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WASHINGTON STATE DEPARTMENT OF ECOLOGY

SEATTLE STEEL MILL CLASS II INSPECTION SEPTEMBER 11-13, 1989

by
Pat Hallinan

Washington Department of Ecology
Environmental Investigations and Laboratory Services Program
Compliance Monitoring Section
Olympia, Washington 98504-8711

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ABSTRACT

Ecology conducted a Class II inspection at the Seattle Steel Mill on September 11-13, 1989. Copper, nickel, and lead in the effluent leaving the mill site (at the junction box) exceeded Washington State marine water quality criteria. Holding pond water reused by the mill, junction box wastewater and wastewater leaving the Seattle Steel property (at the existing NPDES monitoring site) were all contaminated with PCBs at concentrations greater than marine water quality chronic criteria. Holding pond sludge and junction box and ditch sediments at the existing NPDES monitoring site were characterized by a high oil and grease content. All were contaminated with PCBs at concentrations above draft Washington State soil cleanup standards (Ecology, 1990). Sediments at the junction box also exceeded EP Tox dangerous waste criteria for cadmium and lead. Marine sediments collected at the outfall failed both the chemical (for total PCBs and copper) and biological criteria set forth in proposed Washington State sediment quality standards. Recommendations are made regarding the PCB and metals contamination on the mill property and wastewater monitoring parameters that should be included in the next NPDES permit.

INTRODUCTION

Ecology conducted a Class II inspection at the Seattle Steel Mill on September 11-13, 1989, as part of the NPDES permit reissuance process. The existing NPDES permit expired in November 1988, and a new permit is presently being drafted. Pat Hallinan and Keith Seiders from the Ecology Compliance Monitoring Section conducted the inspection. Stan Ciuba, Mike Herald, and Barbara Trejo from Ecology attended the inspection. Jerry Richartz, Seattle Steel's Manager of Materials and Services, provided assistance.

The mill produces reinforcing bars and various other steel products from scrap metal. The majority of water used by the mill cools steel rolling machine parts in one of three production lines: 12-10-inch merchant mill, 22-inch mill, or 32-inch mill. Wastewater from these three mill lines is routed through a settling basin (equipped with oil/water skimmers) then to a holding pond. A portion of the holding pond water is reused as cooling water by the mill. Overflow from the holding pond discharges from the mill site through a 42" storm drain to an effluent junction box (Figure 1). Additionally during a reconnaissance visit to the site, water was observed leaching from the holding pond and entering Longfellow Creek. Further discharges from the site include various cooling water flows which are all routed through the effluent junction box. These flows may include the following: overflow from the 12-10" merchant mill scale pit, overflow and blowdown from the electric arc furnace cooling towers, or overflow from the caster machine scale pit. Stormwater runoff from the mill site also discharges through the junction box. Any makeup water needed by the mill is withdrawn from Longfellow Creek or purchased from the City of Seattle.

From the junction box, mill wastewater is transported to Elliott Bay through an underground sewer and a series of open ditches (see Figure 1). The sewer and open ditches receive shallow ground water inflow which includes leachate from the abandoned West Seattle landfill (Hart Crowser, 1987).

Objectives of this inspection included:

1. Characterize intake water (from Longfellow Creek), holding pond water, junction box effluent, and effluent at the current NPDES monitoring site for Priority Pollutants.

2. Characterize sediments near the wastewater outfall for Priority Pollutants.

3. Characterize holding pond sludge, junction box and effluent ditch sediments for Priority Pollutants and EP Tox metals.

4. Determine the toxicity of intake water, holding pond water, and final effluent using rainbow trout, echinoderm, *Daphnia pulex*, and Microtox bioassays. Outfall sediment toxicity was assessed using *Rhepoxynius abronius*.

5. Characterize the pond leachate entering Longfellow Creek.

PROCEDURES

Twenty-four hour composite samples of intake water (from Longfellow Creek) and holding pond water were collected using ISCO automatic samplers. The samplers were set to collect about 330 mLs of water every 30 minutes for 24 hours. The Seattle Steel discharge at the junction box and at the existing NPDES monitoring site (effluent ditch) are influenced by tides. Therefore, composite samples could not be collected at these locations. Grab samples of junction box and effluent ditch wastewater were collected within four hours of low tide on both days of the inspection. On the first day of the inspection, salinities of the ditch effluent were below 1 o/oo (part per thousand). Ecology also collected grab samples of intake water, holding pond water, holding pond leachate, and at Longfellow Creek above and below the holding pond (Figure 1). Table 1 lists sampling times and parameters analyzed for these samples.

The wastewater samplers were fitted with Teflon tubing and glass sampling bottles. This equipment was cleaned prior to use by washing with non-phosphate detergent and then rinsing three times with deionized water, dilute nitric acid, methylene chloride, and acetone. Collection equipment was air-dried then wrapped with aluminum foil until used in the field.

Two sites were sampled for bottom sediments in the vicinity of the wastewater outfall in Elliott Bay (see Figure 2): immediately at the outfall ("at outfall") and about 80 yards away from the outfall ("near outfall"). Sediment samples were collected with a 0.1 meter square van Veen sampler following recommended Puget Sound protocols (Tetra Tech, 1986). Samples at each site consisted of three to four individual van Veen grabs in which the top two centimeters (cm) of sediment from each grab were removed. Sediment analyzed for volatile organics (VOAs) was taken directly from the van Veen grab. The remaining top two centimeters were composited, thoroughly mixed, then divided for separate analysis. Stainless steel utensils were used in the collection of the sediment samples and were cleaned by the same procedures as the wastewater composite samplers. Table 2 lists bottom sediment sampling times and parameters analyzed.

Sediments were also gathered from the holding pond, at the junction box, and at the existing NPDES monitoring site (effluent ditch). Holding pond sludge was collected (off the intake filter structure) by a stainless steel pipe dredge. Sediments at the junction box were collected using a petite ponar grab sampler while sediments at the effluent ditch were collected by hand using stainless steel spoons and beakers. The pipe dredge and all stainless steel utensils used in the collection of sediments were cleaned by the same procedures as the wastewater composite samplers. The petite ponar grab sampler was not decontaminated before use; however, junction box sediments removed from the sampler were not in contact with any of the sampler surfaces. Table 2 also includes sampling times and parameters analyzed for these sediments.

Flows were measured at two points in the process, the effluent ditch (the current NPDES monitoring site) and in Longfellow Creek above the holding pond. Both were instantaneous measurements. Measurements were made by taking transects of the ditch and Creek and recording velocities and depths using a Marsh-McBirney Model 201 current meter.

The Ecology Manchester Laboratory analyzed samples collected during the inspection for general chemistry parameters, volatiles, semi-volatiles, and pesticides/PCBs. Analytical Resources, Inc. of Seattle conducted the nutrient, sediment TOC, and metal analyses while AmTest Laboratories performed the oil and grease, total phenolics, grain size, and cyanide tests. The Ecology Laboratory also performed the rainbow trout, *Daphnia pulex*, *Rhepoxynius abronius*, and Microtox bioassays. ERC Environmental Laboratories of San Diego, California, (through money provided by EPA) conducted the echinoderm bioassay. Appendices 1 and 5 list the chemical and bioassay test methods used.

Data Quality Assurance

Sampling

A determination of wastewater sampling equipment contamination was made using a field sampling blank. About two gallons of deionized organic free water was obtained from the Ecology Manchester Laboratory prior to the inspection. This water was pumped through a compositor immediately prior to set-up in the field. The water was then subsequently analyzed for priority pollutant organics and metals. No organics were detected in the field sampling blank (Appendix 4). However, copper and iron were detected at 2 and 5 ppb (parts per billion; $\mu g/L$), respectively. Results within ten times these blank concentrations are flagged by a "BT" in this report.

Analysis (General)

Laboratory quality assurance and quality control (QA/QC) methods which were followed during the analyses of general chemistry parameters and priority pollutants are described by Kirchmer (1988) and Huntamer and Smith (1988). Recommended holding times were met for all analyses. For the volatile and semi-volatile analyses, gas chromatograph/mass spectrometer (GC/MS) tuning and mass calibration and initial and continuing calibration (for all compounds detected) met CLP requirements (EPA, 1990). For the pesticide/PCB analyses, GC initial and continuing calibrations met CLP requirements.

Matrix spike and matrix spike duplicate results for water and sediment volatile and pesticide/PCB analyses and water semi-volatile analyses are given in Appendix 2 of this report. No matrix spike analyses were completed for the sediment semi-volatile analyses due to sample interferences (the samples required a large dilution which diluted out the spike compounds). Sample results are not qualified based on matrix spike/matrix spike duplicates (MS/MSD) results as recommended by Kirchmer, 1988.

For the volatile organics, the MS/MSD results indicate the possibility of not detecting the presence of acetone and carbon disulfide in water samples and of acetone, carbon disulfide, 1,2,3-trichlorobenzene, hexachlorobutadiene, 2-butanone, 2-hexanone, and 4-methyl-2-pentanone in sediment samples. For the semi-volatile organics, the results indicate the possibility of not detecting the presence of carbazol, 1-methylnaphthalene, 3,3'-dichlorobenzidine and retene. None of these compounds would be expected to be present at a steel mill. For the pesticides and PCBs, the MS/MSD results do not indicate any systematic problems with the analyses of either the water or sediment samples.

Sediments - Volatile Organics

In the sediment volatile analyses, two of four surrogate recoveries were outside CLP limits for samples #378118 (holding pond sludge) and #378124 (holding pond sludge duplicate sample). In addition, one of four surrogate recoveries was outside CLP limits for samples #378121 (effluent ditch at current NPDES monitoring site), #378122 (marine sediments at the outfall), and #378123 (marine sediments near the outfall). All volatile compounds detected at these sites should be considered as estimates; those compounds that were detected above the method detection limit are flagged by an "E" in this report. None of the surrogate recoveries were less than 10%; therefore, the probability of not detecting a compound is insignificant.

Sediments - Semi-volatile Organics

No surrogate recoveries were obtained in the sediment semi-volatile analyses of samples #378121 (effluent ditch at current NPDES monitoring site) and #378122 (marine sediments at the outfall). Semi-volatile organics detected at these two sites should be considered as estimates; those compounds that were detected above the method detection limit are flagged by an "E" in this report. Surrogate recoveries for the other semi-volatile sediment and water samples met CLP requirements.

Water and Sediments - Pesticide/PCB

Quality Control for the pesticide/PCB analyses included use of two surrogate compounds (hexabromobenzene (HBB) and 4,4'-dibromooctafluorobiphenyl (DBOB)) to estimate the accuracy of the procedure. In the analysis of sample #378107 (holding pond leachate), a zero percent recovery for DBOB was obtained. A PCB was detected (Aroclor-1242 at an estimated concentration of 0.038 μg/L). This value probably underestimates the actual PCB concentration in the holding pond leachate. The presence or absence of other isomers in this sample is also questionable. However, there was a 91% recovery for HBB in this sample which is significant since HBB is a better surrogate for PCBs than DBOB. Recoveries of extraction surrogates for all samples are included in Appendix 3. Generally, when surrogate recoveries are less than 10%, the probability of not detecting a compound becomes significant.

Sediments - Metals

A data review for the metals analyses was provided by the Ecology Manchester Laboratory (Smith, 1989). The data was considered acceptable except for the following: The sediment matrix spikes for arsenic were outside acceptable limits. In addition, the difference between the duplicate results for antimony in the sediment sample exceeded the acceptable limit of +\- one detection limit. As recommended by Kirchmer, 1988, the arsenic results will not be qualified based on MS/MSD results. The antimony results should be considered an estimate and are flagged by an "E" in this report.

Duplicate Analyses

Field duplicates consisted of one water sample (24 hour composite of holding pond water) and one sediment sample (holding pond sludge). The duplicate results of the holding pond water are listed in Table 3. The oil and grease duplicates differed by over 100 mg/L. This is probably the result of sampling variability since check standards were within control limits. For the metals and organics analyses, the relative percent difference (RPD) between the duplicate results were generally low, indicating good precision at levels above the reporting limits.

The results for the duplicate sample of the holding pond sludge are listed in Table 4. For the metals analyses, the RPD between duplicates for antimony and cadmium were over 20 percent. Cadmium was near the method detection limit which accounts for the high RPD. The high value for antimony confirms the findings noted above, i.e., the antimony results should be considered an estimate. Various volatile organics were detected at low concentrations in the holding pond sludge. The RPD between the duplicates for these compounds ranged from 6 to 74 percent. Most volatile organics were near or below the method detection limit which accounts for the high RPD. This suggests an insignificant affect on the quality of the cadmium and volatile organics data.

In the pesticide/PCB scan, the results of one duplicate analysis (sample #378118) detected one PCB isomer (Aroclor-1242 at 12,700 ppb dry - μg/kg dry) while the other analysis (sample #378124) identified three isomers (Aroclor-1242, 1254, and 1260 at 17,900, 5,190, and 220 ppb dry, respectively). Recovery for the extraction surrogates for sample #378124 were nearer to 100 percent (tetrabromobenzene and DBOB recoveries were 70 and 120 percent, respectively compared to sample #378118 recoveries of 53 and 70 percent, respectively). In addition, detection limits for sample #378118 were higher than for sample #378124. Therefore, the results for sample #378124 are probably closer to the true value.

Bioassays

The *Rhepoxynius abornius*, rainbow trout, Microtox, and *Daphnia pulex* bioassays were completed using laboratory controls and reference toxicants. For the *Rhepoxynius*, rainbow trout, and *Daphnia* bioassays, all the laboratory controls were within the minimum survival limit of 90 percent. In addition, no toxicity (reduction in bacterial luminescence) was observed for the laboratory control in the Microtox test. The reference toxicants yielded responses normally observed for each organism (Stinson, 1989, Stinson, 1990; Wade, 1989; Wade, 1989a). The echinoderm fertilization bioassay was completed with a laboratory control. The fertilization in this control was about 80 percent. For this bioassay, target control fertilization of less than 100 percent is desired since any effluent toxic effect can be observed relative to the control (Dinnel *et al.*, 1987).

RESULTS AND DISCUSSION

Flow

During the inspection, the holding pond was overflowing. Though no flow measurements were made of the overflow, it represented about one quarter to one half of the entire plant discharge (estimated by visual observation at the junction box). A flow of 2.9 MGD was measured during the inspection at the effluent ditch. However, this flow rate may overestimate the actual total flow from the mill because of ground water infiltration to the sewer/ditch conveyance system.

Effluent Chemical Characterization

General chemistry data for the water samples collected during the inspection is listed in Table 5. Priority pollutant organics and metals detected in these samples are listed in Table 6 (complete results are in Appendix 4).

Holding pond water had a high oil and grease content in the replicate grab samples (199 and 81.3 mg/L), while no oil and grease was found (at a detection limit of 2.0 mg/L) in the grab sample collected the previous day (sample -11). An oil and grease sheen was observed on both the junction box and effluent ditch wastewater on both days of sampling. However, no oil and grease was detected in these samples at detection limits of 2.0 mg/L. In the oil and grease analyses, light hydrocarbons are partially lost and therefore not accurately quantified by the analytical method used (Huntamer and Smith, 1989).

Substantial differences for metals and conventional parameters (TSS, COD, ammonia, and conductivity) were noted between the holding pond, junction box, and effluent ditch wastewater. Effluent at the junction box was elevated in metals and TSS compared to the holding pond. This suggests that there is another source of metals and TSS from the mill other than the holding pond overflow, e.g., the overflow from the 12-10" merchant mill scale pit, overflow and blowdown from the electric arc furnace cooling towers, or overflow from the caster machine scale pit. Surface water runoff is not a likely source because the inspection was done in late summer; nor is dust depositing at the junction box a likely source because the sampling point is 25 feet below ground level.

For the effluent ditch samples, conductivity, COD, and ammonia were higher, while TSS and total metals were about two to seven times lower compared to the junction box wastewater sample. This is likely the result of both ground water infiltration to the sewer/ditch conveyance system and the settling out of suspended solids in the low velocity sewer/ditch system.

Holding pond, junction box, and effluent ditch metals are compared to Washington State water quality criteria for protection of aquatic life in Table 7 (EPA, 1986). Copper at all three stations exceeded freshwater acute and chronic criteria and saltwater acute criteria. Nickel exceeded both saltwater chronic criteria at the three stations and approached the saltwater acute criteria at the junction box. Lead in the junction box effluent exceeded both salt and freshwater chronic concentrations. Holding pond water also exceeded freshwater chronic criteria for lead. It should be noted that the metals results are for total metals which may overestimate acute toxic threshold concentrations. EPA recommends the use of the total recoverable analytical method when comparing results to water quality criteria (EPA, 1986).

A PCB (aroclor-1242) was detected in all the three wastewater streams at concentrations ranging from 0.18 ppb (parts per billion - $\mu g/L$) for the holding pond composite up to 0.48 ppb for an effluent ditch grab sample. These levels are well above both salt and freshwater chronic criteria of 0.030 and 0.014 ppb, respectively (EPA, 1986). Levels of phthalates and volatile organics in the holding pond, junction box, and effluent ditch waste-water were well below water quality criteria. For the phthalates and benzene, fresh and saltwater acute criteria are 940 and 2,944 ppb, and 5,300 and 5,100 ppb, respectively (EPA, 1986). For chloroform, acute and chronic freshwater criteria are 28,900 and 1,240 ppb, respectively (EPA, 1986). No water quality criterion has been developed for bromodichloromethane.

Effluent Bioassays

Although various metals and a PCB exceeded saltwater chronic criteria in the holding pond and effluent ditch wastewater, no toxic effects (no reduction in bacterial luminescence compared to laboratory controls) were observed for these two samples in the Microtox test (Table 8). The Longfellow Creek intake water also showed no toxicity in the Microtox test.

In the echinoderm fertilization bioassay, no statistically significant (one-sided Dunnett's test with 95 percent confidence limits) reduction in fertilization rates occurred compared to the laboratory controls for the effluent ditch and Longfellow Creek intake water samples (Table 8). However, for the holding pond water, a statistically significant reduction in fertilization did occur at the highest concentration tested (80 percent). The LOEC (lowest observable effects concentration) and NOEC (no observable effects concentration) for the holding pond water were 80 and 40 percent, respectively.

In the two acute bioassays performed (96 hour rainbow trout and 48 hour *Daphnia pulex* tests; Table 8), holding pond, effluent ditch, and Longfellow Creek intake water samples showed no statistically different (one-sided Dunnett's test with 95% confidence limits) mortalities compared to the laboratory controls. Laboratories and methods employed for the effluent bioassays are shown in Appendix 5.

Longfellow Creek and Holding Pond Leachate Chemical Characterization

General Chemistry results from the Longfellow Creek, holding pond and holding pond leachate samples are listed in Table 5. Metals and organics detected in these samples are shown in Table 9. There were about 12 visible seeps at the edge of Longfellow Creek directly adjacent to the holding pond. The largest of these seeps was sampled. Longfellow Creek flow measured above the holding pond (below the intake of Seattle Steel) was about 0.04 cfs.

The data suggests a large impact on Longfellow Creek due to the leachate. Conductivity, alkalinity, hardness, COD, iron, and nutrients were 1.4 to 2.7 times lower for Longfellow Creek below the pond than for above the pond. Temperature increased by over 2.5 degrees Celsius. The pond leachate sample had lower conductivity, alkalinity, hardness, COD, iron, nutrients, and a higher temperature than the Longfellow Creek sample taken above the pond.

A PCB (aroclor-1242) was detected in the holding pond leachate at an estimated concentration of 0.038 ppb. This level exceeded both salt and freshwater chronic water quality criteria (EPA, 1986). No PCBs were detected in any Longfellow Creek samples. Trace amounts of two volatile organics, chloroform at an estimated concentration of 4 ppb and bromodichloromethane at an estimated concentration of 0.5 ppb, were detected in Longfellow Creek below the holding pond. Chloroform was detected in the pond leachate at an estimated concentration of 0.5 ppb. No bromodichloromethane was identified in the pond leachate; however, it was detected in the holding pond at an estimated concentration of 0.5 ppb. Both chloroform and bromodichloromethane are by-products of the chlorination of water (Verschueren, 1983).

Sediment Chemical Characterization

Organic compounds detected in the holding pond sludge, junction box, and effluent ditch sediments are listed in Table 10. Complete results are given in Appendix 3. All sediments were characterized by a high oil and grease content (88.5, 44.0, and 73.5 parts per thousand dry weight for the holding pond sludge, junction box, and effluent ditch sediments, respectively). A hydrocarbon identification detected the presence of lubricating oil. In addition, all the sediments were contaminated with PCBs. The highest PCB levels were in the holding pond sludge (23.3 parts per million dry weight of total PCBs). The total PCB concentration decreased from the junction box (8.7 ppm dry) to the effluent ditch (6.0 ppm dry) sediments. All these sediment PCB concentrations are above draft Washington State soil cleanup standards of 1.0 ppm dry weight (Ecology, 1990). Up to 150 ppm dry weight of PCBs have recently been found in settling basin waste sludge that had been stockpiled adjacent to the settling basin (MK-Environmental, 1990).

Numerous volatile organics (mostly substituted benzenes and toluenes) were detected in the sediment samples. Concentrations at the effluent ditch were generally higher than in either the junction box sediments or holding pond sludge. Additionally, the volatile analyses tentatively identified various straight chained hydrocarbons in these sediments. Polyaromatic hydrocarbons (PAHs) were detected in the effluent ditch sediments (estimated concentration of 378 ppm dry weight). However, no PAHs were identified in either the holding pond sludge (detection limits of 0.89 ppm dry) or junction box sediments (detection limits of 17 ppm dry).

Copper, iron, nickel, and arsenic sediment concentrations were highest at the holding pond then decreased from the junction box to the effluent ditch (Table 11). Antimony, cadmium, lead, silver, and zinc concentrations were substantially elevated at the junction box. The source of these metals is likely from bag house dust from the electric arc furnace air pollution control equipment. Surface water runoff in another likely source. According to mill personnel, sediment deposits at the junction box have never been removed. Therefore, it is unknown whether the high metal concentrations are from a historic or an ongoing source.

Extraction procedure (EP) toxicity metals for the holding pond sludge and junction box and effluent ditch sediments are given in Table 12. Extract cadmium and lead concentrations for the junction box sediments exceeded Washington State dangerous waste levels (Ecology, 1989). For the holding pond and effluent ditch sediments, extract concentrations were well below the dangerous waste levels.

Marine sediments collected at and near the outfall were also characterized by a high oil and grease content (15.6 and 2.4 parts per thousand dry weight for the outfall and near outfall sediments, respectively; Table 13). A hydrocarbon identification for the outfall sediments found lubricating oil while both lubricating oil and PAHs were present in the near outfall sediments. The marine sediments collected were also contaminated with PCBs (2.8 and 0.6 ppm dry weight in the outfall and near outfall sediment, respectively).

Organics detected in the marine sediments are compared to draft Washington State sediment management standards in Table 13 (Ecology, 1990a). Total PCBs at and near the outfall exceeded the draft criteria by over eight and three times, respectively. In the near outfall sediments, both low molecular weight PAHs (LPAHs) and high molecular weight PAHs (HPAHs) exceeded the interim standards by about ten times. The probable source of the PAH sediment contamination is the Wyckoff Wood Treatment facility (Cubbage, 1989). The near outfall sampling station was within 150 yards of this facility. This also may be the source of the PAHs found in the effluent ditch sediments; the PAHs could have been carried by tidal action into the effluent ditch.

Metals found in the marine sediments are compared to draft sediment standards in Table 14. Copper at the outfall exceeded the interim standard. All other metals at the two stations were below the draft standards. All metals, except for arsenic, were 2.4 to 4.4 times higher in the outfall sediments than in the near outfall sediments.

Sediment Bioassay

The marine sediments collected exhibited a high toxicity in the sediment amphipod bioassay (Table 15). For the ten day test, amphipod mortalities of 78 and 51 percent were measured for the outfall and near outfall sediments, respectively. In the proposed Washington State sediment quality standards, biological criteria for the amphipod bioassay are exceeded when a test sample has higher mean mortality than the control sample and the test sample mean mortality exceeds 25 percent. Both the outfall and near outfall sediments failed this criteria. Laboratories and methods employed for the sediment bioassays are shown in Appendix 4.

CONCLUSIONS AND RECOMMENDATIONS

1. Copper, nickel, and lead in the junction box effluent exceeded various freshwater and saltwater Washington State water quality criteria. Concentrations of these metals were higher at the junction box than at the existing NPDES monitoring site (effluent ditch sampling station). Holding pond water, junction box, and effluent ditch wastewater were all contaminated with PCBs at concentrations greater than saltwater chronic criteria. Monitoring mill wastewater for copper, nickel, zinc, and PCBs at the junction box is recommended for the next NPDES permit.

   Holding pond water had a high oil and grease content. Any overflow from the holding pond should be reduced or eliminated (e.g. by re-using more pond water within the mill). If overflow continues, permit limits should be required for the overflow. More effective oil and grease removal for the settling basin/holding pond system may be justified (e.g. additional oil and grease skimmers or dissolved air flotation removal).

2. Holding pond sludge and junction box and effluent ditch sediments were characterized by a high oil and grease content. All were contaminated with PCBs at concentrations above draft Washington State soil cleanup levels. The PCB contamination in these sediments should be remedied. Other oily wastes generated on the mill site (specifically from the scale pits and settling pond oil skimmers) should be tested for PCBs to determine if the contamination is ongoing.

   Sediments at the junction box exceeded EP Tox metals dangerous waste criteria for cadmium and lead. Antimony, cadmium, lead, silver, and zinc concentrations were substantially elevated in the junction box sediments. Copper, iron, and nickel concentrations were highest in the holding pond sludge then decreased from the junction box to the effluent ditch sediments.

Marine sediments collected at the outfall failed both the chemical and biological criteria set forth in proposed Washington State sediment quality standards. The clean up of these sediments may be required when the proposed standards become regulation.

3. Although various metals and total PCBs exceeded water quality criteria, no toxic effects were noted in rainbow trout, *Daphnia pulex*, and Microtox bioassays for the holding pond and effluent ditch wastewater. However, toxic effects were observed for the holding pond water in the echinoderm fertilization bioassay.

4. Holding pond leachate was contaminated with PCBs. Data also suggests the leachate may be effecting water quality in Longfellow Creek. The holding pond should be lined with an impervious liner to prevent any such leakage.

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FIGURES

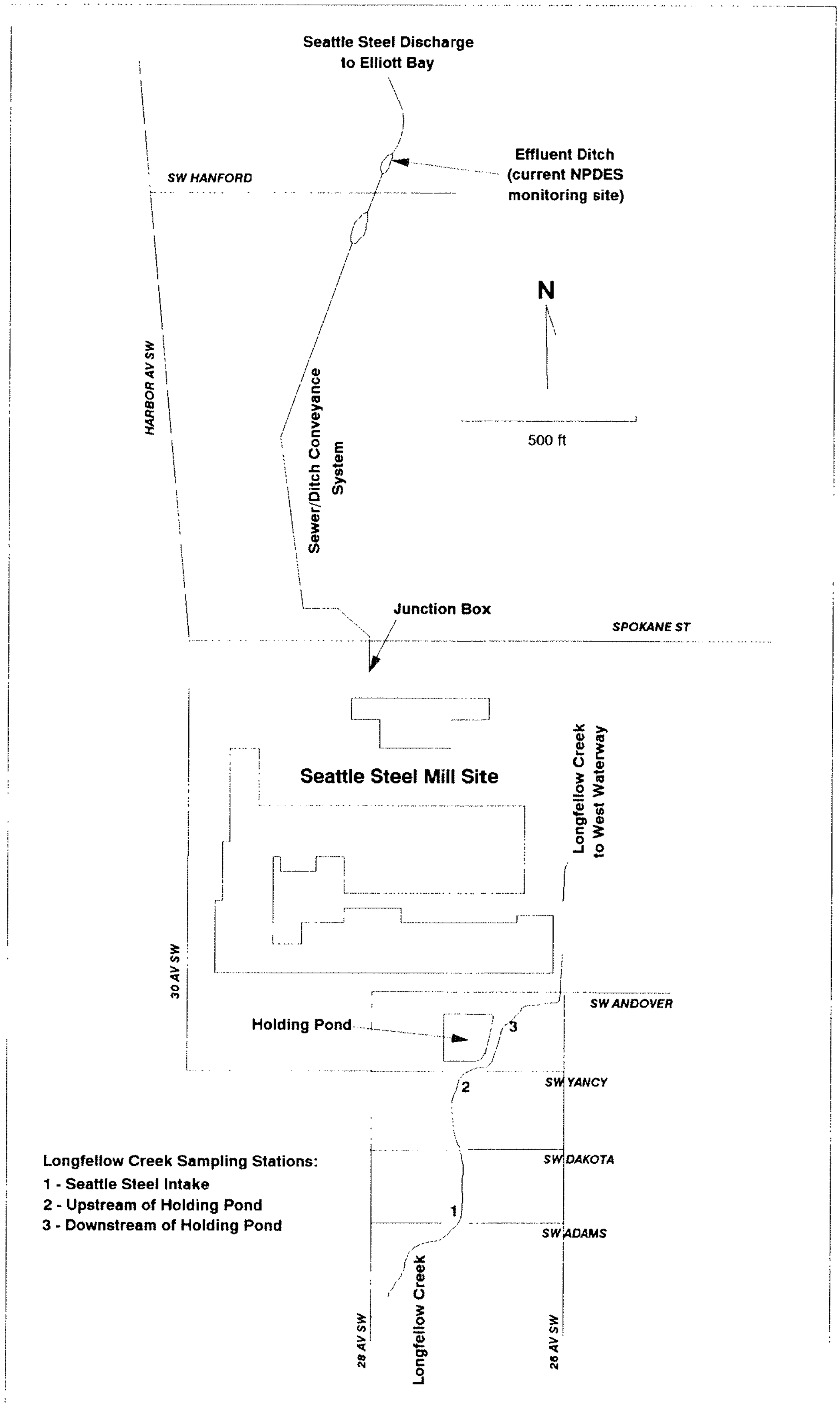

Figure 1 - Sampling and Site Location - Seattle Steel, 9/89

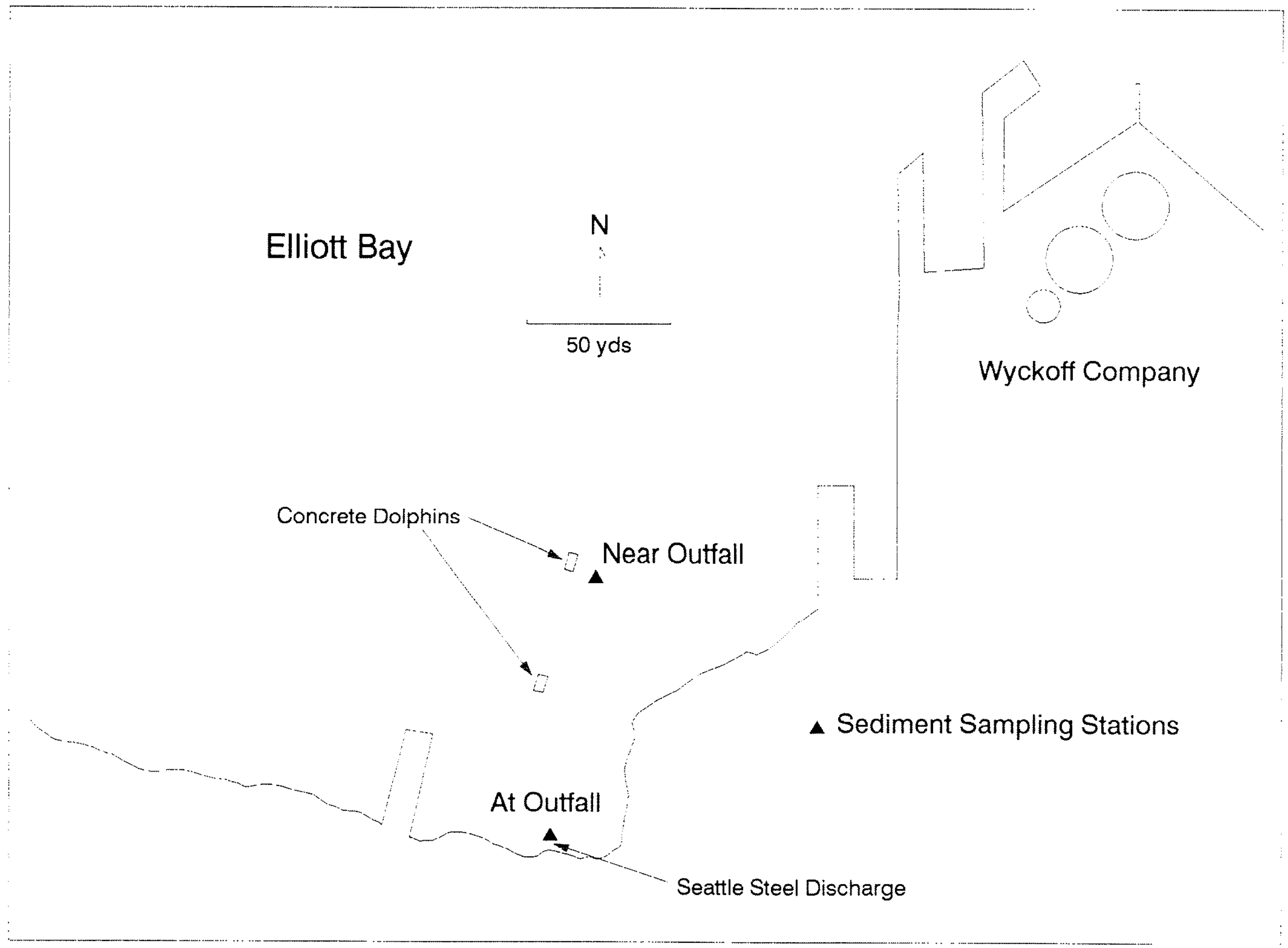

Figure 2 - Marine Sediment Sampling Locations - Seattle Steel, 9/89

TABLES

Table 1 - Water Sampling Times and Parameters Analyzed - Seattle Steel - 9/89.

	Longfellow Creek													
Station:	Seattle Steel Intake			Above Holding Pond	Below Holding Pond	Holding Pond Leachate	Holding Pond				Effluent Ditch		Junction Box	
Date:	9/12-13	9/12	9/13	9/13	9/13	9/13	9/12-13	9/12-13	9/12	9/13	9/12	9/13	9/12	9/13
Time:	1650-1650	1650	1226	1531	1415	1445	1615-1615	1615-1615	1730	1200	1103	1010	1205	1114
Type:	Comp	Grab	Grab	Grab	Grab	Grab	Comp	Comp (dup)	Grab	Grab	Grab	Grab	Grab	Grab
Parameter Lab ID #: 3781	-05	NA	NA	-06	-08	-07	-09	10	-11	-12	-13	-14	-15	-16
General Chemistry														
Turbidity	X			X	X	X	X				X			
pH	X						X							
Conductivity	X						X							
Alkalinity	X			X	X	X	X				X			
Hardness	X			X	X	X	X				X			
Cyanide	X				X	X	X	X			X			
Salinity											X			
Solids(4)	X						X			X	X			
TSS				X	X	X	X		X			X		X
COD	X			X	X	X	X		X	X	X	X	X	X
NH_3	X			X	X	X	X				X	X	X	X
NO_3+NO_2	X			X	X	X	X				X	X	X	X
T-Phosphate	X			X	X	X	X				X	X	X	X
Oil & Grease	X			X	X	X			X	X	X	X	X	X
Organic + Metals														
pp metals	X				X	X	X	X			X		X	
Semivolatiles	X				X	X	X	X			X		X	
Volatiles	X				X	X	X	X			X		X	
Pesticides\PCBs	X				X	X	X	X			X		X	
Phenols	X			X	X	X	X	X			X		X	
Bioassays														
Trout	X						X				X			
Daphnia pulex (acute)	X						X				X			
Microtox	X						X				X			
Echinoderm	X						X				X			
Field Observations														
pH	X	X	X	X	X	X	X		X	X	X	X	X	X
Conductivity	X	X	X	X	X	X	X		X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X		X	X	X	X	X	X
Dissolved Oxygen		X	X	X	X									

Table 2 - Sediment Sampling Times and Parameters Analyzed - Seattle Steel 9/89.

		Marine Sediment		Freshwater Sediment			
	Station:	At Outfall	Near Outfall	Holding Pond	Holding Pond (dup)	Junction Box	Effluent Ditch
	Date:	9/11	9/11	9/12	9/12	9/12	9/12
	Time:	1245	1455	1740	1740	1250	1103
	Type:	Grab	Grab	Grab	Grab	Grab	Grab
Parameter	Lab ID #: 3781	-22	-23	-18	-24	-19	-21
General Chemistry							
% Solids		X	X	X	X	X	X
Grain Size		X	X	X	X	X	X
Oil & Grease				X	X	X	X
Organics and Metals							
pp metals		X	X	X	X	X	X
EP Tox				X	X	X	X
Semevolatiles		X	X	X	X	X	X
Volatiles		X	X	X	X	X	X
Pestcides/PCBs		X	X	X	X	X	X
TOC		X	X	X	X	X	X
Bioassays							
Rhepoxynius Abronius		X	X				

Table 3. Results of Field Duplicate Analyses on Holding Pond Water - Seattle Steel, 9/89.

Parameter	Station:	Holding Pond		Holding Pond (dup)		Mean	RPD*
	Lab ID #: 3781-	09		10			
Cyanide (mg/L)		<.005		<.005			NA
Oil & Grease (mg/L)		199	+	81.3		140	84
Volatile Organics: (µg/L)							
Chloroform		1	J	0.7	J	0.9	35
Benzene		5	U	0.5	J	--	
Bromodichloromethane		0.5	J	0.5	J	0.5	0
Semi-volatile Organics: (µg/L)							
Diethylphthalate		0.9	U	0.2	J	--	
Di-n-Butylphthalate		0.9	U	0.3	J	--	
Pesticides/PCBs: (µg/L)							
Aroclor-1242		0.18		0.21		0.20	15
Metals (total): (µg/L)							
Antimony		1		2		1.5	67
Arsenic		4		4		4	0
Beryllium		1	U	1	U	--	
Cadmium		2	U	2	U	--	
Chromium		5	U	5	U	--	
Copper		43		45		44	5
Iron		1,240		1,270		1,255	2
Lead		4		3		3.5	29
Mercury		0.1	U	0.1	U	--	
Nickel		20		30		25	40
Selenium		1	U	1	U	--	
Silver		3	U	3	U	--	
Thallium		1	U	1	U	--	
Zinc		6		4		5	40

* - Relative percent difference - (x-y)/((x+y)/2)*100
\+ - Lab ID #378112 - Both samples were taken as grabs at the same station at the same time.

Qualifiers:
U - Not detected at quantification limit shown
J - Esitmated amount, value is less than method detection limit

Table 4. Results of Field Duplicate Analyses on Holding Pond Sludge - Seattle Steel, 9/89.

	Sludge Results				EP Tox Results (mg/L)			
Parameter Lab ID #: 3781-	18	24	Mean	RPD*	18	24	Mean	RPD*
Volatile Organics - ug/kg dry:								
Acetone	200 B	320 B	--	--				
Chloroform	18 U	3 J	--	--				
Carbon Disulfide	1,400 B	1,100 B	--	--				
2-Butanone	67 B	100 B	--	--				
Total Xylenes	2 J	3 J	3 J	40				
2-Chlorotoluene	4 J	25 U	--	--				
1,2,4-Trimethylbenzene	6 J	13 J	10 J	74				
Isopropylbenzene	4 J	2 J	3 J	67				
p-Isopropyltoluene	18 E	15 J	17 J	18				
Propylbenzene	9 J	25 U	--	--				
Butylbenzene	17 J	16 J	17 J	6				
1,4-Dichlorobenzene	18 U	6 J	--	--				
4-Methyl-2-Pentanone	25 J	28 J	27 J	11				
1,3,5-Trimethylbenzene	26 E	25 U	--	--				
Toluene	10 J	9 J	10 J	--				
Sec-Butylbenzene	5 J	25 U	--	--				
2-Hexanone	6 J	3 J	5 J	67				
Pesticides/PCBs - ug/kg dry:								
Aroclor-1260	500 U	220	--	--				
Aroclor-1254	500 U	5,190	--	--				
Aroclor-1242	12,700	17,900	15,300	34				
Metals - mg/kg dry:								
Antimony	26.2 E	32.6 E	29.4 E	22	--	--		
Arsenic	107	97	102	10	0.05 U	0.05 U	0.05 U	
Barium	--	--	--	--	0.332	0.358	0.345	8
Beryllium	0.1 U	0.1 U	0.1 U	--	--	--		
Cadmium	1.2	0.7	1.0	53	0.005	0.006	0.006	18
Chromium	912	881	896.5	3	0.005 U	0.005 U	0.005 U	
Copper	2,860	2,740	2,800	4	--	--		
Iron	676,000	650,000	663,000	4	--	--		
Lead	44	41	42.5	7	0.03 U	0.03 U	0.03 U	
Mercury	0.07 U	0.07 U	0.07 U	--	0.0001 U	0.0001 U	0.0001 U	
Nickel	1,150	1,100	1,125	4	--	--		
Selenium	1.2 U	1.4 U	1.2 U	--	0.05 U	0.05 U	0.05 U	
Silver	1.2	1.2	1.2	0	0.003 U	0.003 U	0.003 U	
Thallium	0.1 U	0.1 U	0.1 U	--	--	--		
Zinc	80.1	70.6	75.4	13	--	--		

* - Relative percent difference - (x-y)/((x+y)/2)*100

Qualifiers:

E - Estimate, sediment QA/QC was outside acceptable limits

U - Not detected at detection limit shown

J - Estimate, amount is less than method quantification limit

B - Also detected in method blank. Carbon disulfide is a contaminant peculiar to Manchester Laboratory. The other two are common laboratory contaminants.

Table 5 - Results of Receiving Water and Effluent General Chemistry Analyses - Seattle Steel - 9/89.

	Longfellow Creek													
Station:	Seattle Steel Intake			Above Holding Pond	Below Holding Pond	Holding Pond Leachate	Holding Pond				Effluent Ditch		Junction Box	
Date:	9/12-13	9/12	9/13	9/13	9/13	9/13	9/12-13	9/12-13	9/12	9/13	9/12	9/13	9/12	9/13
Time:	1650-1650	1650	1226	1531	1415	1445	1615-1615	1615-1615	1730	1200	1103	1010	1205	1114
Type:	Comp	Grab	Grab	Grab	Grab	Grab	Comp	Comp (dup)	Grab	Grab	Grab	Grab	Grab	Grab
Parameter Lab ID #: 3781	-05	NA	NA	-06	-08	-07	-09	-10	-11	-12	-13	-14	-15	-16
General Chemistry														
Turbidity (NTU)	2.3			1.5	1.2	0.7	4.6				5.6			
pH (S.U.)	7.6						7.3							
Conductivity (uhmos/cm)	299						147							
Alkalinity (mg/L as $CaCO_3$)	107			108	60	60	51				68			
Hardness (mg/L as $CaCO_3$)	145			143	79	77	67				165			
Cyanide (ug/L)	<5				<5	<5	<5	<5			<5			
Salinity (o/oo)											<1			
TS (mg/L)	263						109			134	682			
TNVS (mg/L)	148						55			77	583			
TSS (mg/L)	23			19	18	21	29		3	26	20	41		83
TNVSS (mg/L)	2						7			9	19			
COD (mg/L)	14.5			8.7	4.3	4.0	9.5		11.5	6.9	55.2	24.9	20.7	14.2
NH_3 (mg/L)	0.027			0.027	0.020	0.014	<0.010				0.337	0.313	0.030	0.020
NO_3+NO_2 (mg/L)	0.903			0.854	0.319	0.026	0.198				0.187	0.146	0.150	0.131
T-Phosphate (mg/L)	0.080			0.084	0.045	0.021	0.021				0.075	0.066	0.050	0.033
Phenols (ug/L)	8			9	<5	7	<5	<5			75			
Oils & Grease (mg/L)	<1.7			10.5	21.3	14.0			<2.0	199(81.3)*+	<2.0	<1.9	<2.6	<1.9
Field Observations														
pH (S.U.)	8.01	7.95	8.08	7.74	8.08	7.50	8.11		7.80	7.85	7.49	8.16	7.85	8.22
Conductivity (uhmos/cm)	305	315	299	300	205	162	144		163	145	1,100	980	320	135
Temperature (°C)	5.8	15.3	14.5	15.5	18.1	24.0	6.9		25.9	24.8	24.0	22.9	25.1	22.5
Dissolved Oxygen (mg/L)		10.1	13.5	9.3(9.2)*	9.8									

* - Results of replicate sample
*+ - Duplicate grab samples were collected for oil and grease analysis
TS - Total Solids
TNVS - Total Non-Volatile Solids
TSS - Total Suspended Solids
TNVSS - Total Non-Volatile Suspended Solids

Table 6 - Results of Effluent Organics and Metals Analyses - Seattle Steel, 9/89.

Parameter (ug/L)	Station: Lab ID #: 3781-	Holding Pond 09		Holding Pond (dup) 10		Junction Box 15		Effluent Ditch 13	
Phthalates:									
Diethylphthalate		0.9	U	0.2	J	0.8	U	0.9	U
Di-n-Butylphthalate		0.9	U	0.3	J	0.8	U	0.2	J
Volatile Organics:									
Chloroform		1	J	0.7	J	1	J	1	J
Benzene		5	U	0.5	J	5	U	5	U
Bromodichloromethane		0.5	J	0.5	J	0.5	J	0.5	J
Pesticides/PCBs:									
Aroclor-1242		0.18		0.21		0.32		0.48	
Metals:									
Antimony		1		2		7		1	
Arsenic		4		4		14		8	
Chromium		5	U	5	U	8		5	U
Copper		43		45		221		61	
Iron		1,240		1,270		5,040		2,190	
Lead		4		3		8		2	
Nickel		20		30		70		30	
Zinc		6		4		23		4	U

Qualifiers:
U - Not detected at detection limit shown.
J - The compound was positively identified. However, the result is less than method quantitation limit.

Table 7 - Results of Effluent Total Metal Analyses Compared to Water Quality Criteria - Seattle Steel, 9/89.

Parameter (µg/L)	Station: Lab ID: 3781-	Holding Pond* 09,10		Junction Box Effluent 15	Water Qualtity Criteria** (ug/L) Freshwater Acute	Freshwater Chronic	Saltwater Acute	Saltwater Chronic
Antimony		1.5		7	9,000	1,600	-	-
Arsenic		4		14	360	190	69	36
Chromium		5	U	8	1,297	155	-	-
Copper		44		221	12.7	8.7	2.9	-
Lead		3.5		8	51.8	2.0	140	5.6
Nickel		25		70	1,049	117	75	8.3
Zinc		5		23	87	78	95	86
Iron		1,255		5,040				
Hardness		67		+ +				

Parameter (µg/L)	Station: Lab ID: 3781- 13	Effluent Ditch		Water Qualtity Criteria** (ug/L) Freshwater Acute	Freshwater Chronic	Saltwater Acute	Saltwater Chronic
Antimony		1		9,000	1,600	-	-
Arsenic		8		360	190	69	36
Chromium		5	U	2,617	312	-	-
Copper		61		28.4	18.1	2.9	-
Lead		2		154.4	6.0	140	5.6
Nickel		30		2,166	241	75	8.3
Zinc		4	U	179	162	95	86
Iron		2,190					
Hardness		165					

* - Average of duplicates

** - Criteria for metals based on total recoverable method. Arsenic and chromium criteria are for arsenic(III) and chromium(III).

+ + - Hardness not measured for this sample; assumed to be equal to holding pond water hardness of 70 mg/L as $CaCO_3$.

Table 8 - Results of Receiving Water and Effluent Bioassays - Seattle Steel, 9/89.

Microtox:

Sample	EC_{50}* (% effluent)
Intake water	>100
Holding pond	>100
Effluent ditch	>100

Echinoderm fertilization bioassay:

Concentration (volume %)	Average % Unfertilized Intake Water	Holding Pond	Effluent Ditch
Control	20.3	28.3	20.5
5.0	16.4	23.0	32.3
10.0	24.6	16.3	26.5
20.0	19.0	20.3	28.0
40.0	23.8	26.8	29.5
80.0	25.5	54.7	22.3
NOEC+	>80.0	40.0	>80.0
LOEC**	NA	80.0	NA

96-hour Rainbow trout bioassay (100 percent concentration):

	# of live organisms Initial	Final	Percent Mortality
Intake water	30	30	0
Holding pond	30	27	10
Effluent ditch	30	29	3
Control	30	29	3

48-hour *Daphnia pulex* bioassay (100 percent concentration):

	# of live organisms Initial	Final	Percent Mortality
Intake water	20	15	25
Holding pond	20	15	25
Effluent ditch	20	19	5
Control	20	18	10

* - All Microtox data was not suitable for data reduction indicating non-toxic samples. EC_{50} was assumed to be greater than 100 percent.

\+ - No observable effects concentration.

** - Lowest observable effects concentration.

Table 9 - Parameters Detected in Longfellow Creek and Holding Pond Water (in bold type) - Seattle Steel, 9/89.

Parameter (ug/L)	Station: Lab ID #: 3781-	Longfellow Creek: Seattle Steel Intake 05	Longfellow Creek: Below Holding Pond 08	Holding Pond Leachate 07	Holding Pond 09	Holding Pond (dup) 10
Phthalates:						
Diethylphthalate		1 U	0.8 U	0.9 U	0.9 U	**0.2 J**
Di-n-Butylphthalate		1 U	0.8 U	0.9 U	0.9 U	**0.3 J**
Volatile Organics:						
Chloroform		5 U	**4 J**	**0.5 J**	**1 J**	**0.7 J**
Benzene		5 U	5 U	5 U	5 U	**0.5 J**
Bromodichloromethane		5 U	**0.5 J**	5 U	**0.5 J**	**0.5 J**
Pesticides/PCBs:						
Aroclor-1242		0.04 U	0.04 U	**0.038 J**	**0.18**	**0.21**
Metals:						
Antimony		1 U	1 U	**4**	**1**	**2**
Arsenic		**1**	**2**	**6**	**4**	**4**
Chromium		5 U	5 U	5 U	5 U	5 U
Copper		3 U	**3 BT**	**4 BT**	**43**	**45**
Iron		**315**	**250**	**201**	**1,240**	**1,270**
Lead		1 U	1 U	1 U	**4**	**3**
Nickel		10 U	10 U	10 U	**20**	**30**
Zinc		4 U	4 U	4 U	**6**	**4**

Qualifiers:
U - Not detected at detection limit shown.
J - The compound was positively identified. However, the result is below method quantitation limit. Benzene and chloroform are common laboratory contaminants.
BT - The result is less than ten times the concentration of the metal found in the field sampling blank.

Table 10 - Parameters detected in Sediment (in bold type) - Seattle Steel, 9/89.

Parameter	Station: Lab ID #: 3781-	Holding Pond 18	Holding Pond (dup) 24	Junction Box 19	Effluent Ditch 21
% Fines*		**>39.7**	**>17.1**	**>57.7**	**>19.3**
% Sand		**5.3**	**5.2**	**14.6**	**12.9**
% Gravel		**0.1**	**<0.1**	**6.4**	**0.2**
% TOC		**4.2**	**4.8**	**2.4**	**5.6**
% Dry Weight		**43.6**	**38.3**	**36.0**	**45.1**
Oil and Grease - mg/kg dry		**88,500**	**86,200**	**44,000**	**73,500**
Hydrocarbon ID		lube oil	lube oil	lube oil	lube oil
Phenols - mg/kg dry:					
Phenol		**3.10**		17 U	200 U
2,4,5-Trichlorophenol		4.30 U		81 U	**84 J**
Phthalates - mg/kg dry:					
bis(2-Ethylhexyl)phthalate		0.89 U		17 U	**44 J**
Di-n-Octylphthalate		0.89 U		17 U	**40 J**
Diethylphthalate		0.89 U		17 U	**27 J**
Di-n-Butylphthalate		0.89 U		17 UJ	**160 J**
Polyaromatic Hydrocarbons (PAHs) - mg/kg dry:					
Pyrene		0.89 U		17 U	**32 J**
Phenanthrene		0.89 U		17 U	**33 J**
Anthracene		0.89 U		17 U	**39 J**
Benzo(a)Anthracene		0.89 U		17 U	**42 J**
Fluoranthene		0.89 U		17 U	**49 J**
Chrysene		0.89 U		17 U	**44 J**
Benzo(a)Pyrene		0.89 U		17 U	**56 J**
Indeno(1,2,3-cd)Pyrene		0.89 U		17 U	**27 J**
Benzo(ghi)Perylene		0.89 U		17 U	**56 J**
Total PAHs		--		--	**378 J**
Miscellaneous - mg/kg dry:					
Carbazole		0.89 UJ		17 U	**110 J**
Dibenzofuran		0.89 U		17 U	**18 J**
Volatile Organics - ug/kg dry:					
Chloroform		18 U	**3 J**	**3 J**	33 U
2-Butanone		**67 B**	**100 B**	9 UJ	**350** E
Trichloroethene		18 U	25 U	6 U	**380** E
Total Xylenes		**2 J**	**3 J**	**7 J**	**85** E
2-chlorotoluene		**4 J**	25 U	6 U	33 U
1,2-Dichlorobenzene		18 U	25 U	6 U	**9 J**
1,2,4-Trimethylbenzene		**6 J**	**13 J**	**4 J**	**110** E

Table 10 - Parameters Detected in Sediment - Continued

Parameter	Station: / Lab ID #: 3781-	Holding Pond 18		Holding Pond (dup) 24		Junction Box 19		Effluent Ditch 21	
Isopropylbenzene		**4**	**J**	**2**	**J**	**1**	**J**	**16**	**J**
p-Isopropyltoluene		**18**	**E**	**15**	**J**	6	U	33	U
Ethylbenzene		18	U	25	U	6	U	**12**	**J**
Propylbenzene		**9**	**J**	25	U	**2**	**J**	**34**	**E**
Butylbenzene		**17**	**J**	**16**	**J**	**0.9**	**J**	33	U
1,4-Dichlorobenzene		18	U	**6**	**J**	6	U	33	U
4-Methyl-2-Pentanone		**25**	**J**	**28**	**J**	**15**		**23**	**J**
1,3,5-Trimethylbenzene		**26**	**E**	25	U	**9**		**300**	**E**
Toluene		**10**	**J**	**9**	**J**	**1**	**J**	**50**	**E**
Chlorobenzene		18	U	25	U	6	U	**17**	**J**
Sec-Butylbenzene		**5**	**J**	25	U	6	U	**19**	**E**
2-Hexanone		**6**	**J**	**3**	**J**	12	U	65	U
Pesticides/PCBs - ug/kg dry:									
4,4'-DDD		100	UJ	5.5	U	11	U	**7.9**	**J**
4,4'-DDE		120	UJ	60	UJ	220	UJ	**27**	**J**
Aroclor-1260		500	UJ	**220**		**180**		**170**	
Aroclor-1254		500	UJ	**5,190**		**1,770**	**J**	**790**	**J**
Aroclor-1248		10,000	UJ	20,000	UJ	**6,750**		3,000	UJ
Aroclor-1242		**12,700**		**17,900**		500	UJ	**4,980**	
Total PCBs		**12,700**		**23,310**		**8,700**	**J**	**5,975**	**J**

* - Silt and clay (<4um-62um)

Qualifiers:
- U - Not detected at quantitation limit shown
- UJ - Estimated method quantitation limit
- J - Estimate, amount is less than method quantitation limit
- B - Also detected in method blank
- E - Estimate, sediment QA/QC was outside acceptable limits

Table 11 - Results of Sediment Metals Analyses - Seattle Steel, 9/89.

Parameter (mg/Kg-dry)	Station: Lab ID #: 3781-	Holding Pond* 18,24		Junction Box 19		Effluent Ditch 21	
Antimony		29.4	E	64.7	E	18.1	E
Arsenic		102		85		79	
Cadmium		0.95		223		2.1	
Chromium		896.5		980		715	
Copper		2,800		2,600		2,080	
Iron		663,000		590,000		552,000	
Lead		42.5		12,800		191	
Mercury		0.07	U	0.32		0.49	
Nickel		1,125		817		774	
Silver		1.2		19.7		1.7	
Zinc		75.4		67,700		410	

* - Average of duplicate pond sediment samples #378118 and #378124
U - Not detected at quantitation limit shown
E - Estimate, sediment QA/QC was outside acceptable limits

Table 12 - Results of Sediment EP Tox Metals Analyses Compared to Dangerous Waste Criteria - Seattle Steel, 9/89.

Parameter Station: (mg/L) Lab ID #: 3781-	Holding Pond* 18,24	Junction Box 19	Effluent Ditch 21	Dangerous Waste Criteria ** (range in mg/L)
Arsenic	0.05 U	0.5 U	0.05 U	5 - 500
Barium	0.345	2.44	0.455	100 - 10,000
Cadmium	0.0055	4.38	0.010	1 - 100
Chromium	0.005 U	0.008	0.005 U	5 - 500
Lead	0.03 U	137	0.03	5 - 500
Mercury	0.0001 U	0.0001 U	0.0001 U	0.2 - 20
Selenium	0.05 U	0.5 U	0.05 U	1 - 100
Silver	0.003 U	0.003 U	0.003 U	5 - 500

* - Average of duplicate pond sediment samples #378118 and #378124

** - Ecology, 1988. Dangerous Waste Regulations, Chapter 173-303-100 WAC, Washington State Department of Ecology, Amended September, 1988.

U - Not detected at quantitation limit shown

Table 13 - Results of Marine Sediment Organics Analyses Compared to Sediment Standards - Seattle Steel, 9/89.

Parameter	Station: Lab ID #: 3781-	Sediment* At Outfall 22		Sediment* Near Outfall 23		Draft Sediment Management Standard** (mg/kg organic carbon)
% Fines+		<22.7		17		
% Sand		72.5		<79.8		
% Gravel		5.8		2.8		
% TOC		2.8		1.4		
% Dry Weight		41.90		39.58		
Oil and Grease - mg/kg dry		15,600		2,440		
Hydrocarbon ID		Lube Oil		Lube Oil/PAHs		
Volatile Organics - ug/kg dry:						
Dichlorodifluoromethane		3	J	39	U	--
Low Molecular Weight PAHs (LPAHs) - mg/kg dry:						
2-Methylnaphthalene		17.0	U	0.78	(56)J	38
1-Methylnaphthalene		17.0	U	1.2	(86)J	--
Acenaphthylene		17.0	U	0.28	(20)J	66
Acenaphthene		17.0	U	**4.0**	**(290)**	16
Fluorene		17.0	U	**5.5**	**(390)**	23
Phenanthrene		17.0	U	**30.0**	**(2,140)**	100
Anthracene		17.0	U	**8.9**	**(640)**	220
Total LPAHs		--		**50.7**	**(3,620)**	370
High Molecular Weight PAHs (HPAHs) - mg/kg dry:						
Fluoranthene		17.0	U	**51.0**	**(3,640)**	160
Pyrene		17.0	U	**28.0**	**(2,000)**	1,000
Benzo(a)Anthracene		17.0	U	**10.0**	**(710)**	110
Chrysene		17.0	U	**13.0**	**(930)**	110
Benzo(b)Fluoranthene		17.0	U	7.9	(560)	--
Benzo(k)Fluoranthene		17.0	U	6.6	(470)	--
Total Benzo Fluoranthenes++		34.0	U	**14.5**	**(1,040)**	230 +++
Benzo(a)Pyrene		17.0	U	**5.6**	**(400)**	99
Indeno(1,2,3-cd)Pyrene		17.0	U	**1.9**	**(135)J**	34
Dibenzo(a,h)Anthracene		17.0	U	**1.4**	**(100)J**	12
Benzo(g,h,i)Perylene		17.0	U	**1.8**	**(130)J**	31
Total HPAHs		17.0	U	**127.2**	**(9,075)J**	960
Miscellaneous - mg/kg dry:						
Carbazole		17.0	UJ	4.4	J	--
4-Nitrophenol		83.0	U	16.0		--
Dibenzofuran		17.0	U	2.8	(0.2)J	15
Pesticides/PCBs - ug/kg dry:						
4,4'-DDD		9.1	J	22	UJ	--
4,4'-DDE		11	J	22	UJ	--
Aroclor-1260		310		69		--
Aroclor-1254		680	J	170		--
Aroclor-1248		2,000	UJ	316		--
Aroclor-1242		1,810		300	UJ	--
Total PCBs		**2,800**	**(100)J**	**555**	**(39.6)**	12
% Extraction Recoveries						
Tetrabromobenzene		120		90		
4,4-Dibromooctaflourene		120		100		

* - Value in ( ) is concentration in mg/kg organic carbon
** - Ecology, 1990a
\+ - Silt + Clay (<4um-62um)
\++ - Total Benzo Fluoranthenes given is the sum of the concentrations of the "B" and "K" isomers
\+++ - Total Benzo Fluoranthenes criterion represents the sum of the concentrations at the "B", "J", and "K" isomers
U - Not detected at quantitation limit shown
J - Estimated amount
UJ - Estimated method quantitation limit

Table 14 - Results of Marine Sediment Metals Compared to Sediment Quality Standards - Seattle Steel, 9/89.

Parameter (mg/Kg dry)	Station: Lab ID #: 3781-	At Outfall 22	Near Outfall 23	Draft Sediment Manage. Standard* (mg/kg dry)
Antimony		2.05 E	0.87 E	--
Arsenic		19.9 E	15.0 E	57
Beryllium		0.2 U	0.2 U	--
Cadmium		1.4	0.5	5.1
Chromium		164	40	260
Copper		**413**	95	390
Iron		103,000	29,000	--
Lead		145	51	450
Nickel		117	31	--
Zinc		339	137	410

E - Estimate, sediment QA/QC was outside acceptable limits
* - Ecology, 1990a

Table 15 - Results of Sediment Bioassays - Seattle Steel, 9/89.

Sample	Lab ID #	Amphipod (Rhepoxynius abronius) % Survival	Avoidance*
At Outfall	378122	22	0.6
Near Outfall	378123	49	8.8
Lab Control		97	6.5

* - Mean # of amphipods on the surface of jar per day

APPENDICES

Appendix 1 - Chemical Analytical Methods - Seattle Steel, 9/89.

Analyses	Method Used*	Laboratory
General Chemistry		
Turbidity	EPA-180.1	Manchester Lab; WA
pH	EPA-150.1	Manchester Lab; WA
Conductivity	EPA-120.1	Manchester Lab; WA
Alkalinity	EPA-310.1	Manchester Lab; WA
Hardness	EPA-130.2	Manchester Lab; WA
Cyanide	EPA-335.2-1	AmTest; Redmond, WA
Salinity	DOE-101.1	Manchester Lab; WA
Solids		
TSS	EPA-160.2	Manchester Lab; WA
TS	EPA-160.3	Manchester Lab; WA
TNVS & TNVSS	EPA-160.4	Manchester Lab; WA
COD	EPA-410.1	Manchester Lab; WA
NH_3	EPA-350.1	Analytical Resources Inc.; WA
NO_3+NO_2	EPA-353.2	Analytical Resources Inc.; WA
T-Phosphate	EPA-365.1	Analytical Resources Inc.; WA
Oil & Grease	EPA-413.1	AmTest; Redmond, WA
Organic + Metals		
pp Metals (water/solids)	EPA-200 Series	Analytical Resources Inc.; WA
Semivolatiles (solids/water)	EPA-8270/625	Manchester Lab; WA
Volatiles (water)	EPA-624	Manchester Lab; WA
Pest/PCBs (water/solids)	EPA-608/8080	Manchester Lab; WA
Phenols	EPA-589	AmTest; Redmond, WA

* - EPA, 1984. 40 CFR Part 136, October 26, 1984.

Appendix 2 - Results of Water Semivolatile Priority Pollutant Matrix Spikes - Seattle Steel, 9/89.

		Water Sample (% Recoveries)		
Parameter	Lab ID #: 3781-	Matrix Spike 05	Matrix Spike Duplicate 05	RPD*
Benzo(a)Pyrene		160	150	6
2,4-Dinitrophenol		120	100	18
Dibenz(a,h)Anthracene		160	160	0
Benzo(a)Anthracene		130	120	8
4-Chloro-3-Methylphenol		150	150	0
Benzoic Acid		64	10	146
Hexachloroethane		56	64	13
Hexachlorocyclopentadiene		49	55	12
Isophorone		100	96	4
Acenaphthene		81	79	3
Diethylphthalate		110	110	0
Di-n-Butylphthalate		110	110	0
Phenanthrene		100	97	3
Butylbenzylphthalate		130	120	8
N-Nitrosodiphenylamine		83	79	5
Fluorene		92	87	6
Carbazol		NAR	NAR	NA
Hexachlorobutadiene		56	66	16
Pentachlorophenol		150	130	14
2,4,6-Trichlorophenol		120	120	0
2-Nitroaniline		150	150	0
2-Nitrophenol		99	99	0
1-Methylnaphthalene		NAR	NAR	NA
Naphthalene		63	66	5
2-Methylnaphthalene		50	54	8
2-Chloronaphthalene		73	74	1
3,3'-Dichlorobenzidine		NAR	NAR	NA
2-Methylphenol		120	120	0
1,2-Dichlorobenzene		59	68	14
o-Chlorophenol		100	110	10
2,4,5-Trichlorophenol		130	120	8
Nitrobenzene		86	78	10
3-Nitroaniline		520	490	6
4-Nitroaniline		340	460	30
4-Nitrophenol		140	130	7
Benzyl Alcohol		0.5 U	0.5 U	NA

Appendix 2 - Results of Water Semivolatile Priority Pollutant Matrix Spikes - Continued

Parameter	Lab ID #: 3781-	Water Sample (% Recoveries) Matrix Spike 05	Matrix Spike Duplicate 05	RDP*
4-Bromophenyl-phenylether		110	94	16
2,4-Dimethylphenol		130	120	8
4-Methylphenol		130	130	0
1,4-Dichlorobenzene		58	66	13
4-Chloroaniline		340	350	3
Phenol		120	120	0
bis(2-Chloroethyl)ether		97	94	3
bis(2-Chloroethoxy)methane		100	95	5
bis(2-Ethylhexyl)phthalate		133	131	2
Di-n-Octylphthalate		150	150	0
Hexachlorobenzene		100	97	3
Anthracene		110	110	0
1,2,4-Trichlorobenzene		57	64	12
2,4-Dichlorophenol		120	110	9
2,4-Dinitrotoluene		110	110	0
Pyrene		130	120	8
Dimethylphthalate		110	100	10
Dibenzofuran		86	85	1
Benzo(ghi)Perylene		160	150	6
Indeno(1,2,3-cd)Pyrene		180	160	12
Benzo(b)Fluoranthene		160	140	13
Fluoranthene		110	110	0
Benzo(k)Fluoranthene		140	140	0
Acenaphthylene		94	94	0
Chrysene		130	120	8
Retene		NAR	NAR	NA
4,6-Dinitro-2-methylphenol		120	120	0
1,3-Dichlorobenzene		60	66	10
2,6-Dinitrotoluene		110	110	0
N-Nitroso-Di-n-propylamine		110	100	10
4-Chlorophenyl-phenylether		93	91	2
bis(2-chloroisopropyl)ether		86	86	0

Appendix 2 - Results of Water and Sediment Volatile Matrix Spikes - Seattle Steel, 9/89.

	Water Sample (% Recoveries)			Sediment Sample (% Recoveries)		
Parameter/Lab ID #: 3781-	Matrix Spike 05	Matrix Spike Duplicate 05	RPD*	Matrix Spike 18	Matrix Spike Duplicate 18	RPD*
Carbon Tetrachloride	101	107	6	65	62	5
Acetone	37	10 U	NA	10 U	310	NA
Chloroform	99	111	11	119	119	0
Benzene	103	110	7	134	128	5
1,1,1-Trichloroethane	101	105	4	113	114	1
Bromomethane	97	111	13	77	90	16
Chloromethane	99	113	13	73	71	3
Dibromomethane	102	105	3	133	126	5
Bromochloromethane	NA	NA	NA	81	85	5
Chloroethane	105	108	3	81	67	19
Vinyl Chloride	103	117	13	69	71	3
Methylene Chloride	94	106	12	69	86	22
Carbon Disulfide	5 U	5 U	NA	10 U	10,000 B	NA
Bromoform	93	100	7	58	59	2
Bromodichloromethane	96	109	13	67	67	0
1,1-Dichloroethane	102	113	10	73	71	3
1,1-Dichloroethene	97	104	7	80	78	3
Trichlorofluoromethane	99	106	7	43	37	15
Dichlorodifluoromethane	94	106	12	56	52	7
1,2-Dichloropropane	103	111	7	93	94	1
2-Butanone	180	94	63	10 U	209	NA
1,1,2-Trichloroethane	100	106	6	171	160	7
Trichloroethene	99	102	3	125	126	1
1,1,2,2-Tetrachloroethane	99	102	3	187	187	0
1,2,3-Trichlorobenzene	94	102	8	1	3	100
Hexachlorobutadiene	92	97	5	6	4 J	40
Naphthalene	96	103	7	39	43	10
Total Xylenes	99	106	7	89	98	10
2-chlorotoluene	98	107	9	104	103	1
1,2-Dichlorobenzene	100	107	7	91	89	2
1,2,4-Trimethylbenzene	97	104	7	111	120	8
DBCP	88	96	9	135	123	9
1,2,3-Trichloropropane	98	106	8	2,400	2,600	8
Tert-Butylbenzene	98	104	6	72	83	14
Isopropylbenzene	98	107	9	87	86	1
p-Isopropyltoluene	97	105	8	11	29	90
Ethylbenzene	100	106	6	69	69	0
Styrene	99	106	7	73	76	4
Propylbenzene	98	105	7	62	76	20
Butylbenzene	98	103	5	11	18	48
4-Chlorotoluene	94	104	10	133	117	13
1,4-Dichlorobenzene	97	104	7	83	95	13

Appendix 2 - Results of Water and Sediment Volatile Matrix Spikes - Continued

	Water Sample (% Recoveries)			Sediment Sample (% Recoveries)		
Parameter/Lab ID #: 3781-	Matrix Spike 05	Matrix Spike Duplicate 05	RPD*	Matrix Spike 18	Matrix Spike Duplicate 18	RPD*
1,2-Dibromoethane	102	105	3	122	125	2
1,2-Dichloroethane	109	121	10	89	90	1
Vinyl Acetate	79	81	3	80	79	1
4-Methyl-2-Pentanone	110	110	0	10 U	350 U	NA
1,3,5-Trimethylbenzene	99	105	6	38	64	51
Bromobenzene	102	109	7	169	177	5
Toluene	102	106	4	97	97	0
Chlorobenzene	100	106	6	102	102	0
1,2,4-Trichlorobenzene	97	105	8	39	33	17
Dibromochloromethane	99	104	5	32	32	0
Tetrachloroethene	93	103	10	70	70	0
Sec-Butylbenzene	96	102	6	37	43	15
1,3-Dichloropropane	102	107	5	123	120	2
Cis-1,2-Dichloroethene	100	110	10	47	92	65
Trans-1,2-Dichloroethene	96	105	9	79	74	7
1,3-Dichlorobenzene	101	110	9	86	96	11
1,1-Dichloropropene	104	109	5	101	95	6
2,2-Dichloropropane	97	109	12	55	73	28
2-Hexanone	130	120	8	10 U	220	NA
1,1,1,2-Tetrachloroethane	102	115	12	90	90	0
cis-1,3-Dichloropropene	102	109	7	32	29	10
Trans-1,3-Dichloropropene	99	106	7	29	26	11

Appendix 2 - Results of Sediment and Water Pest/PCB Matrix Spikes - Seattle Steel, 9/89.

	Water Sample (% Recoveries)			Sediment Sample (% Recoveries)		
Parameter Lab ID #: 3781-	Matrix Spike 05	Matrix Spike Duplicate 05	RPD*	Matrix Spike 21	Matrix Spike Duplicate 21	RPD*
4,4'-DDT	130	124	5	100	76	27
Chlordane	Not Used	Not Used	NA	Not Used	Not Used	NA
Gamma-BHC (Lindane)	120	110	9	80	80	0
Dieldrin	120	120	0	94	81	15
Endrin	I	I	NA	97	94	3
Methoxychlor	25	34	31	83	75	10
4,4'-DDD	110	100	10	100	87	14
4,4'-DDE	110	100	10	110	100	10
Heptachlor	51	42	19	39	45	14
Aldrin	33	45	31	51	47	8
Alpha-BHC	115	110	4	72	54	29
Beta-BHC	143	130	10	80	82	2
Delta-BHC	83	62	29	82	86	5
Alpha-Endosulfan	63	99	44	98	70	33
Heptachlor Epoxide	45	97	73	74	62	18
Endosulfan Sulfate	110 J	130 J	17	100	80	22
Endrin Aldehyde	67	52	25	54	37	37
Toxaphene	Not Used	Not Used	NA	Not Used	Not Used	NA
Aroclor-1260	Not Used	Not Used	NA	Not Used	Not Used	NA
Aroclor-1254	Not Used	Not Used	NA	Not Used	Not Used	NA
Aroclor-1221	Not Used	Not Used	NA	Not Used	Not Used	NA
Aroclor-1232	Not Used	Not Used	NA	Not Used	Not Used	NA
Aroclor-1248	Not Used	Not Used	NA	Not Used	Not Used	NA
Aroclor-1016	Not Used	Not Used	NA	Not Used	Not Used	NA
Beta-Endosulfan	110	140	24	100	88	13
Aroclor-1242	Not Used	Not Used	NA	Not Used	Not Used	NA

Qualifiers:

I - Interference, no analytical result
J - Estimate
U - Not detected
NAR - No analytical result
NA - Not applicable
* - Relative Percent Difference - (x-y)/((x+y)/2)*100

Appendix 3 - Results of Sediment Pest/PCB Surrogates - Seattle Steel, 9/89.

	(% Recoveries)					
	Freshwater Sediment				Marine Sediment	
Parameter Station:	Holding Pond	Holding Pond (dup)	Effluent Ditch	Junction Box	At Outfall	Near Outfall
Lab ID #: 3781-	18	24	21	19	22	23
Tetrabromobenzene	53	70	100	64	120	90
Dibromooctafluorabiphenyl	70	120	110	73	120	100
Matrix Spike #1						
Tetrabromobenzene			110			
Dibromooctafluorobiphenyl			130			
Matrix Spike #2						
Tetrabromobenzene			110			
Dibromooctafluorobiphenyl			120			

Appendix 3 - Results of Sediment Volatile Surrogates - Seattle Steel, 9/89.

	(% Recoveries)					
	Freshwater Sediment				Marine Sediment	
Parameter Station:	Holding Pond	Holding Pond (dup)	Junction Box	Effluent Ditch	At Outfall	Near Outfall
Lab ID #: 3781-	18	24	19	21	22	23
1,2-Dichloroethane	94	97	101	104	104	100
1,4-Bromofluorobenzene	66	70	91	83	93	94
Toluene	117	113	103	112	103	95
1-bromo-2-fluoroethane	63	68	92	79	76	127
Matrix Spike #1						
1,2-Dichloroethane	88					
1,4-Bromofluorobenzene	63					
Toluene	111					
1-bromo-2-fluoroethane	54					
Matrix Spike #2						
1,2-Dichloroethane	88					
1,4-Bromofluorobenzene	62					
Toluene	107					
1-bromo-2-fluoroethane	50					

Appendix 3 - Results of Sediment Semivolatile Surrogates - Seattle Steel, 9/89.

	(% Recoveries)				
	Freshwater Sediments			Marine Sediments	
Compound Lab ID #: 3781-	Holding Pond 18	Junction Box 19	Effluent Ditch 21	At Outfall 22	Near Outfall 23
Pyrene	NAR	137	NAR	NAR	NAR
2-Fluorobiphenyl	108	126	NAR	NAR	NAR
2-Fluorophenol	102	94	NAR	NAR	NAR
Terphenyl	58	128	NAR	NAR	NAR
Nitrobenzene	83	52	NAR	NAR	NAR
Phenol	108	68	NAR	NAR	NAR
Duplicate					
Pyrene	141				98
2-Fluorobiphyenyl	111				108
2-Fluorophenol	104				106
Terphenyl	119				88
Nitrobenzene	76				74
Phenol	79				66

Appendix 3 - Results of Receiving Water and Effluent Semivolatile Surrogates - Seattle Steel, 9/89

	(% Recoveries)							
		Longfellow Creek						
Parameter Station:	Field Sampling Blank	Seattle Steel Intake	Below Holding Pond	Holding Pond Leachate	Holding Pond	Holding Pond (dup)	Junction Box	Effluent Ditch
Lab ID #: 3781-	17	05	08	07	09	10	15	13
Pyrene	127	124	120	124	128	150	148	147
2-Fluorobiphenyl	69	66	76	91	79	89	95	103
2-Fluorophenol	97	84	90	100	79	93	85	96
Terphenyl	134	124	123	124	124	160	148	156
Nitrobenzene	92	86	93	102	83	104	96	106
Phenol	60	61	58	62	54	58	55	68
Matrix Spike #1								
Pyrene	142							
2-Fluorobiphenyl	81							
2-Fluorophenol	107							
Terphenyl	149							
Nitrobenzene	105							
Phenol	105							
Matrix Spike #2								
Pyrene	141							
2-Fluorobiphenyl	82							
2-Fluorophenol	106							
Terphenyl	140							
Nitrobenzene	104							
Phenol	105							

Appendix 3 - Results of Receiving Water and Effluent Pest/PCB Surrogates - Seattle Steel, 9/89

	(% Recoveries)							
		Longfellow Creek						
Parameter Station:	Field Sampling Blank	Seattle Steel Intake	Below Holding Pond	Holding Pond Leachate	Holding Pond	Holding Pond (dup)	Junction Box	Effluent Ditch
Lab ID #: 3781-	17	05	08	07	09	10	15	13
Hexabromobenzene (HBB)	100	100	110	91	87	96	93	100
Dibromooctafluorobiphenyl	92	68	91	0	73	97	94	110
Matrix Spike #1								
HBB		110						
DBOB		91						
Matrix Spike #2								
HBB		100						
DBOB		75						

Appendix 3 - Results of Receiving Water and Effluent Volatile Surrogates - Seattle Steel, 9/89

	(% Recoveries)							
		Longfellow Creek						
Parameter Station:	Field Sampling Blank	Seattle Steel Intake	Below Holding Pond	Holding Pond Leachate	Holding Pond	Holding Pond (dup)	Junction Box	Effluent Ditch
Lab ID #: 3781-	17	05	08	07	09	10	15	13
1,2-Dichloroethane	86	92	87	94	99	94	101	96
1,4-Bromofluorobenzene	99	98	97	98	98	100	100	97
Toluene	100	99	99	99	98	100	99	98
Matrix Spike #1								
1,2-Dichloroethane		96						
1,4-Bromofluorobenzene		102						
Toluene		99						
Matrix Spike #2								
1,2-Dichloroethane		106						
1,4-Bromofluorobenzen		102						
Toluene		102						

Appendix 4 - Results of Sediment Pest/PCB and Metal Priority Pollutant Scans - Seattle Steel, 9/89.

	Freshwater Sediment								Marine Sediment			
Parameter Station:	Holding Pond		Holding Pond (dup)		Effluent Ditch		Junction Box		At Outfall		Near Outfall	
Lab ID #: 3781-	18		24		21		19		22		23	
Pesticides (µg/Kg dry)												
4,4'-DDT	100	UJ	5.5	U	6	U	11	U	7	U	5.5	U
Chlordane	280	UJ	600	UJ	500	UJ	2,700	UJ	300	UJ	110	UJ
Gamma-BHC (Lindane)	12.5	U	5.5	U	6	U	11	U	7	U	5.5	U
Dieldrin	100	UJ	35	U	6	U	11	U	7	U	11	U
Endrin	100	U	5.5	U	6	U	11	U	7	U	5.5	U
Methoxychlor	30	UJ	11	UJ	13	U	11	U	14	U	11	UJ
4,4'-DDD	100	UJ	5.5	U	**7.9**	**J**	11	U	**9.1**	**J**	22	UJ
4,4'-DDE	120	UJ	60	UJ	**27**	**J**	220	UJ	**11**	**J**	22	UJ
Heptachlor	1,200	UJ	300	UJ	65	UJ	220	UJ	30	UJ	5.5	U
Aldrin	1,200	UJ	300	UJ	130	UJ	1,100	UJ	65	UJ	5.5	U
Alpha-BHC	12.5	U	5.5	U	6	U	11	U	7	U	5.5	U
Beta-BHC	100	UJ	5.5	U	6	U	220	UJ	7	U	5.5	U
Delta-BHC	37	UJ	5.5	U	6	U	11	U	7	U	5.5	U
Alpha-Endosulfan	12.5	U	5.5	U	6	U	11	U	7	U	5.5	U
Heptachlor Epoxide	60	UJ	5.5	U	6	U	11	U	7	U	5.5	U
Endosulfan Sulfate	100	UJ	5.5	U	6	U	11	U	7	U	5.5	U
Endrin Aldehyde	100	U	5.5	U	6	U	11	U	7	U	5.5	U
Toxaphene	550	UJ	300	U	130	U	1,100	U	130	U	110	U
Aroclor-1260	500	UJ	220		**170**		**180**		**310**		**69**	
Aroclor-1254	500	UJ	5,190		**790**	**J**	**1,770**	**J**	**680**	**J**	**170**	
Aroclor-1221	500	U	60	U	30	UJ	500	UJ	65	U	55	U
Aroclor-1232	500	U	60	UJ	30	UJ	500	UJ	65	UJ	55	U
Aroclor-1248	10,000	UJ	20,000	UJ	3,000	UJ	**6,750**		2,000	UJ	**316**	
Aroclor-1016	500	U	60	U	30	UJ	500	UJ	65	U	55	U
Beta-Endosulfan	12.5	U	5.5	U	6	U	11	U	7	U	5.5	U
Aroclor-1242	**12,700**		**17,900**		**4,980**		500	UJ	**1,810**		300	UJ
Metals - mg/kg dry:												
Antimony	**26.2**	**E**	**32.6**	**E**	**18.1**	**E**	**64.7**	**E**	**2.05**	**E**	**0.87**	**E**
Arsenic	**107**		**97**		**79**		**85**		**19.9**		**15.0**	
Beryllium	0.1	U	0.1	U	0.1	U	0.1	U	**0.2**		**0.2**	
Cadmium	**1.2**		**0.7**		**2.1**		**223**		**1.4**		**0.5**	
Chromium	**912**		**881**		**715**		**980**		**164**		**40**	
Copper	**2,860**		**2,740**		**2,080**		**2,600**		**413**		**95**	
Iron	**676,000**		**650,000**		**552,000**		**590,000**		**103,000**		**29,000**	
Lead	**44**		**41**		**191**		**12,800**		**145**		**51**	
Mercury	0.07	U	0.07	U	**0.49**		**0.32**		0.07	U	0.07	U
Nickel	**1,150**		**1,100**		**774**		**817**		**117**		**31**	
Selenium	1.2	U	1.4	U	1.2	U	1.4	U	1.5	U	1.3	U
Silver	**1.2**		**1.2**		**1.7**		**19.7**		0.5	U	0.4	U
Thallium	0.1	U	0.1	U	0.59	U	0.1	U	0.2	U	0.1	U
Zinc	**80.1**		**70.6**		**410**		**67,700**		339		137	

Qualifiers:

U - Not detected at quantification limit shown

J - Estimate, amount is less than method detection limit

UJ - Estimated method detection limit

E - Estimate, failed laboratory QA/QC limits

Appendix 4 - Results of Receiving Water and Effluent Volatile Priority Pollutant Scans - Seattle Steel, 9/89.

Parameter (ug/L) Station: Lab ID #: 3781-	Field Sampling Blank 17	Longfellow Creek: Seattle Steel Intake 05	Longfellow Creek: Below Holding Pond 08	Holding Pond Leachate 07	Holding Pond 09	Holding Pond (dup) 10	Junction Box 15	Effluent Ditch 13
Carbon Tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	5 U	5 U	**4 J**	**0.5 J**	**1 J**	**0.7 J**	**1 J**	**1 J**
Benzene	5 U	5 U	5 U	5 U	5 U	0.5 J	5 U	5 U
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	**0.5 J**	5 U	**0.5 J**	**0.5 J**	**0.5 J**	**0.5 J**
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Hexachlorobutadiene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total Xylenes	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-chlorotoluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
DBCP	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
p-Isopropyltoluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Propylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Butylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Chlorotoluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Acetate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,3,5-Trimethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Sec-Butylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cis-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trans-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U
1,1,1,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

U - Not detected at quantification limit shown

J - Estimated amount

Appendix 4 - Results of Receiving Water and Effluent Volatile Priority Pollutant Scans - Seattle Steel, 9/89.

		Longfellow Creek						
Parameter (ug/L) Station: / Lab ID #: 3781-	Field Sampling Blank 17	Seattle Steel Intake 05	Below Holding Pond 08	Holding Pond Leachate 07	Holding Pond 09	Holding Pond (dup) 10	Junction Box 15	Effluent Ditch 13
Carbon Tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	5 U	5 U	**4 J**	**0.5 J**	**1 J**	**0.7 J**	**1 J**	**1 J**
Benzene	5 U	5 U	5 U	5 U	5 U	0.5 J	5 U	5 U
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	**0.5 J**	5 U	**0.5 J**	**0.5 J**	**0.5 J**	**0.5 J**
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Hexachlorobutadiene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total Xylenes	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-chlorotoluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
DBCP	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
p-Isopropyltoluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Propylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Butylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Chlorotoluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Acetate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,3,5-Trimethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Sec-Butylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cis-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trans-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U
1,1,1,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

U - Not detected at quantification limit shown

J - Estimated amount

Appendix 4 - Results of Receiving Water and Effluent Pest/PCB and Metal Priority Pollutant Scans - Seattle Steel, 9/89.

Parameter Station:	Field Sampling Blank	Longfellow Creek Seattle Steel Intake	Longfellow Creek Below Holding Pond	Holding Pond Leachate	Holding Pond	Holding Pond (dup)	Junction Box	Effluent Ditch
(µg/L) Lab ID #: 3781-	17	05	08	07	09	10	15	13
4,4'-DDT	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Chlordane	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Gamma-BHC (Lindane)	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Dieldrin	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Endrin	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Methoxychlor	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
4,4'-DDD	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4,4'-DDE	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Heptachlor	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Aldrin	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Alpha-BHC	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Beta-BHC	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Delta-BHC	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Alpha-Endosulfan	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Heptachlor Epoxide	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Endosulfan Sulfate	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Endrin Aldehyde	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Toxaphene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Aroclor-1260	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Aroclor-1254	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Aroclor-1221	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Aroclor-1232	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Aroclor-1248	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Aroclor-1016	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Beta-Endosulfan	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Aroclor-1242	0.04 U	0.04 U	0.04 U	**0.038 J**	**0.18**	**0.21**	**0.32**	**0.48**
Antimony	1 U	1 U	1 U	**4**	**1**	**2**	**7**	**1**
Arsenic	1 U	**1**	**2**	**6**	**4**	**4**	**14**	**8**
Beryllium	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chromium	5 U	5 U	5 U	5 U	5 U	5 U	**8**	5 U
Copper	**2**	3 U	**3 BT**	**4 BT**	**43**	**45**	**221**	**61**
Iron	**5**	**315**	**250**	**201**	**1,240**	**1,270**	**5,040**	**2,190**
Lead	1 U	1 U	1 U	1 U	**4**	**3**	**8**	**2**
Mercury	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	10 U	10 U	10 U	10 U	**20**	**30**	**70**	**30**
Selenium	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Silver	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Thallium	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Zinc	4 U	4 U	4 U	4 U	**6**	**4**	**23**	4 U

BT - Also detected in Field Transfer Blank.
U - Not detected at detection limit shown
J - Estimate, amount is less than method detection limit

Appendix 4-Results of Receiving Water and Effluent Semivolatile Priority Pollutant Scans-Seattle Steel, 9/89.

Parameter (ug/L)	Station: Lab ID #: 3781-	Field Sampling Blank	Longfellow Creek: Seattle Steel Intake	Longfellow Creek: Below Holding Pond	Holding Pond Leachate	Holding Pond	Holding Pond (dup)	Junction Box	Effluent Ditch
		17	05	08	07	09	10	15	13
Benzo(a)Pyrene		1 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2,4-Dinitrophenol		5 U	6 U	4 U	4 U	4 U	4 U	4 U	5 U
Dibenz(a,h)Anthracene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Benzo(a)Anthracene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
4-Chloro-3-Methylphenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Benzoic Acid		5 U	6 U	4 U	4 U	4 U	4 U	4 U	5 U
Hexachloroethane		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Hexachlorocyclopentadiene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	5 U
Isophorone		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Acenaphthene		1 U	NA	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Diethylphthalate		0.2 J	1 U	0.8 U	0.9 U	0.9 U	**0.2 J**	0.8 U	0.9 U
Di-n-Butylphthalate		1 U	1 U	0.8 U	0.9 U	0.9 U	**0.3 J**	0.8 U	**0.2 J**
Phenanthrene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Butylbenzylphthalate		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
N-Nitrosodiphenylamine		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Fluorene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Carbazol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Hexachlorobutadiene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Pentachlorophenol		5 U	6 U	4 U	4 U	4 U	4 U	4 U	5 U
2,4,6-Trichlorophenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2-Nitroaniline		5 U	6 U	4 U	4 U	4 U	4 U	4 U	5 U
2-Nitrophenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
1-Methylnaphthalene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Naphthalene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2-Methylnaphthalene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2-Chloronaphthalene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
3,3'-Dichlorobenzidine		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2-Methylphenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
1,2-Dichlorobenzene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
o-Chlorophenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2,4,5-Trichlorophenol		5 U	6 U	4 U	4 U	4 U	4 U	4 U	5 U
Nitrobenzene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
3-Nitroaniline			NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline		5 U	6 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	5.0 U
4-Nitrophenol		5 U	6 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	5.0 U
Benzyl Alcohol			NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2,4-Dimethylphenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
4-Methylphenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
1,4-Dichlorobenzene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
4-Chloroaniline		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Phenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
bis(2-Chloroethyl)ether		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
bis(2-Chloroethoxy)methane		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
bis(2-Ethylhexyl)phthalate		2 U	2 U	0.8 U	2 U	1 U	1 U	1.0 U	1 U
Di-n-Octylphthalate		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Hexachlorobenzene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Anthracene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
1,2,4-Trichlorobenzene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2,4-Dichlorophenol		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2,4-Dinitrotoluene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Pyrene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Dimethylphthalate		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Dibenzofuran		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Benzo(ghi)Perylene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Indeno(1,2,3-cd)Pyrene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Benzo(b)Fluoranthene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Fluoranthene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Benzo(k)Fluoranthene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Acenaphthylene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Chrysene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
Retene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
4,6-Dinitro-2-methylphenol		5 U	6 U	4 U	4 U	4 U	4 U	4 U	5 U
1,3-Dichlorobenzene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
2,6-Dinitrotoluene		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
N-Nitroso-Di-n-propylamine		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
4-Chlorophenyl-phenylether		1 U	1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U
bis(2-chloroisopropyl)ether		1 U	0.8 U	0.9 U	0.9 U	0.9 U	0.8 U	0.9 U	

Qualifiers: U - No detected at quantification limit shown J - Estimated value, amount is less than method quantification limit
NA - Not analyzed

Appendix 4 - Results of Sediment Volatile Priority Pollutant Scans - Seattle Steel, 9/89.

Parameter (µg/Kg dry)	Station: Lab ID #: 3781-	Freshwater Sediment Holding Pond 18	Holding Pond (dup) 24	Junction Box 19	Effluent Ditch 21	Marine Sediment At Outfall 22	Near Outfall 23
Carbon Tetrachloride		18 U	25 U	6 U	33 U	32 U	19 U
Acetone		200 B	320 B	39 B	1,400 B	160 B	150 B
Chloroform		18 U	**3 J**	**3 J**	33 U	32 U	19 U
Benzene		18 U	25 U	6 U	33 U	32 U	19 U
1,1,1-Trichloroethane		18 U	25 U	6 U	33 U	32 U	19 U
Bromomethane		35 U	50 U	12 U	65 U	64 U	39 U
Chloromethane		35 U	50 U	12 U	65 U	64 U	39 U
Dibromomethane		18 U	25 U	6 U	33 U	32 U	19 U
Bromochloromethane		18 U	25 U	6 U	33 U	32 U	19 U
Chloroethane		35 U	50 U	12 U	65 U	64 U	39 U
Vinyl Chloride		35 U	50 U	12 U	65 U	64 U	39 U
Methylene Chloride		18 U	25 U	6 U	33 U	32 U	19 U
Carbon Disulfide		1,400 B	1,100 B	300 B	8,900 B	410 B	180 B
Bromoform		18 U	25 U	6 U	33 U	32 U	19 U
Bromodichloromethane		18 U	25 U	6 U	33 U	32 U	19 U
1,1-Dichloroethane		18 U	25 U	6 U	33 U	32 U	19 U
1,1-Dichloroethene		18 U	25 U	6 U	33 U	32 U	19 U
Trichlorofluoromethane		18 U	25 U	6 U	33 U	32 U	19 U
Dichlorodifluoromethane		35 U	50 U	12 U	65 U	**3 J**	39 U
1,2-Dichloropropane		18 U	25 U	6 U	33 U	32 U	19 U
2-Butanone		67 B	100 B	9 UJ	**350 E**	35 BJ	39 U
1,1,2-Trichloroethane		18 U	25 U	6 U	33 U	32 U	19 U
Trichloroethene		18 U	25 U	6 U	**380 E**	32 U	19 U
1,1,2,2-Tetrachloroethane		18 U	25 U	6 U	33 U	32 U	19 U
1,2,3-Trichlorobenzene		7 UJ	25 U	6 U	33 U	32 BU	19 U
Hexachlorobutadiene		18 U	25 U	6 U	33 U	32 U	19 U
Naphthalene		18 U	25 U	6 U	95 B	32 U	19 B
Total Xylenes		**2 J**	**3 J**	**7 J**	**85 E**	32 U	19 U
2-chlorotoluene		4 J	25 U	6 U	33 U	32 U	19 U
1,2-Dichlorobenzene		18 U	25 U	6 U	**9 J**	32 U	19 U
1,2,4-Trimethylbenzene		**6 J**	**13 J**	**4 J**	**110 E**	32 U	19 U
DBCP		18 U	25 U	6 U	33 U	32 U	19 U
1,2,3-Trichloropropane		18 U	25 U	6 U	33 U	32 U	19 U
Tert-Butylbenzene		18 U	25 U	6 U	33 U	32 U	19 U
Isopropylbenzene		**4 J**	**2 J**	**1 J**	**16 J**	32 U	19 U
p-Isopropyltoluene		**18 E**	**15 J**	6 U	33 U	32 U	19 U
Ethylbenzene		18 U	25 U	6 U	**12 J**	32 U	19 U
Styrene		18 U	25 U	6 U	33 U	32 U	19 U
Propylbenzene		**9 J**	25 U	**2 J**	**34 E**	32 U	19 U
Butylbenzene		**17 J**	**16 J**	**0.9 J**	33 U	32 U	19 U
4-Chlorotoluene		18 U	25 U	6 U	33 U	32 U	19 U
1,4-Dichlorobenzene		18 U	**6 J**	6 U	33 U	32 U	19 U

Appendix 4 - Results of Sediment Volatile Priority Pollutant Scans - Continued

Parameter (µg/Kg dry)	Station: / Lab ID #: 3781-	Freshwater Sediment			Marine Sediments		
		Holding Pond	Holding Pond (dup)	Junction Box	Effluent Ditch	At Outfall	Near Outfall
		18	24	19	21	22	23
1,2-Dibromoethane		35 U	50 U	12 U	65 U	64 U	39 U
1,2-Dichloroethane		18 U	25 U	6 U	33 U	32 U	19 U
Vinyl Acetate		35 U	50 U	12 U	65 U	64 U	39 U
4-Methyl-2-Pentanone		**25 J**	**28 J**	**15**	**23 J**	64 U	39 U
1,3,5-Trimethylbenzene		**26 E**	25 U	**9**	**300 E**	32 U	19 U
Bromobenzene		18 U	25 U	6 U	33 U	32 U	19 U
Toluene		**10 J**	**9 J**	**1 J**	**50 E**	32 U	19 U
Chlorobenzene		18 U	25 U	6 U	**17 J**	32 U	19 U
1,2,4-Trichlorobenzene		18 U	25 U	6 U	33 U	32 U	19 U
Dibromochloromethane		18 U	25 U	6 U	33 U	32 U	19 U
Tetrachloroethene		18 U	25 U	6 U	33 U	32 U	19 U
Sec-Butylbenzene		**5 J**	25 U	6 U	**19 E**	32 U	19 U
1,3-Dichloropropane		18 U	25 U	6 U	33 U	32 U	19 U
Cis-1,2-Dichloroethene		18 U	25 U	6 U	33 U	32 U	19 U
Trans-1,2-Dichloroethene		18 U	25 U	6 U	33 U	32 U	19 U
1,3-Dichlorobenzene		18 U	25 U	6 U	33 U	32 U	19 U
1,1-Dichloropropene		18 U	25 U	6 U	33 U	32 U	19 U
2,2-Dichloropropane		18 U	25 U	6 U	33 U	32 U	19 U
2-Hexanone		**6 J**	**3 J**	12 U	65 U	64 U	39 U
1,1,1,2-Tetrachloroethane		18 U	25 U	6 U	33 U	32 U	19 U
cis-1,3-Dichloropropene		18 U	25 U	6 U	33 U	32 U	19 U
Trans-1,3-Dichloropropene		18 U	25 U	6 U	33 U	32 U	19 U

Qualifiers:
U - Not detected at quantification limit shown
UJ - Estimated method detection limit
J - Estimate, amount is less than method quantification limit
B - Also detected in method blank
E - Estimate, sediment QA/QC was outside acceptable limits

Appendix 4 - Results of Sediment Volatile Priority Pollutant Scans - Continued

Parameter (µg/Kg dry)	Station: / Lab ID #: 3781-	Freshwater Sediment: Holding Pond 18	Holding Pond (dup) 24	Junction Box 19	Marine Sediments: Effluent Ditch 21	At Outfall 22	Near Outfall 23
1,2-Dibromoethane		35 U	50 U	12 U	65 U	64 U	39 U
1,2-Dichloroethane		18 U	25 U	6 U	33 U	32 U	19 U
Vinyl Acetate		35 U	50 U	12 U	65 U	64 U	39 U
4-Methyl-2-Pentanone		**25 J**	**28 J**	**15**	**23 J**	64 U	39 U
1,3,5-Trimethylbenzene		**26 E**	25 U	**9**	**300 E**	32 U	19 U
Bromobenzene		18 U	25 U	6 U	33 U	32 U	19 U
Toluene		**10 J**	**9 J**	**1 J**	**50 E**	32 U	19 U
Chlorobenzene		18 U	25 U	6 U	**17 J**	32 U	19 U
1,2,4-Trichlorobenzene		18 U	25 U	6 U	33 U	32 U	19 U
Dibromochloromethane		18 U	25 U	6 U	33 U	32 U	19 U
Tetrachloroethene		18 U	25 U	6 U	33 U	32 U	19 U
Sec-Butylbenzene		**5 J**	25 U	6 U	**19 E**	32 U	19 U
1,3-Dichloropropane		18 U	25 U	6 U	33 U	32 U	19 U
Cis-1,2-Dichloroethene		18 U	25 U	6 U	33 U	32 U	19 U
Trans-1,2-Dichloroethene		18 U	25 U	6 U	33 U	32 U	19 U
1,3-Dichlorobenzene		18 U	25 U	6 U	33 U	32 U	19 U
1,1-Dichloropropene		18 U	25 U	6 U	33 U	32 U	19 U
2,2-Dichloropropane		18 U	25 U	6 U	33 U	32 U	19 U
2-Hexanone		**6 J**	**3 J**	12 U	65 U	64 U	39 U
1,1,1,2-Tetrachloroethane		18 U	25 U	6 U	33 U	32 U	19 U
cis-1,3-Dichloropropene		18 U	25 U	6 U	33 U	32 U	19 U
Trans-1,3-Dichloropropene		18 U	25 U	6 U	33 U	32 U	19 U

Qualifiers:
- U - Not detected at quantification limit shown
- UJ - Estimated method detection limit
- J - Estimate, amount is less than method quantification limit
- B - Also detected in method blank
- E - Estimate, sediment QA/QC was outside acceptable limits

Appendix 4. Results of Sediment Semivolatile Priority Pollutant Scans-Seattle Steel, 9/89

		Freshwater Sediment					Marine Sediment			
Parameter (µg/Kg dry)	Station: Lab ID #: 3781-	Holding Pond 18		Junction Box 19		Effluent Ditch 21		At Outfall 22		Near Outfall 23	
Fluorene		0.89	U	17.0	U	200	U	17.0	U	**5.5**	
4-Nitroaniline		4.30	UJ	81.0	UJ	960	UJ	83.0	UJ	16.0	UJ
4,6-Dinitro-2-Methylphenol		4.30	U	81.0	U	960	U	83.0	U	16.0	U
N-Nitrosodiphenylamine		0.89	U	17.0	U	200	U	17.0	U	3.4	U
4-Bromophenyl-phenylether		0.89	U	17.0	U	200	U	17.0	U	3.4	U
Hexachlorobenzene		0.89	U	17.0	U	200	U	17.0	U	3.4	U
Pentachlorophenol		4.30	U	81.0	U	200	U	83.0	U	16.0	U
Phenanthrene		0.89	U	17.0	U	**33**	**J**	17.0	U	**30.0**	
Anthracene		0.89	U	17.0	U	**39**	**J**	17.0	U	**8.9**	
Carbazole		0.89	UJ	17.0	U	**110**	**J**	17.0	UJ	**4.4**	**J**
Di-n-Butylphthalate		0.89	U	17.0	UJ	**160**	**J**	17.0	U	3.4	U
Fluoranthene		0.89	U	17.0	U	**49**	**J**	17.0	U	**51.0**	
Pyrene		0.89	U	17.0	U	**32**	**J**	17.0	U	**28.0**	
Retene		0.89	U	17.0	U	200	U	17.0	U	3.4	U
Butylbenxylphthalate		0.89	U	17.0	U	200	U	17.0	U	3.4	U
3,3'-Dichlorobenzidine		0.89	U	17.0	U	200	U	17.0	U	3.4	U
Benzo(a)Anthracene		0.89	U	17.0	U	**42**	**J**	17.0	U	**10.0**	
bis(2-Ethylhexyl)Phthalate		0.89	U	17.0	U	**44**	**J**	17.0	U	3.4	U
AChrysene		0.89	U	17.0	U	**44**	**J**	17.0	U	**13.0**	
Di-n-Octyl Phthalate		0.89	U	17.0	U	**40**	**J**	17.0	U	3.4	U
Benzo(b)Fluoranthene		0.89	U	17.0	U	200	U	17.0	U	**7.9**	
Benzo(k)Fluoranthene		0.89	U	17.0	U	200	U	17.0	U	**6.6**	
Benzo(a)Pyrene		0.89	U	17.0	U	**56**	**J**	17.0	U	**5.6**	
Indeno(1,2,3-cd)Pyrene		0.89	U	17.0	U	**27**	**J**	17.0	U	**1.9**	**J**
Dibenzo(a,h)Anthracene		0.89	U	17.0	U	200	U	17.0	U	**1.4**	**J**
Benzo(ghi)Perylene		0.89	U	17.0	U	**56**	**J**	17.0	U	**1.8**	**J**

Qualifiers:

U - Not detected at detection limit shown
E - Estimate, sediment QA/QC was outside acceptable limits
UJ - Estimated method detection limit
R - No analytical result
J - Estimate, amount is less than method detection limit

Appendix 5 - Effluent and Sediment Bioassay Methods - Seattle Steel, 9/89.

Test Organism	Test Sample	Reference Method	Test Laboratory	Test Duration	Test Concent.	Type of Test	Endpoint Measured
Amphipod *(Rhepoxynius abronius)*	Sediment	1	Ecology	10 days	N/A	Acute and Chronic	Survival and avoidance
Daphnia pulex	Effluent	2	Ecology	48 hrs	100%	Acute	Survival
Rainbow Trout (*Oncorhynchus mykiss*)	Effluent	3	Ecology	96 hrs	65%	Acute	Survival
Microtox (*Photobacterium phosphoreum*)	Effluent	4	Ecology	5,10,15 mins.	11.4, 22.7, 44.9, 90.9%	Acute/ Chronic	Reduction in bacterial luminescence
Echinoderm (*Dendraster excentricus*)	Effluent	5	ERC Environ. San Diego, CA	20 mins	5, 10, 20, 40, 80%	Chronic	% Fertilization

1 Swartz, R., W. DeBen, J. Phillips, J. Lamberson, and F. Cole, 1985. Phoxocephalid Amphipod Bioassay for Marine Sediment Toxicity. Cardwell, Purdy, and Bahner (eds), Aquatic Toxicology and Hazard Assessment: Proceeding of the Seventh Annual Symposium ASTM STP 854. As amended by Chapman, P.M. and S. Becker, 1986. Recommended Protocols for Conducting Laboratory Bioassays on Puget Sound Sediments. Puget Sound Estuary Program, U.S. EPA, Seattle, WA.

2 EPA/600/4-85/013, "Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms."

3 Department of Ecology procedure "Static Acute Fish Toxicity Test."

4 Beckman Microtox System Operating Manual. Microbics Corporation, Carlsbad, CA.

5 Dinnel, P.A., J.M. Link, and Q.J. Stober, 1987. "Improved Methodology for a Sea Urchin Sperm Cell Bioassay for Marine Waters." Arch. Environ. Contam. Toxicol., 16, 23-32, 1987.