt; 3</td><td>29 <t< td=""><td>39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<></td></t<></td></w></td></w<></td></w<></td></w<></td></v<></td></w<></td></w>	W>	9 <w< td=""><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>ų</td><td>V 7 &lt;</td><td>W 14 &lt;</td><td>T 16</td><td><w <<="" td=""><td>W&gt; 3</td><td>29 <t< td=""><td>39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<></td></t<></td></w></td></w<></td></w<></td></w<></td></v<></td></w<>	5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>ų</td><td>V 7 &lt;</td><td>W 14 &lt;</td><td>T 16</td><td><w <<="" td=""><td>W&gt; 3</td><td>29 <t< td=""><td>39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<></td></t<></td></w></td></w<></td></w<></td></w<></td></v<>	2 <	W	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>ų</td><td>V 7 &lt;</td><td>W 14 &lt;</td><td>T 16</td><td><w <<="" td=""><td>W&gt; 3</td><td>29 <t< td=""><td>39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<></td></t<></td></w></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>ų</td><td>V 7 &lt;</td><td>W 14 &lt;</td><td>T 16</td><td><w <<="" td=""><td>W&gt; 3</td><td>29 <t< td=""><td>39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<></td></t<></td></w></td></w<></td></w<>	8 <w< td=""><td>ų</td><td>V 7 &lt;</td><td>W 14 &lt;</td><td>T 16</td><td><w <<="" td=""><td>W&gt; 3</td><td>29 <t< td=""><td>39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<></td></t<></td></w></td></w<>	ų	V 7 <	W 14 <	T 16	<w <<="" td=""><td>W&gt; 3</td><td>29 <t< td=""><td>39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<></td></t<></td></w>	W> 3	29 <t< td=""><td>39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<></td></t<>	39 <t< td=""><td>9 <t< td=""><td>201</td></t<></td></t<>	9 <t< td=""><td>201</td></t<>	201
2181	" (68.	569 8	<w 5<="" td=""><td>W&gt;</td><td>W&gt; 4</td><td>5 <v< td=""><td>7 &lt;</td><td>Ś</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>œ</td><td>1 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>21 <t< td=""><td>23 <t< td=""><td>8 <w< td=""><td>52</td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<></td></v<></td></w>	W>	W> 4	5 <v< td=""><td>7 &lt;</td><td>Ś</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>œ</td><td>1 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>21 <t< td=""><td>23 <t< td=""><td>8 <w< td=""><td>52</td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<></td></v<>	7 <	Ś	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>œ</td><td>1 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>21 <t< td=""><td>23 <t< td=""><td>8 <w< td=""><td>52</td></w<></td></t<></td></t<></td></w<></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>œ</td><td>1 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>21 <t< td=""><td>23 <t< td=""><td>8 <w< td=""><td>52</td></w<></td></t<></td></t<></td></w<></td></w<></td></w<>	8 <w< td=""><td>œ</td><td>1 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>21 <t< td=""><td>23 <t< td=""><td>8 <w< td=""><td>52</td></w<></td></t<></td></t<></td></w<></td></w<>	œ	1 7 <	W 10 <	W 16	<w< td=""><td>W&gt; 3</td><td>21 <t< td=""><td>23 <t< td=""><td>8 <w< td=""><td>52</td></w<></td></t<></td></t<></td></w<>	W> 3	21 <t< td=""><td>23 <t< td=""><td>8 <w< td=""><td>52</td></w<></td></t<></td></t<>	23 <t< td=""><td>8 <w< td=""><td>52</td></w<></td></t<>	8 <w< td=""><td>52</td></w<>	52
1	68.	570 8	<w 5<="" td=""><td>W&gt;</td><td>W&gt; 6</td><td>5 <v< td=""><td>7 &lt;</td><td>W</td><td>W&gt; 9</td><td>6 <w< td=""><td>8 <w< td=""><td>ý V</td><td>1 1</td><td>W 13 &lt;</td><td>T 16</td><td><w (<="" td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>9 <t< td=""><td>46</td></t<></td></t<></td></w<></td></w></td></w<></td></w<></td></v<></td></w>	W>	W> 6	5 <v< td=""><td>7 &lt;</td><td>W</td><td>W&gt; 9</td><td>6 <w< td=""><td>8 <w< td=""><td>ý V</td><td>1 1</td><td>W 13 &lt;</td><td>T 16</td><td><w (<="" td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>9 <t< td=""><td>46</td></t<></td></t<></td></w<></td></w></td></w<></td></w<></td></v<>	7 <	W	W> 9	6 <w< td=""><td>8 <w< td=""><td>ý V</td><td>1 1</td><td>W 13 &lt;</td><td>T 16</td><td><w (<="" td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>9 <t< td=""><td>46</td></t<></td></t<></td></w<></td></w></td></w<></td></w<>	8 <w< td=""><td>ý V</td><td>1 1</td><td>W 13 &lt;</td><td>T 16</td><td><w (<="" td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>9 <t< td=""><td>46</td></t<></td></t<></td></w<></td></w></td></w<>	ý V	1 1	W 13 <	T 16	<w (<="" td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>9 <t< td=""><td>46</td></t<></td></t<></td></w<></td></w>	W> 3	19 <w< td=""><td>18 <t< td=""><td>9 <t< td=""><td>46</td></t<></td></t<></td></w<>	18 <t< td=""><td>9 <t< td=""><td>46</td></t<></td></t<>	9 <t< td=""><td>46</td></t<>	46
ı	" (68	571 8	<w 5<="" td=""><td>-W</td><td>W&gt; 6</td><td>5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>Ŷ</td><td>cT 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>8 <w< td=""><td>24</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></v<></td></w>	-W	W> 6	5 <v< td=""><td>2 &lt;</td><td>W</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>Ŷ</td><td>cT 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>8 <w< td=""><td>24</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<></td></v<>	2 <	W	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>Ŷ</td><td>cT 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>8 <w< td=""><td>24</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>Ŷ</td><td>cT 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>8 <w< td=""><td>24</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<>	8 <w< td=""><td>Ŷ</td><td>cT 7 &lt;</td><td>W 10 &lt;</td><td>W 16</td><td><w< td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>8 <w< td=""><td>24</td></w<></td></t<></td></w<></td></w<></td></w<>	Ŷ	cT 7 <	W 10 <	W 16	<w< td=""><td>W&gt; 3</td><td>19 <w< td=""><td>18 <t< td=""><td>8 <w< td=""><td>24</td></w<></td></t<></td></w<></td></w<>	W> 3	19 <w< td=""><td>18 <t< td=""><td>8 <w< td=""><td>24</td></w<></td></t<></td></w<>	18 <t< td=""><td>8 <w< td=""><td>24</td></w<></td></t<>	8 <w< td=""><td>24</td></w<>	24
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3 861	19/(19/18 68.	572 39	<t 5<="" td=""><td><t 1<="" td=""><td>7 <t< td=""><td>20 <t< td=""><td>25 &lt;</td><td>٢T</td><td>6 <w< td=""><td>(v &lt; W</td><td>8 <w< td=""><td>51 &lt;</td><td>7 7 C</td><td>W 161</td><td>55</td><td>٢</td><td>2 <w 2<="" td=""><td>200</td><td>205</td><td>111</td><td>889</td></w></td></w<></td></w<></td></t<></td></t<></td></t></td></t>	<t 1<="" td=""><td>7 <t< td=""><td>20 <t< td=""><td>25 &lt;</td><td>٢T</td><td>6 <w< td=""><td>(v &lt; W</td><td>8 <w< td=""><td>51 &lt;</td><td>7 7 C</td><td>W 161</td><td>55</td><td>٢</td><td>2 <w 2<="" td=""><td>200</td><td>205</td><td>111</td><td>889</td></w></td></w<></td></w<></td></t<></td></t<></td></t>	7 <t< td=""><td>20 <t< td=""><td>25 &lt;</td><td>٢T</td><td>6 <w< td=""><td>(v &lt; W</td><td>8 <w< td=""><td>51 &lt;</td><td>7 7 C</td><td>W 161</td><td>55</td><td>٢</td><td>2 <w 2<="" td=""><td>200</td><td>205</td><td>111</td><td>889</td></w></td></w<></td></w<></td></t<></td></t<>	20 <t< td=""><td>25 &lt;</td><td>٢T</td><td>6 <w< td=""><td>(v &lt; W</td><td>8 <w< td=""><td>51 &lt;</td><td>7 7 C</td><td>W 161</td><td>55</td><td>٢</td><td>2 <w 2<="" td=""><td>200</td><td>205</td><td>111</td><td>889</td></w></td></w<></td></w<></td></t<>	25 <	٢T	6 <w< td=""><td>(v &lt; W</td><td>8 <w< td=""><td>51 &lt;</td><td>7 7 C</td><td>W 161</td><td>55</td><td>٢</td><td>2 <w 2<="" td=""><td>200</td><td>205</td><td>111</td><td>889</td></w></td></w<></td></w<>	(v < W	8 <w< td=""><td>51 &lt;</td><td>7 7 C</td><td>W 161</td><td>55</td><td>٢</td><td>2 <w 2<="" td=""><td>200</td><td>205</td><td>111</td><td>889</td></w></td></w<>	51 <	7 7 C	W 161	55	٢	2 <w 2<="" td=""><td>200</td><td>205</td><td>111</td><td>889</td></w>	200	205	111	889
x	(68.	573 29	<t 5<="" td=""><td><w i.<="" td=""><td>3 <t< td=""><td>15 <t< td=""><td>22 &lt;</td><td>T</td><td>12 <t< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>27 &lt;</td><td>2 L</td><td>W 82</td><td>38</td><td><t (<="" td=""><td>5 <w 1<="" td=""><td>161 <t< td=""><td>163</td><td>58</td><td>620</td></t<></td></w></td></t></td></w<></td></t<></td></t<></td></t<></td></w></td></t>	<w i.<="" td=""><td>3 <t< td=""><td>15 <t< td=""><td>22 &lt;</td><td>T</td><td>12 <t< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>27 &lt;</td><td>2 L</td><td>W 82</td><td>38</td><td><t (<="" td=""><td>5 <w 1<="" td=""><td>161 <t< td=""><td>163</td><td>58</td><td>620</td></t<></td></w></td></t></td></w<></td></t<></td></t<></td></t<></td></w>	3 <t< td=""><td>15 <t< td=""><td>22 &lt;</td><td>T</td><td>12 <t< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>27 &lt;</td><td>2 L</td><td>W 82</td><td>38</td><td><t (<="" td=""><td>5 <w 1<="" td=""><td>161 <t< td=""><td>163</td><td>58</td><td>620</td></t<></td></w></td></t></td></w<></td></t<></td></t<></td></t<>	15 <t< td=""><td>22 &lt;</td><td>T</td><td>12 <t< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>27 &lt;</td><td>2 L</td><td>W 82</td><td>38</td><td><t (<="" td=""><td>5 <w 1<="" td=""><td>161 <t< td=""><td>163</td><td>58</td><td>620</td></t<></td></w></td></t></td></w<></td></t<></td></t<>	22 <	T	12 <t< td=""><td>W&gt; 9</td><td>8 <w< td=""><td>27 &lt;</td><td>2 L</td><td>W 82</td><td>38</td><td><t (<="" td=""><td>5 <w 1<="" td=""><td>161 <t< td=""><td>163</td><td>58</td><td>620</td></t<></td></w></td></t></td></w<></td></t<>	W> 9	8 <w< td=""><td>27 &lt;</td><td>2 L</td><td>W 82</td><td>38</td><td><t (<="" td=""><td>5 <w 1<="" td=""><td>161 <t< td=""><td>163</td><td>58</td><td>620</td></t<></td></w></td></t></td></w<>	27 <	2 L	W 82	38	<t (<="" td=""><td>5 <w 1<="" td=""><td>161 <t< td=""><td>163</td><td>58</td><td>620</td></t<></td></w></td></t>	5 <w 1<="" td=""><td>161 <t< td=""><td>163</td><td>58</td><td>620</td></t<></td></w>	161 <t< td=""><td>163</td><td>58</td><td>620</td></t<>	163	58	620
		574 48	<t 6<="" td=""><td><t ii<="" td=""><td>6 <t< td=""><td>30 <t< td=""><td>35 &lt;</td><td>τ,</td><td>23 <t< td=""><td>ń <w< td=""><td>8 <w< td=""><td>63</td><td>2 &lt;</td><td>W 165</td><td>54</td><td>٢</td><td>W 1</td><td>861</td><td>181</td><td>135</td><td>954</td></w<></td></w<></td></t<></td></t<></td></t<></td></t></td></t>	<t ii<="" td=""><td>6 <t< td=""><td>30 <t< td=""><td>35 &lt;</td><td>τ,</td><td>23 <t< td=""><td>ń <w< td=""><td>8 <w< td=""><td>63</td><td>2 &lt;</td><td>W 165</td><td>54</td><td>٢</td><td>W 1</td><td>861</td><td>181</td><td>135</td><td>954</td></w<></td></w<></td></t<></td></t<></td></t<></td></t>	6 <t< td=""><td>30 <t< td=""><td>35 &lt;</td><td>τ,</td><td>23 <t< td=""><td>ń <w< td=""><td>8 <w< td=""><td>63</td><td>2 &lt;</td><td>W 165</td><td>54</td><td>٢</td><td>W 1</td><td>861</td><td>181</td><td>135</td><td>954</td></w<></td></w<></td></t<></td></t<></td></t<>	30 <t< td=""><td>35 &lt;</td><td>τ,</td><td>23 <t< td=""><td>ń <w< td=""><td>8 <w< td=""><td>63</td><td>2 &lt;</td><td>W 165</td><td>54</td><td>٢</td><td>W 1</td><td>861</td><td>181</td><td>135</td><td>954</td></w<></td></w<></td></t<></td></t<>	35 <	τ,	23 <t< td=""><td>ń <w< td=""><td>8 <w< td=""><td>63</td><td>2 &lt;</td><td>W 165</td><td>54</td><td>٢</td><td>W 1</td><td>861</td><td>181</td><td>135</td><td>954</td></w<></td></w<></td></t<>	ń <w< td=""><td>8 <w< td=""><td>63</td><td>2 &lt;</td><td>W 165</td><td>54</td><td>٢</td><td>W 1</td><td>861</td><td>181</td><td>135</td><td>954</td></w<></td></w<>	8 <w< td=""><td>63</td><td>2 &lt;</td><td>W 165</td><td>54</td><td>٢</td><td>W 1</td><td>861</td><td>181</td><td>135</td><td>954</td></w<>	63	2 <	W 165	54	٢	W 1	861	181	135	954

	Field	Ace-	Ace-		Benzo(a)-	Benzn(b)-	Benzo(k)-	Benzo-			Dibenzo-			Indeno-				Total
5	Sample	naph-	naph-	Anthra-	anthra-	fluoran.	fluoran-	(g,h,i)-	Benzo(a)-	Chry-	-ne(h,e)	Fluor-	Fluor-	(1,2,3-	Naph-	Phen-		of 16
2	Number	thene	thylene	cene	cene	thene	thene	perylyne	pyrene	sene	thracene	anthene	ene	cd)pyrene	thalene	anthrene	Pyrene	PALIS
	68575	47 <t< td=""><td>8 <t< td=""><td>20) <t< td=""><td>51 <t< td=""><td>86</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>98</td><td>7 <w< td=""><td>237</td><td>66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<>	8 <t< td=""><td>20) <t< td=""><td>51 <t< td=""><td>86</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>98</td><td>7 <w< td=""><td>237</td><td>66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<>	20) <t< td=""><td>51 <t< td=""><td>86</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>98</td><td>7 <w< td=""><td>237</td><td>66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<>	51 <t< td=""><td>86</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>98</td><td>7 <w< td=""><td>237</td><td>66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<>	86	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>98</td><td>7 <w< td=""><td>237</td><td>66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>98</td><td>7 <w< td=""><td>237</td><td>66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<></td></w<></td></w<></td></w<>	8 <w< td=""><td>98</td><td>7 <w< td=""><td>237</td><td>66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<></td></w<></td></w<>	98	7 <w< td=""><td>237</td><td>66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<></td></w<>	237	66 <t< td=""><td>6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<></td></t<>	6 <v< td=""><td>V 239</td><td>236</td><td>188</td><td>1276</td></v<>	V 239	236	188	1276
-	68576	42 <t< td=""><td>6 <t< td=""><td>21 <t< td=""><td>73</td><td>112</td><td>NIU 69</td><td>6 <w< td=""><td>32 <t< td=""><td>108</td><td>7 <w< td=""><td>218</td><td>61 <t< td=""><td>44 <t< td=""><td>&gt; 190 -</td><td>CT 225</td><td>183</td><td>1315</td></t<></td></t<></td></w<></td></t<></td></w<></td></t<></td></t<></td></t<>	6 <t< td=""><td>21 <t< td=""><td>73</td><td>112</td><td>NIU 69</td><td>6 <w< td=""><td>32 <t< td=""><td>108</td><td>7 <w< td=""><td>218</td><td>61 <t< td=""><td>44 <t< td=""><td>&gt; 190 -</td><td>CT 225</td><td>183</td><td>1315</td></t<></td></t<></td></w<></td></t<></td></w<></td></t<></td></t<>	21 <t< td=""><td>73</td><td>112</td><td>NIU 69</td><td>6 <w< td=""><td>32 <t< td=""><td>108</td><td>7 <w< td=""><td>218</td><td>61 <t< td=""><td>44 <t< td=""><td>&gt; 190 -</td><td>CT 225</td><td>183</td><td>1315</td></t<></td></t<></td></w<></td></t<></td></w<></td></t<>	73	112	NIU 69	6 <w< td=""><td>32 <t< td=""><td>108</td><td>7 <w< td=""><td>218</td><td>61 <t< td=""><td>44 <t< td=""><td>&gt; 190 -</td><td>CT 225</td><td>183</td><td>1315</td></t<></td></t<></td></w<></td></t<></td></w<>	32 <t< td=""><td>108</td><td>7 <w< td=""><td>218</td><td>61 <t< td=""><td>44 <t< td=""><td>&gt; 190 -</td><td>CT 225</td><td>183</td><td>1315</td></t<></td></t<></td></w<></td></t<>	108	7 <w< td=""><td>218</td><td>61 <t< td=""><td>44 <t< td=""><td>&gt; 190 -</td><td>CT 225</td><td>183</td><td>1315</td></t<></td></t<></td></w<>	218	61 <t< td=""><td>44 <t< td=""><td>&gt; 190 -</td><td>CT 225</td><td>183</td><td>1315</td></t<></td></t<>	44 <t< td=""><td>&gt; 190 -</td><td>CT 225</td><td>183</td><td>1315</td></t<>	> 190 -	CT 225	183	1315
-	68577	59 <t< td=""><td>8 <t< td=""><td>27 <t< td=""><td>47 <t< td=""><td>94</td><td>6 <w< td=""><td>6 <w< td=""><td>18 <t< td=""><td>85</td><td>7 <w< td=""><td>230</td><td>83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<>	8 <t< td=""><td>27 <t< td=""><td>47 <t< td=""><td>94</td><td>6 <w< td=""><td>6 <w< td=""><td>18 <t< td=""><td>85</td><td>7 <w< td=""><td>230</td><td>83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<>	27 <t< td=""><td>47 <t< td=""><td>94</td><td>6 <w< td=""><td>6 <w< td=""><td>18 <t< td=""><td>85</td><td>7 <w< td=""><td>230</td><td>83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<>	47 <t< td=""><td>94</td><td>6 <w< td=""><td>6 <w< td=""><td>18 <t< td=""><td>85</td><td>7 <w< td=""><td>230</td><td>83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<>	94	6 <w< td=""><td>6 <w< td=""><td>18 <t< td=""><td>85</td><td>7 <w< td=""><td>230</td><td>83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<>	6 <w< td=""><td>18 <t< td=""><td>85</td><td>7 <w< td=""><td>230</td><td>83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<></td></w<></td></t<></td></w<>	18 <t< td=""><td>85</td><td>7 <w< td=""><td>230</td><td>83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<></td></w<></td></t<>	85	7 <w< td=""><td>230</td><td>83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<></td></w<>	230	83 <t< td=""><td>6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<></td></t<>	6 <v< td=""><td>V 294</td><td>321</td><td>161</td><td>1457</td></v<>	V 294	321	161	1457
_	68578	6() <t< td=""><td>% <t< td=""><td>29 <t< td=""><td>33 <t< td=""><td>78</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>82</td><td>7 <w< td=""><td>227</td><td>85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<>	% <t< td=""><td>29 <t< td=""><td>33 <t< td=""><td>78</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>82</td><td>7 <w< td=""><td>227</td><td>85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<>	29 <t< td=""><td>33 <t< td=""><td>78</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>82</td><td>7 <w< td=""><td>227</td><td>85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<>	33 <t< td=""><td>78</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>82</td><td>7 <w< td=""><td>227</td><td>85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<>	78	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>82</td><td>7 <w< td=""><td>227</td><td>85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>82</td><td>7 <w< td=""><td>227</td><td>85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<></td></w<></td></w<></td></w<>	8 <w< td=""><td>82</td><td>7 <w< td=""><td>227</td><td>85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<></td></w<></td></w<>	82	7 <w< td=""><td>227</td><td>85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<></td></w<>	227	85 <t< td=""><td>6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<></td></t<>	6 <v< td=""><td>V 267</td><td>327</td><td>173</td><td>1369</td></v<>	V 267	327	173	1369
-	68579	47 <t< td=""><td>5 <w< td=""><td>23 <t< td=""><td>51 <t< td=""><td>74</td><td>6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>128</td><td>7 <w< td=""><td>381</td><td>72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<></td></w<></td></t<>	5 <w< td=""><td>23 <t< td=""><td>51 <t< td=""><td>74</td><td>6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>128</td><td>7 <w< td=""><td>381</td><td>72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<></td></w<>	23 <t< td=""><td>51 <t< td=""><td>74</td><td>6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>128</td><td>7 <w< td=""><td>381</td><td>72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<>	51 <t< td=""><td>74</td><td>6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>128</td><td>7 <w< td=""><td>381</td><td>72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<>	74	6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>128</td><td>7 <w< td=""><td>381</td><td>72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<></td></w<></td></w<></td></w<></td></w<>	6 <w< td=""><td>% <w< td=""><td>128</td><td>7 <w< td=""><td>381</td><td>72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<></td></w<></td></w<></td></w<>	% <w< td=""><td>128</td><td>7 <w< td=""><td>381</td><td>72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<></td></w<></td></w<>	128	7 <w< td=""><td>381</td><td>72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<></td></w<>	381	72 <t< td=""><td>6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<></td></t<>	6 <v< td=""><td>V 203</td><td>285</td><td>271</td><td>1535</td></v<>	V 203	285	271	1535
-	68580	52 <t< td=""><td>5 <w< td=""><td>24 <t< td=""><td>72 <t< td=""><td>87</td><td>6 <w< td=""><td>6 <w< td=""><td>22 <t< td=""><td>134</td><td>7 <w< td=""><td>319</td><td>66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></w<></td></t<>	5 <w< td=""><td>24 <t< td=""><td>72 <t< td=""><td>87</td><td>6 <w< td=""><td>6 <w< td=""><td>22 <t< td=""><td>134</td><td>7 <w< td=""><td>319</td><td>66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></w<>	24 <t< td=""><td>72 <t< td=""><td>87</td><td>6 <w< td=""><td>6 <w< td=""><td>22 <t< td=""><td>134</td><td>7 <w< td=""><td>319</td><td>66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<>	72 <t< td=""><td>87</td><td>6 <w< td=""><td>6 <w< td=""><td>22 <t< td=""><td>134</td><td>7 <w< td=""><td>319</td><td>66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<></td></w<></td></t<></td></w<></td></w<></td></t<>	87	6 <w< td=""><td>6 <w< td=""><td>22 <t< td=""><td>134</td><td>7 <w< td=""><td>319</td><td>66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<></td></w<></td></t<></td></w<></td></w<>	6 <w< td=""><td>22 <t< td=""><td>134</td><td>7 <w< td=""><td>319</td><td>66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<></td></w<></td></t<></td></w<>	22 <t< td=""><td>134</td><td>7 <w< td=""><td>319</td><td>66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<></td></w<></td></t<>	134	7 <w< td=""><td>319</td><td>66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<></td></w<>	319	66 <t< td=""><td>6 &lt; 9</td><td>V 217</td><td>246</td><td>248</td><td>1487</td></t<>	6 < 9	V 217	246	248	1487
-	68581	201	21 <t< td=""><td>75 <t< td=""><td>114 UI</td><td>115 UIN</td><td>6 <w< td=""><td>6 <w< td=""><td>58 <t< td=""><td>153 UI</td><td>7 <w< td=""><td>353</td><td>260</td><td>6 <v< td=""><td>V 786</td><td>821</td><td>283</td><td>2858</td></v<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<>	75 <t< td=""><td>114 UI</td><td>115 UIN</td><td>6 <w< td=""><td>6 <w< td=""><td>58 <t< td=""><td>153 UI</td><td>7 <w< td=""><td>353</td><td>260</td><td>6 <v< td=""><td>V 786</td><td>821</td><td>283</td><td>2858</td></v<></td></w<></td></t<></td></w<></td></w<></td></t<>	114 UI	115 UIN	6 <w< td=""><td>6 <w< td=""><td>58 <t< td=""><td>153 UI</td><td>7 <w< td=""><td>353</td><td>260</td><td>6 <v< td=""><td>V 786</td><td>821</td><td>283</td><td>2858</td></v<></td></w<></td></t<></td></w<></td></w<>	6 <w< td=""><td>58 <t< td=""><td>153 UI</td><td>7 <w< td=""><td>353</td><td>260</td><td>6 <v< td=""><td>V 786</td><td>821</td><td>283</td><td>2858</td></v<></td></w<></td></t<></td></w<>	58 <t< td=""><td>153 UI</td><td>7 <w< td=""><td>353</td><td>260</td><td>6 <v< td=""><td>V 786</td><td>821</td><td>283</td><td>2858</td></v<></td></w<></td></t<>	153 UI	7 <w< td=""><td>353</td><td>260</td><td>6 <v< td=""><td>V 786</td><td>821</td><td>283</td><td>2858</td></v<></td></w<>	353	260	6 <v< td=""><td>V 786</td><td>821</td><td>283</td><td>2858</td></v<>	V 786	821	283	2858
_	68582	156	17 <t< td=""><td>58 <t< td=""><td>133</td><td>181 UIN</td><td>6 <w< td=""><td>6 <w< td=""><td>65 <j< td=""><td>163</td><td>7 <w< td=""><td>309</td><td>2(8)</td><td>6 <v< td=""><td>V 584</td><td>641</td><td>246</td><td>2572</td></v<></td></w<></td></j<></td></w<></td></w<></td></t<></td></t<>	58 <t< td=""><td>133</td><td>181 UIN</td><td>6 <w< td=""><td>6 <w< td=""><td>65 <j< td=""><td>163</td><td>7 <w< td=""><td>309</td><td>2(8)</td><td>6 <v< td=""><td>V 584</td><td>641</td><td>246</td><td>2572</td></v<></td></w<></td></j<></td></w<></td></w<></td></t<>	133	181 UIN	6 <w< td=""><td>6 <w< td=""><td>65 <j< td=""><td>163</td><td>7 <w< td=""><td>309</td><td>2(8)</td><td>6 <v< td=""><td>V 584</td><td>641</td><td>246</td><td>2572</td></v<></td></w<></td></j<></td></w<></td></w<>	6 <w< td=""><td>65 <j< td=""><td>163</td><td>7 <w< td=""><td>309</td><td>2(8)</td><td>6 <v< td=""><td>V 584</td><td>641</td><td>246</td><td>2572</td></v<></td></w<></td></j<></td></w<>	65 <j< td=""><td>163</td><td>7 <w< td=""><td>309</td><td>2(8)</td><td>6 <v< td=""><td>V 584</td><td>641</td><td>246</td><td>2572</td></v<></td></w<></td></j<>	163	7 <w< td=""><td>309</td><td>2(8)</td><td>6 <v< td=""><td>V 584</td><td>641</td><td>246</td><td>2572</td></v<></td></w<>	309	2(8)	6 <v< td=""><td>V 584</td><td>641</td><td>246</td><td>2572</td></v<>	V 584	641	246	2572
-	68583	166	17 <t< td=""><td>63 <t< td=""><td>61</td><td>95</td><td>6 <w< td=""><td>6 <w< td=""><td>24 <t< td=""><td>92</td><td>7 <w< td=""><td>297</td><td>223</td><td>6 <v< td=""><td>V 672</td><td>723</td><td>232</td><td>2665</td></v<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<>	63 <t< td=""><td>61</td><td>95</td><td>6 <w< td=""><td>6 <w< td=""><td>24 <t< td=""><td>92</td><td>7 <w< td=""><td>297</td><td>223</td><td>6 <v< td=""><td>V 672</td><td>723</td><td>232</td><td>2665</td></v<></td></w<></td></t<></td></w<></td></w<></td></t<>	61	95	6 <w< td=""><td>6 <w< td=""><td>24 <t< td=""><td>92</td><td>7 <w< td=""><td>297</td><td>223</td><td>6 <v< td=""><td>V 672</td><td>723</td><td>232</td><td>2665</td></v<></td></w<></td></t<></td></w<></td></w<>	6 <w< td=""><td>24 <t< td=""><td>92</td><td>7 <w< td=""><td>297</td><td>223</td><td>6 <v< td=""><td>V 672</td><td>723</td><td>232</td><td>2665</td></v<></td></w<></td></t<></td></w<>	24 <t< td=""><td>92</td><td>7 <w< td=""><td>297</td><td>223</td><td>6 <v< td=""><td>V 672</td><td>723</td><td>232</td><td>2665</td></v<></td></w<></td></t<>	92	7 <w< td=""><td>297</td><td>223</td><td>6 <v< td=""><td>V 672</td><td>723</td><td>232</td><td>2665</td></v<></td></w<>	297	223	6 <v< td=""><td>V 672</td><td>723</td><td>232</td><td>2665</td></v<>	V 672	723	232	2665
-	68584	148	15 <t< td=""><td>52 <t< td=""><td>63</td><td>67 UIN</td><td>54 <t< td=""><td>6 <w< td=""><td>29 <t< td=""><td>76</td><td>7 <w< td=""><td>216</td><td>189</td><td>6 <v< td=""><td>V 567</td><td>615</td><td>165</td><td>2189</td></v<></td></w<></td></t<></td></w<></td></t<></td></t<></td></t<>	52 <t< td=""><td>63</td><td>67 UIN</td><td>54 <t< td=""><td>6 <w< td=""><td>29 <t< td=""><td>76</td><td>7 <w< td=""><td>216</td><td>189</td><td>6 <v< td=""><td>V 567</td><td>615</td><td>165</td><td>2189</td></v<></td></w<></td></t<></td></w<></td></t<></td></t<>	63	67 UIN	54 <t< td=""><td>6 <w< td=""><td>29 <t< td=""><td>76</td><td>7 <w< td=""><td>216</td><td>189</td><td>6 <v< td=""><td>V 567</td><td>615</td><td>165</td><td>2189</td></v<></td></w<></td></t<></td></w<></td></t<>	6 <w< td=""><td>29 <t< td=""><td>76</td><td>7 <w< td=""><td>216</td><td>189</td><td>6 <v< td=""><td>V 567</td><td>615</td><td>165</td><td>2189</td></v<></td></w<></td></t<></td></w<>	29 <t< td=""><td>76</td><td>7 <w< td=""><td>216</td><td>189</td><td>6 <v< td=""><td>V 567</td><td>615</td><td>165</td><td>2189</td></v<></td></w<></td></t<>	76	7 <w< td=""><td>216</td><td>189</td><td>6 <v< td=""><td>V 567</td><td>615</td><td>165</td><td>2189</td></v<></td></w<>	216	189	6 <v< td=""><td>V 567</td><td>615</td><td>165</td><td>2189</td></v<>	V 567	615	165	2189
-	68585	173	15 <t< td=""><td>64 <t< td=""><td>33 <t< td=""><td>37 <t< td=""><td>W&gt; 9</td><td>6 <w< td=""><td>8 <w< td=""><td>51 <t< td=""><td>7 <w< td=""><td>269</td><td>223</td><td>6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<>	64 <t< td=""><td>33 <t< td=""><td>37 <t< td=""><td>W&gt; 9</td><td>6 <w< td=""><td>8 <w< td=""><td>51 <t< td=""><td>7 <w< td=""><td>269</td><td>223</td><td>6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<>	33 <t< td=""><td>37 <t< td=""><td>W&gt; 9</td><td>6 <w< td=""><td>8 <w< td=""><td>51 <t< td=""><td>7 <w< td=""><td>269</td><td>223</td><td>6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<>	37 <t< td=""><td>W&gt; 9</td><td>6 <w< td=""><td>8 <w< td=""><td>51 <t< td=""><td>7 <w< td=""><td>269</td><td>223</td><td>6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<></td></w<></td></t<></td></w<></td></w<></td></t<>	W> 9	6 <w< td=""><td>8 <w< td=""><td>51 <t< td=""><td>7 <w< td=""><td>269</td><td>223</td><td>6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<></td></w<></td></t<></td></w<></td></w<>	8 <w< td=""><td>51 <t< td=""><td>7 <w< td=""><td>269</td><td>223</td><td>6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<></td></w<></td></t<></td></w<>	51 <t< td=""><td>7 <w< td=""><td>269</td><td>223</td><td>6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<></td></w<></td></t<>	7 <w< td=""><td>269</td><td>223</td><td>6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<></td></w<>	269	223	6 <v< td=""><td>V 638</td><td>737</td><td>200</td><td>2441</td></v<>	V 638	737	200	2441
-	68586	150	14 <t< td=""><td>55 <t< td=""><td>57</td><td>83</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>06</td><td>7 <w< td=""><td>310</td><td>198</td><td>6 <v< td=""><td>V 596</td><td>668</td><td>234</td><td>2455</td></v<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<>	55 <t< td=""><td>57</td><td>83</td><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>06</td><td>7 <w< td=""><td>310</td><td>198</td><td>6 <v< td=""><td>V 596</td><td>668</td><td>234</td><td>2455</td></v<></td></w<></td></w<></td></w<></td></w<></td></t<>	57	83	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>06</td><td>7 <w< td=""><td>310</td><td>198</td><td>6 <v< td=""><td>V 596</td><td>668</td><td>234</td><td>2455</td></v<></td></w<></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>06</td><td>7 <w< td=""><td>310</td><td>198</td><td>6 <v< td=""><td>V 596</td><td>668</td><td>234</td><td>2455</td></v<></td></w<></td></w<></td></w<>	8 <w< td=""><td>06</td><td>7 <w< td=""><td>310</td><td>198</td><td>6 <v< td=""><td>V 596</td><td>668</td><td>234</td><td>2455</td></v<></td></w<></td></w<>	06	7 <w< td=""><td>310</td><td>198</td><td>6 <v< td=""><td>V 596</td><td>668</td><td>234</td><td>2455</td></v<></td></w<>	310	198	6 <v< td=""><td>V 596</td><td>668</td><td>234</td><td>2455</td></v<>	V 596	668	234	2455
-	68587	147	14 <t< td=""><td>53 <t< td=""><td>47 <t< td=""><td>: 39 <t< td=""><td>36 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>57 &lt;7</td><td>W&gt; 7</td><td>176</td><td>661</td><td>6 <v< td=""><td>V 554</td><td>615</td><td>142</td><td>2079</td></v<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<></td></t<>	53 <t< td=""><td>47 <t< td=""><td>: 39 <t< td=""><td>36 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>57 &lt;7</td><td>W&gt; 7</td><td>176</td><td>661</td><td>6 <v< td=""><td>V 554</td><td>615</td><td>142</td><td>2079</td></v<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<>	47 <t< td=""><td>: 39 <t< td=""><td>36 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>57 &lt;7</td><td>W&gt; 7</td><td>176</td><td>661</td><td>6 <v< td=""><td>V 554</td><td>615</td><td>142</td><td>2079</td></v<></td></w<></td></w<></td></t<></td></t<></td></t<>	: 39 <t< td=""><td>36 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>57 &lt;7</td><td>W&gt; 7</td><td>176</td><td>661</td><td>6 <v< td=""><td>V 554</td><td>615</td><td>142</td><td>2079</td></v<></td></w<></td></w<></td></t<></td></t<>	36 <t< td=""><td>6 <w< td=""><td>8 <w< td=""><td>57 &lt;7</td><td>W&gt; 7</td><td>176</td><td>661</td><td>6 <v< td=""><td>V 554</td><td>615</td><td>142</td><td>2079</td></v<></td></w<></td></w<></td></t<>	6 <w< td=""><td>8 <w< td=""><td>57 &lt;7</td><td>W&gt; 7</td><td>176</td><td>661</td><td>6 <v< td=""><td>V 554</td><td>615</td><td>142</td><td>2079</td></v<></td></w<></td></w<>	8 <w< td=""><td>57 &lt;7</td><td>W&gt; 7</td><td>176</td><td>661</td><td>6 <v< td=""><td>V 554</td><td>615</td><td>142</td><td>2079</td></v<></td></w<>	57 <7	W> 7	176	661	6 <v< td=""><td>V 554</td><td>615</td><td>142</td><td>2079</td></v<>	V 554	615	142	2079
	68588	1(1)	11 <t< td=""><td>36 <t< td=""><td>41 <t< td=""><td>T&gt; ())</td><td>6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>69</td><td>7 <w< td=""><td>197</td><td>148 <t< td=""><td>6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<>	36 <t< td=""><td>41 <t< td=""><td>T&gt; ())</td><td>6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>69</td><td>7 <w< td=""><td>197</td><td>148 <t< td=""><td>6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<></td></t<>	41 <t< td=""><td>T&gt; ())</td><td>6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>69</td><td>7 <w< td=""><td>197</td><td>148 <t< td=""><td>6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<></td></t<>	T> ())	6 <w< td=""><td>6 <w< td=""><td>% <w< td=""><td>69</td><td>7 <w< td=""><td>197</td><td>148 <t< td=""><td>6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<></td></t<></td></w<></td></w<></td></w<></td></w<>	6 <w< td=""><td>% <w< td=""><td>69</td><td>7 <w< td=""><td>197</td><td>148 <t< td=""><td>6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<></td></t<></td></w<></td></w<></td></w<>	% <w< td=""><td>69</td><td>7 <w< td=""><td>197</td><td>148 <t< td=""><td>6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<></td></t<></td></w<></td></w<>	69	7 <w< td=""><td>197</td><td>148 <t< td=""><td>6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<></td></t<></td></w<>	197	148 <t< td=""><td>6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<></td></t<>	6 <w< td=""><td>V 431</td><td>144</td><td>158</td><td>1703</td></w<>	V 431	144	158	1703
-	68589	56 <t< td=""><td>7 <t< td=""><td>18 <t< td=""><td>58</td><td>59 UIN</td><td>44 <t< td=""><td>6 <w< td=""><td>29 <t< td=""><td>67</td><td>7 <w< td=""><td>137</td><td>75 <t< td=""><td>6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<></td></t<></td></w<></td></t<></td></w<></td></t<></td></t<></td></t<></td></t<>	7 <t< td=""><td>18 <t< td=""><td>58</td><td>59 UIN</td><td>44 <t< td=""><td>6 <w< td=""><td>29 <t< td=""><td>67</td><td>7 <w< td=""><td>137</td><td>75 <t< td=""><td>6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<></td></t<></td></w<></td></t<></td></w<></td></t<></td></t<></td></t<>	18 <t< td=""><td>58</td><td>59 UIN</td><td>44 <t< td=""><td>6 <w< td=""><td>29 <t< td=""><td>67</td><td>7 <w< td=""><td>137</td><td>75 <t< td=""><td>6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<></td></t<></td></w<></td></t<></td></w<></td></t<></td></t<>	58	59 UIN	44 <t< td=""><td>6 <w< td=""><td>29 <t< td=""><td>67</td><td>7 <w< td=""><td>137</td><td>75 <t< td=""><td>6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<></td></t<></td></w<></td></t<></td></w<></td></t<>	6 <w< td=""><td>29 <t< td=""><td>67</td><td>7 <w< td=""><td>137</td><td>75 <t< td=""><td>6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<></td></t<></td></w<></td></t<></td></w<>	29 <t< td=""><td>67</td><td>7 <w< td=""><td>137</td><td>75 <t< td=""><td>6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<></td></t<></td></w<></td></t<>	67	7 <w< td=""><td>137</td><td>75 <t< td=""><td>6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<></td></t<></td></w<>	137	75 <t< td=""><td>6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<></td></t<>	6 <v< td=""><td>V 265</td><td>202</td><td>114</td><td>1072</td></v<>	V 265	202	114	1072
-	68590	65 <t< td=""><td>7 <t< td=""><td>15 <t< td=""><td>34 <t< td=""><td>28 <t< td=""><td>18 <t< td=""><td>€ <w< td=""><td>8 <w< td=""><td>55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<></td></t<></td></t<>	7 <t< td=""><td>15 <t< td=""><td>34 <t< td=""><td>28 <t< td=""><td>18 <t< td=""><td>€ <w< td=""><td>8 <w< td=""><td>55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<></td></t<>	15 <t< td=""><td>34 <t< td=""><td>28 <t< td=""><td>18 <t< td=""><td>€ <w< td=""><td>8 <w< td=""><td>55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<>	34 <t< td=""><td>28 <t< td=""><td>18 <t< td=""><td>€ <w< td=""><td>8 <w< td=""><td>55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<></td></t<>	28 <t< td=""><td>18 <t< td=""><td>€ <w< td=""><td>8 <w< td=""><td>55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<></td></t<>	18 <t< td=""><td>€ <w< td=""><td>8 <w< td=""><td>55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></t<>	€ <w< td=""><td>8 <w< td=""><td>55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<>	8 <w< td=""><td>55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<></td></w<>	55 <t< td=""><td>7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<></td></t<>	7 <w< td=""><td>125</td><td>79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<></td></w<>	125	79 <t< td=""><td>6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<></td></t<>	6 <v< td=""><td>V 307</td><td>207</td><td>101</td><td>1601</td></v<>	V 307	207	101	1601
-	68591	56 <t< td=""><td>6 <t< td=""><td>16 <t< td=""><td>38 <t< td=""><td>56 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<></td></t<>	6 <t< td=""><td>16 <t< td=""><td>38 <t< td=""><td>56 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<></td></t<>	16 <t< td=""><td>38 <t< td=""><td>56 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<>	38 <t< td=""><td>56 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></t<>	56 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></w<></td></t<>	6 <w< td=""><td>6 <w< td=""><td>8 <w< td=""><td>59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<></td></w<>	6 <w< td=""><td>8 <w< td=""><td>59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<></td></w<></td></w<>	8 <w< td=""><td>59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<></td></w<>	59 <t< td=""><td>7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<></td></t<>	7 <w< td=""><td>124</td><td>7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<></td></w<>	124	7() <t< td=""><td>6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<></td></t<>	6 <v< td=""><td>V 272</td><td>161</td><td>79</td><td>985</td></v<>	V 272	161	79	985
	68592	41 <t< td=""><td>5 <w< td=""><td>13 <t< td=""><td>31 <t< td=""><td>43 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>W&gt; 8</td><td>49 &lt;7</td><td>7 <w< td=""><td>901</td><td>56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<></td></w<></td></t<>	5 <w< td=""><td>13 <t< td=""><td>31 <t< td=""><td>43 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>W&gt; 8</td><td>49 &lt;7</td><td>7 <w< td=""><td>901</td><td>56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<></td></w<>	13 <t< td=""><td>31 <t< td=""><td>43 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>W&gt; 8</td><td>49 &lt;7</td><td>7 <w< td=""><td>901</td><td>56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></t<></td></t<>	31 <t< td=""><td>43 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>W&gt; 8</td><td>49 &lt;7</td><td>7 <w< td=""><td>901</td><td>56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<></td></w<></td></w<></td></w<></td></t<></td></t<>	43 <t< td=""><td>6 <w< td=""><td>6 <w< td=""><td>W&gt; 8</td><td>49 &lt;7</td><td>7 <w< td=""><td>901</td><td>56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<></td></w<></td></w<></td></w<></td></t<>	6 <w< td=""><td>6 <w< td=""><td>W&gt; 8</td><td>49 &lt;7</td><td>7 <w< td=""><td>901</td><td>56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<></td></w<></td></w<></td></w<>	6 <w< td=""><td>W&gt; 8</td><td>49 &lt;7</td><td>7 <w< td=""><td>901</td><td>56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<></td></w<></td></w<>	W> 8	49 <7	7 <w< td=""><td>901</td><td>56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<></td></w<>	901	56 <t< td=""><td>6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<></td></t<>	6 <w< td=""><td>V 201</td><td>159</td><td>77%</td><td>783</td></w<>	V 201	159	77%	783

NOTES: "..." indicates that data is not available for this parameter or sample.

"M" after station number indicates mid-depth exposure; all others on hottom

"NA" = not available; cages lost.

" <T" = a measurable frace amount: interpret with caution

"<W" = no measurable response (zeru); less than reported value.

"UIN" = unreliable: indeterminate interference (result not included in 'Total PAHs')

65

# Table C-7. continued.All concentrations in ug.kg<sup>-1</sup> (ppb), wet weight.

transformed concentration data; percentages were arc sin/x-transformed. Significant correlations at p < 0.05 are underlined (n Mussel contaminant correlation coefficients for Total PAHs and metals. Pearson Product-Moment analysis on log (x+1)-= 13) . Table C-8.

	TPAHs	As	Cd	Cu	Ъb	Mg	Nłu	Hg	Nickel	Zn	Moist	Lipids
TPAHs	1 (0)	0.02	0.34	110	80.0	0.51	91-0	0.42	-0.24	0.50	-0.22	0.50
As	0.02	1 00	0.18	0.38	0.37	61.0-	-0.52	-0.28	61-0-	15 ()-	0.16	0.20
PD	0.34	HL 0	1 (0)	20.07	10.0	0.58	0.26	0.18	0.20	0.35	-0.27	016
Ca	110-	0.38	0.02	001	01.0	-0.07	-0.18	0.06	-0.15	68.0-	0.13	-0.12
Ρþ	0.08	0.37	10.0	010	100	-0.26	-0.55	60.01	0.37	64.0	0.63	20.01
Mg	0.51	61-19-	0.58	-0.07	-0.26	1 (X)	0.81	0.25	-0.09	0.83	0.23	11-0-
Ma	0.36	-0.52	01 26	-018	() 55	18.0	1 ()()	0.20	12.0-	28.0	-0.42	11.02
Hg	0.42	-0.28	.0 18	0.06	60.01	0.25	0.20	1 ()()	-0.05	0.18	0.07	0.18
Nicket	62-0-	64 ()-	-0.20	51.01	0.37	6() ()-	-0.21	50.05	1 (X)	20.01	0.37	-0.38
Zn	0.50	-0.54	0.35	66.0-	EF 0-	0.83	0.85	0.18	-0.07	001	-0.35	10.0-
Maist	-0.22	0.16	-0.27	0.13	0.63	-0.23	-0.42	0.07	61.17	-0.35	1 ()(1	-0.57
1 fnide	0 50	0.20	0.16	-0.12	-0.07	110-	11 0-	0 18	81-0-	0.01	12:0-	(10)

Mussel contaminant correlation coefficients for PAH compounds and metals. Pearson Product-Moment analysis on log (x+1)-transformed concentration data; percentages were arc sin/x-transformed. Significant correlations at p < 0.05 are underlined. Pearson Product-Moment (n = 13) . Table C-9.

Acen	Acen 1 (N)	Acy 0.99 1.00	<b>Anth</b> 0.99	BaA U21 Ous	86F 0.85 0.90	BkF 0.59	HaP ().8() ().83	Chry 0.87 0.92	Flan 0.93 0.96	Flaor LOO D 98	1P -0.33 -0.31	Naph 0.99 1.(X)	Phen 0.99 0.98	Pyr 0.92 0.95	TPAIIS 0.97 0.98	As 0.02 -0.03	Cd 0.31 0.32	Cu -0.13 -0.15	44 0 0	
Anth	6610	76.0	101	160	28.0	0.58	181	0.87	120	66.0	-() 26	191	1.00	160	96.0	0.08	0.29	-0.07		KE D
BaA	160	24.0	164	001	0.98	0.60	191	<u>99.0</u>	0.46	16.0	KL O.	0.94	0.91	192	24.0	-0.02	61.0	80.0-	0-	02
BbF	0.85	06.0	0.85	0.98	1 ()()	0.60	161	<u>99</u> 0	0.96	0.85	11.0-	0.88	0.85	19.0	0.92	90.0-	61.0	-0.07	0-	ŝ
BkF	0.59	0.62	0.58	09.0	0.60	1 00	0.30	0.63	0.69	. 62.0	10.0-	0.64	0.61	0.70	0.73	\$0.0	0.35	-013	0.0	×
BaP	0.80	0.83	18.0	6670	16.0	0.30	1 (0)	06.0	0.82	0.80	-0.15	0.80	0.79	0.83	0.79	-012	0.03	10.0-	0.0-	7
Chry	0.87	0.92	0.87	66-11	0.99	0.63	06.0	1 (10	191	0.87	-0.13	1670	0.87	9.98	0.94	-0.07	61.0	010	0.0-	5
Flan	67.0	0.96	0.92	0.96	0.96	0.69	0.82	19.1	001	0.92	61.01	9670	66.0	1.00	1.98	0.01	0.32	-0.12	0.0	~
Haer	1.00	86.0	1.99	0.91	0.85	0.59	0.80	0.87	0.92	1 ()()	-0.30	96.0	1.00	192	0.96	0.02	0.31	11-0-	0	_
đ	££ ()-	-0.31	-0.26	-018	11.0-	10.0-	-0.15	-0.13	61.01	-030	1 (0)	0.31	-0.28	81 ()-	-0.22	95 (1	-0.06	0.02	0.0-	
Naph	0.99	1.00	1.97	0.94	0.88	0.64	0.80	161)	0.96	0.98	16.0-	1 00	0.98	24.0	97.0	10.01	0.34	-0.15	0.0	_
Phen	66.0	0.98	T (6)	19.0	0.85	0.61	92.0	28.0	0.93	()() T	-0.28	<u>86.0</u>	00.1	0.92	1.97	0.06	0.33	()()-	0.16	
Pyr	0.92	24.0	191	1.97	0.97	0.20	0.83	36.0	100	0.92	)(I U-	24.0	0.92	1 (10	0.98	10.0-	0.31	-0.12	0.0	_
TPAHs	1.97	0.98	96.0	1.95	0.92	0.73	0.79	0.94	0.98	0.96	-0.22	0.98	0.97	86.0	100.1	0.02	0.34	11.0.	0.0	~
As	0.02	-0.03	0.09	-0.07	90.05	0.05	-0.12	20.02	t0 0	0.02	0.36	0.0-	90.0	10.01	0.02	1 00	HI O	0.38	0.37	
Cd	0.31	0.32	0.29	61.0	61.0	0.35	0.03	0.19	0.32	15.05	0.06	0.34	0.33	0.31	0.34	0.13	001	0.07	0.0	_
Cu	0.13	-0.15	20.0-	HO ()*	-0.07	-0.13	10.01	010-	-0.12	11 0-	0.05	-0.15	60 0-	-0.12	110-	0 38	0.07	1.00	10	_
Pb	0.08	()()()	KI ()	-0.02	£0.0°	0.08	10.04	-0.02	0.03	11.0	-0.05	0.00	0.16	10.0	0.08	0.37	0.01	01.0	÷.	_
Mg	0.52	0.55	() 46	1) 46	() 42	PF ()	0.13	0.43	0.47	0.51	-0.50	0.54	61 ()	0.48	0.51	64 0-	0.58	-0.07	-() 2(	~
Mn	() 41	1) 48	0.31	0.43	() 4()	0.26	61 ()	0.38	91 ()	0.38	61:01	0.45	0.34	0.38	0.36	-0.52	1) 26	-018	-0.5	~
å	() 2()	KF ()	0.54	0.58	0.52	-0.13	0.76	0.52	0.42	0.50	60.0-	0.45	61 (1	0.42	() 42	-0.28	KU OF	0.06	-0.0	-
Nickel	-0.27	08.05	-0.22	-0.29	-0.29	-0.24	-0.20	16.02	-0.33	0.23	90.02	-0.32	-0.22	-0.32	-0.29	61-01-	-0.20	-0.15	0.30	~
Z.n	() 40	0.55	0.42	0.50	() 5()	61 ()	()† ()	() 4)(	0.49	1) 47	()†()-	0.53	510	0.51	0.50	-0.54	0.35	6t (I-	-0.4	~
Mobil	-0.15	-0.25	90.0-	-0.30	-0.38	90.0-	41 24	0.35	-0.35	11.0-	0.07	-0.25	010	91 ()-	-0.22	0.16	-0.27	0.13	9.0	-
Lipids	0.41	0.46	0.39	0.55	0.59	0.24	0.51	197	0.60	0.39	0.03	HT ()	() 41	0.59	0.50	() 2()	0.16	-0.12	10.0-	

## Table C-9. continued.

	Mn	Hg	Nickel	Zn	Moist	Lipids
Acen	0.41	0.50	-() 27	0.49	-0.15	0.41
Acy	0.48	0.48	-0.30	0.55	-0.25	0.46
Anth	0.31	0.54	-0.22	0.42	-0)()	0.39
BaA	0.43	0.58	-() 29	().5()	-0.30	0.55
BbF	0.40	0.52	-() 29	0.50	-0.38	0.59
BkF	0.26	-0.13	-0.24	0.49	-0.06	0.24
BaP	0.39	0.76	-0.20	* 0.40	-0.24	0.51
Chry	0.38	0.52	-0.31	0.48	-() 35	0.61
Flan	0.36	0.42	-0.33	0.49	-0.35	0.60
Fluor	0,38	0.50	-0.23	0.47	-0.11	0.39
đ	-0.49	-0.09	-0.06	-0.40	0.07	0.03
Naph	0.45	0.45	-0.32	0.53	-() 25	0.48
Phen	0.34	0.49	-0.22	0.45	-0.10	0.41
Pyr	0.38	0.42	-0.32	0.51	-0.36	0.59
TPAIIs	0.36	0.42	-0.29	0.50	-0.22	0.50
As	-().52	-0.28	-0.49	-0.54	0.16	0.20
PD	0.26	8t ()-	-0.20	0.35	-0.27	0 16
Cn C	-0.18	0.06	-0.15	-0.39	0.13	-0.12
Pb	-0.55	6()'()-	0.37	-0.43	0.63	-0.07
Mg	0.81	0.25	-().()-	0.83	-0.23	110-
Mn	1 ()()	0.20	-0.21	0.85	-0.42	11 0-
Hg	0.20	1.00	-0.05	81.0	0.07	0.18
Nickel	-0.21	-() ()-	001	-0.07	0.37	-0.38
Zn	0.85	0.18	-0.07	1.00	-0.35	-0.01
Moist	-() 42	0.07	0.37	-0.35	1 00	-0.57
Lipids	-0.11	0.18	-0.38	10.01	-0.57	(K) (

Mussel contaminant correlation coefficients for PAHs and metals, including mid-depth exposure data. Pearson Product-Moment analysis on log (x+1)-transformed concentration data; percentages were arc  $\sin\sqrt{x}$ -transformed. Significant correlations at p < 0.05 are underlined. Pearson Product-Moment (n = 16). Table C-10.

	Acen	Acy	Anth	BaA	BbF	BAF	BaP	Chry	Flan	Fluor	đ	Naph	Phen	Pyr	TPAHs	As	Cd	Cu	Pb	Mg
Acen	1 (X)	96.0	0.98	0.90	0.83	0.60	9.79	0.81	0.85	1.(X).	-0.39	66.0	66.0	0.86	0.95	0.03	0.22	-010	010	0.38
Arv	86.0	1 ()()	0.96	0.90	0.84	0.64	0.82	0.80	0.83	0.98	-0.33	86.0	19.1	0.84	0.93	0.03	0 18	-0.13	0.05	0.34
Anth	86.0	0.96	1.00	0.89	0.83	0.59	0.81	0.81	0.86	66.0	-0.35	26.0	1.00	0.86	0.94	0.08	0.13	[0]0-	0 23	0.28
BaA	06.0	0.90	0.89	1.(X)	0.98	0.52	0.88	19.0	0.94	0.20	-0.28	0.93	06.0	0.95	0.95	-0.15	0.18	0.05	-0.03	0.41
BbF	0.83	0.84	0.83	86.0	1.00	0.57	0.85	6.99	0.95	0.82	-() 25	0.87	0.84	0.97	0.92	-0.16	0.16	80.08	-0.04	0.39
BkF	0.60	0.64	0.59	0.57	0.57	001	0.32	0.55	1970	1970	-014	0.64	0.62	0.62	0.20	0.11	0.17	-0.11	0.14	0.23
BaP	0.79	0.82	0.81	0.88	0.85	() 32	1 (8)	0.79	0.73	0.79	-0.17	0.77	0.79	0.24	0.74	-().()8	-0.09	-0.02	0.03	0.14
Chrv	0.81	0.80	0.81	76.0	0.99	0.55	0.79	007	86.0	0.81	-0.2K	0.85	0.82	0.98	193	-() 22	0.17	11.0	10 0-	0.42
Flan	0.85	0.83	0.86	0.94	24.0	1970	0.73	0.98	()() [	0.85	-0.33	0.89	0.87	001	0.96	-0.15	0.21	60.0	10.0	0.42
Fluor	1 (0)	0.98	66.0	060	0.82	1970	0.79	0.81	0.85	1 ()()	-0.3K	0.98	66.0	0.85	0.95	0.04	0.20	-0.05	0.15	0.35
4	fit U-	-0.33	-0.35	-0 2H	-0.25	-0.14	-0.17	-0.28	-0.33	-0.38	0071	-0.38	-0.37	-0.32	-() 35	0.21	-0.06	-0112	-0.13	-0.30
Nanh	66.0	0.98	0.95	0.93	0.87	0.64	0.77	0.85	0.89	0.98	-0.38	1 00	14.0	06.0	19.0	-0.02	0.29	-0.05	10.0	0.44
Phen	66.0	76.0	1.00	060	0.84	0.62	67.0	0.82	0.87	0.99	-0.37	0.97	1.00	0.88	0.96	0.05	0.17	-0.02	0.20	0.31
Pvr	0.86	0.84	0.86	0.95	0.97	0.62	0.74	0.98	1.00	0.85	-0.32	06.0	0.88	1 (0)	0.96	-0.16	0.21	0.08	-00 (0-	0.42
TPAHs	0.95	66.0	0.94	26.0	26.0	0.20	0.74	0.93	0.96	0.95	-0.35	191	0.96	0.96	1.00	-():()2	0.27	0.04	0.07	0.44
As	0.03	0.03	0.08	-() 15	-0.16	0.11	-0.08	-0.22	-0.15	0.04	0.21	-0.02	0.05	-0.16	-0.05	1.00	10.01	0.16	0.42	-0.52
3	0.22	0.18	0.13	0.18	0.16	0.17	-0.0	0.17	0.21	0.20	-0.06	0.29	0.17	0.21	0.27	10.0	1 (0)	019	-0.22	0.25
3 5	0.06	-0.13	10.0-	0.05	0.08	[] ()-	-0.02	011	0.09	-() ()-	-0.12	-0) ()-2	-0.02	0.08	0.04	016	61.0	1 00	0.01	0.16
5 4	010	0.05	0.23	-0.03	-0.04	0.14	0.03	-0.04	0.01	0.15	-0.13	0.01	0.20	-(),()()	0.07	0.42	-0.22	0.01	1 (0)	11-()-
Ma	0.38	55.0	0.28	0.41	0.39	0 23	0.14	() 42	0.42	0.35	-0.30	0.44	0.31	0.42	().44	-0.52	1.75	0.16	-0.4]	1 ()()
e V	55.0	0.37	0.22	0.42	0.39	016	0.25	0.39	0.35	0.31	-0.35	0.42	0.25	0.37	0.36	-0.53	0.52	0.02	<u>-0.61</u>	0.86
- H	1.48	0.48	() 44	0.51	0.43	-0.11	0.72	0.38	0.28	() 48	-0.08	0.43	() 45	0.30	0.35	-0.17	-0.04	0.02	-0.08	0.19
Nickel	61 ()-	-() 24	-0.18	-0.22	-0.22	-0.19	-0.20	-0.23	-0.26	-0.16	-0.18	-0.22	-0 [8	-0.26	-0.21	-0.35	0.08	-0.07	0.28	0.08
Zu	1410	0.43	0.34	0.50	0.51	0.37	0.26	15.0	0.49	() 4]	68 ()-	0.51	0.38	0.50	0.50	-0.53	0.57	-0.09	-(),47	0.87
Moist	110-	-0.24	60.0-	-0.35	-0.43	-0) ()-	-0.25	-1) 42	-() 42	-0.13	0.13	-0.27	-0.14	-0.43	-0.28	0.23	-0.16	0.02	0.56	-0.21
Linids	0.42	0.43	0.42	0.59	0.65	0.24	0.49	0.67	0.67	() 41	-0.15	0 46	() 44	0.66	0.56	0.06	0.06	0.03	+0.04	-0.04

## Table C-10. continued.

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_	Ми	11g	Nicket	Zn	Moist	Lipids
Acen	0.35	0.48	-0.19	0.44	-0.17	0.42
Acy	0.37	0.48	-0.24	0.43	-() 24	() 13
Anth	0.22	61 ()	-0.18	0.34	6() ()-	0.42
BaA	0.42	12.0	-0.22	0.50	-().35	0.59
BbF	0.39	0.43	-0.22	0.51	-() 43	0.65
BkF	91.0	-0.11	61 ()-	0.37	-0) ()	0.24
BaP	0.25	0.72	-0.20	0.26	-0.25	61 ()
Chry	0.39	0.38	-0.23	12.0	-0.42	0.67
Flan	0.35	0.28	-0.26	61-0	-0.42	0.67
Fluor	0.31	0.48	-0.16	0.41	-0.13	[17])
đ	-0.35	-0.08	-0.18	-039	0.13	-0.15
Naph	0.42	0.43	-0.22	0.51	-0.27	0.49
Phen	0 25	0.45	-0.18	0.38	-0.14	() 44
Pyr	0.37	0.30	-0.26	0.50	-().43	0.66
TPAILs	1136	0.35	-0.21	0.50	-0.28	0.56
As	0.53	-0.17	-0.35	-0.53	0.23	0.06
Cd	0.52	-0.04	0.08	0.57	-016	0.06
C	0.02	0.02	-0.07	60 01	0.02	0.03
Pb	1970-	-0.08	0.28	-() 47	0.56	-0.04
Мg	0.86	61.0	0.08	0.87	-0.21	10 0-
Mn	1 00	019	-0.05	0.88	-0.37	-0.06
Hg	0.19	1.00	0.02	0.17	0.11	0.10
Nickel	-0.05	0.02	00.1	0.11	0.35	-0.34
Zn	0.88	0.17	0.11	1.00	-0.33	0.06
Moist	-0.37	0.11	0.35	-0.33	1 (X)	1970-
Lipids	-0.06	0.10	-0.34	0.06	<u>1910-</u>	00.1



