EPA Region 5 Records Ctr.
366859

Ecological Risk Assessment

Former Wisconsin Steel Works
Navistar International Transportation Corp.
Chicago, Illinois

ARCADIS GERAGHTY & MILLER

ARCADIS Geraghty & Miller, Inc.
35 East Wacker Drive, Suite 1000
Chicago, Illinois 60601

REPORT

December 1999

ARCADIS GERAGHTY&MILLER

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December 3, 1999

Jamie Tull
Principal Scientist

Gregory A. Vanderlaan
WSW Project Manager

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1.0 Introduction

The purpose of this ecological risk assessment (ERA) is to evaluate the potential for adverse effects to the ecological community in the north and south barge slips of the Former Wisconsin Steel Works (WSW) Site in Chicago, Illinois (Figures 1 and 2) associated with exposure to chemicals in surface water, sediment and fish tissues. This report has been prepared on behalf of Navistar International Transportation Corp. (Navistar).

A human health risk assessment for the North and South Slips was determined unnecessary based on the lack of human exposure. The slips are surrounded by industrial property, and are not used in ways that would encourage recreational exposure to sediments, water, or resident biota in the North and South Slips.

The methods used in this assessment are generally consistent with the United States Environmental Protection Agency's (USEPA) *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (1996) and the *Guidance for Ecological Risk Assessment* (USEPA, 1998).

Consistent with this guidance, this ERA is comprised of the following components:

1) Problem Formulation;

2) Analysis; and

3) Risk Characterization.

Each of these components is described in greater detail in the following sections. This risk assessment has been prepared based on the information available for the North and South Barge Slips. These data include chemical data for sediment, surface water, and fish tissues, sediment toxicity tests, and benthic community sampling reported by the United States Fish and Wildlife Service (USFWS) in 1994, and chemical data for sediment and surface water reported by the Illinois Environmental Protection Agency (Illinois EPA) in 1996.

In order to more accurately assess the ecological risk associated with the slips, the following tasks were completed:

1) The sediment chemical data in the USFWS report are reported as dry weight concentrations, but were found to be wet weight concentrations. Therefore, the dry weight normalized data were determined and reevaluated relative to background sediment concentrations (dry weight).

2) Sediment chemical data for polynuclear aromatic hydrocarbons (PAHs) are reported at potentially elevated concentrations in both slips. Modeling is used to evaluate the potential toxicity to aquatic organisms associated with the detected PAH concentrations.

3) Toxicity testing conducted by the USFWS indicates unacceptable toxicity in two of the south barge slip samples. These results are reexamined to determine if any significant correlation exists between the toxicity test results and the sediment chemical data or test ammonia data.

4) PAHs, polychlorinated biphenyls (PCBs), and metals were detected in the whole body tissue samples of fish collected from the two slips. These results are used to estimate the potential risks to fish-eating (piscivorous) birds.

Based on these lines of evidence conclusions are drawn regarding the potential for chemicals in the sediment, surface water, and biota to pose an imminent hazard to the ecological community at the Site.

2.0 Problem Formulation

Problem formulation is the process of reviewing existing data and site conditions to develop preliminary hypotheses about how adverse ecological effects might occur. The problem formulation phase of the ERA is used to focus the remainder of the assessment on those chemicals, transport mechanisms, and exposure pathways that are most likely to be associated with adverse ecological effects. The problem formulation phase includes a description of the environmental setting, chemicals of concern (COCs) known or suspected to exist at the Site, a brief discussion of the COC fate and transport characteristics as they relate to potential COC migration, a brief discussion of the potential toxicity associated with the COCs; and a discussion of the exposure pathways that are most likely to be complete. Each of these elements is described in greater detail in the following sections.

2.1 Site Characterization

The WSW site is in southeastern Chicago, Illinois in Section 7 and 8, T37N, R15E of the 3rd Principal Meridian, in Hyde Park Township, Cook County, Illinois. The address of the site is 2701 East 106th Street, Chicago, Illinois, 60617. The site is located in an industrialized area of Chicago that is adjacent to the Calumet River and contains two barge slips that were historically used for the shipping of raw materials to the WSW site and steel products from the WSW site. The WSW site has been used to produce steel since 1875. During the 1930s, the WSW operation was expanded to become a fully integrated steel manufacturing facility, and by 1966, over one million tons of steel were produced a year at the WSW site. All operations ceased at the facility in 1982, and the facility was demolished in anticipation of developing the property for alternative commercial uses.

The north barge slip is not currently being used, while the south barge slip is being used for shipping and receiving

operations by other industries in the Site vicinity. A National Pollutant Discharge Elimination System (NPDES) permitted outfall is present in the south slip that receives non-contact cooling water from the Acme Steel plant located adjacent to the WSW site. All storm drains and outfalls from the WSW site to the barge slips have been sealed.

The north barge slip is currently not used for commercial traffic. The slip is approximately 1227 feet long by 180 feet wide (USFWS, 1994). The banks are sheer walls, with water depths that range from 12 to 25 feet.

The south barge slip is currently used for industrial barge traffic. The slip is approximately 964 feet long by 174 feet wide (USFWS, 1994). The banks are sheer except in the immediate vicinity of the Acme Steel outfall, where the bank has slumped creating a shallow shoreline area approximately 500 feet long. With the exception of this one shallow area, water depth ranges from 10 feet to 25 feet.

The barge slips are connected to the Calumet River approximately 3 miles south of Calumet Harbor on Lake Michigan, and 2 miles north of the O'Brien Lock and Dam. The Calumet River has a reversible flow and passes though predominantly heavy industrial areas.

Existing data indicate that PAHs, metals, PCBs (measured as Aroclors), and some volatile organic compounds (VOCs) are present in the sediment and surface water of the north and south barge slips along the Calumet River.

2.2 Previous Investigations

The USFWS and the Illinois EPA have conducted ecological investigations of the north and south barge slips. In July 1993, the USFWS collected six sediment samples from the north barge slip and six sediment samples from the south barge slip. In June 1996, the Illinois EPA collected four sediment and surface water samples from the north slip and two sediment and surface water samples from the south barge slip. The locations of sediment and surface water samples are shown on Figure 3.

2.3 Data Summary

The following section summarizes the data used in this ERA.

2.3.1 Sediment

Sediment samples were collected by the USFWS and the Illinois EPA with a Ponar dredge (USFWS, 1994). The sediment in the north and south barge slips are primarily impacted by PAHs, PCBs and metals. Although acetone and 2-butanone were detected in sediment samples from the slips, they are present at low concentrations, are potentially laboratory contaminants, and are not believed to be related to site activities. Data summaries for north slip sediment on a wet weight, dry weight and organic carbon normalized basis are presented in

Tables 1 through 3, respectively. Data summaries for south slip sediment on a wet weight, dry weight and organic carbon normalized basis are presented in Tables 4 through 6, respectively. Raw sediment data on a wet weight, dry weight, and organic carbon normalized basis are provided in Appendices A, B and C, respectively. The data previously reported by the USFWS as dry weight chemical results (USFWS, 1994) have been determined to be wet weight chemical concentrations, and have been analyzed accordingly.

2.3.2 Surface Water

Surface water samples were collected by the Illinois EPA with a "Bacon Bomber" sampler (IEAP, 1996). The water samples were collected from approximately 4 to 6 feet below the river surface. The samples were analyzed for metals, volatile organic compounds, semi-volatile organic compounds, pesticides and PCBs. Metals were detected in the surface water samples collected from the north slip. Metals and very low levels of benzene and chloroform were detected in surface water samples collected in the south barge slip. Because of the small data set for surface water, a statistical summary was not prepared. The raw surface water data is presented in Appendix D.

2.3.3 Sediment Toxicity Tests

The USFWS (1994) conducted 96-hour sediment toxicity tests using larval fathead minnows (*Pimephales promelas*). The results indicate that the majority of the samples from the north and south slips exhibit no significant toxicity. Two samples from the south slip exhibit significant toxicity relative to the controls. The data and the associated sediment chemical data are evaluated in this assessment.

2.3.4 Tissue Data

Fish samples were collected from the two slips using three types of nets (i.e., baited minnow traps, gill nets, and hoop nets) by the USFWS (USFWS, 1994). A composite sample of three whole common carp (*Cyprinus carpio*) from the north barge slip and three whole white perch (*Morone americana*) from each of the north and south barge slips were saved for chemical analysis. The analysis indicated the presence of PCBs (Aroclor 1248), and metals in the white perch and carp samples from the north barge slip. The white perch from the south barge slip contained PCBs (Aroclor 1248), PAHs (fluoranthene and pyrene), and metals. The analytical data for fish tissue samples are presented in Table 7.

2.4 Habitat Characterization

The barge slips and the section of the Calumet River adjacent to the Site represent highly disturbed aquatic environments that have been used extensively for bulk cargo transport, effluent discharge and other industrial activities. Limited foraging habitat exists for piscivorous birds in the shallow

portion of the south slip at the Acme Steel outfall. The USFWS also reports that the shallow enclosed end of the north slip is used by piscivorous birds and waterfowl (USFWS, 1994). Given the distinct lack of aquatic vegetation and benthos, the waterfowl are likely using the north slip primarily for loafing or resting. Gulls and other piscivorous birds have been observed foraging for small fish in the south slip.

The water quality in the slips was characterized by moderately high water temperatures (18.5°C to 27°C), relatively low dissolved oxygen conditions (5.5 mg/L to 8.2 mg/L), and relatively high pH (8.0 to 8.4 standard pH units) during the July 1993 sampling (USFWS, 1994). The slips are connected to the Calumet River but were reported to have zero flow during the July 1993 sampling event. These data indicate a habitat with relatively poor water quality conditions, particularly for sessile benthic organisms.

The surrounding upland areas are highly disturbed industrial environments that are unlikely to represent significant habitat. Lake Calumet, which is located approximately 1.25 miles to the southwest of the Site represents the most significant habitat resource in the Site vicinity.

2.5 Potential Receptors

Potential receptors within the slips include benthic and epibenthic invertebrates, fish and waterfowl. Piscivorous (i.e. fish eating) birds have been observed feeding in the south slip in the immediate vicinity of the Acme Steel outfall. For the purposes of this ERA, aquatic receptors including benthic and epibenthic invertebrates and fish are evaluated as a single receptor group (i.e., aquatic organisms) due to the similarities in the potential exposures they are likely to experience. In addition, because they have been observed at the Site, piscivorous birds are evaluated in the ERA for potential adverse effects associated with chemical exposure through the food web.

2.6 Fate and Transport

The chemical classes of greatest ecological concern at the Site are the PCBs, PAHs and metals. VOCs are typically not toxic to aquatic organisms at concentrations that have been reported for the Site. In general, PCBs and PAHs are not highly water soluble, and have a tendency to partition to organic carbon in aquatic environments. The lighter molecular weight PAHs (e.g. naphthalene, phenanthrene) are more water soluble than the heavier weight compounds [e.g., dibenzo (a,h)anthracene, indeno (1,2,3-cd) pyrene]. Conversely, the heavier weight PAHs and the PCBs tend to have a higher affinity for lipids, and therefore, are more likely to partition to the fats of an organism once taken up in the environment. The more lipophilic compounds are more likely to bioaccumulate through the food chain.

It should be noted that PAHs are not considered to pose a significant food web bioaccumulation risk due to the fact that they are readily metabolized by organisms with mixed function oxidation (MFO) systems, such as fish (Neff, 1979). This means that PAHs are readily metabolized and excreted, and therefore, do not bioaccumulate in a manner similar to PCBs.

Many metals are expected to be present naturally in aquatic environments because they can be derived from weathering of the earth's crust. Therefore, many metals are likely to be present within an aquatic system that have no relationship to industrial activities at the Site or in the Site vicinity. Metal bioavailability varies depending in part on the chemical form present and the pH and hardness of the water.

2.7 Chemicals of Potential Ecological Concern

COCs were selected by screening all existing sediment, surface water and fish tissue data to identify the chemicals most likely to contribute to significant ecological risks. All chemicals that were detected at least once in each environmental medium were initially considered as COCs. Because relatively few compounds were detected in fish tissue, all priority pollutant chemicals detected in fish were included as COCs (Table 7). COCs in sediment and surface water were selected by comparing mean chemical concentrations to regional background chemical concentration ranges and selected media-specific toxicity benchmark values. The results of these comparisons for sediment and surface water are presented in the following sections.

2.7.1 Sediment COCs

Mean concentrations of all chemicals in sediment were initially screened against regional background chemical concentration values. The comparison is a way to identify COCs carried to the next level of the risk assessment. Mean chemical concentrations were calculated on a wet weight, dry weight, and organic carbon normalized basis for both the north barge slip and the south barge slip. These results are presented in Tables 1 through 6. The analytical data is tabulated in Appendix A.

Two sources of data were used to establish a range of concentrations within the Calumet River system that characterized background chemical conditions. The first source of background chemical concentration data was the Illinois EPA's *Evaluation of Stream Sediment Data 1974-1980* (Illinois EPA, 1984). This document presents a range of concentrations of metals, nutrients and organic compounds that have been classified by Illinois EPA as non-elevated, slightly elevated, elevated, highly elevated or extremely elevated based on their distribution in the watersheds considered. Due to the industrial land use in the Site vicinity,

concentrations of chemicals within the Calumet River are expected to be somewhat elevated above pristine conditions. For this reason, chemical concentrations within the barge slip sediments were compared against the Illinois EPA elevated classification for chemicals in sediment.

The second source of background data used in this assessment was the US Geological Survey's *Surface Water Quality Assessment of the Upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Geochemical Data for Fine Fraction Streambed Sediment from High and Low Order Streams, 1987* (USGS, 1987). Background chemical concentrations used from this document were the 50th and 90th percentile distributions of element concentrations from high order streams of the upper Illinois River Basin, which includes the Calumet River system. Due to the industrial nature of the surrounding area, the 90th percentile metal concentrations were considered representative of background concentrations in the Site vicinity.

The results of the background sediment comparison are presented in Table 8. Of the chemicals detected in the north slip or south slip sediment, a total of 11 metals and 4 PCBs were identified at concentrations above background, and were carried through to the next step in the COC selection process.

In addition to the background screen, mean concentrations of chemicals in sediment were compared against the sediment effects concentrations (SECs) presented in the USEPA *Assessment and Remediation of Contaminated Sediments (ARCS) Program: Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyallella Azteca and the Midge Chironomus Riparius* (USEPA, 1996). The concentrations used for comparison purposes were the ARCS Effects Range Median (ER-M) values from 14-day *Hyallela Azteca* toxicity tests, normalized to one percent organic carbon. For those COCs for which 14-day toxicity test values were unavailable, guidelines based on 28-day *Hyallela Azteca* toxicity tests were used.

It is widely accepted that bulk sediment chemistry data is an inaccurate basis for predicting toxic conditions in sediment (USEPA, 1993a, 1993b, 1993c; Di Toro et al.1991). However, to be conservative, the dry weight concentrations of metals in sediment and the organic carbon normalized concentrations for organic chemicals in sediment were compared to the ARCS SECs. Sixteen PAH compounds, 4 PCB Aroclors, and 6 metals have mean concentrations that exceed the SECs on a dry weight, or organic carbon normalized basis. The results of the toxicity benchmark screening for sediment are presented in Table 9.

In addition to the previously described data for PAHs, PCBs and metals, several pesticides were detected in sediment of the North and South Slips. The

concentrations of pesticides detected in sediments were not substantially elevated. Detected concentrations in sediments are most likely from historical uses within the watershed. Because the pesticide compounds were not detected at substantially elevated concentrations or at significant frequency on the WSW site, pesticides in sediment are unlikely to be site related. Therefore, pesticides are not considered further in this ERA.

Based on the comparison to background and the toxicity benchmark screening, a total of 30 chemicals are identified as COCs in sediment. The COCs in sediment for the north and south barge slips are presented in Table 10.

2.7.2 Surface Water COCs

Table 11 presents a comparison of surface water concentrations in the slips to USEPA aquatic water quality criteria (AWQC) for freshwater aquatic life protection, the Illinois secondary contact and indigenous aquatic life standards provided in 35 IAC 302 Subpart D, and the Illinois criteria for general use waters. The state of Illinois regulations indicate that the general use criteria should be applied to the reach of the Calumet River adjacent to the Site. However, for the purposes of this assessment the USEAPA AWAC and the Illinois secondary contact and indigenous aquatic life standards are considered more appropriate.

None of the surface water chemical concentrations exceeded these criteria. Therefore, no adverse effects to ecological receptors are expected as a result of exposure to chemicals in surface water, and no COCs in surface water were selected.

2.8 Exposure Assessment

Exposure assessment is the process of describing and quantifying the potential chemical uptake that could occur at the Site. Included in the exposure assessment is a description of potentially complete exposure pathways for each receptor group evaluated, and estimation of the magnitude of exposure associated with potentially complete exposure pathways, for each receptor.

A site conceptual exposure model (Figure 4) is used to depict our current understanding of the potential chemical sources, release mechanisms, transport mechanisms, and exposure pathways that may exist at the Site. Without a complete exposure pathway, no risk to a receptor is possible. The exposure pathways that are expected to be complete for each of the receptor groups evaluated in this ERA are presented in Figure 4 and discussed briefly below.

Aquatic plants including algae and emergent macrophytes may take up COCs from the water column, or in some instances, from the interstitial sediment pore-water. Other aquatic receptors including sediment invertebrates and fish may be exposed to COCs in sediment and surface water through direct contact and ingestion.

Piscivorous birds may be exposed to COCs in the tissues of their prey items, and through direct contact with sediment and surface water. However, the direct contact pathways (i.e., dermal contact, and sediment or water ingestion) for piscivorous birds are expected to be negligible compared to the fish ingestion pathway. The potentially complete exposure pathways for all receptor groups are presented in Figure 4.

3.0 Analysis

The analysis phase of the ERA addresses the potential toxicity and exposure of aquatic organisms and piscivorous birds to the Site COCs. Multiple lines of evidence or methods of evaluation are used to estimate the risks to ecological receptors. The weight of these lines of evidence is used to draw conclusions regarding potential ecological risks.

3.1 Aquatic Organisms

Potential risks to aquatic organisms (Invertebrates and fish) are evaluated along four lines of evidence: 1) comparisons of sediment chemical concentrations to sediment quality guideline values; 2) evaluation of the USFWS toxicity test results; 3) modeling of PAH toxicity potential in sediment; and 4) evaluation of the benthic community analysis.

3.1.1 Toxicity Assessment

The COCs selected in sediment include several light and heavy molecular weight PAHs, metals, and the PCB compounds Aroclor 1242, Aroclor 1248, Aroclor 1254, and Aroclor 1260. The potential toxicity to aquatic organisms associated with each chemical group is discussed below.

3.1.1.1 PAH Toxicity

PAHs are often categorized into two groups according to their molecular weight. The low molecular weight PAHs (LPAHs) consist of 2 to 3 ring compounds and the high molecular weight PAHs (HPAHs) consist of 4 to 6 ring compounds. The potential for exposure to and toxicity from LPAHs is generally greater than from HPAHs because the lighter fraction is generally more soluble and therefore more available. High molecular weight PAHs are generally less soluble, more tightly sorbed to particles, and therefore less available to aquatic organisms. Table 12 presents general toxicity data on PAHs that summarizes toxicities of individual compounds into 2 ranges of toxicity values for LPAH or HPAH groups.

Acute toxicity to invertebrates from aquatic exposure of LPAHs ranges from 0.05 to 5.8 mg/L (Table 12). Generally, fish appear to be less sensitive than invertebrates by an order of magnitude, with acute toxicity ranging from 0.5 to 150 mg/L. Chronic effects are seen in microorganisms at concentrations ranging from 0.3 to 62 mg/L, in invertebrates at 0.02 mg/L, and in fish from 0.85 to 3.2 mg/L (Table 12).

Although there are data available for describing the toxicity of dissolved HPAHs, the concentrations required to cause effects are unlikely to occur once oil has fractionated due to the low aqueous solubility of these compounds and the tendency to adsorb to organic carbon (Appendix B). Invertebrates and fish appear to have similar ranges of sensitivity to HPAHs, ranging from 0.25 to >1 mg/L. Data on chronic effects of HPAHs was only found for microorganisms and ranged from 0.005 to 8.1 mg/L (Table 12). The majority of PAHs, particularly HPAHs, will fractionate and become strongly sorbed to suspended particulates and the sediment. Data on toxicity of PAHs associated with sediments or gravel to aquatic organisms are also presented in Table 12. These data confirm that sediment-sorbed PAHs are generally much less toxic than PAHs in the aqueous phase due to their decreased bioavailability. Acute toxicity to invertebrates is reported to occur at sediment or soil concentrations ranging from 5.1 to 670 mg/kg, while chronic effects are seen at 94 mg/kg dry weight (Table 12). Mortality and sublethal effects are reported to have occurred in fish exposed to sediments containing 3,900 mg/kg total PAHs.

3.1.1.2 PCB Toxicity

The toxicity of PCBs to aquatic invertebrates varies considerably among test conditions. Lower chlorinated PCB mixtures are reported to be more toxic to invertebrates than those with higher chlorination (Stalling and Mayer, 1972; Nebeker, et al., 1974; Sericano et al., 1991). The acute toxicity of PCBs to various aquatic invertebrate species can vary with sex, life-stage, and age (Lowe et al., 1972; DiPinto et al., 1993). In addition to lethality, other observed effects include growth inhibition and altered ion transport. For some PCB isomers the effects appear to be reversible. A few laboratory studies have evaluated the effects of PCB-spiked sediments on several different marine aquatic invertebrates. DiPinto et al., (1993) investigated the effect of exposing a species of copepod (*Microarthridian littorale*) for 96 hours to sediments containing 21 mg/kg to 333 mg/kg Aroclor 1254. They reported that exposure to 83 mg/kg of Aroclor 1254 significantly affected copepod survival, but concentrations of 42 mg/kg or less did not. They also reported that the LC_{50} values (concentration that kills 50% of the test population in a specified period of time) for females and males were 251 mg/kg and 117 mg/kg, respectively. DiPinto et al., (1993) also examined the reproductive impairment of the copepods exposed to a range of 4 mg/kg to 83 mg/kg Aroclor 1254 spiked in sediments for 12 days. Egg production and total reproductive capacity were significantly reduced at 4.2 mg/kg and a reduction of larval copepods was observed at 8.3 mg/kg.

McLeese and Metcalfe (1980) reported LC_{50} values for marine sand shrimp of greater than 0.78 mg/kg in sediment for

Aroclor 1242 and greater than 3.4 mg/kg for Aroclor 1254. A study on the exposure of an infaunal amphipod to Aroclor 1254 for 10 days resulted in an LC_{50} of 10.8 mg/kg (Swartz et al., 1988).

Laboratory and field studies have been conducted to evaluate the effects of PCBs in fish (Halter and Johnson, 1974; Nebeker et al., 1974; and Harding and Addison, 1986). Results of these studies indicate that PCBs make their way into fish by two exposure routes: 1) direct uptake from sediment and water; and 2) ingestion of contaminated prey. Based on a review of the literature, it appears that concentrations of PCBs in the range of 1 µg/L or lower do not adversely affect the survival of adults and their offspring (Hansen et al., 1974b; Snarski and Publisi, 1976).

The results of the studies noted above indicate that LC-50 values for sensitive species of freshwater and marine organisms exposed to various Aroclors vary from 0.1 to 10.0 µg/l during exposures of 7 to 38 days. In general, toxicity increased with increasing exposure, crustaceans and younger developmental stages were the most sensitive groups tested. The lower chlorinated biphenyls were more toxic than higher chlorinated biphenyls.

3.1.3 Metal Toxicity

The toxicity of metals identified as COC varies significantly between species, life stages and water quality conditions (e.g., hardness). A summary of the toxicity information for COC metals is beyond the scope of this text. The relative toxicity of the metals is represented by the various regulatory criteria for water and quality guidelines for sediment used to evaluate risk in this assessment.

3.1.2 Toxicity Analysis for Aquatic Organisms

Chemical-specific toxicity information for PAHs is limited to a handful of the 17 priority pollutant PAH compounds. This limits the ability to assess risk by compound. The ΣPAH model was developed by Swartz et.al. (1995) to evaluate the potential toxicity of mixtures of PAH compounds present in field sediment samples. A detailed description of the ΣPAH model can be found in Swartz et. al., (1995). A brief discussion of the model application to individual samples collected at the Site is provided below.

Chemical-specific interstitial pore-water PAH concentrations were predicted using sediment equilibrium partitioning (USEPA 1993) for each sample. The predicted concentrations were divided by the 10-day LC-50 values predicted by the ΣPAH model. The resulting chemical-specific ratios were then summed to arrive at a cumulative toxic unit value for each sample. The results of the ΣPAH model for the Site are presented in Table 13. As discussed by Swartz et al. (1995), cumulative toxic unit values of 0.186 or less are unlikely to contribute to sediment toxicity. Cumulative toxic unit values of 3.29 or higher are expected to

cause toxicity to aquatic organisms under almost all circumstances. The predicted toxic unit values for all samples from the north and south barge slips are less than the 0.186 level. This indicates that no PAH related toxicity is expected for aquatic organisms in the barge slips at the Site.

3.1.3 Toxicity Test Results Evaluation

The USFWS performed toxicity tests on a total of 20 bulk sediment samples collected from seven locations in the north and south barge slips in July and November of 1993. Toxicity tests were carried out using larval fathead minnows (*Pimephales promelas*). The results of the USFWS toxicity testing are presented in Table 14.

Significant toxicity was observed in samples from two locations (i.e., WSW-5 and WSW-6) in the south slip (Table 14). Review of the toxicity test results indicates that the majority of the mortality observed occurred at the 48-hour mark of the 96-hour test. For this reason, correlation analysis was performed using the 48-hour toxicity test results, simultaneously collected data for unionized ammonia, and estimated water concentration data for the sediment COCs from co-located samples based on equilibrium partitioning calculations.

Correlation analyses were performed for all sediment COCs and the unionized ammonia results collected during the sediment toxicity tests to determine which constituents exhibit the strongest relationship to the observed toxicity. The highest correlation coefficient was computed for unionized ammonia (r^2=0.89). The only other compounds with r^2 values greater than 0.5 were naphthalene (r^2 = 0.88), fluorene (r^2 = 0.72) and dibenzo(a,h)anthracene (r^2 = 0.64). The correlation coefficients for the sum of the light molecular weight PAH (LPAH) and high molecular weight PAHs (HPAH) are 0.82 and 0.52. The r^2 values for PCBs were negative, suggesting that the observed toxicity is not associated with PCB concentrations in sediment. Correlations with metals were not attempted as bulk sediment metal concentrations typically are not good indicators of potential toxicity (DiToro et. al., 1991; USEPA 1996).

Measured concentrations of unionized ammonia in the toxicity test water, and predicted pore water concentrations of PAHs were compared to the AWQC, and published toxicity values, respectively, to further evaluate the source of the observed toxicity. The 1-hour maximum AWQC for unionized ammonia is 0.26 mg/l for the pH and temperature conditions reported at the 48-hour time interval for all samples. The mean measured unionized ammonia concentrations (n =2 replicates per sample location) reported for this time interval range from 0.13 mg/l to 0.73 mg/l for the July sample tests, and from 0.33 mg/l to 1.5 mg/l for the November samples (USFWS, 1994). Only two of the July sediment samples had unionized ammonia concentrations below the AWQC.

Pore water PAH concentrations were predicted using equilibrium partitioning (Di Toro et al., 1991). The predicted concentrations vary over several orders of magnitude but none of the concentrations for an individual compound exceed 1 µg/l (parts per billion) (Table 12). The USEPA and Illinois EPA have not published or promulgated AWQC for PAHs in the water column because insufficient data are available (USEPA, 1986). Additional toxicity information reported by USEPA are summarized in Table 12. The PAH toxicity data for chronic exposure range from a low of 6.3 µg/l to a high of 3,980 µg/l. These guidelines are several orders of magnitude greater than the predicted PAH concentrations in the sediment pore water. It is reasonable to anticipate that the exposure concentration in the toxicity test chamber is even lower than the predicted pore water concentrations due to dilution and weathering.

Based on comparison of the measured unionized ammonia concentrations to the AWQC, and a comparison of the predicted PAH pore water concentrations to published toxicity values, it appears that the majority of the observed toxicity, if not all of it, is associated with unionized ammonia, and not the detected PAHs in sediment.

3.1.4 Benthic Community Analysis

Benthic community data collected by the USFWS in July 1993 indicate that the north and south barge slips are sparsely populated with aquatic worms (Oligochaetes), chironomids (aquatic larval midge or fly larva), and exotic molluscs (i.e., Asiatic clam and zebra mussels). As noted by the USFWS, these species are typically tolerant of low quality water conditions and are pollutant tolerant relative to other benthic organisms. This very simple and depauperate community structure is a common result of the conditions that are found in industrial slips and harbors that have disturbed bottom conditions (e.g., due to ship traffic) and poor water quality due to a lack of circulation. The sediment moisture content (range is 46% to 62%) and grain-size (predominantly fined grained, greater than 85% by weight less than 0.1 mm diameter) data collected by the USFWS indicates fairly consistent sediment conditions throughout both slips. As noted by the USFWS (1994) the conditions observed in the slips may not be associated with chemical effects.

North slip benthos collected by the USFWS included 4 chironomids, 170 oligochaetes, and 7 fresh water Asiatic clams (*Corbicula fluminea*). The South slip had similar results with 5 chironomids, 43 oligochaetes, and 6 Asiatic clams.

Benthos were not collected from the Calumet River sampling stations; therefore no reference comparisons can be made. The numbers of organisms collected between the North and South slips are not directly comparable because the level of sampling effort in the South

slip was apparently substantially greater, particularly in the vicinity of sampling location 8 and 11 near the midpoint and mouth of the slip (USFWS, 1994). Overall, the benthic invertebrate data are inadequate to evaluate with any certainty the factors that most strongly influence the benthos in the slips. This line of evidence is inconclusive with regard to the potential for COC related adverse effects.

3.1.5 Summary

The USFWS and Illinois EPA data indicate that COCs in sediment in the barge slips are present at elevated concentrations in some samples from the north and south slips. Comparisons to ARCS ERM guidelines indicate that several PAHs and metals are at concentrations that should be evaluated further. Further evaluation in the form of 96-hour fathead minnow toxicity testing indicates that toxic conditions distinguishable from control conditions were observed in samples from WSW-5 and WSW-6. Our examination of the ammonia and PAH data and published toxicity information indicate that ammonia, rather than PAHs, has a much greater potential to be the driving toxicant.

3.2 Analysis of Risks to Piscivorous Birds

The risk of adverse effects to piscivorous birds is evaluated using a simple fish consumption model. Toxicity reference values (TRVs) for the two PAHs and the Aroclor detected in fish samples from the barge slips were developed and compared to the predicted dose received from consuming fish from the barge slips. This model does not consider sediment and water ingestion as these pathways are considered negligible routes of exposure for birds that feed primarily on water column fish species.

3.2.1 COC Toxicity for Piscivorous Birds

The toxicity of PAHs and PCBs to birds is discussed below.

3.2.1.1 PAH Toxicity to Birds

Our current understanding of PAH toxicity to birds is based largely on non-piscivorous bird species. Mallards fed diets containing 4,000 milligrams per kilogram (mg/kg) total PAHs in the diet for a period of 7 months showed no visible signs of toxicity. However, upon necropsy, liver weights were noted to have increased by 25% (Patton and Dieter, 1980 in USFWS, 1987). Ingestion tolerance for birds appears to be quite high. In a 14-day feeding study, no mortality or toxic effects were observed in adult mallard ducks fed up to 100,000 mg weathered crude oil/kg diet in which PAHs were the primary toxicants of concern (Stubblefield et al., 1995a). Further, in a one-generation study, mallards fed up to 20,000 mg weathered crude oil/kg diet had no significant changes in mortality, body weight, food consumption, number and condition of eggs laid, fertility and hatch

success, and fledge rate (Stubblefield et al., 1995b). While more sensitive, mallard ducklings also appear to tolerate crude oil well. Ducklings exposed from 8 weeks of age had normal growth (as compared to a control group) when fed 25,000 mg crude oil/kg diet (Stubblefield et al., 1995b)

3.2.1.2 PCB Toxicity to Birds

Food ingestion is the principal pathway through which piscivorous birds are exposed to PCBs (Niethammer et al., 1984 and Focardi et al., 1988). While acute toxicity (LD_{50}) values have been reported to range from 604 mg/kg to more than 6,000 mg/kg PCBs in the diet (USFWS, 1985a), the vast majority of the recent research has focused on sub-lethal, chronic endpoints. These endpoints include hepatotoxicity and enzyme induction; endocrine and growth effects; immune system effects; mutagenicity; reproductive impairment; and teratogenicity.

While such effects have been observed in the laboratory at high PCB doses, the most prevalent effect observed in the field is reproductive impairment, including embryotoxicity and aberrant parental incubation behavior. Reproductive impairment has been attributed to higher chlorinated PCBs, such as Aroclor 1254 and 1260. Three principal causes of reproductive impairment have been hypothesized, eggshell thinning, abnormal parental incubation behavior, and embryonic mortality. However, repeatable and positive results are reported only for the latter two, as summarized in recent review articles by Barron et al., (1995) and Peakall and Lincer (1996).

Laboratory studies to evaluate the effects of PCBs on hatching and fledging success of young birds have reported no observed adverse effect levels (NOAEL) and lowest observed adverse effect levels (LOAEL) that range from 3.0 mg/kg to 50 mg/kg, and from 10 mg/kg to 33 mg/kg, respectively (Stotz and Greichus, 1978; McLane and Hughes, 1980; Peakall and Peakall, 1973; and Custer and Heinz, 1980).

3.2.2 Toxicity Reference Values

Toxicity Reference Values (TRVs) represent levels of daily intake in mg/kg/day or chemical concentrations that are not expected to cause adverse effects in the exposed population. In this assessment, TRVs have been derived for the great blue heron (*Ardea herodias*) based on the available toxicity data. The TRVs developed for the great blue heron are presented in Table 15, and are discussed briefly below. The TRV will be compared to predicted COC doses for the consumption of fish to estimate the potential for adverse effects.

Aroclor 1248 was the only PCB detected in fish tissues from the south slip. Opresko et al., (1994) developed a TRV for Aroclor 1254 based on a dietary study of reproductive effects in ring-necked pheasants. No applicable

toxicity data nor a TRV was found for Aroclor 1248. However, Aroclor 1254 and Aroclor 1248 are expected to elicit similar toxic effects due to the similarity in chlorine content (i.e. 48% by weight for Aroclor 1248 versus 54% for Aroclor 1254). Therefore, the TRV developed by Opresko et al. (1994) was used in the evaluation of PCB risks to birds.

As indicated above the toxicity data for PAH effects in birds has been based largely on dietary exposures to mixtures of PAHs in crude oil or oil products. In the literature search conducted, no chemical-specific PAH toxicity data suitable to developing TRVs for birds was obtained. Therefore, TRVs for the two PAH compounds that were detected in fish tissue samples (i.e. pyrene and fluoranthene) were adopted from the USEPA's Biological Technical Advisory Group (BTAG). The BTAG has developed low and high TRVs for a number of chemicals to be applied at US Navy CLEAN sites around the United States.

The BTAG developed TRVs for benzo(a)pyrene and naphthalene based on mammalian toxicity data. Because the TRV for benzo(a)pyrene is lower (1.31 mg/kg/day) than the TRV for naphthalene (50 mg/kg/day) (Personal Communication with Clarence Calahan of USEPA), the TRV for benzo(a)pyrene was used to assess PAH risks to birds. An uncertainty factor of 10 was applied to convert from mammals to the great blue heron resulting in a TRV of 0.131 mg/kg/day for both detected PAH compounds. The TRVs for the COCs in fish tissue are presented in Table 15.

3.2.3 Dose Estimation

As shown in Figure 4, the only potentially complete exposure pathway that is expected to be significant for birds is the ingestion of fish. The potential dose that could be experienced by piscivorous birds foraging in the south slip was estimated using the following equation:

Dose IP = (AUF * PC*PI)/BW

Where:

Dose IP = Dose received through ingestion of prey (mg/kg/day);

AUF = Area use factor (unitless);

PC = COC concentration in prey item (mg/kg);

PI = Prey ingestion rate (kg/day); and

BW = Body weight (kg).

Approximately 500 feet of suitable shoreline exists within the south slip where wading piscivorous birds may forage. This area represents approximately 0.5 percent of a typical great blue heron home range. An area use factor of 0.005 was used based on the smallest reported great blue heron home range size of 0.6 hectares (USEPA, 1993d) and a suitable foraging area of

500 square feet within the south slip. Mean concentrations of COCs in white perch and common carp collected from the south slip were used to represent the prey concentration. The prey ingestion rate was set at 18 percent of the blue heron body weight (USEPA, 1993d). The predicted doses for great blue heron potentially using the slips are presented in Table 16.

4.0 Risk Characterization

Risk characterization integrates the results of the toxicity and exposure assessments and examines the weight of the various lines of evidence (LOE) evaluated to derive an understanding of the potential for ecological risks at the Site.

The line of evidence used to evaluate the potential risks to aquatic organisms are:

- Comparison of the surface water chemical data to the applicable ambient water quality criteria. None of the water quality criteria were exceeded.

- Comparison of the sediment chemical data to toxicity based sediment quality guidance values on a dry weight and organic carbon normalized basis. In this LOE, 27 COCs were detected at concentrations that exceed an ARCS 14-day *Hyallela azteca* sediment quality guidance value.

- Correlation analysis of the sediment toxicity test data for larval fathead minnows and sediment and test solution chemical data. This LOE indicates that the majority of the toxicity observed is most strongly correlated ($r^2 = 0.89$) with the unionized ammonia concentrations detected in the sediment test solutions the 48-hour time interval. Some degree of toxicity may be associated with naphthalene and fluorene, which have correlation coefficients of 0.88 and 0.72, respectively. However, comparisons of the measured unionized ammonia concentrations and the predicted pore water PAH concentrations to their respective AWQC indicates that only unionized ammonia is likely to be present in the test solution at potentially toxic levels.

- The USFWS data for the benthic community in the slips is limited and comprised primarily of species tolerant of stressful chemical, as well as physical conditions (i.e., high temperature, and low dissolved oxygen). Given the lack of water circulation in the slips and the low dissolved oxygen conditions, the assemblage of benthic species identified is not surprising. There is no strong indication that chemical toxicity associated with site-related COCs is the controlling factor for the benthos in the north and south slips under current conditions.

The results for the aquatic community assessment indicate that physically stressful conditions are likely to prevail much of the time in the north and south barge slips. This is due in large part to the lack of flowing water in the slips. Overall, there is no indication that the COCs detected in the sediment and surface water pose an imminent hazard to the aquatic communities in the slips and adjacent Calumet River.

The risk characterization for the avian community consists of a comparison of predicted COC doses to the great blue heron TRVs to arrive at a hazard quotient for each COC. Hazard quotients of 1 or less indicate that adverse effects are not expected as a result of exposure to COCs at the Site. Hazard quotients above one are typically interpreted as an indication that a more refined assessment may be appropriate.

The risk characterization for great blue herons is presented in Table 16. None of the estimated doses are predicted to pose a significant ecological risk to the heron or other piscivorous birds.

5.0 Uncertainty Assessment

Several sources of uncertainty influence our ability to draw firm conclusions about the potential for ecological risks at the slips. Primary among these factors is the bioavailability and toxicity, of the metals present in sediment of the north and south slips. Bulk sediment chemistry data for metals is not a sound indicator of the bioavailable fraction of metals. Therefore, it is unclear whether the measured concentrations are present in a bioavailable form, and thus, capable of causing adverse ecological effects to aquatic receptors. The toxicity test results indicate that non-toxic conditions prevail in the majority of the north and south slip for water column species and unionized ammonia is likely the driving toxicant in the samples from locations WSW-5 and WSW-6. This result suggests that metals are not the toxicant.

The background data sets used for comparison purposes in this assessment were derived from watershed scale studies of the Illinois and Des Plaines River basins. It is likely that the concentrations of chemicals in the immediate vicinity of the Site are elevated due to the heavy industrial activity in this part of Chicago. Therefore, the background comparison may be overly conservative with respect to local background conditions.

Another source of uncertainty in this assessment is the TRV developed for the great blue heron. The TRV for Aroclor 1254 was used in the absence of a published TRV or applicable toxicity data for Aroclor 1248. This approach is not expected to result in an under-estimation of PCB toxicity because the higher chlorinated Aroclor 1254 compound is expected to have similar toxicity. The TRVs for the PAH compounds were derived from the BTAG TRV for benzo(a)pyrene developed for mammals. Because of its chemical structure, benzo(a)pyrene is

expected to be more toxic and have a greater rate of uptake than are the detected compounds pyrene and fluoranthene. Furthermore, an uncertainty factor of 10 was applied to convert the TRV from small mammals to birds. This approach is likely to have over- rather than underestimated potential PAH toxicity to birds.

Overall, with the exception of the bulk sediment data for metals that does not allow interpretation of the bioavailable fraction, the sources of uncertainty described above are not likely to result in significant under-estimation of risk to ecological receptors in the slips.

6.0 Conclusions

This ERA has been conducted to evaluate the potential for adverse ecological effects associated with COC concentrations in surface water, sediment and fish tissue at the WSW Site in Chicago, Illinois. The ERA has been conducted using multiple lines of evidence including media-specific criteria comparisons, evaluation of the potential toxicity of PAH mixtures, correlation analyses of toxicity test results, and analysis of potential food-web exposures based on the data available from the USFWS (1994) and the Illinois EPA (1996).

The results of this assessment indicate that organic compounds are present in the sediments of the north and south slip at concentrations above background and regional toxicity guidance values. However, these concentrations do not pose a significant risk or imminent hazard to aquatic receptors or piscivorous birds that utilize the slips for habitat or foraging.

Although several metals were present in sediment of the north and south slip at concentrations above background levels and toxicity screening values, the available data and lines of evidence evaluated do not indicate that metals are likely to pose a significant risk. First, metals were not detected in the surface water samples at concentrations exceeding the chronic AWQC. Second, the toxicity observed in the fat head minnow toxicity test is attributed to unionized ammonia. Finally, metals were not detected at elevated levels in fish tissues and the associated risks to piscivorous birds appear to be negligible. Therefore, metals do not appear to be associated with adverse effects to aquatic or avian receptors at the slips.

Concerned parties have proposed that the slips be dredged to remove potentially contaminated sediment. However, the results of this assessment indicate that no imminent hazard to the aquatic or avian communities utilizing the barge slips exists, and thus, this action does not appear to be warranted.

Based on this analysis, no recommendations for remedial actions are provided as they do not appear warranted at this time.

7.0 References

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TABLES

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Table 1 **North Slip Sediment Sample Chemical Data Summary (Wet Weight) (a)**
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Organic Compound Concentrations (µg/kg Wet Weight)					
Acetone	4 / 4	78	140	280	280
2-Butanone	4 / 4	15	34	62	62
Toluene	1 / 8	<4	27	180	180
4-Methylphenol	1 / 4	<620	1100	<2700	2400
Naphthalene	9 / 10	390	850	<2700	1100
2-Methylnaphthalene	3 / 4	340	670	<2700	630
Acenaphthene	2 / 10	<58	340	<2700	190
Dibenzofuran	3 / 4	200	530	<2700	350
Phenanthrene	10 / 10	460	1300	4100	4100
Fluorene	8 / 10	120	380	<2700	410
Fluoranthene	7 / 10	<58	2000	12000	12000
Anthracene	10 / 10	190	490	1600	1600
Pyrene	7 / 10	<58	2100	8400	8400
Benzo(a)anthracene	10 / 10	340	1300	6200	6200
Chrysene	9 / 10	<58	1800	6200	6200
Benzo(b)fluoranthene	9 / 10	<19	990	4600	4600
Bis(2-ethylhexyl)phthalate	1 / 4	<620	670	<2700	690
Benzo(k)fluoranthene	8 / 10	<19	700	3700	3700
Benzo(a)pyrene	10 / 10	250	1000	4100	4100
Dibenzo(a,h)anthracene	4 / 10	<35	690	<2700	1400
Benzo(g,h,i)perylene	2 / 10	<81	650	<2700	1400
Indeno(1,2,3-cd)pyrene	7 / 10	410	710	2200	2200
delta-BHC	4 / 10	2.6	42	<160	4.8
Aldrin	4 / 10	4.3	22	<71	13.0
Dieldrin	4 / 10	2.1	11	<34	7.3
Endrin	4 / 10	9.4	19	<80	37
Endosulfan II	3 / 10	<5.5	21	<71	8.5
4,4'-DDD	4 / 10	2.6	52	<200	5.2
Endrin ketone	3 / 8	<5.5	98	<420	12
Endrin aldehyde	4 / 10	1.5	100	<390	4.2
alpha-Chlordane	4 / 4	3.1	9.2	13	13
gamma-Chlordane	4 / 4	2.7	3.3	3.7	3.7
Toxaphene	1 / 10	220	1200	<4300	220
Arochlor 1242	5 / 10	<55	620	1800	1800
Arochlor 1248	2 / 10	<61	600	<2100	420
Arochlor 1254	8 / 10	96	550	<3200	460
Arochor 1260	4 / 10	78	1100	<4200	170
Metals (mg/kg wet weight)					
Aluminum	4 / 4	5892	6400	7031	7031
Arsenic	10 / 10	5.8	13	20	20

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Table 1 (cont.) North Slip Sediment Sample Chemical Data Summary (Wet Weight) (a)
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Metals (mg/kg wet weight)					
Barium	4 / 4	35	45	61	61
Beryllium	1 / 4	0.47	0.37	<0.83	0.47
Cadmium	9 / 10	<0.6	2.4	4.2	4.2
Calcium	4 / 4	18328	38000	53919	53919
Chromium	10 / 10	15	69	123	123
Cobalt	4 / 4	3.3	5.1	6.9	6.9
Copper	10 / 10	29	91	136	136
Iron	10 / 10	24174	57000	86500	86500
Lead	10 / 10	63	200	310	310
Magnesium	4 / 4	7624	9700	11229	11229
Manganese	4 / 4	805	1300	2512	2512
Mercury	10 / 10	0.14	0.3	0.54	0.54
Nickel	10 / 10	13	42	63	63
Potassium	4 / 4	1034	1500	1803	1803
Selenium	2 / 10	0.2	0.5	<1.3	0.3
Silver	1 / 4	<0.8	0.5	0.9	0.9
Sodium	4 / 4	149	230	269	269
Thallium	2 / 4	<0.19	0.19	0.3	0.3
Vanadium	4 / 4	15	19	22	22
Zinc	10 / 10	175	700	1050	1050
Cyanide	9 / 10	0.5	1.7	3.7	3.7

Notes:

(a) Data taken from USFWS, 1994 and Illinois EPA, 1999

(b) one half of the detection limit used in place of non-detect results in calculating average concentrations.

µg/kg micrograms per kilogram

mg/kg milligrams per kilogram

ARCADIS GERAGHTY & MILLER

Table 2 **North Slip Sediment Sample Chemical Data Summary (Dry Weight) (a)**
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Organic Compound Concentrations (µg/kg Dry Weight)					
Acetone	4 / 4	133	330	760	760
2-Butanone	4 / 4	25	75	170	170
Toluene	1 / 8	<8	70	490	490
4-Methylphenol	1 / 4	<1200	2500	6500	6500
Naphthalene	9 / 10	780	1900	<4500	3000
2-Methylnaphthalene	3 / 4	642	1300	<4500	1700
Acenaphthene	2 / 10	<130	680	<4500	510
Dibenzofuran	3 / 4	385	990	<4500	950
Phenanthrene	10 / 10	920	2800	6800	6800
Fluorene	8 / 10	240	780	<4500	1100
Fluoranthene	7 / 10	<130	3800	20000	20000
Anthracene	10 / 10	380	1000	2700	2700
Pyrene	7 / 10	<130	4300	14000	14000
Benzo(a)anthracene	10 / 10	680	2500	10300	10300
Chrysene	9 / 10	<130	3600	10300	10300
Benzo(b)fluoranthene	9 / 10	<44	2000	7700	7700
Bis(2-ethylhexyl)phthalate	1 / 4	<1170	1300	<4500	1900
Benzo(k)fluoranthene	8 / 10	<44	1400	6200	6200
Benzo(a)pyrene	10 / 10	625	2000	6800	6800
Dibenzo(a,h)anthracene	4 / 10	<81	1500	<4500	3700
Benzo(g,h,i)perylene	2 / 10	<190	1400	<4500	3000
Indeno(1,2,3-cd)pyrene	7 / 10	820	1500	3700	3700
delta-BHC	4 / 10	4.3	96	<420	11
Aldrin	4 / 10	7.2	51	<190	35
Dieldrin	4 / 10	3.5	24	<89	16
Endrin	4 / 10	16	41	<170	70
Endosulfan II	3 / 10	<9.2	47	<190	23
4,4'-DDD	4 / 10	4.3	120	<530	13
Endrin ketone	3 / 8	<9.2	230	<1100	32
Endrin aldehyde	4 / 10	2.5	230	<1000	8
alpha-Chlordane	4 / 4	5.2	19	26	26
gamma-Chlordane	4 / 4	4.5	7	9	9
Toxaphene	1 / 10	<470	2700	<11300	590
Arochlor 1242	5 / 10	<92	1400	3800	3800
Arochlor 1248	2 / 10	<110	1400	<5500	810
Arochlor 1254	8 / 10	160	1200	<6700	1200
Arochor 1260	4 / 10	130	2600	<11000	410
Metals Concentrations (mg/kg dry weight)					
Aluminum	4 / 4	8490	12100	17800	17800
Arsenic	10 / 10	8.4	29	51	51
Barium	4 / 4	67.3	81	89	89
Beryllium	1 / 4	<1	0.7	1.2	1.2
Cadmium	9 / 10	<0.86	5.3	11	11
Calcium	4 / 4	44900	66100	94100	94100
Chromium	10 / 10	21.2	153	270	270
Cobalt	4 / 4	4.8	10	14	14

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Table 2 (cont.) **North Slip Sediment Sample Chemical Data Summary (Dry Weight) (a)**
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Metals Concentrations (mg/kg dry weight)					
Copper	10 / 10	41.2	203	360	360
Iron	10 / 10	39800	122000	180200	180200
Lead	10 / 10	91.2	440	820	820
Magnesium	4 / 4	13800	17500	19300	19300
Manganese	4 / 4	1160	2760	6400	6400
Mercury	10 / 10	0.24	0.6	1.3	1.3
Nickel	10 / 10	18.9	93	170	170
Potassium	4 / 4	1490	2900	4300	4300
Selenium	2 / 10	0.33	1.1	<3.4	0.8
Silver	1 / 4	<1.1	0.9	<2	1.5
Sodium	4 / 4	377	400	470	470
Thallium	2 / 4	<0.27	0.3	0.5	0.5
Vanadium	4 / 4	20.9	35	48	48
Zinc	10 / 10	252	1600	2600	2600
Cyanide	9 / 10	0.85	3.7	7.4	7.4

Notes:

(a) Data taken from USFWS, 1994. Average percent moisture data used to compute dry weight concentrations when no percent moisture data for a sample was available.

(b) one half of the detection limit used in place of non-detect results in calculating average concentrations.

µg/kg micrograms per kilogram

mg/kg milligrams per kilogram

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Table 3 North Slip Sediment Sample Chemical Data Summary Normalized for Organic Carbon Content (a)
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average Concentration	Maximum Reported Result	Maximum Detected Concentration
Organic Compound Concentrations Normalized to Organic Carbon (µg/kg OC)					
Acetone	4 / 4	3100	7600	18000	18000
2-Butanone	4 / 4	580	1800	3900	3900
Toluene	1 / 8	<180	1600	11000	11000
4-Methylphenol	1 / 4	<27000	57900	151000	151000
Naphthalene	9 / 10	17100	44600	<105000	71000
2-Methylnaphthalene	3 / 4	15000	30600	<105000	40000
Acenaphthylene	8 / 10	2000	17100	<105000	26000
Acenaphthene	2 / 10	<3500	16200	<105000	12000
Dibenzofuran	3 / 4	9000	23200	<105000	22000
Phenanthrene	10 / 10	20100	65200	159000	159000
Fluorene	8 / 10	5300	18400	<105000	26000
Fluoranthene	7 / 10	<3500	87900	467000	467000
Anthracene	10 / 10	8300	23800	62000	62000
Pyrene	7 / 10	<3500	97600	327000	327000
Benzo(a)anthracene	10 / 10	14900	58300	241000	241000
Chrysene	9 / 10	<3500	84700	241000	241000
Benzo(b)fluoranthene	9 / 10	<1100	46600	179000	179000
Bis(2-ethylhexyl)phthalate	1 / 4	<27000	30900	<105000	44000
Benzo(k)fluoranthene	8 / 10	<1100	31500	144000	144000
Benzo(a)pyrene	10 / 10	16200	46600	159000	159000
Dibenzo(a,h)anthracene	4 / 10	<2100	36400	<105000	97000
Benzo(g,h,i)perylene	2 / 10	<4800	30900	<105000	61000
Indeno(1,2,3-cd)pyrene	7 / 10	17900	35100	86000	86000
delta-BHC	4 / 10	100	2300	<11000	300
Aldrin	4 / 10	170	1200	<4900	800
Dieldrin	4 / 10	82	600	<2300	370
Endrin	4 / 10	370	900	<3400	1600
Endosulfan II	3 / 10	<210	1100	<4900	500
4,4'-DDD	4 / 10	100	2900	<14000	300
Endrin ketone	3 / 8	<210	6000	<29000	760
Endrin aldehyde	4 / 10	58	5700	<27000	200
alpha-Chlordane	4 / 4	120	400	610	610
gamma-Chlordane	4 / 4	100	160	200	200
Toxaphene	1 / 10	<11000	64600	<297000	14000
Arochlor 1242	5 / 10	<2100	31600	<83000	76000
Arochlor 1248	2 / 10	<2700	33100	<145000	19000
Arochlor 1254	8 / 10	3700	26700	<135000	32000
Arochor 1260	4 / 10	3000	62700	<290000	9000

Notes:

(a) Data taken from USFWS (1994). Dry weight concentrations organic carbon normalized using average total organic carbon concentrations when no data were available.

(b) one half of the detection limit used in place of non-detect results in calculating average concentrations.

µg/kg OC micrograms per kilogram of organic carbon

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Table 4 **South Slip Sediment Sample Chemical Data Summary (wet weight) (a)**
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Organic Compound Concentrations (µg/kg wet weight)					
Acetone	1 / 2	<19	30	50	50
2-Butanone	2 / 2	10	13	15	15
Benzene	3 / 8	3.6	19	120	120
Toluene	4 / 8	<4.2	120	920	920
m-Xylene	2 / 6	<4.2	5.6	<22	11
o,p-Xylene	2 / 6	2.5	5.3	<22	12
Xylene (total)	1 / 2	<20	17	23	23
4-Methylphenol	2 / 2	940	1000	1100	1100
Naphthalene	8 / 8	1600	6800	16000	16000
2-Methylnaphthalene	1 / 2	2200	1900	<3300	2200
Phenanthrene	8 / 8	3700	19000	100000	100000
Acenaphthene	1 / 8	2600	2500	<5400	2600
Acenaphthylene	4 / 8	630	2000	<5400	2500
Anthracene	8 / 8	1200	7700	40000	40000
Dibenzofuran	1 / 2	2700	2200	<3300	2700
Fluorene	8 / 8	950	3800	18000	18000
Fluoranthene	8 / 8	5000	32000	130000	130000
Pyrene	8 / 8	4600	17000	60000	60000
Benzo(a)anthracene	8 / 8	2800	7600	24000	24000
Chrysene	8 / 8	3100	11000	39000	39000
Benzo(b)fluoranthene	8 / 8	2300	7200	23000	23000
Benzo(k)fluoranthene	8 / 8	1500	3500	9500	9500
Benzo(a)pyrene	8 / 8	2600	7100	23000	23000
Dibenzo(a,h)anthracene	6 / 8	2100	12000	51000	51000
Indeno(1,2,3-cd)pyrene	8 / 8	2000	5900	19000	19000
Benzo(g,h,i)perylene	7 / 8	2400	7500	27000	27000
delta-BHC	2 / 8	4.9	48	<130	7.2
Aldrin	2 / 8	18	31	<59	57
Dieldrin	2 / 8	6.2	12	<28	11
4,4'-DDE	1 / 8	<6.1	24	<59	20
Endrin	2 / 8	39	44	<87	55
Endosulfan II	1 / 8	<6.7	24	<59	18
4,4'-DDD	2 / 8	5.4	62	<160	12
Endosulfan sulfanate	1 / 8	3.1	350	<960	3.1
4,4'-DDT	1 / 8	<6.1	65.00	<170	8.50
Methoxychlor	2 / 8	30	960	<2600	57
Endrin aldehyde	2 / 8	4	120	<330	5
alpha-Chlordane	2 / 2	14	15	16	16
gamma-Chlordane	2 / 2	5.1	8.6	12	12
Toxaphene	2 / 8	250	1400	<3500	440

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Table 4 (cont.) South Slip Sediment Sample Chemical Data Summary (wet weight) (a)
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Organic Compound Concentrations (µg/kg wet weight)					
Arochlor 1242	8 / 8	790	2500	4000	4000
Arochlor 1254	2 / 8	420	1400	<3500	570
Arochlor 1260	2 / 8	190	1300	<3500	350
Metals Concentrations (mg/kg wet weight)					
Aluminum	2 / 2	5029	5700	6345	6345
Arsenic	6 / 6	8	14	19	19
Barium	2 / 2	38	44	49.6	49.6
Cadmium	6 / 6	1.9	6.4	22.8	22.8
Calcium	2 / 2	24320	27000	29921	29921
Chromium	6 / 6	35	85	139	139
Cobalt	2 / 2	5.0	5.2	5.4	5.4
Copper	6 / 6	55	99	143	143
Iron	6 / 6	29948	57000	101000	101000
Lead	6 / 6	141	340	765	765
Magnesium	2 / 2	9664	10000	11214	11214
Manganese	2 / 2	680	880	1089	1089
Mercury	6 / 6	0.2	0.5	0.79	0.79
Nickel	6 / 6	23	44	67	67
Potassium	2 / 2	1115	1300	1428	1428
Selenium	2 / 6	0.3	0.5	<1.1	0.3
Silver	2 / 2	0.8	1.0	1.2	1.2
Sodium	2 / 2	97	110	129	129
Thallium	2 / 2	0.4	0.4	0.4	0.4
Vanadium	2 / 2	18	21	24	24
Zinc	6 / 6	481	1100	1990	1990
Cyanide	6 / 6	0.9	2.3	3.6	3.6

Notes:

(a) Data taken from USFWS, 1994
(b) one half of the detection limit used in place of non-detect results in calculating average concentrations.
µg/kg micrograms per kilogram
mg/kg milligrams per kilogram

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Table 5 South Slip Sediment Sample Chemical Data Summary (Dry Weight) (a)
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Organic Compound Concentrations (µg/kg Dry Weight)					
Acetone	1 / 2	<36	60	100	100
2-Butanone	2 / 2	19	25	31	31
Benzene	3 / 8	7.5	38	230	230
m-Xylene	2 / 6	<9.3	12	<48	23
Xylene (total)	1 / 2	43	32	43	43
4-Methylphenol	2 / 2	1900	2000	2100	2100
Naphthalene	8 / 8	3300	14000	33000	33000
2-Methylnaphthalene	1 / 2	4200	3800	4200	4200
Phenanthrene	8 / 8	7600	42000	220000	220000
Acenaphthene	1 / 8	4900	5300	<12000	4900
Acenaphthylene	4 / 8	1400	4200	5500	5500
Anthracene	8 / 8	2400	17000	90000	88000
Dibenzofuran	1 / 2	5100	4200	5100	5100
Fluorene	8 / 8	2100	8200	40000	40000
Fluoranthene	8 / 8	10000	68000	290000	290000
Pyrene	8 / 8	9400	35000	132000	130000
Benzo(a)anthracene	8 / 8	5700	16000	53000	53000
Chrysene	8 / 8	6300	24000	86000	86000
Benzo(b)fluoranthene	8 / 8	4700	15000	51000	51000
Benzo(k)fluoranthene	8 / 8	3300	7300	21000	21000
Benzo(a)pyrene	8 / 8	5300	15000	51000	51000
Dibenzo(a,h)anthracene	6 / 8	4000	27000	110000	110000
Indeno(1,2,3-cd)pyrene	8 / 8	4100	13000	42000	42000
Benzo(g,h,i)perylene	7 / 8	4500	16000	60000	60000
delta-BHC	2 / 8	10	100	<290	14
Aldrin	2 / 8	37	64	<130	110
Dieldrin	2 / 8	13	26	21	21
4,4'-DDE	1 / 8	<12	52	<130	41
Endrin	2 / 8	80	91	100	100
Endosulfan II	1 / 8	34	51	34	34
4,4'-DDD	2 / 8	11	130	23	23
Endosulfan sulfanate	1 / 8	5.8	760	5.9	5.8
4,4'-DDT	1 / 8	17	140	17	17
Methoxychlor	2 / 8	61	2100	110	110
Endrin aldehyde	2 / 8	8.4	260	10	10
alpha-Chlordane	2 / 2	29	29	30	30
gamma-Chlordane	2 / 2	10	17	23	23
Toxaphene	2 / 8	510	2900	830	830
Arochlor 1242	8 / 8	1600	5400	8900	8900
Arochlor 1254	2 / 8	860	3000	1100	1100
Arochlor 1260	2 / 8	390	2900	660	660

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Table 5 (cont.) South Slip Sediment Sample Chemical Data Summary (Dry Weight) (a)
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Total	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Metal Concentrations (mg/kg dry weight)					
Aluminum	2 / 2	9500	11000	12000	12000
Arsenic	6 / 6	15	29	42	42
Barium	2 / 2	72	82	91	91
Cadmium	6 / 6	3.5	14	50	50
Calcium	2 / 2	46000	50000	55000	55000
Chromium	6 / 6	64	180	260	260
Cobalt	2 / 2	9.4	10	9.8	10
Copper	6 / 6	100	210	320	320
Iron	6 / 6	56000	121000	225000	220000
Lead	6 / 6	270	720	1700	1700
Magnesium	2 / 2	18000	19000	21000	21000
Manganese	2 / 2	1300	1600	2000	2000
Mercury	6 / 6	0.3	1	1.6	1.6
Nickel	6 / 6	42	93	150	150
Potassium	2 / 2	2100	2400	2600	2600
Selenium	2 / 6	0.5	1	<2.4	0.5
Silver	2 / 2	1.5	2	2.2	2.2
Sodium	2 / 2	180	210	240	240
Thallium	2 / 2	0.7	1	0.8	0.8
Vanadium	2 / 2	34	39	43	43
Zinc	6 / 6	910	2400	4400	4400
Cyanide	6 / 6	1.6	4.9	8.0	8.0

Notes:

(a) Data taken from USFWS, 1994. Average percent moisture data used to compute dry weight concentrations when no percent moisture data for a sample was available.

(b) one half of the detection limit used in place of non-detect results in calculating average concentrations.

µg/kg micrograms per kilogram

mg/kg milligrams per kilogram

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Table 6 **South Slip Sediment Sample Chemical Data Summary Normalized for Organic Carbon Content (a)**
Former Wisconsin Steel Works
Chicago, Illinois

Constituent	Frequency Detects / Analyses	Minimum Concentration	Average (b) Concentration	Maximum Reported Result	Maximum Detected Concentration
Organic Compound Concentrations Normalized to Organic Carbon (µg/kg OC)					
Acetone	1 / 2	<700	1200	2000	2000
2-Butanone	2 / 2	370	500	600	600
Benzene	3 / 8	140	700	4500	4500
m-Xylene	2 / 6	<180	200	<940	400
Xylene (total)	1 / 2	<800	600	850	850
4-Methylphenol	2 / 2	38000	39000	41000	41000
Naphthalene	8 / 8	64000	260000	580000	580000
2-Methylnaphthalene	1 / 2	82000	74000	<130000	82000
Phenanthrene	8 / 8	150000	890000	4930000	4930000
Acenaphthene	1 / 8	97000	110000	<260000	97000
Acenaphthylene	4 / 8	29000	84000	<230000	120000
Anthracene	8 / 8	48000	360000	1970000	1970000
Dibenzofuran	1 / 2	100000	83000	<130000	100000
Fluorene	8 / 8	41000	170000	890000	890000
Fluoranthene	8 / 8	200000	1430000	6410000	6410000
Pyrene	8 / 8	180000	740000	2960000	2960000
Benzo(a)anthracene	8 / 8	110000	330000	1180000	1180000
Chrysene	8 / 8	120000	500000	1920000	1920000
Benzo(b)fluoranthene	8 / 8	92000	320000	1130000	1130000
Benzo(k)fluoranthene	8 / 8	64000	150000	470000	470000
Benzo(a)pyrene	8 / 8	100000	310000	1130000	1130000
Dibenzo(a,h)anthracene	6 / 8	78000	560000	2510000	2510000
Indeno(1,2,3-cd)pyrene	8 / 8	80000	260000	940000	940000
Benzo(g,h,i)perylene	7 / 8	89000	340000	1330000	1330000
delta-BHC	2 / 8	200	2100	<6300	270
Aldrin	2 / 8	720	1300	<2800	2100
Dieldrin	2 / 8	250	500	<1400	410
4,4'-DDE	1 / 8	<230	1000	<2800	800
Endrin	2 / 8	1600	1800	<4100	2000
Endosulfan II	1 / 8	<270	1000	<2800	670
4,4'-DDD	2 / 8	220	2700	<7900	450
Endosulfan sulfanate	1 / 8	120	15000	<46000	120
4,4'-DDT	1 / 8	<230	2800	<8400	340
Methoxychlor	2 / 8	1200	41000	<120000	2100
Endrin aldehyde	2 / 8	160	5200	<15000	200
alpha-Chlordane	2 / 2	560	600	590	590
gamma-Chlordane	2 / 2	200	300	450	450
Toxaphene	2 / 8	10000	58000	<160000	16000
Arochlor 1242	8 / 8	32000	110000	190000	190000
Arochlor 1254	2 / 8	17000	59000	<160000	21000
Arochlor 1260	2 / 8	7600	57000	<160000	13000

Notes:

(a) Data taken from USFWS (1994) and Illinois EPA, (1996). Dry weight concentrations organic carbon normalized using average total organic carbon concentrations when no data were available.

(b) one half of the detection limit used in place of non-detect results in calculating average concentrations.

µg/kg OC micrograms per kilogram of organic carbon

Table 7 **Summary of COC Concentrations in Composite Fish Samples from the South Slip (a)**
Former Wisconsin Steel Works
Chicago, Illinois

	Concentrations in mg/kg wet weight				
Chemical		White Perch (b)		Commmon Carp (c)	Mean Concentration
Aroclor 1248		0.9		1.0	0.95
Fluoranthene		0.046	<	0.025	0.03
Pyrene		0.038	<	0.025	0.025
Chromium	<	2.1		2	1.5
Copper		23.5		8.9	16.2
Lead		2.7		0.64	1.7
Nickel		4.8		5.2	5
Selenium		2.4	<	1.4	1.6
Zinc		110		131	121

Notes:
All concentrations reported in mg/kg wet weight.
(a) Data taken from USFWS, 1994.
(b) Composite dample of three whole white perch samples collected from the south slip.
(c) Composite sample of three whole common carp sampels collected from the south slip.
mg/kg - milligrams per kilogram

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Table 8 Comparison of Site Sediment and Regional Background Concentrations
Former Wisconsin Steel Works
Chicago, Illinois

	IEPA Classification (a)			USGS NAWQAP (b)		North Slip			South Slip		
Chemical	Non-Elevated	Slightly Elevated	Elevated	50th Percentile	90th Percentile	Minimum	Average	Maximum	Minimum	Average	Maximum
Metal Concentrations in mg/kg dry weight											
Aluminum				53000	63000	8490	12100	17800	9500	11000	12000
Arsenic	8	11	17	9.3	12	**8**	**29**	**51**	**15**	**29**	**42**
Barium				440	460	67	81	89	72	82	91
Beryllium				2	2	<1	1	1	ND	ND	ND
Cadmium	0.5	1	2	<2	15	**<0.86**	**5**	**11**	**4**	**14**	**50**
Chromium	16	23	38	77	250	**21**	**153**	**270**	**64**	**180**	**260**
Cobalt				14	18	5	10	14	9	10	10
Copper	38	60	100	52	180	**41**	**203**	**360**	**100**	**210**	**320**
Iron	18000	23000	32000	33000	46000	**39800**	**122000**	**180200**	**56000**	**121000**	**220000**
Lead	28	38	60	75	320	**91**	**440**	**820**	**270**	**720**	**1700**
Magnesium				24000	32000	13800	17500	19300	18000	19000	21000
Manganese	1300	1800	2800	740	1500	**1160**	**2760**	**6400**	**1300**	**1600**	**2000**
Mercury	0.07	0.1	0.17	0.44	2.01	**0.2**	**0.6**	**1.3**	**0.3**	**1.0**	**1.6**
Nickel				33	75	**19**	**93**	**170**	**42**	**93**	**150**
Selenium				1.1	1.8	0.3	1.1	0.8	0.5	0.9	0.5
Silver				<2	7	**<1.1**	**0.9**	**2**	**1.5**	**1.9**	**2.2**
Vanadium				72	92	21	35	48	34	39	43
Zinc	80	100	170	200	770	**252**	**1600**	**2600**	**910**	**2400**	**4400**
Organic Compound Concentrations in µg/kg dry weight											
Arochlor 1242	10	50	200			**<92**	**1400**	**3800**	**1600**	**5400**	**8900**
Arochlor 1254	10	50	200			**160**	**1200**	**1200**	**860**	**3000**	**1100**
Arochlor 1260	10	50	200			NA	NA	NA	**390**	**2900**	**660**

a. Values shown represent the upper end of the reported concentration range for each classification (IEPA, 1984).
b. Values represent the 50th and 90th percentile concentrations for fine fraction streambed sediments from high order streams in the Illinois river basin (USGS, 1987).
Bold Values exceed one or more background level.
µg/kg micrograms per kilogram
mg/kg milligrams per kilogram

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Table 9

Comparison of Site Concentrations to ARCS (a) ER-M Values
Former Wisconsin Steel Works
Chicago, Illinois

Chemical	ARCS Effects Range Median (a)		North Slip Minimum	North Slip Average	North Slip Maximum Detect		South Slip Minimum	South Slip Average	South Slip Maximum Detect	
Organic Compounds Normalized for Organic Carbon (µg/kg OC dry wt)										
Acetone			3100	7600	18000		<700	1200	2000	(f)
2-Butanone			580	1800	3900		370	500	600	(e)
Benzene			NA	NA	NA		140	700	4500	
Toluene			<180	1600	11000		0	0	0	
Ethylbenzene			NA	NA	NA		<150	0	0	
m-Xylene			NA	NA	NA		<180	200	400	
o,p-Xylene			NA	NA	NA		0	0	0	
Xylene (total)			NA	NA	NA		<800	600	850	(f)
Bis(2-ethylhexyl)phthalate			<27000	30900	44000		NA	NA	NA	
4-Methylphenol		b	<27000	57900	151000		38000	39000	41000	
Naphthalene	15868	b	**17100**	**44600**	**71000**		**64000**	**260000**	**580000**	
2-Methylnaphthalene		c	15000	30600	40000		82000	74000	82000	
Phenanthrene	51429	c	20100	**65200**	**159000**	(e)	**150000**	**890000**	**4930000**	
Acenaphthene	885	b	**<3500**	**16200**	**12000**	(e)	**97000**	**110000**	**97000**	
Acenaphthylene	1000	b	**2000**	**17100**	**26000**		**29000**	**84000**	**120000**	
Anthracene	16609	b	8300	**23800**	**62000**		**48000**	**360000**	**1970000**	
Dibenzofuran			9000	23200	22000		100000	83000	100000	
Fluorene	17054	b	5300	**18400**	**26000**		**41000**	**170000**	**890000**	
Fluoranthene	71252	b	<3500	**87900**	**467000**		**200000**	**1430000**	**6410000**	
Pyrene	64706	c	<3500	**97600**	**327000**		**180000**	**740000**	**2960000**	
Benzo(a)anthracene	30824	c	14900	**58300**	**241000**		**110000**	**330000**	**1180000**	
Chrysene	40588	b	<3500	**84700**	**241000**		**120000**	**500000**	**1920000**	
Benzo(b)fluoranthene	2395	c	<1100	**46600**	**179000**		**92000**	**320000**	**1130000**	
Benzo(k)fluoranthene	2395	b	<1100	**31500**	**144000**		**64000**	**150000**	**470000**	
Benzo(a)pyrene	36471	b	16200	**46600**	**159000**		**100000**	**310000**	**1130000**	
Dibenzo(a,h)anthracene	1125	c, d	**<2100**	**36400**	**97000**		**78000**	**560000**	**2510000**	
Indeno(1,2,3-cd)pyrene	26000	c, d	17900	**35100**	**86000**		**80000**	**260000**	**940000**	(f)
Benzo(g,h,i)perylene	31000	c, d	<4800	30900	**61000**		**89000**	**340000**	**1330000**	(f)
delta-BHC			100	2300	2500		200	2100	270	

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Table 9 (cont.)

Comparison of Site Concentrations to ARCS (a) ER-M Values
Former Wisconsin Steel Works
Chicago, Illinois

Chemical	ARCS Effects Range Median (a)		North Slip Minimum	North Slip Average	North Slip Maximum Detect	South Slip Minimum	South Slip Average	South Slip Maximum Detect
Organic Compounds Normalized for Organic Carbon (µg/kg OC dry wt.)								
Aldrin			170	1200	1100	720	1300	2100
Dieldrin			82	600	550	250	500	410
4,4'-DDE			NA	NA	NA	<230	1000	800
Endrin			370	900	1700	1600	1800	2000
Endrin Ketone			<210	6000	760	NA	NA	NA
Endosulfan II			<210	1100	1100	<270	1000	670
4,4'-DDD			100	2900	3200	220	2700	450
Endosulfan sulfanate			NA	NA	NA	120	15000	120
4,4'-DDT			NA	NA	NA	<230	2800	340
Methoxychlor			NA	NA	NA	1200	41000	2100
Endrin aldehyde			58	5700	6300	160	5200	200
alpha-Chlordane			120	400	610	560	600	590
gamma-Chlordane			100	160	200	200	300	450
Chlordane			3700	5900	4000	<7300	0	0
Toxaphene			<11000	64600	67000	10000	58000	16000
Arochlor 1242	4028		<2100	**31600**	**76000**	**32000**	**110000**	**190000**
Arochlor 1248	4028		<2700	**33100**	**34000**	NA	NA	NA
Arochlor 1254	4028		3700	**26700**	**67000**	**17000**	**59000**	**21000**
Arochlor 1260	4028		NA	NA	NA	**7600**	**57000**	**13000**
Metals (mg/kg dry wt.)								
Aluminum	58030	c	8490	12100	17800	9500	11000	12000
Arsenic	33	b	8.4	29	**51**	15	29	**42**
Barium			67	81	89	72	82	91
Cadmium	5.2	b	<0.86	**5.3**	**11**	4	**14**	**50**
Chromium	293	b	21	153	270	64	180	260
Cobalt			4.8	10	14	9.4	9.6	9.8
Copper	122	b	41	**203**	**360**	100	**210**	**320**
Iron	280000		39800	122000	180200	56000	121000	220000
Lead	251	b	91	**440**	**820**	**270**	**720**	**1700**

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Table 9 (cont.)

Comparison of Site Concentrations to ARCS (a) ER-M Values
Former Wisconsin Steel Works
Chicago, Illinois

Chemical	ARCS Effects Range Median (a)		North Slip Minimum	North Slip Average	North Slip Maximum Detect	South Slip Minimum	South Slip Average	South Slip Maximum Detect
Metals (mg/kg dry wt.)								
Magnesium			13800	17500	19300	18000	19000	21000
Manganese	1678	b	1160	**2760**	**6400**	1300	1600	**2000**
Mercury			0.2	0.6	1.3	0.3	1.0	1.6
Nickel	47.5	b	19	**93**	**170**	42	**93**	**150**
Selenium			0.3	1.1	0.8	0.5	0.9	0.5
Silver			<1.1	0.9	1.5	1.5	1.9	2.2
Vanadium			21	35	48	34	39	43
Zinc	422	b	252	**1600**	**2600**	**910**	**2400**	**4400**
Cyanide			0.9	3.7	7.4	1.6	4.9	8.0

a. Assessment and Remediation of Contaminated Sediments Program. United States Envronmental Protection Agency
b. Based on a 14 day toxicity test using *Hyallela Azteca*
c. Based on a 28 day toxicity test using *Hyallela Azteca*
d. Criteria provided for Total PCBs.
e. Mean computed using 1/2 detection limit for non detect values was greater than the maximum detected concentration due to elevated detection limits in some samples. In these cases, the maximum detected concentration is the more appropriate measure for comparison purposes.
f. Compound detected in only one sample. Detected concentration used as to represent average value.

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Table 10. Chemicals of Potential Concern in Sediment
Former Wisconsin Steel Works, Chicago, Illinois.

Organic Compounds	Metals
Naphthalene	Arsenic
Phenanthrene	Cadmium
Acenaphthene	Chromium
Acenaphthylene	Copper
Anthracene	Lead
Fluorene	Manganese
Fluoranthene	Nickel
Pyrene	Zinc
Benzo(a)anthracene	Mercury
Chrysene	Silver
Benzo(b)fluoranthene	
Benzo(k)fluoranthene	
Benzo(a)pyrene	
Dibenzo(a,h)anthracene	
Indeno(1,2,3-cd)perylene	
Benzo (g,h,I)perylene	
Arochlor 1242	
Arochlor 1248	
Arochlor 1254	
Arochlor 1260	

Table 11. Comparison of Surface Water Concentrations to Illinois Water Quality Criteria
Former Wisconsin Steel Works
Chicago, Illinois

Chemical	Illinois Derived Water Quality Criteria (a)		Illinois Surface Water Quality Critieria (b)			USEPA Ambient Water Quality Criteria (c)	Slip Concentrations	
			General Use Waters		Secondary and Indigenous Aquatic Life Standards (b)			
	Acute	Chronic	Acute	Chronic			North Slip (d)	South Slip (d)
Organic Compounds (μg/l)								
Benzene	5200	416					ND	8
Chloroform	1870	150					3	3
Metal Concentrations (μg/l)								
Aluminum							334	654
Barium			5000	5000	5000		26.4	27.6
Calcium							43900	40200
Copper			26 (e)	17 (e)	1000	16 (e)	6.7	9.1
Iron (total)			1000 (dsv.)	1000 (dsv.)	2000		370	642
Lead			160 (e)	34 (e)	100	3.9 (e)	3.3	4.1
Magnesium							14100	12000
Manganese			1000	1000	1000		38.4	53.4
Nickel			1000	1000	1000	220 (e)	24.7	<14
Potassium							4060	3070
Sodium							38300	37500
Zinc			1000	1000	1000	150 (e)	11.2	14.5

(a) Published in the Illinois Register pursuant to 35 IAC 302.Subpart F.
(b) 35 IAC 302
(c) Values are the continuous concentration (4-day average) for freshwater aquatic life protection. All concentrations are dissolved.
(d) Too few surface water samples were collected for statistical analysis; maximum total (unfiltered) concentrations in the north slip and south slip are reported.
(e) Hardness based values. Hardness value of 150 mg/L used to compute criteria.
(dsv.) Dissolved

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Table 12 **Comparison of Predicted Pore Water PAH Concentrations to USEPA and Illinois Ambient Water Quality Criteria**
Former Wisconsin Steel Works
Chicago Illinois

Chemical	Illinois Derived Water Quality Criteria (a) Acute	Illinois Derived Water Quality Criteria (a) Chronic	Illinois Secondary Contact and Indigenous Aquatic Life Standards (b)	USEPA Ambient Water Quality Criteria Acute	USEPA Ambient Water Quality Criteria Chronic	Range of Predicted Pore Water Conc.
Organic Compounds (µg/l)						
Naphthalene	670	68	--	2300	620	1.0E-02 - 1.8E-01
Phenanthrene	46	3.7	--	30	6.3	4.3E-03 - 6.0E-02
Acenaphthene	124	9.9	--	1700	520	1.5E-04 - 2.1E-02
Acenaphthylene	--	--	--	--	--	2.3E-04 - 1.5E-02
Anthracene	--	--	--	--	--	2.9E-04 - 4.3E-03
Fluorene	--	--	--	--	--	7.4E-04 - 4.1E-03
LPAHs	--	--	--	--	--	1.7E-02 - 2.5E-01
Fluoranthene	--	--	--	3980	--	1.0E-05 - 7.7E-03
Pyrene	--	--	--	--	--	1.0E-05 - 3.8E-03
Benzo(a)anthracene	--	--	--	--	--	3.8E-05 - 4.2E-04
Chrysene	--	--	--	--	--	2.7E-06 - 7.2E-04
Benzo(b)fluoranthene	--	--	--	--	--	2.8E-07 - 1.3E-04
Benzo(k)fluoranthene	--	--	--	--	--	2.8E-07 - 6.1E-05
Benzo(a)pyrene	--	--	--	--	--	1.1E-05 - 1.5E-04
Dibenzo(a,h)anthracene	--	--	--	--	--	1.7E-07 - 8.9E-05
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	4.5E-06 - 3.8E-05
Benzo(g,h,i)perylene	--	--	--	--	--	1.9E-07 - 2.1E-05
HPAHs	--	--	--	--	--	8.2E-05 - 1.3E-02
				Acute (e)	Chronic (e)	Range of Mean Measured 48-Hour Unionized Ammonia (mg/L) (f)
Inorganic Compounds (mg/L)						
Unionized Ammonia				0.26	0.059	0.14 - 1.3

(a) Published in the Illinois Register pursuant to 35 IAC 302.Subpart F
(b) 35 IAC 302.407
(c) Marshack, J. (1998) A compilation of Water Quality Goals California State Water Resouces Control Board, Sacramento, CA. March
(d) Too few surface water samples were collected for statistical analysis; maximum concentrations in the north slip and south slip are reported.
(e) USEPA AWQC for unionized ammonia for temperature of 20 degrees centigrade and pH of 8.2 (Marshack, 1998).
(f) Unionized ammonia concentrations represent the minimum and maximum mean concentrations measured at the 48-hour time interval for the fathead minnow toxicity test (USFWS, 1994).

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Table 13

Swartz Model for PAH Toxicity
Former Wisconsin Steel Works
Chicago, Illinois

			X-202		X-203	
Chemical	10-day LC-50iw (ug/L)	Pure compound Solubility (ug/L)	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units
Naphthalene	3500	31690	2.1E-02	6.1E-06	1.6E-02	4.6E-06
Phenanthrene	240	1002	1.1E-02	4.6E-05	1.9E-02	7.8E-05
Acenaphthene	970	3420	1.0E-03	1.1E-06	4.6E-03	4.7E-06
Acenaphthylene	490	3930	1.9E-03	4.0E-06	6.8E-03	1.4E-05
Anthracene	180	44.6	6.3E-04	3.5E-06	1.3E-03	7.2E-06
Fluorene	270	1685	1.2E-03	4.3E-06	2.3E-03	8.7E-06
Fluoranthene	29	206	4.4E-04	1.5E-05	2.7E-03	9.3E-05
Pyrene	14	132	4.4E-04	3.2E-05	1.9E-03	1.4E-04
Benzo(a)anthracene	6.6	9.4	1.1E-04	1.6E-05	3.7E-04	5.7E-05
Chrysene	6.6	1.8	1.5E-04	2.2E-05	3.7E-04	5.7E-05
Benzo(b)fluoranthene	0.38	1.5	3.1E-05	8.2E-05	9.0E-05	2.4E-04
Benzo(k)fluoranthene	0.17	1.5	2.1E-05	1.2E-04	7.2E-05	4.2E-04
Benzo(a)pyrene	1.9	3.8	3.8E-05	2.0E-05	9.6E-05	5.1E-05
Dibenzo(a,h)anthracene	1.9	3.8	4.6E-06	2.4E-06	8.5E-06	4.5E-06
Indeno(1,2,3-cd)pyrene	1.9	3.8	5.0E-06	2.6E-06	1.5E-05	8.0E-06
Benzo(g,h,i)perylene	1.9	3.8	2.2E-06	1.2E-06	4.1E-06	2.2E-06
Total Toxic Units				**3.8E-04**		**1.2E-03**

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Table 13

Swartz Model for PAH Toxicity
Former Wisconsin Steel Works
Chicago, Illinois

	X-204		X-205		WSW-1A+B	
Chemical	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units
Naphthalene	9.3E-03	2.6E-06	9.9E-03	2.8E-06	1.9E-02	5.4E-06
Phenanthrene	5.8E-03	2.4E-05	5.7E-03	2.4E-05	7.0E-03	2.9E-05
Acenaphthene	1.2E-03	1.3E-06	5.0E-04	5.1E-07	2.0E-03	2.0E-06
Acenaphthylene	8.7E-04	1.8E-06	9.1E-04	1.9E-06	2.9E-03	6.0E-06
Anthracene	3.1E-04	1.7E-06	2.9E-04	1.6E-06	5.1E-04	2.8E-06
Fluorene	6.3E-04	2.3E-06	6.9E-04	2.5E-06	7.4E-04	2.7E-06
Fluoranthene	2.6E-04	8.9E-06	3.0E-04	1.0E-05	4.4E-04	1.5E-05
Pyrene	2.9E-04	2.1E-05	4.7E-04	3.3E-05	9.3E-04	6.7E-05
Benzo(a)anthracene	6.0E-05	9.1E-06	5.8E-05	8.8E-06	6.6E-05	1.0E-05
Chrysene	8.3E-05	1.3E-05	8.2E-05	1.2E-05	1.4E-04	2.1E-05
Benzo(b)fluoranthene	1.3E-05	3.6E-05	1.3E-05	3.5E-05	2.1E-05	5.5E-05
Benzo(k)fluoranthene	1.2E-05	7.3E-05	6.8E-06	4.0E-05	1.4E-05	7.9E-05
Benzo(a)pyrene	2.1E-05	1.1E-05	2.3E-05	1.2E-05	2.6E-05	1.4E-05
Dibenzo(a,h)anthracene	2.3E-06	1.2E-06	2.2E-06	1.2E-06	1.6E-05	8.3E-06
Indeno(1,2,3-cd)pyrene	2.5E-06	1.3E-06	2.4E-06	1.3E-06	8.2E-06	4.3E-06
Benzo(g,h,i)perylene	1.1E-06	5.9E-07	1.1E-06	5.7E-07	2.5E-06	1.3E-06
Total Toxic Units		**2.1E-04**		**1.9E-04**		**3.2E-04**

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Table 13 **Swartz Model for PAH Toxicity**
Former Wisconsin Steel Works
Chicago, Illinois

	WSW-2A+B		WSW-3A+B		WSW-4A+B	
Chemical	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units
Naphthalene	2.2E-02	6.2E-06	1.0E-02	2.8E-06	5.3E-03	1.5E-06
Phenanthrene	9.1E-03	3.8E-05	4.3E-03	1.8E-05	2.4E-03	9.9E-06
Acenaphthene	1.9E-03	2.0E-06	1.5E-04	1.6E-07	9.5E-04	9.8E-07
Acenaphthylene	3.4E-03	6.9E-06	1.7E-03	3.5E-06	1.2E-03	2.5E-06
Anthracene	6.1E-04	3.4E-06	2.9E-04	1.6E-06	1.7E-04	9.7E-07
Fluorene	8.5E-04	3.2E-06	4.3E-04	1.6E-06	2.3E-04	8.7E-07
Fluoranthene	1.3E-04	4.4E-06	1.0E-05	3.4E-07	6.3E-05	2.2E-06
Pyrene	1.3E-04	9.2E-06	1.0E-05	7.3E-07	6.4E-05	4.6E-06
Benzo(a)anthracene	7.2E-05	1.1E-05	3.8E-05	5.8E-06	2.3E-05	3.5E-06
Chrysene	1.9E-04	2.8E-05	2.7E-06	4.1E-07	4.7E-05	7.1E-06
Benzo(b)fluoranthene	2.7E-05	7.1E-05	2.8E-07	7.5E-07	7.5E-06	2.0E-05
Benzo(k)fluoranthene	7.1E-06	4.2E-05	2.8E-07	1.7E-06	5.0E-06	3.0E-05
Benzo(a)pyrene	1.1E-05	5.6E-06	1.6E-05	8.6E-06	9.8E-06	5.2E-06
Dibenzo(a,h)anthracene	1.1E-05	6.0E-06	1.7E-07	8.9E-08	1.1E-06	5.6E-07
Indeno(1,2,3-cd)pyrene	9.8E-06	5.2E-06	4.5E-06	2.3E-06	3.2E-06	1.7E-06
Benzo(g,h,i)perylene	2.5E-06	1.3E-06	1.9E-07	1.0E-07	1.2E-06	6.4E-07
Total Toxic Units		**2.4E-04**		**4.8E-05**		**9.1E-05**

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Table 13

Swartz Model for PAH Toxicity
Former Wisconsin Steel Works
Chicago, Illinois

	WSW-9A+B		WSW-10A+B		X-208	
Chemical	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units
Naphthalene	1.2E-02	3.6E-06	1.2E-02	3.5E-06	2.0E-02	5.7E-06
Phenanthrene	5.6E-03	2.3E-05	6.9E-03	2.9E-05	1.7E-02	7.3E-05
Acenaphthene	8.7E-04	9.0E-07	9.2E-04	9.4E-07	5.8E-03	5.9E-06
Acenaphthylene	2.6E-04	5.4E-07	2.0E-03	4.1E-06	8.5E-03	1.7E-05
Anthracene	3.8E-04	2.1E-06	4.8E-04	2.7E-06	1.0E-03	5.6E-06
Fluorene	5.0E-04	1.9E-06	6.4E-04	2.4E-06	2.0E-03	7.3E-06
Fluoranthene	3.3E-04	1.1E-05	4.1E-04	1.4E-05	1.2E-03	4.0E-05
Pyrene	6.9E-04	4.9E-05	7.9E-04	5.6E-05	1.1E-03	7.7E-05
Benzo(a)anthracene	4.8E-05	7.2E-06	5.7E-05	8.6E-06	1.7E-04	2.6E-05
Chrysene	1.1E-04	1.7E-05	1.4E-04	2.1E-05	1.9E-04	2.9E-05
Benzo(b)fluoranthene	1.4E-05	3.7E-05	1.6E-05	4.3E-05	4.6E-05	1.2E-04
Benzo(k)fluoranthene	9.1E-06	5.4E-05	1.0E-05	6.0E-05	3.2E-05	1.9E-04
Benzo(a)pyrene	2.0E-05	1.1E-05	2.1E-05	1.1E-05	6.3E-05	3.3E-05
Dibenzo(a,h)anthracene	6.9E-06	3.6E-06	6.2E-06	3.3E-06	1.1E-05	5.7E-06
Indeno(1,2,3-cd)pyrene	5.9E-06	3.1E-06	5.8E-06	3.0E-06	1.4E-05	7.5E-06
Benzo(g,h,i)perylene	4.8E-06	2.5E-06	4.7E-06	2.5E-06	5.2E-06	2.8E-06
Total Toxic Units		**2.3E-04**		**2.6E-04**		**6.5E-04**

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Table 13 **Swartz Model for PAH Toxicity**
Former Wisconsin Steel Works
Chicago, Illinois

	X-209		WSW-5A+B		WSW-6A+B	
Chemical	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units
Naphthalene	1.6E-01	4.6E-05	1.8E-01	5.1E-05	1.3E-01	3.7E-05
Phenanthrene	5.7E-02	2.4E-04	4.7E-02	2.0E-04	3.3E-02	1.4E-04
Acenaphthene	8.4E-03	8.7E-06	8.2E-03	8.5E-06	8.5E-03	8.8E-06
Acenaphthylene	1.2E-02	2.4E-05	1.2E-02	2.5E-05	3.8E-03	7.7E-06
Anthracene	3.9E-03	2.2E-05	3.3E-03	1.8E-05	2.4E-03	1.4E-05
Fluorene	5.6E-03	2.1E-05	4.1E-03	1.5E-05	3.0E-03	1.1E-05
Fluoranthene	3.6E-03	1.3E-04	5.7E-03	2.0E-04	3.9E-03	1.3E-04
Pyrene	3.3E-03	2.3E-04	3.2E-03	2.3E-04	2.1E-03	1.5E-04
Benzo(a)anthracene	6.9E-04	1.0E-04	3.5E-04	5.3E-05	2.4E-04	3.6E-05
Chrysene	6.9E-04	1.0E-04	6.2E-04	9.4E-05	4.0E-04	6.0E-05
Benzo(b)fluoranthene	1.8E-04	4.8E-04	1.2E-04	3.2E-04	8.3E-05	2.2E-04
Benzo(k)fluoranthene	1.2E-04	7.2E-04	5.3E-05	3.1E-04	3.6E-05	2.1E-04
Benzo(a)pyrene	2.2E-04	1.2E-04	1.3E-04	7.1E-05	9.6E-05	5.0E-05
Dibenzo(a,h)anthracene	1.3E-05	6.7E-06	8.9E-05	4.7E-05	6.1E-05	3.2E-05
Indeno(1,2,3-cd)pyrene	4.3E-05	2.3E-05	3.8E-05	2.0E-05	2.6E-05	1.4E-05
Benzo(g,h,i)perylene	7.0E-06	3.7E-06	2.6E-05	1.3E-05	1.8E-05	9.6E-06
Total Toxic Units		**2.27E-03**		**1.66E-03**		**1.13E-03**

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Table 13

Swartz Model for PAH Toxicity
Former Wisconsin Steel Works
Chicago, Illinois

	WSW-7A+B		WSW-8A+B		WSW-11A+B	
Chemical	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units	Predicted Pore Water conc. (ug/l)	Toxicity Units
Naphthalene	4.2E-02	1.2E-05	3.4E-02	9.8E-06	3.7E-02	1.1E-05
Phenanthrene	2.4E-02	9.8E-05	2.1E-02	8.8E-05	6.3E-02	2.6E-04
Acenaphthene	1.0E-02	1.0E-05	1.0E-02	1.0E-05	1.1E-02	1.2E-05
Acenaphthylene	1.5E-02	3.0E-05	1.5E-02	3.0E-05	3.9E-03	8.0E-06
Anthracene	1.9E-03	1.0E-05	1.6E-03	8.9E-06	4.5E-03	2.5E-05
Fluorene	2.1E-03	7.8E-06	1.8E-03	6.7E-06	3.5E-03	1.3E-05
Fluoranthene	3.2E-03	1.1E-04	3.2E-03	1.1E-04	8.1E-03	2.8E-04
Pyrene	1.8E-03	1.3E-04	1.7E-03	1.2E-04	4.0E-03	2.8E-04
Benzo(a)anthracene	1.9E-04	2.9E-05	2.0E-04	3.0E-05	4.4E-04	6.7E-05
Chrysene	2.9E-04	4.4E-05	3.0E-04	4.6E-05	7.5E-04	1.1E-04
Benzo(b)fluoranthene	6.4E-05	1.7E-04	6.6E-05	1.7E-04	1.4E-04	3.6E-04
Benzo(k)fluoranthene	3.2E-05	1.9E-04	3.2E-05	1.9E-04	6.1E-05	3.6E-04
Benzo(a)pyrene	7.2E-05	3.8E-05	7.8E-05	4.1E-05	1.6E-04	8.2E-05
Dibenzo(a,h)anthracene	4.9E-05	2.6E-05	1.1E-05	6.0E-06	8.6E-05	4.5E-05
Indeno(1,2,3-cd)pyrene	2.0E-05	1.0E-05	2.0E-05	1.0E-05	4.0E-05	2.1E-05
Benzo(g,h,i)perylene	1.4E-05	7.3E-06	1.1E-05	6.1E-06	2.5E-05	1.3E-05
Total Toxic Units		**9.22E-04**		**8.93E-04**		**1.95E-03**

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Table 13

Swartz Model for PAH Toxicity
Former Wisconsin Steel Works
Chicago, Illinois

Chemical	WSW-12A+B Predicted Pore Water conc. (ug/l)	Toxicity Units
Naphthalene	4.7E-02	1.3E-05
Phenanthrene	5.8E-01	2.4E-03
Acenaphthene	1.1E-02	1.2E-05
Acenaphthylene	1.6E-02	3.2E-05
Anthracene	4.1E-02	2.3E-04
Fluorene	4.0E-02	1.5E-04
Fluoranthene	3.7E-02	1.3E-03
Pyrene	1.7E-02	1.2E-03
Benzo(a)anthracene	1.8E-03	2.8E-04
Chrysene	3.0E-03	4.5E-04
Benzo(b)fluoranthene	5.7E-04	1.5E-03
Benzo(k)fluoranthene	2.3E-04	1.4E-03
Benzo(a)pyrene	6.9E-04	3.6E-04
Dibenzo(a,h)anthracene	4.1E-04	2.1E-04
Indeno(1,2,3-cd)pyrene	1.7E-04	8.8E-05
Benzo(g,h,i)perylene	1.1E-04	5.5E-05
Total Toxic Units		**9.68E-03**

ARCADIS GERAGHTY&MILLER

Table 14 **48-Hour Toxicity Test Results Correlation Analysis**
Former Wisconsin Steel Works
Chicago, Illinois

Location (a)	Mean 48-hour Percent Mortality (b)	Mean 48-hour Unionized NH3 (mg/L)	Napthalene	Phenanthrene	Acenapthene	Acenapthylene	Anthracene
WSW-1-C	1.5	0.38	1.9E-02	7.0E-03	2.0E-03	2.9E-03	5.1E-04
WSW-1	2.5	0.62	1.9E-02	7.0E-03	2.0E-03	2.9E-03	5.1E-04
WSW-2	0	0.36	2.2E-02	9.1E-03	2.0E-03	3.4E-03	6.1E-04
WSW-3-C	5	0.14	1.0E-02	4.3E-03	1.5E-04	1.7E-03	2.9E-04
WSW-5-C	23	0.57	1.8E-01	4.7E-02	8.2E-03	1.2E-02	3.3E-03
WSW-5	35	1.3	1.8E-01	4.7E-02	8.2E-03	1.2E-02	3.3E-03
WSW-6	40	1.3	1.3E-01	3.3E-02	8.5E-03	3.8E-03	2.4E-03
WSW-7-C	5	0.6	4.2E-02	2.4E-02	1.0E-02	1.5E-02	1.9E-03
WSW-9-C	5	0.29	1.1E-02	4.8E-03	7.5E-04	2.3E-04	3.3E-04
WSW-11-C	2.5	0.38	3.6E-02	6.0E-02	2.1E-02	3.8E-03	4.3E-03
r^2 values		0.89	0.88	0.52	0.21	0.39	0.52

Notes:

All predicted pore-water concentrations are reported in µg/l. Pore water concentrations predicted using equilibrium partiioning methodology (Di Toro et al., 1993).

LPAH - Low molecular weight (i.e. <200 grams/mole) polycyclic aromatic hydrocarbons

HPAH - High molecular weight (i.e. > 200 grams.mole) polycyclic aromatic hydrocarbons

a. North slip locations include WSW-1 through WSW-4, WSW-9 and WSW-10. All other locations are from the south slip.

b. Percent mortality at the 48-hour mark of the 96-hour toxicity test. 48 hour results used because the highest mortality was observed during this time period.

ARCADIS GERAGHTY & MILLER

Table 14 **48-Hour Toxicity Test Results Correlation Analysis**
Wisconsin Steel Works
Chicago, Illinois

Location (a)	Mean 48-hour Percent Mortality (b)	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b) fluoranthene	Benzo(k)fluorant hene	Benzo(a) pyrene	Dibenzo(a,h) anthracene
WSW-1-C	1.5	9.3E-04	6.6E-05	1.4E-04	2.1E-05	1.4E-05	2.6E-05	1.6E-05
WSW-1	2.5	9.3E-04	6.6E-05	1.4E-04	2.1E-05	1.4E-05	2.6E-05	1.6E-05
WSW-2	0	1.3E-04	7.2E-05	1.9E-04	2.7E-05	7.1E-06	1.1E-05	1.1E-05
WSW-3-C	5	1.0E-05	3.8E-05	2.7E-06	2.8E-07	2.8E-07	1.6E-05	1.7E-07
WSW-5-C	23	3.2E-03	3.5E-04	6.2E-04	1.2E-04	5.3E-05	1.3E-04	8.9E-05
WSW-5	35	3.2E-03	3.5E-04	6.2E-04	1.2E-04	5.3E-05	1.3E-04	8.9E-05
WSW-6	40	2.1E-03	2.4E-04	4.0E-04	8.3E-05	3.6E-05	9.6E-05	6.1E-05
WSW-7-C	5	1.8E-03	1.9E-04	2.9E-04	6.4E-05	3.2E-05	7.2E-05	4.9E-05
WSW-9-C	5	5.9E-04	4.1E-05	9.8E-05	1.2E-05	9.1E-06	1.7E-05	5.9E-06
WSW-11-C	2.5	3.8E-03	4.2E-04	7.2E-04	1.3E-04	6.1E-05	1.5E-04	8.3E-05
r^2 values		0.52	0.53	0.52	0.58	0.54	0.60	0.64

Notes:

All predicted pore-water concentrations are reported in µg/l. Pore water concentrations predicted using equilibrium partiioning methodology (Di Toro et al., 1993).

LPAH - Low molecular weight (i.e. <200 grams/mole) polycyclic aromatic hydrocarbons

HPAH - High molecular weight (i.e. > 200 grams.mole) polycyclic aromatic hydrocarbons

a. North slip locations include WSW-1 through WSW-4, WSW-9 and WSW-10. All other locations are from the south slip.

b. Percent mortality at the 48-hour mark of the 96-hour toxicity test. 48 hour results used because the highest mortality was observed during this time period.

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Table 14 **48-Hour Toxicity Test Results Correlation Analysis**
Wisconsin Steel Works
Chicago, Illinois

Location (a)	Mean 48-hour Percent Mortality (b)	LPAH	HPAH	Aroclor 1242	Aroclor 1254	Aroclor 1260
WSW-1-C	1.5	3.2E-02	1.7E-03	5.0E-03	4.8E-05	NA
WSW-1	2.5	3.2E-02	1.7E-03	5.0E-03	4.8E-05	NA
WSW-2	0	3.8E-02	5.8E-04	4.7E-03	3.3E-05	NA
WSW-3-C	5	1.7E-02	8.2E-05	3.6E-03	1.4E-05	NA
WSW-5-C	23	2.5E-01	1.0E-02	5.3E-03	9.0E-05	1.4E-05
WSW-5	35	2.5E-01	1.0E-02	5.3E-03	9.0E-05	1.4E-05
WSW-6	40	1.8E-01	7.0E-03	7.2E-03	9.3E-05	1.5E-05
WSW-7-C	5	9.5E-02	5.7E-03	1.7E-02	1.1E-04	1.8E-05
WSW-9-C	5	1.7E-02	1.1E-03	3.4E-03	8.4E-05	NA.
WSW-11-C	2.5	1.3E-01	1.3E-02	2.2E-01	1.2E-04	1.8E-05
r^2 values		0.82	0.52	-0.22	0.38	-0.90

Notes:

All predicted pore-water concentrations are reported in µg/l. Pore water concentrations predicted using equilibrium partiioning methodology (Di Toro et al., 1993).

LPAH - Low molecular weight (i.e. <200 grams/mole) polycyclic aromatic hydrocarbons

HPAH - High molecular weight (i.e. > 200 grams.mole) polycyclic aromatic hydrocarbons

a. North slip locations include WSW-1 through WSW-4, WSW-9 and WSW-10. All other locations are from the south slip.

b. Percent mortality at the 48-hour mark of the 96-hour toxicity test. 48 hour results used because the highest mortality was observed during this time period.

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Table 15 **Calculation of Toxicity Reference Values for the Great Blue Heron**
Former Wisconsin Steel Works
Chicago, Illinois

Chemical	Test Species	Test Species NOAEL (mg/kg/day)	Test Species BW (kg)	Great Blue Heron BW (kg)	Great Blue Heron TRV (mg/kg/day)	Toxicity Test Reference
Aroclor 1248				2.23	0.135	a
Fluoranthene				2.23	0.131	b
Pyrene				2.23	0.131	b
Chromium				2.23	NA	c
Copper	Chicken	47	0.534	2.23	29	Mehring et.al. , 1960
Lead	Japanese Quail	1.1	0.15	2.23	0.45	Edens et.al., 1976
Nickel				2.23	NA	c
Selenium	Mallard Duck	0.8	1	2.23	0.61	Heinz et.al., 1989
Zinc	Chicken	14.5	1.935	2.23	13.8	Stahl et.al., 1990

a. Blue Heron TRV for Aroclor 1254 as presented by Opresko et.al. (1954) used for evaluation of Aroclor 1248.
b. TRV based on the BTAG low TRV for benzo(a)pyrene developed for mammals. A Safety factor of 10 applied to convert the TRV in mammals to a TRV in Birds.
c. Chromium and Nickel are not expected to bioaccumulate to any significant degree and are expected to be present in fish tissue under prisitne conditions.

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Table 16 **Point Estimate Exposure Model for the Great Blue Heron**
Former Wisconsin Steel Works - South Slip
Chicago, Illinois

Chemical of Concern (a)	Blue Heron Body Weight (kg)	Area use Factor (unitless) (b)	Mean Measured Prey Concentration (mg/kg) (c)	Prey Ingestion Rate (kg/day) (d)	Predicted Dose (mg/kg/day) (e)	Toxicity Reference Value (mg/kg/day)	Hazard Quotient
Aroclor 1248	2.23	0.005	0.95	0.40	8.6E-04	0.135	6.3E-03
Fluoranthene	2.23	0.005	0.029	0.40	2.6E-05	0.131	2.0E-04
Pyrene	2.23	0.005	0.025	0.40	2.3E-05	0.131	1.7E-04
Chromium	2.23	0.005	1.53	0.40	1.4E-03	NA	NA
Copper	2.23	0.005	16.2	0.40	1.5E-02	29.3	5.0E-04
Lead	2.23	0.005	16.2	0.40	1.5E-02	0.45	3.2E-02
Nickel	2.23	0.005	16.2	0.40	1.5E-02	NA	NA
Selenium	2.23	0.005	1.55	0.40	1.4E-03	0.61	2.3E-03
Zinc	2.23	0.005	121	0.40	1.1E-01	13.8	7.8E-03

Notes:

a. All chemicals detected in white perch or common carp samples from the south slip considered COCs in fish tissue

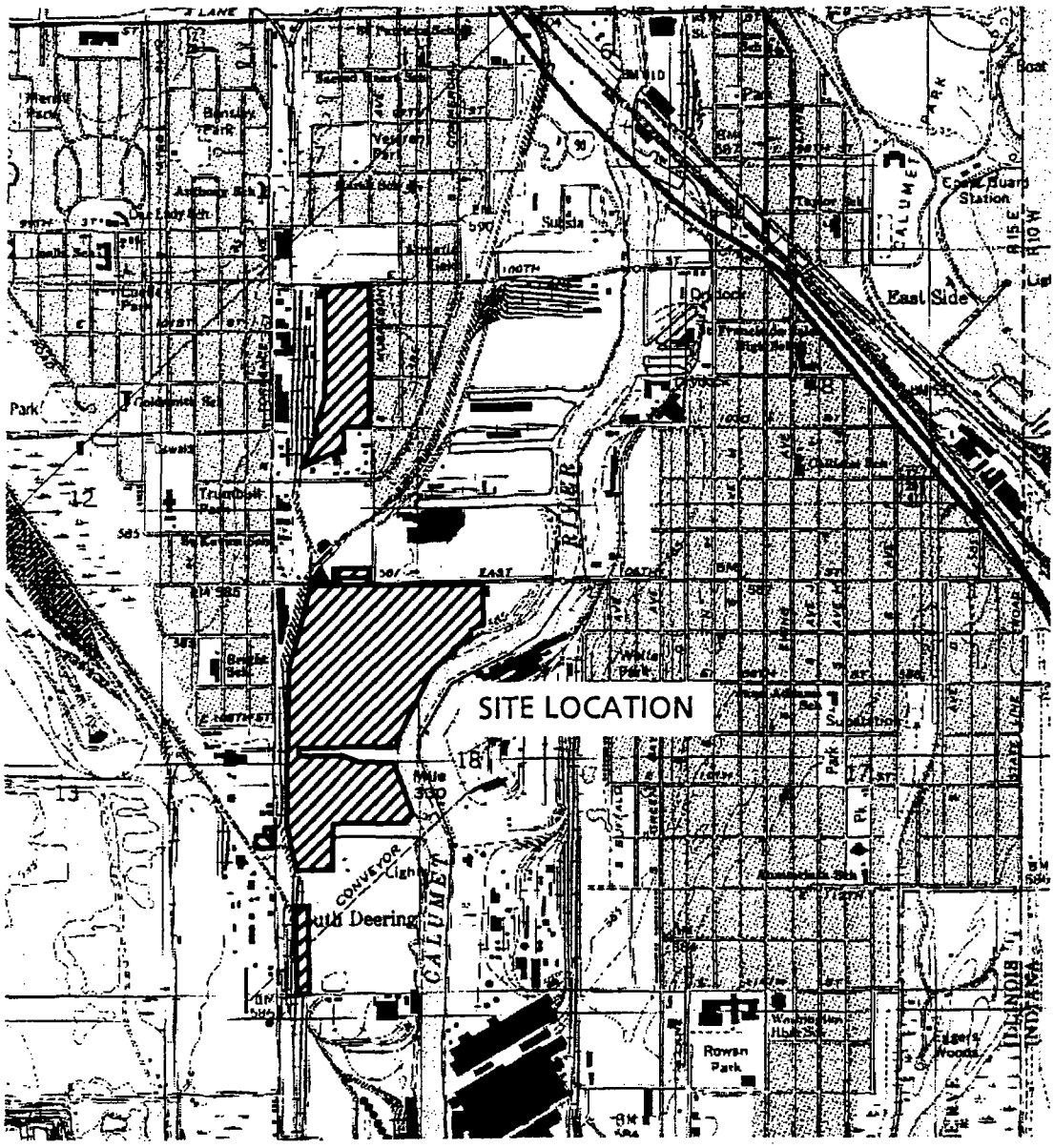
b. Approximately 500 square feet of the south slip is suitable habitat for wading birds. This area comprises approximately 0.5 % of the 0.6 hectare mean fall home range for Great Blue Herons (USEPA, 1996).

c. Mean concentrations of COCs in white perch and common carp samples from the south slip using 1/2 the LOD for non-detect values

d. Prey ingestion rate is equal to 18% of body weight (Kushlan, 1978)

e. Dose through ingestion of fish = Area Use Factor*(Prey Concentration * Prey ingestion Rate)/Body Weight

FIGURES



SOURCE: USGS 7.5 MIN. TOPOGRAPHIC MAP, LAKE CALUMET, ILLINOIS QUADRANGLE, 1991

NOTE: SITE BOUNDARIES ARE APPROXIMATE

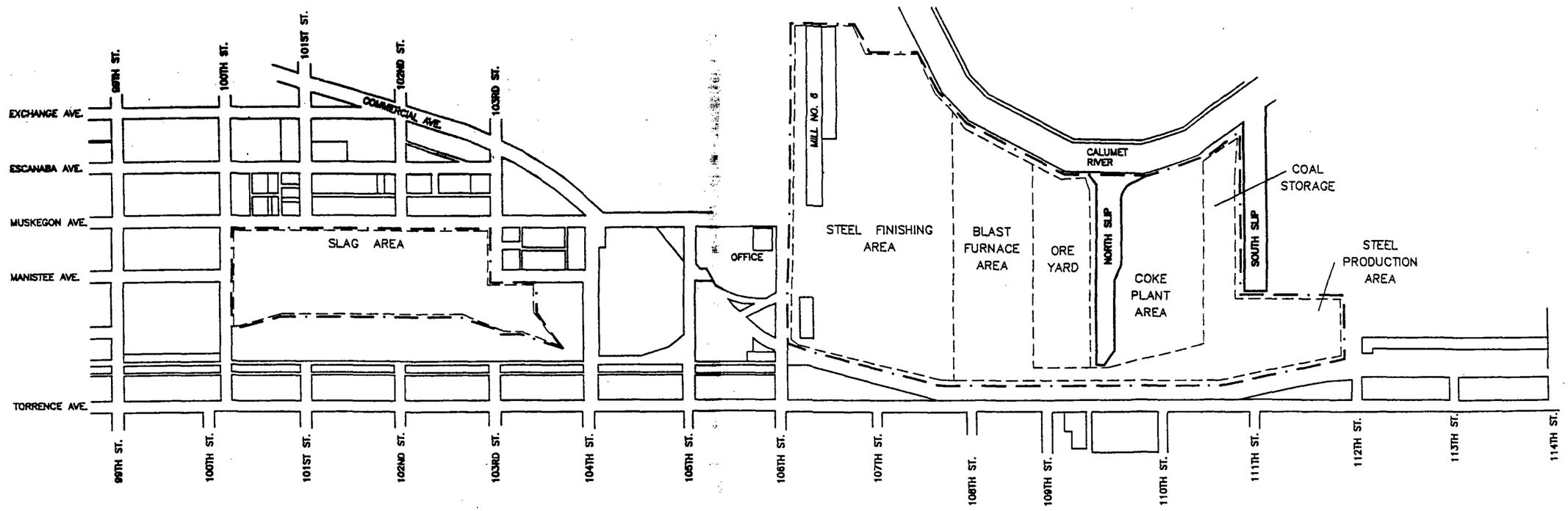
ARCADIS GERAGHTY & MILLER

35 East Wacker Drive
Suite 1000, Chicago, Illinois 60601
Tel: 312/263-6703 Fax: 312/263-7897

SITE LOCATION MAP
WISCONSIN STEEL WORKS SITE
CHICAGO, ILLINOIS

PROJECT NUMBER
CI0664.003

FIGURE NUMBER
1



SOURCE: FIGURES 5-2a AND 5-2b, PHASE II RI WORK PLAN, NOVEMBER 1995.

Date: 10/8/98 Project No.: CI000664.0003/00014 Filename: 99CI0455.DWG Drwn By/Plot Scale: SGozner/1=500

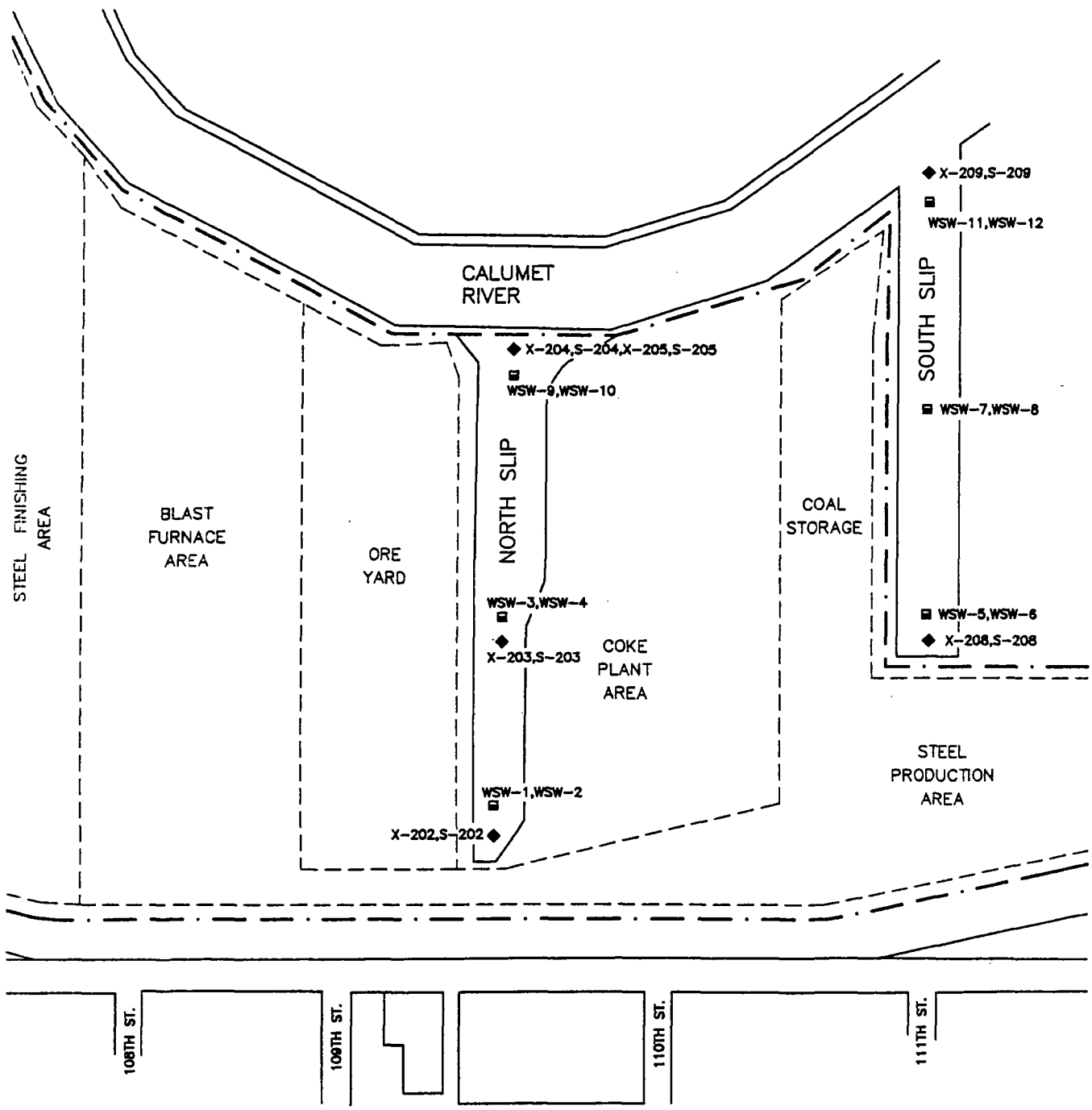
NO.	DATE	REVISION DESCRIPTION	BY	CKD	NO.	DATE	REVISION DESCRIPTION	BY	CKD

ARCADIS GERAGHTY & MILLER
35 East Wacker Drive
Suite 1000, Chicago, Illinois 60601
Tel: 312/263-6703 Fax: 312/263-7697

FORMER WISCONSIN STEEL WORKS SITE
CHICAGO, ILLINOIS

DRAWN	DATE	PROJECT MANAGER	DEPARTMENT MANAGER
SGozner	October 5, 1999	G VANDERLAAN	G VANDERLAAN
		LEAD DESIGN PROF. SGozner	CHECKED M COHN
SITE PLAN		PROJECT NUMBER CI000664.0003	FIGURE NUMBER 2

Date: 10/5/99 Project No.: CI000664.0003/00014 Filename: 99CI0456.DWG Drwn By/Plot Scale: SGozner/1=500



LEGEND

- USFWS SEDIMENT SAMPLE/IDENTIFICATION
- ILLINOIS EPA SURFACE WATER AND SEDIMENT SAMPLE/IDENTIFICATION
  - X = SEDIMENT SAMPLE
  - S = SURFACE WATER SAMPLE

0 200 400

SCALE IN FEET

SOURCE: FIGURES 5-2a AND 5-2b, PHASE II RI WORK PLAN, NOVEMBER 1995.

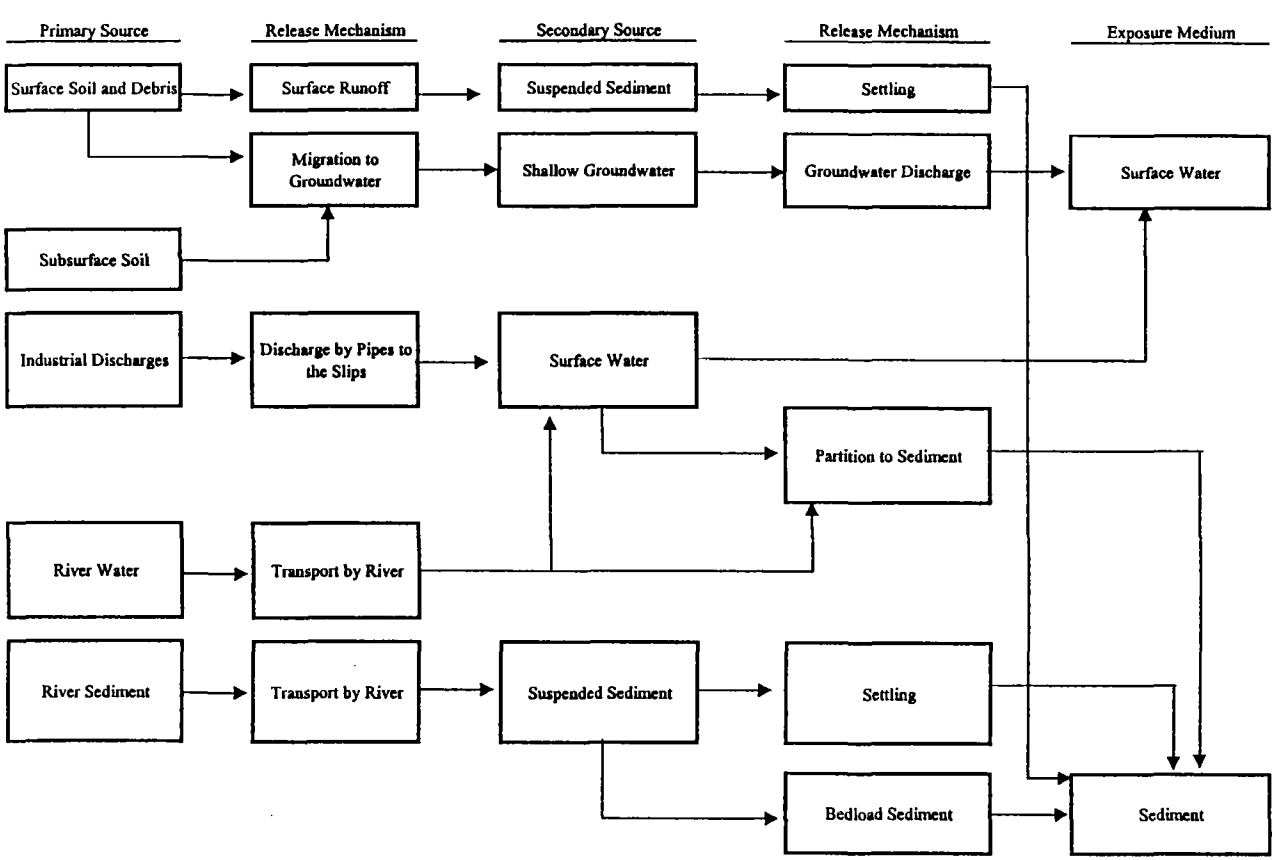
ARCADIS GERAGHTY&MILLER
35 East Wacker Drive
Suite 1000, Chicago, Illinois 60601
Tel: 312/263-6703 Fax: 312/263-7887

SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS
NORTH AND SOUTH BARGE SLIPS
FORMER WISCONSIN STEEL WORKS SITE
CHICAGO, ILLINOIS

PROJECT NUMBER CI0664.003

FIGURE NUMBER 3

Figure 4 Site Conceptual Exposure Model
Former Wisconsin Steel Works
Chicago, Illinois



Exposure Route	Receptors: Aquatic Plants	Receptors: Invertebrates	Receptors: Fish
Uptake	X		
Direct Contact		X	X
Ingestion		X	X
Uptake	X		
Direct Contact		X	X
Ingestion		X	X

APPENDIX A

Bulk Sediment Data

North Slip - Bulk Sediment

Sample Location		X-202		X-203		X-204
Moisture Content (organics)		0.63		0.4		0.48
Percent Solids (Metals)		0.395		0.694		0.573
Total Organic Carbon (mg/kg)		42866.66667		42866.67		42866.67
TOC		0.042866667		0.042867		0.042867
Sampler	IEPA		IEPA		IEPA	
Date Sampled	Jun-96		Jun-96		Jun-96	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Acetone		280		80		140
2-Butanone		62	J	15		35
Toluene		180	U	17	U	19
4-Methylphenol		2400	U	2700	U	630
Naphthalene		1100	U	2700		670
2-Methylnaphthalene	J	630	U	2700	J	340
Acenaphthylene	J	240	U	2700	J	150
Acenaphthene	J	190	U	2700	U	630
Dibenzofuran	J	350	U	2700	J	200
Phenanthrene		1500		4100		1100
Fluorene	J	410	U	2700	U	630
Fluoranthene		1200		12000		1000
Anthracene	J	480	J	1600	J	330
Pyrene		1200		8400		1100
Benzo(a)anthracene		1100		6200		860
Chrysene		1500		6200		1200
Benzo(b)fluoranthene		990		4600	J	600
Bis(2-ethylhexyl)phthalate	J	690	U	2700	U	630
Benzo(k)fluoranthene	J	670		3700	J	550
Benzo(a)pyrene		1000		4100		770
Dibenzo(a,h)anthracene	U	890	U	2700	U	630
Benzo(g,h,i)perylene	U	890	U	2700	U	630
Indeno(1,2,3-cd)pyrene	U	890	J	2200	U	630
delta-BHC	JP	4	JP	2.6	P	4.8
Aldrin	P	13	P	4.3	P	12
Dieldrin	JP	5.8	JP	2.1	JP	6.3
Endrin	P	19	P	9.4	P	11
Endosulfan II	JP	8.5	U	5.5	P	7
4,4'-DDE	JP	4.8	JP	2.6	JP	4.3
Endrin ketone		12	U	5.5	P	9.1
Endrin aldehyde	JP	3	JP	1.5	JP	4.2
alpha-Chlordane	P	9.6		3.1	P	11
gamma-Chlordane	JP	3.2	JP	2.7	P	3.4
Chlordane (total)						
Toxaphene	JP	220	U	280	U	320
Aroclor 1242		480	U	55		490
Aroclor 1248	U	89	P	180		420
Aroclor 1254		290	P	96		390
Aroclor 1260		150	P	78		150
Aluminum		7031		5892.06		6245.7
Antimony	UJ	5.0165	UJ	4.9968	UJ	4.7559
Arsenic		5.9645		5.8296		6.3603
Barium	B	35.1945		61.419		44.3502

North Slip - Bulk Sediment

Sample Location		X-202		X-203		X-204
Moisture Content (organics)		0.63		0.4		0.48
Percent Solids (Metals)		0.395		0.694		0.573
Total Organic Carbon (mg/kg)		42866.66667		42866.67		42866.67
TOC		0.042866667		0.042867		0.042867
Sampler	IEPA		IEPA		IEPA	
Date Sampled	Jun-96		Jun-96		Jun-96	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Beryllium	B	0.474	U	0.8328	U	0.573
Cadmium	B	0.79	U	0.59684		1.5471
Calcium		18328		31160.6		53919.3
Chromium		25.991		14.7128		42.2874
Cobalt	JB	5.5695	B	3.3312	B	4.8132
Copper		51.35		28.5928		46.2984
Iron		24174		27621.2		44808.6
Lead		105.07		63.2928		104.286
Magnesium		7623.5		9577.2		10314
Manganese	J	2512.2	J	805.04	J	1014.21
Mercury		0.13825		0.21514		0.13752
Nickel		18.0515		13.1166		26.7591
Potassium		1698.5		1034.06		1581.48
Selenium	JB	0.3002	JB	0.22902	UJ	0.9741
Silver	U	0.79	U	0.7634	B	0.8595
Sodium	B	148.915	B	261.638	B	268.737
Thallium	U	0.20145	U	0.18738	B	0.25212
Vanadium		18.9995		14.5046		19.3674
Zinc		309.285		174.888		352.968
Cyanide	U	0.5135		1.1104		0.9168

North Slip - Bulk Sediment

Sample Location		X-205		WSW-1A+B
Moisture Content (organics)		0.47		0.62
Percent Solids (Metals)		0.591		
Total Organic Carbon (mg/kg)		42866.67		38100
TOC		0.042867		0.0381
Sampler	IEPA		USFWS	
Date Sampled	Jun-96		Jul-93	
	Qualifier	Result	Qualifier	Result
Acetone		78		na
2-Butanone		22		na
Toluene	U	19	U	5.3
4-Methylphenol	U	620		na
Naphthalene		730		890
2-Methylnaphthalene	J	340		na
Acenaphthylene	J	160	U	660
Acenaphthene	J	130	U	660
Dibenzofuran	J	210		na
Phenanthrene		1100		860
Fluorene	J	350		240
Fluoranthene		1200		1100
Anthracene	J	320		350
Pyrene		1800		2300
Benzo(a)anthracene		850		620
Chrysene		1200		1300
Benzo(b)fluoranthene	J	600		600
Bis(2-ethylhexyl)phthalate	U	620		na
Benzo(k)fluoranthene	U	620		390
Benzo(a)pyrene		850		620
Dibenzo(a,h)anthracene	U	620		1400
Benzo(g,h,i)perylene	U	620	U	920
Indeno(1,2,3-cd)pyrene	U	620		670
delta-BHC	P	4.8	U	160
Aldrin	P	13	U	71
Dieldrin	P	7.3	U	34
Endrin	P	37	U	21
Endosulfan II	P	7.6	U	71
4,4'-DDD	JP	5.2	U	200
Endrin ketone	P	7	U	420
Endrin aldehyde	JP	4.1	U	390
alpha-Chlordane	P	13		na
gamma-Chlordane	P	3.7		na
Chlordane (total)			U	250
Toxaphene	U	320	U	4300
Aroclor 1242		560	U	1200
Aroclor 1248	U	61	U	2100
Aroclor 1254		450	J	460
Aroclor 1260		170	U	4200
Aluminum		6560.1		na
Antimony	UJ	4.8462		na
Arsenic		12.4701		19.3
Barium		39.7743		na

North Slip - Bulk Sediment

Sample Location		X-205		WSW-1A+B
Moisture Content (organics)		0.47		0.62
Percent Solids (Metals)		0.591		
Total Organic Carbon (mg/kg)		42866.67		38100
TOC		0.042867		0.0381
Sampler	IEPA		USFWS	
Date Sampled	Jun-96		Jul-93	
	Qualifier	Result	Qualifier	Result
Beryllium	U	0.591		na
Cadmium		1.182		4.2
Calcium		46748.1		na
Chromium		31.2048		101
Cobalt	B	6.8556		na
Copper		47.7528		136
Iron		41842.8		65400
Lead		92.196		310
Magnesium		11229		na
Manganese	J	1034.25		na
Mercury		0.18321		0.4
Nickel		23.4036		63.4
Potassium		1802.55		na
Selenium	UJ	0.9456	U	1.3
Silver	U	0.7683		na
Sodium	B	222.807		na
Thallium	B	0.31914		na
Vanadium		21.6897		na
Zinc		309.684		986
Cyanide		0.50235		1.9

North Slip - Bulk Sediment

Sample Location		WSW-2A+B		WSW-3A+B		WSW-4A+B
Moisture Content (organics)		0.6		0.57		0.5
Percent Solids (Metals)						
Total Organic Carbon (mg/kg)		35300		38900		45700
TOC		0.0353		0.0389		0.0457
Sampler	USFWS		USFWS		USFWS	
Date Sampled	Jul-93		Jul-93		Jul-93	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Acetone		na		na		na
2-Butanone		na		na		na
Toluene	U	5	U	4.7	U	4
4-Methylphenol		na		na		na
Naphthalene		1000		540	J	390
2-Methylnaphthalene		na		na		na
Acenaphthylene		370		220	J	220
Acenaphthene	U	620	U	58	U	500
Dibenzofuran		na		na		na
Phenanthrene		1100		610	J	460
Fluorene		270		160	J	120
Fluoranthene	U	620	U	58	U	500
Anthracene	J	410		230	J	190
Pyrene	U	620	U	58	U	500
Benzo(a)anthracene		660		410		340
Chrysene		1700	U	58		690
Benzo(b)fluoranthene		760	U	19		340
Bis(2-ethylhexyl)phthalate		na		na		na
Benzo(k)fluoranthene		200	U	19		230
Benzo(a)pyrene		250		450		370
Dibenzo(a,h)anthracene		990	U	35	U	300
Benzo(g,h,i)perylene	U	880	U	81	U	700
Indeno(1,2,3-cd)pyrene		780		420		410
delta-BHC	U	150	U	140	U	120
Aldrin	U	68	U	63	U	54
Dieldrin	U	32	U	30	U	26
Endrin	U	20	U	19	U	16
Endosulfan II	U	68	U	63	U	54
4,4'-DDD	U	190	U	170	U	150
Endrin ketone	U	400	U	370	U	320
Endrin aldehyde	U	380	U	350	U	300
alpha-Chlordane		na		na		na
gamma-Chlordane		na		na		na
Chlordane (total)	U	240	U	220	U	190
Toxaphene	U	4100	U	3800	U	3300
Aroclor 1242	U	1100	U	1000	U	880
Aroclor 1248	U	2000	U	1900	U	1600
Aroclor 1254	J	310	J	160	J	260
Aroclor 1260	U	4000	U	3700	U	3200
Aluminum		na		na		na
Antimony		na		na		na
Arsenic		14		17.9		19.9
Barium		na		na		na

North Slip - Bulk Sediment

Sample Location		WSW-2A+B		WSW-3A+B		WSW-4A+B
Moisture Content (organics)		0.6		0.57		0.5
Percent Solids (Metals)						
Total Organic Carbon (mg/kg)		35300		38900		45700
TOC		0.0353		0.0389		0.0457
Sampler	USFWS		USFWS		USFWS	
Date Sampled	Jul-93		Jul-93		Jul-93	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Beryllium		na		na		na
Cadmium		3.1		3.8		3.4
Calcium		na		na		na
Chromium		86.2		115		123
Cobalt		na		na		na
Copper		128		120		113
Iron		62700		69300		68100
Lead		290		266		241
Magnesium		na		na		na
Manganese		na		na		na
Mercury		0.27		0.54		0.38
Nickel		61.7		52.8		58.9
Potassium		na		na		na
Selenium	U	1.3	U	1.2	U	1
Silver		na		na		na
Sodium		na		na		na
Thallium		na		na		na
Vanadium		na		na		na
Zinc		1020		1050		823
Cyanide		1.7		3.1		3.7

North Slip - Bulk Sediment

Sample Location		WSW-9A+B		WSW-10A+B
Moisture Content (organics)		0.537		0.52
Percent Solids (Metals)				
Total Organic Carbon (mg/kg)		49700		49500
TOC		0.0497		0.0495
Sampler	USFWS		USFWS	
Date Sampled	Jul-93		Jul-93	
	Qualifier	Result	Qualifier	Result
Acetone		na		na
2-Butanone		na		na
Toluene		na		na
4-Methylphenol		na		na
Naphthalene		930		940
2-Methylnaphthalene		na		na
Acenaphthylene	J	47	J	370
Acenaphthene	U	460	U	500
Dibenzofuran		na		na
Phenanthrene		1100		1400
Fluorene	J	260	J	340
Fluoranthene		1300		1700
Anthracene	J	420		550
Pyrene		2700		3200
Benzo(a)anthracene		710		870
Chrysene		1700		2100
Benzo(b)fluoranthene		650		770
Bis(2-ethylhexyl)phthalate		na		na
Benzo(k)fluoranthene		420		480
Benzo(a)pyrene		760		840
Dibenzo(a,h)anthracene		980		910
Benzo(g,h,i)perylene		1400		1400
Indeno(1,2,3-cd)pyrene		760		770
delta-BHC	U	110	U	120
Aldrin	U	50	U	54
Dieldrin	U	24	U	26
Endrin	U	74	U	80
Endosulfan II	U	50	U	54
4,4'-DDD	U	140	U	150
Endrin ketone		na		na
Endrin aldehyde	U	280	U	300
alpha-Chlordane		na		na
gamma-Chlordane		na		na
Chlordane (total)	U	170	U	190
Toxaphene	U	3000	U	3200
Arochlor 1242	J	760		1800
Arochlor 1248	U	1500	U	1600
Arochlor 1254	U	3000	U	3200
Arochor 1260	U	3000	U	3200
Aluminum		na		na
Antimony		na		na
Arsenic		15.6		15.1
Barium		na		na

North Slip - Bulk Sediment

Sample Location		WSW-9A+B		WSW-10A+B
Moisture Content (organics)		0.537		0.52
Percent Solids (Metals)				
Total Organic Carbon (mg/kg)		49700		49500
TOC		0.0497		0.0495
Sampler	USFWS		USFWS	
Date Sampled	Jul-93		Jul-93	
	Qualifier	Result	Qualifier	Result
Beryllium		na		na
Cadmium		2.7		2.8
Calcium		na		na
Chromium		70.8		78.4
Cobalt		na		na
Copper		123		118
Iron		77200		86500
Lead		247		250
Magnesium		na		na
Manganese		na		na
Mercury		0.36		0.34
Nickel		50.3		54
Potassium		na		na
Selenium	U	1.1	U	1
Silver		na		na
Sodium		na		na
Thallium		na		na
Vanadium		na		na
Zinc		986		962
Cyanide		1.8		2.3

South Slip - Bulk Sediment

Sample Location		X-208		X-209		WSW-5A+B
Moisture Content (organics)		0.51		0.47		0.52
Percent Solids (metals)		0.531		0.547		
Total Organic Carbon		50825		50825		57200
TOC		0.050825		0.05083		0.0572
Sampler		IEPA		IEPA		USFWS
Date Sampled		Jun-96		Jun-96		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Acetone		50	U	19		na*
2-Butanone	J	15	J	10		na*
Benzene	U	20		120		4.7
Toluene		22	U	19		8.8
Ethylbenzene	U	20	U	19	U	4.2
m-Xylene		na*		na*		11
o,p-Xylene		na*		na*		12
Xylene (total)	U	20		23		na*
4-Methylphenol	J	940	J	1100		na*
Naphthalene	J	1600		14000		16000
2-Methylnaphthalene	U	3300	J	2200		na*
Phenanthrene		3700		13000		11000
Acenaphthene	U	3300	J	2600	U	5200
Acenaphthylene	U	3300	J	2500	U	5200
Anthracene	J	1200		5000	J	4300
Dibenzofuran	U	3300	J	2700		na*
Fluorene	J	1100		3400	J	2500
Fluoranthene		5000		17000		27000
Pyrene		4600		15000		15000
Benzo(a)anthracene	J	2800		12000		6200
Chrysene	J	3100		12000		11000
Benzo(b)fluoranthene	J	2300	J	9700		6600
Benzo(k)fluoranthene	J	1600	J	6600		2900
Benzo(a)pyrene	J	2600	J	9900		6100
Dibenzo(a,h)anthracene	U	3300	J	2100		15000
Indeno(1,2,3-cd)pyrene	J	2000	J	6500		5800
Benzo(g,h,i)perylene	U	3300	J	2400		8900
delta-BHC	P	4.9	J	7.2	U	120
Aldrin	P	18	P	57	U	56
Dieldrin	JP	6.2	P	11	U	27
4,4'-DDE	P	20	U	6.1	U	56
Endrin	P	39	P	55	U	83
Endosulfan II	U	6.7	P	18	U	56
4,4'-DDD	JP	5.4	P	12	U	160
Endosulfan sulfanate	U	6.7	JP	3.1	U	920
4,4'-DDT	P	8.5	U	6.1	U	170
Methoxychlor	J	30	P	57	U	2500
Endrin aldehyde	JP	4.1	JP	5.4	U	310
alpha-Chlordane		14	P	16		na*
gamma-Chlordane	P	5.1	P	12		na*
Chlordane		na*		na*	U	200
Toxaphene	JP	250	P	440	U	3300
Aroclor 1242		790		2100		1200

South Slip - Bulk Sediment

Sample Location		X-208		X-209		WSW-5A+B
Moisture Content (organics)		0.51		0.47		0.52
Percent Solids (metals)		0.531		0.547		
Total Organic Carbon		50825		50825		57200
TOC		0.050825		0.05083		0.0572
Sampler		IEPA		IEPA		USFWS
Date Sampled		Jun-96		Jun-96		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Arochlor 1254		420		570	U	3300
Arochlor 1260		190		350	U	3300
Aluminum		5028.57		6345.2		na*
Antimony	UJ	4.9383	UJ	4.4854		na*
Arsenic		10.7262		8.3691		12.4
Barium	B	38.3913		49.6129		na*
Beryllium	U	0.6372	U	0.6564		na*
Cadmium		1.8585		2.0786		3.2
Calcium		24319.8		29920.9		na*
Chromium		139.122		34.8439		69.6
Cobalt	B	4.9914	B	5.3606		na*
Copper		54.693		62.358		102
Iron		29948.4		36922.5		47800
Lead		141.246		148.237		229
Magnesium		9664.2		11213.5		na*
Manganese	J	679.68	J	1088.53		na*
Mercury		0.7434		0.18598		0.79
Nickel		30.1077		22.8099		43.7
Potassium		1115.1		1427.67		na*
Selenium	JB	0.2655	JB	0.28991	U	1.1
Silver	B	0.7965	B	1.2034		na*
Sodium	B	128.502	B	96.819		na*
Thallium	B	0.41418	B	0.40478		na*
Vanadium		18.1602		23.6304		na*
Zinc		481.086		1049.69		942
Cyanide		2.124		0.8752		2.5

South Slip - Bulk Sediment

Sample Location		WSW-6A+B		WSW-7A+B		WSW-8A+B
Moisture Content (organics)		0.52		0.54		0.54
Percent Solids (metals)						
Total Organic Carbon		55300		50825		50825
TOC		0.0553		0.050825		0.050825
Sampler		USFWS		USFWS		USFWS
Date Sampled		Jul-93		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Acetone		na*				
2-Butanone		na*				
Benzene	J	3.6	U	22	U	4.3
Toluene	U	4.2		920		6.3
Ethylbenzene	U	4.2	U	22	U	4.3
m-Xylene		5.1	U	22	U	4.3
o,p-Xylene	J	2.5	U	22	U	4.3
Xylene (total)		na*		na*		
4-Methylphenol		na*		na*		
Naphthalene		11000	J	3200	J	2600
2-Methylnaphthalene		na*		na*		
Phenanthrene		7400	J	4700	J	4220
Acenaphthene	U	5200	U	5400	U	5400
Acenaphthylene	J	780	U	5400	U	5400
Anthracene	J	3100	J	2100	J	1800
Dibenzofuran		na*		na*		
Fluorene	J	1800	J	1100	J	950
Fluoranthene		18000		13000		13000
Pyrene		9700		7200		6900
Benzo(a)anthracene		4100		2900		3000
Chrysene		6800	J	4400	J	4600
Benzo(b)fluoranthene		4400		3000		3100
Benzo(k)fluoranthene		1900		1500	J	1500
Benzo(a)pyrene		4200		2800		3000
Dibenzo(a,h)anthracene		9900		7000	U	3300
Indeno(1,2,3-cd)pyrene	J	3900	J	2600	J	2600
Benzo(g,h,i)perylene	J	6100	J	4100	J	3400
delta-BHC	U	120	U	130	U	130
Aldrin	U	56	U	59	U	59
Dieldrin	U	27	U	28	U	28
4,4'-DDE	U	56	U	59	U	59
Endrin	U	83	U	87	U	87
Endosulfan II	U	56	U	59	U	59
4,4'-DDD	U	160	U	160	U	160
Endosulfan sulfanate	U	920	U	960	U	960
4,4'-DDT	U	170	U	170	U	170
Methoxychlor	U	2500	U	2600	U	2600
Endrin aldehyde	U	310	U	330	U	330
alpha-Chlordane		na*		na*		
gamma-Chlordane		na*		na*		
Chlordane	U	200	U	200	U	200
Toxaphene	U	3300	U	3500	U	3500
Arochlor 1242		1600		3400		3600

South Slip - Bulk Sediment

Sample Location		WSW-6A+B		WSW-7A+B		WSW-8A+B
Moisture Content (organics)		0.52		0.54		0.54
Percent Solids (metals)						
Total Organic Carbon		55300		50825		50825
TOC		0.0553		0.050825		0.050825
Sampler		USFWS		USFWS		USFWS
Date Sampled		Jul-93		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Arochlor 1254	U	3300	U	3500	U	3500
Arochlor 1260	U	3300	U	3500	U	3500
Aluminum		na*		na*		
Antimony		na*		na*		
Arsenic		13.8		na*		
Barium		na*		na*		
Beryllium		na*		na*		
Cadmium		3.3		na*		
Calcium		na*		na*		
Chromium		77.3		na*		
Cobalt		na*		na*		
Copper		114		na*		
Iron		52800		na*		
Lead		249		na*		
Magnesium		na*		na*		
Manganese		na*		na*		
Mercury		0.54		na*		
Nickel		47.3		na*		
Potassium		na*		na*		
Selenium	U	1		na*		
Silver		na*		na*		
Sodium		na*		na*		
Thallium		na*		na*		
Vanadium		na*		na*		
Zinc		1050		na*		
Cyanide		2.1		na*		

South Slip - Bulk Sediment

Sample Location		WSW-11A+B		WSW-12A+B
Moisture Content (organics)		0.551		0.547
Percent Solids (metals)				
Total Organic Carbon		46000		44800
TOC		0.046		0.0448
Sampler		USFWS		USFWS
Date Sampled		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result
Acetone				
2-Butanone				
Benzene	U	4.3	U	4.2
Toluene	U	4.3	U	4.2
Ethylbenzene	U	4.3	U	4.2
m-Xylene	U	4.3	U	4.2
o,p-Xylene	U	4.3	U	4.2
Xylene (total)				
4-Methylphenol				
Naphthalene	J	2500	J	3100
2-Methylnaphthalene				
Phenanthrene		11000		100000
Acenaphthene	U	5300	U	5200
Acenaphthylene	J	630	J	2500
Anthracene	J	4400		40000
Dibenzofuran				
Fluorene	J	1600		18000
Fluoranthene		29000	E	130000
Pyrene		14000		60000
Benzo(a)anthracene		5900		24000
Chrysene		10000		39000
Benzo(b)fluoranthene		5600		23000
Benzo(k)fluoranthene		2500		9500
Benzo(a)pyrene		5300		23000
Dibenzo(a,h)anthracene		11000		51000
Indeno(1,2,3-cd)pyrene		4600		19000
Benzo(g,h,i)perylene	J	6600		27000
delta-BHC	U	130	U	120
Aldrin	U	57	U	56
Dieldrin	U	28	U	27
4,4'-DDE	U	57	U	56
Endrin	U	85	U	83
Endosulfan II	U	57	U	56
4,4'-DDD	U	160	U	160
Endosulfan sulfanate	U	940	U	920
4,4'-DDT	U	170	U	170
Methoxychlor	U	2500	U	2500
Endrin aldehyde	U	320	U	310
alpha-Chlordane				
gamma-Chlordane				
Chlordane	U	200	U	200
Toxaphene	U	3400	U	3300
Arochlor 1242		4000		3600

South Slip - Bulk Sediment

Sample Location		WSW-11A+B		WSW-12A+B
Moisture Content (organics)		0.551		0.547
Percent Solids (metals)				
Total Organic Carbon		46000		44800
TOC		0.046		0.0448
Sampler		USFWS		USFWS
Date Sampled		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result
Arochlor 1254	U	3400	U	3300
Arochlor 1260	U	3400	U	3300
Aluminum				
Antimony				
Arsenic		19		18.7
Barium				
Beryllium				
Cadmium		5.4		22.8
Calcium				
Chromium		110		78.7
Cobalt				
Copper		143		118
Iron		101000		74900
Lead		765		487
Magnesium				
Manganese				
Mercury		0.25		0.52
Nickel		66.5		56
Potassium				
Selenium	U	1.1	U	1.1
Silver				
Sodium				
Thallium				
Vanadium				
Zinc		1990		1330
Cyanide		3.6		2.8

APPENDIX B

Dry Weight Sediment Data

North Slip - Dry Weight

Sample Location		X-202		X-203		X-204
Moisture Content (organics)		0.63		0.4		0.48
Percent Solids (Metals)		0.395		0.694		0.573
Total Organic Carbon (mg/kg)		42866.66667		42866.67		42866.67
TOC		0.042866667		0.042867		0.042867
Sampler	IEPA		IEPA		IEPA	
Date Sampled	Jun-96		Jun-96		Jun-96	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Chemical						
Acetone		756.76		133.33		269.2308
2-Butanone		167.57	J	25.00		67.30769
Toluene		486.49	U	28.33	U	36.53846
4-Methylphenol		6486.49	U	4500.00	U	1211.538
Naphthalene		2972.97	U	4500.00		1288.462
2-Methylnaphthalene	J	1702.70	U	4500.00	J	653.8462
Acenaphthylene	J	648.65	U	4500.00	J	288.4615
Acenaphthene	J	513.51	U	4500.00	U	1211.538
Dibenzofuran	J	945.95	U	4500.00	J	384.6154
Phenanthrene		4054.05		6833.33		2115.385
Fluorene	J	1108.11	U	4500.00	U	1211.538
Fluoranthene		3243.24		20000.00		1923.077
Anthracene	J	1297.30	J	2666.67	J	634.6154
Pyrene		3243.24		14000.00		2115.385
Benzo(a)anthracene		2972.97		10333.33		1653.846
Chrysene		4054.05		10333.33		2307.692
Benzo(b)fluoranthene		2675.68		7666.67	J	1153.846
Bis(2-ethylhexyl)phthalate	J	1864.86	U	4500.00	U	1211.538
Benzo(k)fluoranthene	J	1810.81		6166.67	J	1057.692
Benzo(a)pyrene		2702.70		6833.33		1480.769
Dibenzo(a,h)anthracene	U	2405.41	U	4500.00	U	1211.538
Benzo(g,h,i)perylene	U	2405.41	U	4500.00	U	1211.538
Indeno(1,2,3-cd)pyrene	U	2405.41	J	3666.67	U	1211.538
delta-BHC	JP	10.81	JP	4.33	P	9.230769
Aldrin	P	35.14	P	7.17	P	23.07692
Dieldrin	JP	15.68	JP	3.50	JP	12.11538
Endrin	P	51.35	P	15.67	P	21.15385
Endosulfan II	JP	22.97	U	9.17	P	13.46154
4,4'-DDD	JP	12.97	JP	4.33	JP	8.269231
Endrin ketone		32.43	U	9.17	P	17.5
Endrin aldehyde	JP	8.11	JP	2.50	JP	8.076923
alpha-Chlordane	P	25.95		5.17	P	21.15385
gamma-Chlordane	JP	8.65	JP	4.50	P	6.538462
Chlordane (total)						
Toxaphene	JP	594.59	U	466.67	U	615.3846
Arochlor 1242		1297.30	U	91.67		942.3077
Arochlor 1248	U	240.54	P	300.00		807.6923
Arochlor 1254		783.78	P	160.00		750
Arochlor 1260		405.41	P	130.00		288.4615
Aluminum		17800		8490		10900
Antimony	UJ	12.7	UJ	7.2	UJ	8.3
Arsenic		15.1		8.4		11.1

North Slip - Dry Weight

Sample Location		X-202		X-203		X-204
Moisture Content (organics)		0.63		0.4		0.48
Percent Solids (Metals)		0.395		0.694		0.573
Total Organic Carbon (mg/kg)		42866.66667		42866.67		42866.67
TOC		0.042866667		0.042867		0.042867
Sampler	IEPA		IEPA		IEPA	
Date Sampled	Jun-96		Jun-96		Jun-96	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Barium	B	89.1		88.5		77.4
Beryllium	B	1.2	U	1.2	U	1
Cadmium	B	2	U	0.86		2.7
Calcium		46400		44900		94100
Chromium		65.8		21.2		73.8
Cobalt	JB	14.1	B	4.8	B	8.4
Copper		130		41.2		80.8
Iron		61200		39800		78200
Lead		266		91.2		182
Magnesium		19300		13800		18000
Manganese	J	6360	J	1160	J	1770
Mercury		0.35		0.31		0.24
Nickel		45.7		18.9		46.7
Potassium		4300		1490		2760
Selenium	JB	0.76	JB	0.33	UJ	1.7
Silver	U	2	U	1.1	B	1.5
Sodium	B	377	B	377	B	469
Thallium	U	0.51	U	0.27	B	0.44
Vanadium		48.1		20.9		33.8
Zinc		783		252		616
Cyanide	U	1.3		1.6		1.6

North Slip - Dry Weight

Sample Location		X-205		WSW-1A+B		WSW-2A+B
Moisture Content (organics)		0.47		0.62		0.6
Percent Solids (Metals)		0.591				
Total Organic Carbon (mg/kg)		42866.67		38100		35300
TOC		0.042867		0.0381		0.0353
Sampler	IEPA		USFWS		USFWS	
Date Sampled	Jun-96		Jul-93		Jul-93	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Chemical						
Acetone		147.1698		na		na
2-Butanone		41.50943		na		na
Toluene	U	35.84906	U	13.94737	U	12.5
4-Methylphenol	U	1169.811		na		na
Naphthalene		1377.358		2342.105		2500
2-Methylnaphthalene	J	641.5094		na		na
Acenaphthylene	J	301.8868	U	1736.842		925
Acenaphthene	J	245.283	U	1736.842	U	1550
Dibenzofuran	J	396.2264		na		na
Phenanthrene		2075.472		2263.158		2750
Fluorene	J	660.3774		631.5789		675
Fluoranthene		2264.151		2894.737	U	1550
Anthracene	J	603.7736		921.0526	J	1025
Pyrene		3396.226		6052.632	U	1550
Benzo(a)anthracene		1603.774		1631.579		1650
Chrysene		2264.151		3421.053		4250
Benzo(b)fluoranthene	J	1132.075		1578.947		1900
Bis(2-ethylhexyl)phthalate	U	1169.811		na		na
Benzo(k)fluoranthene	U	1169.811		1026.316		500
Benzo(a)pyrene		1603.774		1631.579		625
Dibenzo(a,h)anthracene	U	1169.811		3684.211		2475
Benzo(g,h,i)perylene	U	1169.811	U	2421.053	U	2200
Indeno(1,2,3-cd)pyrene	U	1169.811		1763.158		1950
delta-BHC	P	9.056604	U	421.0526	U	375
Aldrin	P	24.5283	U	186.8421	U	170
Dieldrin	P	13.77358	U	89.47368	U	80
Endrin	P	69.81132	U	55.26316	U	50
Endosulfan II	P	14.33962	U	186.8421	U	170
4,4'-DDD	JP	9.811321	U	526.3158	U	475
Endrin ketone	P	13.20755	U	1105.263	U	1000
Endrin aldehyde	JP	7.735849	U	1026.316	U	950
alpha-Chlordane	P	24.5283		na		na
gamma-Chlordane	P	6.981132		na		na
Chlordane (total)			U	657.8947	U	600
Toxaphene	U	603.7736	U	11315.79	U	10250
Arochlor 1242		1056.604	U	3157.895	U	2750
Arochlor 1248	U	115.0943	U	5526.316	U	5000
Arochlor 1254		849.0566	J	1210.526	J	775
Arochlor 1260		320.7547	U	11052.63	U	10000
Aluminum		11100		na		na
Antimony	UJ	8.2		na		na
Arsenic		21.1		50.78947		35

North Slip - Dry Weight

Sample Location		X-205		WSW-1A+B		WSW-2A+B
Moisture Content (organics)		0.47		0.62		0.6
Percent Solids (Metals)		0.591				
Total Organic Carbon (mg/kg)		42866.67		38100		35300
TOC		0.042867		0.0381		0.0353
Sampler	IEPA		USFWS		USFWS	
Date Sampled	Jun-96		Jul-93		Jul-93	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Barium		67.3		na		na
Beryllium	U	1		na		na
Cadmium		2		11.05263		7.75
Calcium		79100		na		na
Chromium		52.8		265.7895		215.5
Cobalt	B	11.6		na		na
Copper		80.8		357.8947		320
Iron		70800		172105.3		156750
Lead		156		815.7895		725
Magnesium		19000		na		na
Manganese	J	1750		na		na
Mercury		0.31		1.052632		0.675
Nickel		39.6		166.8421		154.25
Potassium		3050		na		na
Selenium	UJ	1.6	U	3.421053	U	3.25
Silver	U	1.3		na		na
Sodium	B	377		na		na
Thallium	B	0.54		na		na
Vanadium		36.7		na		na
Zinc		524		2594.737		2550
Cyanide		0.85		5		4.25

North Slip - Dry Weight

Sample Location		WSW-3A+B		WSW-4A+B		WSW-9A+B
Moisture Content (organics)		0.57		0.5		0.537
Percent Solids (Metals)						
Total Organic Carbon (mg/kg)		38900		45700		49700
TOC		0.0389		0.0457		0.0497
Sampler	USFWS		USFWS		USFWS	
Date Sampled	Jul-93		Jul-93		Jul-93	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Chemical						
Acetone		na		na		na
2-Butanone		na		na		na
Toluene	U	10.93023	U	8		na
4-Methylphenol		na		na		na
Naphthalene		1255.814	J	780		2008.639309
2-Methylnaphthalene		na		na		na
Acenaphthylene		511.6279	J	440	J	101.511879
Acenaphthene	U	134.8837	U	1000	U	993.5205184
Dibenzofuran		na		na		na
Phenanthrene		1418.605	J	920		2375.809935
Fluorene		372.093	J	240	J	561.5550756
Fluoranthene	U	134.8837	U	1000		2807.775378
Anthracene		534.8837	J	380	J	907.1274298
Pyrene	U	134.8837	U	1000		5831.533477
Benzo(a)anthracene		953.4884		680		1533.477322
Chrysene	U	134.8837		1380		3671.706263
Benzo(b)fluoranthene	U	44.18605		680		1403.887689
Bis(2-ethylhexyl)phthalate		na		na		na
Benzo(k)fluoranthene	U	44.18605		460		907.1274298
Benzo(a)pyrene		1046.512		740		1641.468683
Dibenzo(a,h)anthracene	U	81.39535	U	600		2116.63067
Benzo(g,h,i)perylene	U	188.3721	U	1400		3023.758099
Indeno(1,2,3-cd)pyrene		976.7442		820		1641.468683
delta-BHC	U	325.5814	U	240	U	237.5809935
Aldrin	U	146.5116	U	108	U	107.9913607
Dieldrin	U	69.76744	U	52	U	51.83585313
Endrin	U	44.18605	U	32	U	159.8272138
Endosulfan II	U	146.5116	U	108	U	107.9913607
4,4'-DDD	U	395.3488	U	300	U	302.3758099
Endrin ketone	U	860.4651	U	640		na
Endrin aldehyde	U	813.9535	U	600	U	604.7516199
alpha-Chlordane		na		na		na
gamma-Chlordane		na		na		na
Chlordane (total)	U	511.6279	U	380	U	367.1706263
Toxaphene	U	8837.209	U	6600	U	6479.481641
Aroclor 1242	U	2325.581	U	1760	J	1641.468683
Aroclor 1248	U	4418.605	U	3200	U	3239.740821
Aroclor 1254	J	372.093	J	520	U	6479.481641
Aroclor 1260	U	8604.651	U	6400	U	6479.481641
Aluminum		na		na		na
Antimony		na		na		na
Arsenic		41.62791		39.8		33.69330454

North Slip - Dry Weight

Sample Location		WSW-3A+B		WSW-4A+B		WSW-9A+B
Moisture Content (organics)		0.57		0.5		0.537
Percent Solids (Metals)						
Total Organic Carbon (mg/kg)		38900		45700		49700
TOC		0.0389		0.0457		0.0497
Sampler	USFWS		USFWS		USFWS	
Date Sampled	Jul-93		Jul-93		Jul-93	
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Barium		na		na		na
Beryllium		na		na		na
Cadmium		8.837209		6.8		5.831533477
Calcium		na		na		na
Chromium		267.4419		246		152.9157667
Cobalt		na		na		na
Copper		279.0698		226		265.6587473
Iron		161162.8		136200		166738.6609
Lead		618.6047		482		533.4773218
Magnesium		na		na		na
Manganese		na		na		na
Mercury		1.255814		0.76		0.777537797
Nickel		122.7907		117.8		108.6393089
Potassium		na		na		na
Selenium	U	2.790698	U	2	U	2.375809935
Silver		na		na		na
Sodium		na		na		na
Thallium		na		na		na
Vanadium		na		na		na
Zinc		2441.86		1646		2129.589633
Cyanide		7.209302		7.4		3.887688985

North Slip - Dry Weight

Sample Location		WSW-10A+B
Moisture Content (organics)		0.52
Percent Solids (Metals)		
Total Organic Carbon (mg/kg)		49500
TOC		0.0495
Sampler	USFWS	
Date Sampled	Jul-93	
	Qualifier	Result
Chemical		
Acetone		na
2-Butanone		na
Toluene		na
4-Methylphenol		na
Naphthalene		1958.333
2-Methylnaphthalene		na
Acenaphthylene	J	770.8333
Acenaphthene	U	1041.667
Dibenzofuran		na
Phenanthrene		2916.667
Fluorene	J	708.3333
Fluoranthene		3541.667
Anthracene		1145.833
Pyrene		6666.667
Benzo(a)anthracene		1812.5
Chrysene		4375
Benzo(b)fluoranthene		1604.167
Bis(2-ethylhexyl)phthalate		na
Benzo(k)fluoranthene		1000
Benzo(a)pyrene		1750
Dibenzo(a,h)anthracene		1895.833
Benzo(g,h,i)perylene		2916.667
Indeno(1,2,3-cd)pyrene		1604.167
delta-BHC	U	250
Aldrin	U	112.5
Dieldrin	U	54.16667
Endrin	U	166.6667
Endosulfan II	U	112.5
4,4'-DDD	U	312.5
Endrin ketone		na
Endrin aldehyde	U	625
alpha-Chlordane		na
gamma-Chlordane		na
Chlordane (total)	U	395.8333
Toxaphene	U	6666.667
Aroclor 1242		3750
Aroclor 1248	U	3333.333
Aroclor 1254	U	6666.667
Aroclor 1260	U	6666.667
Aluminum		na
Antimony		na
Arsenic		31.45833

North Slip - Dry Weight

Sample Location		WSW-10A+B
Moisture Content (organics)		0.52
Percent Solids (Metals)		
Total Organic Carbon (mg/kg)		49500
TOC		0.0495
Sampler	USFWS	
Date Sampled	Jul-93	
	Qualifier	Result
Barium		na
Beryllium		na
Cadmium		5.833333
Calcium		na
Chromium		163.3333
Cobalt		na
Copper		245.8333
Iron		180208.3
Lead		520.8333
Magnesium		na
Manganese		na
Mercury		0.708333
Nickel		112.5
Potassium		na
Selenium	U	2.083333
Silver		na
Sodium		na
Thallium		na
Vanadium		na
Zinc		2004.167
Cyanide		4.791667

South Slip - Dry Weight

Sample Location		X-208		X-209		WSW-5A+B
Moisture Content (organics)		0.51		0.47		0.52
Percent Solids (metals)		0.531		0.547		
Total Organic Carbon		50825		50825		57200
TOC		0.050825		0.05083		0.0572
Sampler		IEPA		IEPA		USFWS
Date Sampled		Jun-96		Jun-96		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Chemical						
Acetone		102.0408	U	35.8491		na*
2-Butanone	J	30.61224	J	18.8679		na*
Benzene	U	40.81633		226.415		9.79166667
Toluene		44.89796	U	35.8491		18.3333333
Ethylbenzene	U	40.81633	U	35.8491	U	8.75
m-Xylene		na*		na*		22.9166667
o,p-Xylene		na*		na*		25
Xylene (total)	U	40.81633		43.3962		na*
4-Methylphenol	J	1918.367	J	2075.47		na*
Naphthalene	J	3265.306		26415.1		33333.3333
2-Methylnaphthalene	U	6734.694	J	4150.94		na*
Phenanthrene		7551.02		24528.3		22916.6667
Acenaphthene	U	6734.694	J	4905.66	U	10833.3333
Acenaphthylene	U	6734.694	J	4716.98	U	10833.3333
Anthracene	J	2448.98		9433.96	J	8958.33333
Dibenzofuran	U	6734.694	J	5094.34		na*
Fluorene	J	2244.898		6415.09	J	5208.33333
Fluoranthene		10204.08		32075.5		56250
Pyrene		9387.755		28301.9		31250
Benzo(a)anthracene	J	5714.286		22641.5		12916.6667
Chrysene	J	6326.531		22641.5		22916.6667
Benzo(b)fluoranthene	J	4693.878	J	18301.9		13750
Benzo(k)fluoranthene	J	3265.306	J	12452.8		6041.66667
Benzo(a)pyrene	J	5306.122	J	18679.2		12708.3333
Dibenzo(a,h)anthracene	U	6734.694	J	3962.26		31250
Indeno(1,2,3-cd)pyrene	J	4081.633	J	12264.2		12083.3333
Benzo(g,h,i)perylene	U	6734.694	J	4528.3		18541.6667
delta-BHC	P	10	J	13.5849	U	250
Aldrin	P	36.73469	P	107.547	U	116.666667
Dieldrin	JP	12.65306	P	20.7547	U	56.25
4,4'-DDE	P	40.81633	U	11.5094	U	116.666667
Endrin	P	79.59184	P	103.774	U	172.916667
Endosulfan II	U	13.67347	P	33.9623	U	116.666667
4,4'-DDD	JP	11.02041	P	22.6415	U	333.333333
Endosulfan sulfanate	U	13.67347	JP	5.84906	U	1916.66667
4,4'-DDT	P	17.34694	U	11.5094	U	354.166667
Methoxychlor	J	61.22449	P	107.547	U	5208.33333
Endrin aldehyde	JP	8.367347	JP	10.1887	U	645.833333
alpha-Chlordane		28.57143	P	30.1887		na*
gamma-Chlordane	P	10.40816	P	22.6415		na*
Chlordane		na*		na*	U	416.666667
Toxaphene	JP	510.2041	P	830.189	U	6875

South Slip - Dry Weight

Sample Location		X-208		X-209		WSW-5A+B
Moisture Content (organics)		0.51		0.47		0.52
Percent Solids (metals)		0.531		0.547		
Total Organic Carbon		50825		50825		57200
TOC		0.050825		0.05083		0.0572
Sampler		IEPA		IEPA		USFWS
Date Sampled		Jun-96		Jun-96		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Arochlor 1242		1612.245		3962.26		2500
Arochlor 1254		857.1429		1075.47	U	6875
Arochlor 1260		387.7551		660.377	U	6875
Aluminum		9470		11600		na*
Antimony	UJ	9.3	UJ	8.2		na*
Arsenic		20.2		15.3		25.8333333
Barium	B	72.3		90.7		na*
Beryllium	U	1.2	U	1.2		na*
Cadmium		3.5		3.8		6.66666667
Calcium		45800		54700		na*
Chromium		262		63.7		145
Cobalt	B	9.4	B	9.8		na*
Copper		103		114		212.5
Iron		56400		67500		99583.3333
Lead		266		271		477.083333
Magnesium		18200		20500		na*
Manganese	J	1280	J	1990		na*
Mercury		1.4		0.34		1.64583333
Nickel		56.7		41.7		91.0416667
Potassium		2100		2610		na*
Selenium	JB	0.5	JB	0.53	U	2.29166667
Silver	B	1.5	B	2.2		na*
Sodium	B	242	B	177		na*
Thallium	B	0.78	B	0.74		na*
Vanadium		34.2		43.2		na*
Zinc		906		1919		1962.5
Cyanide		4		1.6		5.20833333

South Slip - Dry Weight

Sample Location		WSW-6A+B		WSW-7A+B		WSW-8A+B
Moisture Content (organics)		0.52		0.54		0.54
Percent Solids (metals)						
Total Organic Carbon		55300		50825		50825
TOC		0.0553		0.050825		0.050825
Sampler		USFWS		USFWS		USFWS
Date Sampled		Jul-93		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Chemical						
Acetone		na*		na*		na*
2-Butanone		na*		na*		na*
Benzene	J	7.5	U	47.826087	U	9.347826087
Toluene	U	8.75		2000		13.69565217
Ethylbenzene	U	8.75	U	47.826087	U	9.347826087
m-Xylene		10.625	U	47.826087	U	9.347826087
o,p-Xylene	J	5.20833333	U	47.826087	U	9.347826087
Xylene (total)		na*		na*		na*
4-Methylphenol		na*		na*		na*
Naphthalene		22916.6667	J	6956.52174	J	5652.173913
2-Methylnaphthalene		na*		na*		na*
Phenanthrene		15416.6667	J	10217.3913	J	9173.913043
Acenaphthene	U	10833.3333	U	11739.1304	U	11739.13043
Acenaphthylene	J	1625	U	11739.1304	U	11739.13043
Anthracene	J	6458.33333	J	4565.21739	J	3913.043478
Dibenzofuran		na*		na*		na*
Fluorene	J	3750	J	2391.30435	J	2065.217391
Fluoranthene		37500		28260.8696		28260.86957
Pyrene		20208.3333		15652.1739		15000
Benzo(a)anthracene		8541.66667		6304.34783		6521.73913
Chrysene		14166.6667	J	9565.21739	J	10000
Benzo(b)fluoranthene		9166.66667		6521.73913		6739.130435
Benzo(k)fluoranthene		3958.33333		3260.86957	J	3260.869565
Benzo(a)pyrene		8750		6086.95652		6521.73913
Dibenzo(a,h)anthracene		20625		15217.3913	U	7173.913043
Indeno(1,2,3-cd)pyrene	J	8125	J	5652.17391	J	5652.173913
Benzo(g,h,i)perylene	J	12708.3333	J	8913.04348	J	7391.304348
delta-BHC	U	250	U	282.608696	U	282.6086957
Aldrin	U	116.666667	U	128.26087	U	128.2608696
Dieldrin	U	56.25	U	60.8695652	U	60.86956522
4,4'-DDE	U	116.666667	U	128.26087	U	128.2608696
Endrin	U	172.916667	U	189.130435	U	189.1304348
Endosulfan II	U	116.666667	U	128.26087	U	128.2608696
4,4'-DDD	U	333.333333	U	347.826087	U	347.826087
Endosulfan sulfanate	U	1916.66667	U	2086.95652	U	2086.956522
4,4'-DDT	U	354.166667	U	369.565217	U	369.5652174
Methoxychlor	U	5208.33333	U	5652.17391	U	5652.173913
Endrin aldehyde	U	645.833333	U	717.391304	U	717.3913043
alpha-Chlordane		na*		na*		na*
gamma-Chlordane		na*		na*		na*
Chlordane	U	416.666667	U	434.782609	U	434.7826087
Toxaphene	U	6875	U	7608.69565	U	7608.695652

South Slip - Dry Weight

Sample Location		WSW-6A+B		WSW-7A+B		WSW-8A+B
Moisture Content (organics)		0.52		0.54		0.54
Percent Solids (metals)						
Total Organic Carbon		55300		50825		50825
TOC		0.0553		0.050825		0.050825
Sampler		USFWS		USFWS		USFWS
Date Sampled		Jul-93		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Arochlor 1242		3333.33333		7391.30435		7826.086957
Arochlor 1254	U	6875	U	7608.69565	U	7608.695652
Arochlor 1260	U	6875	U	7608.69565	U	7608.695652
Aluminum		na*		na*		
Antimony		na*		na*		
Arsenic		28.75		na*		
Barium		na*		na*		
Beryllium		na*		na*		
Cadmium		6.875		na*		
Calcium		na*		na*		
Chromium		161.041667		na*		
Cobalt		na*		na*		
Copper		237.5		na*		
Iron		110000		na*		
Lead		518.75		na*		
Magnesium		na*		na*		
Manganese		na*		na*		
Mercury		1.125		na*		
Nickel		98.5416667		na*		
Potassium		na*		na*		
Selenium	U	2.08333333		na*		
Silver		na*		na*		
Sodium		na*		na*		
Thallium		na*		na*		
Vanadium		na*		na*		
Zinc		2187.5		na*		
Cyanide		4.375		na*		

South Slip - Dry Weight

Sample Location		WSW-11A+B		WSW-12A+B
Moisture Content (organics)		0.551		0.547
Percent Solids (metals)				
Total Organic Carbon		46000		44800
TOC		0.046		0.0448
Sampler		USFWS		USFWS
Date Sampled		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result
Chemical				
Acetone		na*		na*
2-Butanone		na*		na*
Benzene	U	9.576837416	U	9.271523179
Toluene	U	9.576837416	U	9.271523179
Ethylbenzene	U	9.576837416	U	9.271523179
m-Xylene	U	9.576837416	U	9.271523179
o,p-Xylene	U	9.576837416	U	9.271523179
Xylene (total)		na*		na*
4-Methylphenol		na*		na*
Naphthalene	J	5567.928731	J	6843.267108
2-Methylnaphthalene		na*		na*
Phenanthrene		24498.88641		220750.5519
Acenaphthene	U	11804.00891	U	11479.0287
Acenaphthylene	J	1403.11804	J	5518.763797
Anthracene	J	9799.554566		88300.22075
Dibenzofuran		na*		na*
Fluorene	J	3563.474388		39735.09934
Fluoranthene		64587.97327	E	286975.7174
Pyrene		31180.40089		132450.3311
Benzo(a)anthracene		13140.3118		52980.13245
Chrysene		22271.71492		86092.71523
Benzo(b)fluoranthene		12472.16036		50772.62693
Benzo(k)fluoranthene		5567.928731		20971.30243
Benzo(a)pyrene		11804.00891		50772.62693
Dibenzo(a,h)anthracene		24498.88641		112582.7815
Indeno(1,2,3-cd)pyrene		10244.98886		41942.60486
Benzo(g,h,i)perylene	J	14699.33185		59602.64901
delta-BHC	U	289.532294	U	264.9006623
Aldrin	U	126.9487751	U	123.6203091
Dieldrin	U	62.36080178	U	59.60264901
4,4'-DDE	U	126.9487751	U	123.6203091
Endrin	U	189.3095768	U	183.2229581
Endosulfan II	U	126.9487751	U	123.6203091
4,4'-DDD	U	356.3474388	U	353.200883
Endosulfan sulfanate	U	2093.541203	U	2030.905077
4,4'-DDT	U	378.6191537	U	375.2759382
Methoxychlor	U	5567.928731	U	5518.763797
Endrin aldehyde	U	712.6948775	U	684.3267108
alpha-Chlordane		na*		na*
gamma-Chlordane		na*		na*
Chlordane	U	445.4342984	U	441.5011038
Toxaphene	U	7572.383073	U	7284.768212

South Slip - Dry Weight

Sample Location		WSW-11A+B		WSW-12A+B
Moisture Content (organics)		0.551		0.547
Percent Solids (metals)				
Total Organic Carbon		46000		44800
TOC		0.046		0.0448
Sampler		USFWS		USFWS
Date Sampled		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result
Arochlor 1242		8908.685969		7947.019868
Arochlor 1254	U	7572.383073	U	7284.768212
Arochlor 1260	U	7572.383073	U	7284.768212
Aluminum		na*		na*
Antimony		na*		na*
Arsenic		42.31625835		41.2803532
Barium		na*		na*
Beryllium		na*		na*
Cadmium		12.02672606		50.33112583
Calcium		na*		na*
Chromium		244.9888641		173.7306843
Cobalt		na*		na*
Copper		318.4855234		260.4856512
Iron		224944.3207		165342.1634
Lead		1703.786192		1075.055188
Magnesium		na*		na*
Manganese		na*		na*
Mercury		0.556792873		1.14790287
Nickel		148.1069042		123.6203091
Potassium		na*		na*
Selenium	U	2.449888641	U	2.428256071
Silver		na*		na*
Sodium		na*		na*
Thallium		na*		na*
Vanadium		na*		na*
Zinc		4432.071269		2935.98234
Cyanide		8.017817372		6.181015453

APPENDIX C

Organic Carbon Normalized Sediment Data

North Slip - Org. Carb. Norm.

Sample Location		X-202		X-203	
Moisture Content (organics)		0.63		0.4	
Percent Solids (Metals)		0.395		0.694	
Total Organic Carbon (mg/kg)		42866.66667		42866.66667	
TOC		0.042866667		0.042866667	
Sampler	IEPA		IEPA		IEPA
Date Sampled	Jun-96		Jun-96		Jun-96
Chemical	Qualifier	Result (ug/gOC)			
Acetone		17653.73461		3110.419907	
2-Butanone		3909.041234	J	583.2037325	
Toluene		11348.82939	U	660.9642302	U
4-Methylphenol		151317.7252	U	104976.6719	U
Naphthalene		69353.95738	U	104976.6719	
2-Methylnaphthalene	J	39720.90286	U	104976.6719	J
Acenaphthylene	J	15131.77252	U	104976.6719	J
Acenaphthene	J	11979.31991	U	104976.6719	U
Dibenzofuran	J	22067.16826	U	104976.6719	J
Phenanthrene		94573.57824		159409.0202	
Fluorene	J	25850.11139	U	104976.6719	U
Fluoranthene		75658.8626		466562.986	
Anthracene	J	30263.54504	J	62208.39813	J
Pyrene		75658.8626		326594.0902	
Benzo(a)anthracene		69353.95738		241057.5428	
Chrysene		94573.57824		241057.5428	
Benzo(b)fluoranthene		62418.56164		178849.1446	J
Bis(2-ethylhexyl)phthalate	J	43503.84599	U	104976.6719	U
Benzo(k)fluoranthene	J	42242.86495		143856.9207	J
Benzo(a)pyrene		63049.05216		159409.0202	
Dibenzo(a,h)anthracene	U	56113.65642	U	104976.6719	U
Benzo(g,h,i)perylene	U	56113.65642	U	104976.6719	U
Indeno(1,2,3-cd)pyrene	U	56113.65642	J	85536.54743	U
delta-BHC	JP	252.1962087	JP	101.088647	P
Aldrin	P	819.6376781	P	167.18507	P
Dieldrin	JP	365.6845025	JP	81.64852255	JP
Endrin	P	1197.931991	P	365.474339	P
Endosulfan II	JP	535.9169434	U	213.8413686	P
4,4'-DDD	JP	302.6354504	JP	101.088647	JP
Endrin ketone		756.588626	U	213.8413686	P
Endrin aldehyde	JP	189.1471565	JP	58.32037325	JP
alpha-Chlordane	P	605.2709008		120.5287714	P
gamma-Chlordane	JP	201.7569669	JP	104.9766719	P
Chlordane (total)		na*		na*	
Toxaphene	JP	13870.79148	U	10886.46967	U
Aroclor 1242		30263.54504	U	2138.413686	
Aroclor 1248	U	5611.365642	P	6998.44479	
Aroclor 1254		18284.22513	P	3732.503888	
Aroclor 1260		9457.357824	P	3032.659409	

North Slip - Org. Carb. Norm.

Sample Location	X-204		X-205		WSW-1A+B
Moisture Content (organics)	0.48		0.47		0.62
Percent Solids (Metals)	0.573		0.591		
Total Organic Carbon (mg/kg)	42866.66667		42866.66667		38100
TOC	0.042866667		0.042866667		0.0381
Sampler		IEPA		USFWS	
Date Sampled		Jun-96		Jul-93	
Chemical					
Acetone	6280.655581		3433.199331		na
2-Butanone	1570.163895		968.3382728		na
Toluene	852.374686	U	836.2921447	U	366.072662
4-Methylphenol	28262.95011	U	27289.53314		na
Naphthalene	30057.42314		32131.22451		61472.57909
2-Methylnaphthalene	15253.0207	J	14965.22785		na
Acenaphthylene	6729.273837	J	7042.460166	U	45586.40696
Acenaphthene	28262.95011	J	5721.998885	U	45586.40696
Dibenzofuran	8972.365115	J	9243.228968		na
Phenanthrene	49348.00813		48416.91364		59400.46968
Fluorene	28262.95011	J	15405.38161		16576.87526
Fluoranthene	44861.82558		52818.45125		75977.34494
Anthracene	14804.40244	J	14084.92033		24174.60975
Pyrene	49348.00813		79227.67687		158861.7212
Benzo(a)anthracene	38581.17		37413.06963		42823.59442
Chrysene	53834.19069		52818.45125		89791.40765
Benzo(b)fluoranthene	26917.09535	J	26409.22562		41442.18815
Bis(2-ethylhexyl)phthalate	28262.95011	U	27289.53314		na
Benzo(k)fluoranthene	24674.00407	U	27289.53314		26937.4223
Benzo(a)pyrene	34543.60569		37413.06963		42823.59442
Dibenzo(a,h)anthracene	28262.95011	U	27289.53314		96698.43901
Benzo(g,h,i)perylene	28262.95011	U	27289.53314	U	63544.68849
Indeno(1,2,3-cd)pyrene	28262.95011	U	27289.53314		46277.1101
delta-BHC	215.3367628	P	211.273805	U	11051.25017
Aldrin	538.3419069	P	572.1998885	U	4903.992264
Dieldrin	282.6295011	P	321.3122451	U	2348.390662
Endrin	493.4800813	P	1628.568913	U	1450.476585
Endosulfan II	314.032779	P	334.5168579	U	4903.992264
4,4'-DDD	192.90585	JP	228.8799554	U	13814.06272
Endrin ketone	408.2426128	P	308.1076323	U	29009.5317
Endrin aldehyde	188.4196674	JP	180.4630418	U	26937.4223
alpha-Chlordane	493.4800813	P	572.1998885		na*
gamma-Chlordane	152.530207	P	162.8568913		na*
Chlordane (total)	na*		na*	U	17267.57839
Toxaphene	14355.78418	U	14084.92033	U	297002.3484
Arochlor 1242	21982.29453		24648.61058	U	82884.3763
Arochlor 1248	18841.96674	U	2684.937938	U	145047.6585
Arochlor 1254	17496.11198		19806.91922	J	31772.34425
Arochor 1260	6729.273837		7482.613926	U	290095.317

North Slip - Org. Carb. Norm.

Sample Location		WSW-2A+B		WSW-3A+B		WSW-4A+B
Moisture Content (organics)		0.6		0.57		0.5
Percent Solids (Metals)						
Total Organic Carbon (mg/kg)		35300		38900		45700
TOC		0.0353		0.0389		0.0457
Sampler	USFWS		USFWS		USFWS	
Date Sampled	Jul-93		Jul-93		Jul-93	
Chemical						
Acetone		na		na		na
2-Butanone		na		na		na
Toluene	U	354.1076	U	280.9828	U	175.0547046
4-Methylphenol		na		na		na
Naphthalene		70821.53		32283.14	J	17067.8337
2-Methylnaphthalene		na		na		na
Acenaphthylene		26203.97		13152.39	J	9628.008753
Acenaphthene	U	43909.35	U	3467.448	U	21881.83807
Dibenzofuran		na		na		na
Phenanthrene		77903.68		36467.99	J	20131.29103
Fluorene		19121.81		9565.373	J	5251.641138
Fluoranthene	U	43909.35	U	3467.448	U	21881.83807
Anthracene	J	29036.83		13750.22	J	8315.098468
Pyrene	U	43909.35	U	3467.448	U	21881.83807
Benzo(a)anthracene		46742.21		24511.27		14879.64989
Chrysene		120396.6	U	3467.448		30196.93654
Benzo(b)fluoranthene		53824.36	U	1135.888		14879.64989
Bis(2-ethylhexyl)phthalate		na		na		na
Benzo(k)fluoranthene		14164.31	U	1135.888		10065.64551
Benzo(a)pyrene		17705.38		26902.61		16192.56018
Dibenzo(a,h)anthracene		70113.31	U	2092.425	U	13129.10284
Benzo(g,h,i)perylene	U	62322.95	U	4842.47	U	30634.5733
Indeno(1,2,3-cd)pyrene		55240.79		25109.11		17943.10722
delta-BHC	U	10623.23	U	8369.702	U	5251.641138
Aldrin	U	4815.864	U	3766.366	U	2363.238512
Dieldrin	U	2266.289	U	1793.508	U	1137.85558
Endrin	U	1416.431	U	1135.888	U	700.2188184
Endosulfan II	U	4815.864	U	3766.366	U	2363.238512
4,4'-DDD	U	13456.09	U	10163.21	U	6564.551422
Endrin ketone	U	28328.61	U	22119.93	U	14004.37637
Endrin aldehyde	U	26912.18	U	20924.25	U	13129.10284
alpha-Chlordane		na*		na*		na
gamma-Chlordane		na*		na*		na
Chlordane (total)	U	16997.17	U	13152.39	U	8315.098468
Toxaphene	U	290368.3	U	227177.6	U	144420.1313
Aroclor 1242	U	77903.68	U	59783.58	U	38512.03501
Aroclor 1248	U	141643.1	U	113588.8	U	70021.88184
Aroclor 1254	J	21954.67	J	9565.373	J	11378.5558
Aroclor 1260	U	283286.1	U	221199.3	U	140043.7637

North Slip - Org. Carb. Norm.

Sample Location		WSW-9A+B		WSW-10A+B
Moisture Content (organics)		0.537		0.52
Percent Solids (Metals)				
Total Organic Carbon (mg/kg)		49700		49500
TOC		0.0497		0.0495
Sampler	USFWS		USFWS	
Date Sampled	Jul-93		Jul-93	
Chemical				
Acetone		na		na
2-Butanone		na		na
Toluene		na		na
4-Methylphenol		na		na
Naphthalene		40415.28		39562.29
2-Methylnaphthalene		na		na
Acenaphthylene	J	2042.493	J	15572.39
Acenaphthene	U	19990.35	U	21043.77
Dibenzofuran		na		na
Phenanthrene		47803.02		58922.56
Fluorene	J	11298.89	J	14309.76
Fluoranthene		56494.47		71548.82
Anthracene	J	18252.06		23148.15
Pyrene		117334.7		134680.1
Benzo(a)anthracene		30854.67		36616.16
Chrysene		73877.39		88383.84
Benzo(b)fluoranthene		28247.24		32407.41
Bis(2-ethylhexyl)phthalate		na		na
Benzo(k)fluoranthene		18252.06		20202.02
Benzo(a)pyrene		33027.54		35353.54
Dibenzo(a,h)anthracene		42588.14		38299.66
Benzo(g,h,i)perylene		60840.2		58922.56
Indeno(1,2,3-cd)pyrene		33027.54		32407.41
delta-BHC	U	4780.302	U	5050.505
Aldrin	U	2172.864	U	2272.727
Dieldrin	U	1042.975	U	1094.276
Endrin	U	3215.839	U	3367.003
Endosulfan II	U	2172.864	U	2272.727
4,4'-DDD	U	6084.02	U	6313.131
Endrin ketone		na		na
Endrin aldehyde	U	12168.04	U	12626.26
alpha-Chlordane		na		na
gamma-Chlordane		na		na
Chlordane (total)	U	7387.739	U	7996.633
Toxaphene	U	130371.9	U	134680.1
Arochlor 1242	J	33027.54		75757.58
Arochlor 1248	U	65185.93	U	67340.07
Arochlor 1254	U	130371.9	U	134680.1
Arochor 1260	U	130371.9	U	134680.1

South Slip - Org. Carb. Norm

Sample Location		X-208		X-209		WSW-5A+B
Moisture Content (organics)		0.51		0.47		0.52
Percent Solids (metals)		0.531		0.547		
Total Organic Carbon		50825		50825		57200
TOC		0.050825		0.05083		0.0572
Sampler		IEPA		IEPA		USFWS
Date Sampled		Jun-96		Jun-96		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Acetone		2007.689	U	705.343		na*
2-Butanone	J	602.3068	J	371.233		na*
Benzene	U	803.0758		4454.8		171.182984
Toluene		883.3834	U	705.343		320.512821
Ethylbenzene	U	803.0758	U	705.343	U	152.972028
m-Xylene		na*		na*		400.641026
o p-Xylene		na*		na*		437.062937
Xylene (total)	U	803.0758		853.836		na*
4-Methylphenol	J	37744.56	J	40835.6		na*
Naphthalene	J	64246.06		519726		582750.583
2-Methylnaphthalene	U	132507.5	J	81671.3		na*
Phenanthrene		148569		482603		400641.026
Acenaphthene	U	132507.5	J	96520.6	U	189393.939
Acenaphthylene	U	132507.5	J	92808.3	U	189393.939
Anthracene	J	48184.55		185617	J	156614.219
Dibenzofuran	U	132507.5	J	100233		na*
Fluorene	J	44169.17		126219	J	91054.7786
Fluoranthene		200768.9		631096		983391.608
Pyrene		184707.4		556850		546328.671
Benzo(a)anthracene	J	112430.6		445480		225815.851
Chrysene	J	124476.7		445480		400641.026
Benzo(b)fluoranthene	J	92353.71	J	360096		240384.615
Benzo(k)fluoranthene	J	64246.06	J	245014		105623.543
Benzo(a)pyrene	J	104399.9	J	367521		222173.66
Dibenzo(a,h)anthracene	U	132507.5	J	77959		546328.671
Indeno(1,2,3-cd)pyrene	J	80307.58	J	241302		211247.086
Benzo(g,h,i)perylene	U	132507.5	J	89096		324155.012

South Slip - Org. Carb. Norm

Sample Location		X-208		X-209		WSW-5A+B
Moisture Content (organics)		0.51		0.47		0.52
Percent Solids (metals)		0.531		0.547		
Total Organic Carbon		50825		50825		57200
TOC		0.050825		0.05083		0.0572
Sampler		IEPA		IEPA		USFWS
Date Sampled		Jun-96		Jun-96		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
delta-BHC	P	196.7536	J	267.288	U	4370.62937
Aldrin	P	722.7682	P	2116.03	U	2039.62704
Dieldrin	JP	248.9535	P	408.356	U	983.391608
4,4'-DDE	P	803.0758	U	226.452	U	2039.62704
Endrin	P	1565.998	P	2041.78	U	3023.01865
Endosulfan II	U	269.0304	P	668.22	U	2039.62704
4,4'-DDD	JP	216.8305	P	445.48	U	5827.50583
Endosulfan sulfanate	U	269.0304	JP	115.082	U	33508.1585
4,4'-DDT	P	341.3072	U	226.452	U	6191.72494
Methoxychlor	J	1204.614	P	2116.03	U	91054.7786
Endrin aldehyde	JP	164.6305	JP	200.466	U	11290.7925
alpha-Chlordane		562.153	P	593.973		na*
gamma-Chlordane	P	204.7843	P	445.48		na*
Chlordane		na*		na*	U	7284.38228
Toxaphene	JP	10038.45	P	16334.3	U	120192.308
Aroclor 1242		31721.49		77959		43706.2937
Aroclor 1254		16864.59		21160.3	U	120192.308
Aroclor 1260		7629.22		12993.2	U	120192.308

South Slip - Org. Carb. Norm

Sample Location		WSW-6A+B		WSW-7A+B		WSW-8A+B
Moisture Content (organics)		0.52		0.54		0.54
Percent Solids (metals)						
Total Organic Carbon		55300		50825		50825
TOC		0.0553		0.050825		0.050825
Sampler		USFWS		USFWS		USFWS
Date Sampled		Jul-93		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
Acetone		na*		na*		na*
2-Butanone		na*		na*		na*
Benzene	J	135.62387	U	940.995316	U	183.9218118
Toluene	U	158.227848		39350.7132		269.4668406
Ethylbenzene	U	158.227848	U	940.995316	U	183.9218118
m-Xylene		192.133816	U	940.995316	U	183.9218118
o,p-Xylene	J	94.1832429	U	940.995316	U	183.9218118
Xylene (total)		na*		na*		na*
4-Methylphenol		na*		na*		na*
Naphthalene		414406.269	J	136872.046	J	111208.5374
2-Methylnaphthalene		na*		na*		na*
Phenanthrene		278782.399	J	201030.818	J	180500.0107
Acenaphthene	U	195901.145	U	230971.578	U	230971.5777
Acenaphthylene	J	29385.1718	U	230971.578	U	230971.5777
Anthracene	J	116787.221	J	89822.2802	J	76990.52589
Dibenzofuran		na*		na*		na*
Fluorene	J	67811.9349	J	47049.7658	J	40633.88866
Fluoranthene		678119.349		556042.687		556042.687
Pyrene		365430.983		307962.104		295130.3492
Benzo(a)anthracene		154460.518		124040.292		128317.5431
Chrysene		256178.421	J	188199.063	J	196753.5662
Benzo(b)fluoranthene		165762.508		128317.543		132594.7946
Benzo(k)fluoranthene		71579.2646		64158.7716	J	64158.77157
Benzo(a)pyrene		158227.848		119763.04		128317.5431
Dibenzo(a,h)anthracene		372965.642		299407.601	U	141149.2975
Indeno(1,2,3-cd)pyrene	J	146925.859	J	111208.537	J	111208.5374
Benzo(g,h,i)perylene	J	229807.113	J	175367.309	J	145426.5489

South Slip - Org. Carb. Norm

Sample Location		WSW-6A+B		WSW-7A+B		WSW-8A+B
Moisture Content (organics)		0.52		0.54		0.54
Percent Solids (metals)						
Total Organic Carbon		55300		50825		50825
TOC		0.0553		0.050825		0.050825
Sampler		USFWS		USFWS		USFWS
Date Sampled		Jul-93		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result	Qualifier	Result
delta-BHC	U	4520.79566	U	5560.42687	U	5560.42687
Aldrin	U	2109.70464	U	2523.57835	U	2523.578349
Dieldrin	U	1017.17902	U	1197.6304	U	1197.630403
4,4'-DDE	U	2109.70464	U	2523.57835	U	2523.578349
Endrin	U	3126.88366	U	3721.20875	U	3721.208751
Endosulfan II	U	2109.70464	U	2523.57835	U	2523.578349
4,4'-DDD	U	6027.72755	U	6843.6023	U	6843.602301
Endosulfan sulfanate	U	34659.4334	U	41061.6138	U	41061.61381
4,4'-DDT	U	6404.46052	U	7271.32744	U	7271.327445
Methoxychlor	U	94183.2429	U	111208.537	U	111208.5374
Endrin aldehyde	U	11678.7221	U	14114.9297	U	14114.92975
alpha-Chlordane		na*		na*		na*
gamma-Chlordane		na*		na*		na*
Chlordane	U	7534.65943	U	8554.50288	U	8554.502876
Toxaphene	U	124321.881	U	149703.8	U	149703.8003
Arochlor 1242		60277.2755		145426.549		153981.0518
Arochlor 1254	U	124321.881	U	149703.8	U	149703.8003
Arochlor 1260	U	124321.881	U	149703.8	U	149703.8003

South Slip - Org. Carb. Norm

Sample Location		WSW-11A+B		WSW-12A+B
Moisture Content (organics)		0.551		0.547
Percent Solids (metals)				
Total Organic Carbon		46000		44800
TOC		0.046		0.0448
Sampler		USFWS		USFWS
Date Sampled		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result
Acetone		na*		na*
2-Butanone		na*		na*
Benzene	U	208.1921177	U	206.9536424
Toluene	U	208.1921177	U	206.9536424
Ethylbenzene	U	208.1921177	U	206.9536424
m-Xylene	U	208.1921177	U	206.9536424
o,p-Xylene	U	208.1921177	U	206.9536424
Xylene (total)		na*		na*
4-Methylphenol		na*		na*
Naphthalene	J	121041.9289	J	152751.498
2-Methylnaphthalene		na*		na*
Phenanthrene		532584.4873		4927467.676
Acenaphthene	U	256608.8893	U	256228.3191
Acenaphthylene	J	30502.56609	J	123186.6919
Anthracene	J	213033.7949		1970987.07
Dibenzofuran		na*		na*
Fluorene	J	77466.83451		886944.1816
Fluoranthene		1404086.376	E	6405707.979
Pyrene		677834.802		2956480.605
Benzo(a)anthracene		285658.9523		1182592.242
Chrysene		484167.7157		1921712.394
Benzo(b)fluoranthene		271133.9208		1133317.565
Benzo(k)fluoranthene		121041.9289		468109.4292
Benzo(a)pyrene		256608.8893		1133317.565
Dibenzo(a,h)anthracene		532584.4873		2513008.515
Indeno(1,2,3-cd)pyrene		222717.1492		936218.8584
Benzo(g,h,i)perylene	J	319550.6924		1330416.272

South Slip - Org. Carb. Norm

Sample Location		WSW-11A+B		WSW-12A+B
Moisture Content (organics)		0.551		0.547
Percent Solids (metals)				
Total Organic Carbon		46000		44800
TOC		0.046		0.0448
Sampler		USFWS		USFWS
Date Sampled		Jul-93		Jul-93
	Qualifier	Result	Qualifier	Result
delta-BHC	U	6294.180304	U	5912.961211
Aldrin	U	2759.755979	U	2759.381898
Dieldrin	U	1355.669604	U	1330.416272
4,4'-DDE	U	2759.755979	U	2759.381898
Endrin	U	4115.425583	U	4089.798171
Endosulfan II	U	2759.755979	U	2759.381898
4,4'-DDD	U	7746.683451	U	7883.948281
Endosulfan sulfanate	U	45511.76528	U	45332.70262
4,4'-DDT	U	8230.851167	U	8376.695049
Methoxychlor	U	121041.9289	U	123186.6919
Endrin aldehyde	U	15493.3669	U	15275.1498
alpha-Chlordane		na*		na*
gamma-Chlordane		na*		na*
Chlordane	U	9683.354314	U	9854.935352
Toxaphene	U	164617.0233	U	162606.4333
Arochlor 1242		193667.0863		177388.8363
Arochlor 1254	U	164617.0233	U	162606.4333
Arochlor 1260	U	164617.0233	U	162606.4333

APPENDIX D

Surface Water Data

Surface Water Quality Data,
North Barge Slip, Former Wisconsin Steel Works, Chicago, Illinois.

Sample Location	S-102		S-103		S-104		S-105	
Sampler	IEPA		IEPA		IEPA		IEPA	
Date Sampled	Jun-96		Jun-96		Jun-96		Jun-96	
Chloroform	3	J	3	J	3	J	3	J
Aluminum	334		208		284		306	
Arsenic	<1		<1		1.2	B	<1	
Barium	26.4	B	24.6	B	25.8	B	25.2	B
Cadmium	<4		<4		4.3	B	<4	
Calcium	43900		40400		39900		39800	
Copper	<9		6.7		<9		<5.6	
Iron	361		258		370		291	
Lead	3.1		3.3		2.9	B	2.3	B
Magnesium	14100		11900		11800		11800	
Manganese	38.4		33.3		33.8		32.5	
Nickel	17.5	B	24.7	B	<14		<14	
Potassium	4060	B	2690	B	2720	B	2240	B
Sodium	37500		37800		37900		38300	
Zinc	11.2	B	9.8	B	9	B	8.1	B

Concentrations in milligrams per liter (ppb).

B - detected in blank
J - estimated value

Surface Water Quality Data,
South Barge Slip, Former Wisconsin Steel Works, Chicago, Illinois.

Sample Location	S-108		S-109	
Sampler	IEPA		IEPA	
Date Sampled	Jun-96		Jun-96	
Chloroform	3	J	3	J
Benzene	8	J	<10	
Toluene	<10		<10	
Aluminum	574		654	
Arsenic	1.2	B	1.8	B
Barium	27.3	B	27.6	B
Calcium	40100		40200	
Iron	602		642	
Lead	4		4.1	
Magnesium	11900		12000	
Manganese	43.7		53.4	
Nickel	<14		<14	
Potassium	2100		3070	B
Sodium	37500		36900	
Zinc	13.8	B	14.5	B

Concentrations in milligrams per liter (ppb).

B - detected in blank
J - estimated value