BrightFields, Inc.

# Appendix 4

# AMTRAK MAINTENANCE FACILITY
## WILMINGTON, DELAWARE

## SIRB ID: DE-0170

# GENERAL SITE INFORMATION

**Site Name:** Amtrak Maintenance Facility

**SIRB ID Number:** DE-0170

**Site Location and Description:** TheAmtrak Maintenance Facility encompasses approximately 62 acres along Vandever Avenue in Wilmington, Delaware. The Amtrak Maintenance Facility is considered to be the portion of the Amtrak property north of the former roundhouse. The area south of this is the Former Refueling Facility. The Amtrak Maintenance Facility is bounded to the north by Shellpot Creek, to the east by the former Conrail Edgemor Railyards, and to the west by the active mainline Amtrak track. The surrounding area is primarily an industrial area.

In the 1980's this site and the Amtrak Refueling Site were referred to as the same property. Indication of the site as a separate entity did not start to appear until the early 1990s. The Maintenance Facility is most distinguished by the area north of the former roundhouse area, which formerly held a 250,000-gallon diesel fuel tank to refuel the locomotives.

**Previous Site Uses:**

The Wilmington Amtrak Maintenance Facility was constructed in 1903. Since the original construction, the operations have consisted primarily of the maintenance, service and overhaul of locomotives, rail cars, and rail road equipment. The Amtrak Maintenance Facility is a yard used primarily for the maintenance of locomotives, and rail road equipment. Additional activities include the fabrication of concrete forms and track panels. In 1995, fueling operations were moved from the Former Fueling Facility to the Amtrak Maintenance Facility. A new fueling area with a 10,000 gallon above ground storage tank (AST) was installed.

PCBs historically were contained in dielectric fluids in the transformers in some locomotives and passenger cars.

According to the Draft RI/FFS Work Plan by Secor, beginning in the late 1970's and continuing into the 1980's, transformers on locomotives and self propelled passenger cars were redesigned to reduce the PCB concentrations in transformer fluids. The PCB fluids were removed from the transformers and replaced with new dielectric fluids. The removal involved the use of trichlorobenzene to reduce the PCB concentrations in the transformers. The trichlorobenzene was recovered using a distillation process and reused (this operation ceased in 1987) (Secor, 2008).

**Site Regulatory Status:** This section briefly summarizes previous investigations performed on the site through the SIRB program. A current SIRB regulatory status is also included.

A number of investigations have been conducted at the Amtrak Maintenance Facility and Refueling Facility since 1981. The table below lists a chronology of investigations, reports, remedial actions, and regulatory actions that are pertinent to this site.

**Chronology of Investigations and Regulatory Actions**

| Investigation or Regulatory Action | Dates | Description |
|---|---|---|
| **Assessment of PCBs at the Wilmington Maintenance Facility** | Jan. 1981 | Forty-one (41) soil samples were collected for PCBs in backfilled soils along roadways and mainline tracks, and in marshes and puddles throughout the yard. Thirty-five (35) additional samples were collected from split-spoon samples at 18 well locations along the perimeter and throughout the yard. Sediment, surface water, groundwater, sewer water and sewer sediment samples were also collected (Woodward-Clyde, 1981). |
| **Analyses of Soil Samples from AMTRAK** | July 1982 | Sixty-four (64) samples were collected from one-and two foot soil cores from areas bordering Brandywine Creek, its tributary, and on-site drainage areas for analyses of PCBs and oil and grease. Five (5) of these samples were collected in a swampy area between Outfall 002 and Shellpot Creek, four (4) from the track area west of the Wheel Shop, and six (6) between Building 23 and 27 (Radiation Management, 1982). |
| **Soil Sampling in 1983 and 1984.** | 1983-1984 | Two hundred-seventy-four (274) samples were collected at depths from six to 12 inches along the perimeter of the AMTRAK Wilmington Shops, in the Maintenance Facility, and around the locomotive shop (Radiation Management, 1984) |
| **Soil Removal Activities of 1984 and 1985.** | 1984-1985 | During 1984 and 1985 approximately 10,000 cubic yards of PCB impacted soils were removed from "hot spots" in and around the Maintenance Facility. The cleanup area included: in and around the locomotive shop, oil and drum staging area between Buildings 23 and 2, the mainline track area, and the track area south of the locomotive shop. |
| **Soil Removal Activities of 1986** | 1986 | Approximately 2,000 yards of soil were removed in the vicinity of the Wheel Shop. |
| **Preliminary Assessment of the Wilmington AMTRAK Rail Yard - Maintenance Facility** | Feb. 1989 | This report summarized previously collected data and no new data were collected prepared by NUS Corporation and dated February 23, 1989. |

## Chronology of Investigations and Regulatory Actions (continued)

| Investigation or Regulatory Action | Dates | Description |
|---|---|---|
| **Tank Closure Record - Wilmington Maintenance Facility** | May 1991 | This report documents the removal of two 8,000-gallon buried tanks in the Former Fueling Facility and one 5,000-gallon kerosene UST from north of the roundhouse by Joseph T. Hardy Sons, Inc. |
| **Inspection Report - AMTRAK Wilmington Maintenance Facility** | Dec. 1994 | This investigation included the collection and analyses of three surface soil (at depths of 0 to 1 foot) samples (two were collected on-site and one in a nearby community park), seven surface water samples, and seven sediment samples (co-located with the water samples). Subsequently, two on-site surface soil samples and seven sediment samples were collected because the initial samples were not analyzed within the required holding times. All samples were submitted for Target Compound List (TCL) and Target Analyte List (TAL) analyses. No groundwater samples were collected during the investigation (DNREC, 1994). |
| **Analytical Summary Report PCB Soil/Ballast Excavation Project Amtrak Maintenance Shops** | May 1996 | A total of 3,777 tons of soil was removed from the track area north of Car Shop 1and disposed off site (Clean Harbors, 1996). |
| **Soil Removal Activities of 1997-2000.** | 1997-2000 | During the construction of an addition to the Wheel Shop, 2,400 cubic yards of soil and construction debris was excavated and stockpiled at the Former Fueling Facility. Fifteen (15) soil samples were collected from the pile from 1997 to 2000 to analyze PCBs. The soil stockpile was removed from the site in 2005. |
| **Summary Report of Soil Removal Activities, Proposed Warehouse Building Area** | Dec. 2005 | Ninety-eight (98) soil samples were collected from 26 borings in September and October 2005. Based on the results, two areas measuring approximately 60 feet by 60 feet and 20 feet by 20 feet were excavated to a depth of 8.3 feet and 3.5 feet, respectively. A total of 1,137 tons of material was disposed at a TSCA approved landfill. |
| **Soil Characterization and Removal Activities** | Sept. 2006 | SECOR collected 48 samples from 12 borings to characterize soil northeast of Car Shop 1. An area approximately 130 feet by 180 feet was excavated to a depth of 0.5 feet to 3.0 feet. |
| **Locomotive/Wheel Shop Areas Subsurface Investigations Report of Findings** | Sept. 2007 | Ten one-inch diameter peizometers were installed to approximately 10 feet bgs to evaluate potential occurrences of light nonaqueous phase liquids (LNAPL) on the water table. PCB aroclor concentrations were found in two samples. The LNAPL that accumulated in the peizometers is removed monthly (SECOR, 2007). |

| Investigation or Regulatory Action | Dates | Description |
|---|---|---|
| **Remedial Investigation and Focused Feasibility Study Work Plan** | July 2008 | The RI/FFS Work Plan was written per DNREC's request because of sampling results from the drainage ditch north of the Eastern Drainage Ditch. The purpose of the Work Plan is to characterize site soils (surface and subsurface), groundwater, and sediments in the drainage features associated with the Maintenance Facility. The Work Plan also describes proposed focused feasibility activities, which aim to reduce PCB mass loading to nearby surface water (SECOR, 2008). |

***Current Regulatory Status:***

There have been multiple interim remedial actions that have taken place at the former maintenance facility, but currently DNREC is reviewing the SECOR Remedial Investigation and Focused Feasibility Study Work Plan for the Amtrak Maintenance Facility. No Final Plan of Remedial Action has been completed for the Amtrak Maintenance Facility as of January 2009.

# SUMMARY OF SITE PCB INFORMATION

**Site Investigation PCB Findings:**

PCBs were detected in the majority of samples collected from the Amtrak Maintenance Facility. The Amtrak Maintenance Facility was divided into four drainage areas for overland flow evaluation. These four areas were then evaluated depending on the samples that fell within each area. Once the areas were established, BrightFields calculated a 95% UCL of the mean of the concentration of total PCBs observed in the surface soils for overland flow calculations for each area. The result indicated that the 95% UCL of the mean concentration of total PCBs in surface soils ranged from 64.1 to 692 mg/kg. This did not include surface soils that were under impervious surfaces.

Total PCBs were detected in the subsurface unsaturated and saturated soils at concentrations ranging from non-detect to 4,000 mg/kg. Historical site data indicates that there is confining clay layer approximately 10 feet below ground surface in most areas. The boring logs and samples indicate that the contamination is confined by this layer. Shallow groundwater was observed on the property between 1.5 to 10 feet bgs, which would indicate that it is in constant contact with contaminated soils.

| Concentrations of PCBs on Site | | | |
|---|---|---|---|
| **Sample Matrix** | **Corresponding Figure** | **Analytical Methods** | **Range of Total PCBs** |
| Surface Soil | Figure 2 | Method 8082 and Congener Analysis | 0.023 to 7,100 mg/kg |
| Subsurface Soil (unsaturated) | Figure 3 | Method 8082 and Congener Analysis | Not detected to 4,000 mg/kg |
| Subsurface Soil (saturated) | Figure 4 | Method 8082 and Congener Analysis | Not detected to 42 mg/kg |
| Ground Water | Figure 5 | Congener Analysis | Not detected to 10.9 µg/L |

Please find the attached historical information for the Amtrak Maintenance Facility

**Acreage where PCBs detected:**

Estimated surface soil area impacted by PCBs is approximately 54 acres (Figure 2) of which only 24 acres (Figure 6) may still be contributing to mass loading via overland flow. The remaining 30 acres were found to be under impervious surfaces during the site evaluation. Approximately 57 acres of subsurface unsaturated soil may be impacted by PCBs (Figure 3). Approximately 32 acres of subsurface saturated soil may be impacted by PCBs (Figure 4).

**PCB Remediation Status:**

During the historical review of this site, BrightFields was able to identify six separate removal actions complete on the site spanning from 1984 to 2006. The total amount of soil removed from site is approximately 58,000 tons. This number was estimated based off of the type of material identified in the boring logs, which consisted of sandy silt in the surface soils, and from information pertaining to the extent of the excavations. The total surface area associated with these removals is approximately six acres. These removals were taken into account in the calculations performed for mass loading.

# PCB MASS LOADING SUMMARY

The PCB mass loading rate to surface water via overland flow and via groundwater transport are discussed below. A summary of the results is included below and the details of the calculations are included as attachments to this Appendix.

## OVERLAND FLOW:

Overland flow has been determined on this site by using the Revised Universal Soil Loss Equation (RUSLE). The RUSLE predicts the long term average annual rate of erosion on an area based on rainfall patterns, soil type, topography, cover/canopy factors and support management practices. These factors are site-specific and require information pertaining directly to the site. A breakdown of the individual factors is presented below with a brief explanation of their selection.

### Ground Cover and Canopy:

BrightFields assessed the surface cover and flow paths using aerial photography and contour mapping (DataMill, 2007). During this assessment BrightFields identified four separate drainage areas and/or greater concentrated areas. Each of these areas was assessed separately in all of the overland flow calculations. The cover/management factors (C) assigned to the site and their associated flow paths ranged from 0.05 to 0.45, which corresponds to areas instituting a vegetative cover primarily consisting of trees, short brush, and weeds, and areas of bare ground.

### Site Sediment and Erosion Control Practices:

BrightFields did not find any specific sediment and erosion controls associated with the Amtrak Maintenance Facility.

### Input Factors and Results:

A breakdown of the individual factors is presented below with a brief explanation of their choice.

**Area 1: Northeast Portion of the Property**

| RUSLE Factors | Values Provided | Explanation of Selection |
|---|---|---|
| R = rainfall-runoff erosivity index ($10^2$ ft-tonf-in/ac-hr) | 170 | An appropriate value for R for the site was determined from plots of Rainfall patterns for the Eastern U.S. (Wischmeier and Smith, 1978). |

| RUSLE Factors | Values Provided | Explanation of Selection |
|---|---|---|
| K = soil erodibility (0.01 tonf acre hr/acre ft-ton in) | 0.24 | The soil erodibility factor was chosen based on the information provided by the Phase II Remedial Investigation and Focused Feasibility Study of the Amtrak Maintenance Facility in Wilmington, DE. The geology section indicated that surface soils generally consisted of fine to coarse sand with cinder ash. |
| LS = topographic factor (dimensionless) | 0.510 | The slope length was estimated to 270 feet, which is the distance between the Area 1 centroid and the Eastern Drainage Ditch along the overland flow path. The associated slope (3.7 %) and slope length were used to calculate a topographic factor of 0.510 by the USDA windows based program. |
| C = cover/management factor (dimensionless) | 0.05 | The cover/management factor C assigned to Area 1 and associated flow path was 0.05, which corresponds to vegetative cover consisting of trees, short brush, and weeds. |
| P = support practice factor (dimensionless) | 1.0 | There are no sediment and erosion controls in place on this portion of the property. |

The average annual erosion rate is based on the windows based RUSLE2 program (RUSLE2 License, version 2006-Jul-24).

Based on the calculations performed, the total PCB loading from the Amtrak Maintenance Facility Area 1 to the surface water body under current site conditions is 2,900 grams per year.

**Area 2: Southeast Portion of the Property**

| RUSLE Factors | Values Provided | Explanation of Selection |
|---|---|---|
| R = rainfall-runoff erosivity index ($10^2$ ft-tonf-in/ac-hr) | 170 | An appropriate value for R for the site was determined from plots of Rainfall patterns for the Eastern U.S. (Wischmeier and Smith, 1978). |
| K = soil erodibility (0.01 tonf acre hr/acre ft-ton in) | 0.24 | The soil erodibility factor was chosen based on the information provided by the Phase II Remedial Investigation and Focused Feasibility Study of the Amtrak Maintenance Facility in Wilmington, DE. The geology section indicated that surface soils generally consisted of fine to coarse sand with cinder ash. |
| LS = topographic factor (dimensionless) | 1.2 | The slope length was estimated to 52.6 feet, which is the distance between the Area 2 centroid and the Eastern Drainage Ditch along the overland flow path. The associated slope (11.4 %) and slope length were used to calculate a topographic factor of 1.2 by the USDA windows based program. |

| RUSLE Factors | Values Provided | Explanation of Selection |
|---|---|---|
| C = cover/management factor (dimensionless) | 0.45 | The cover/management factor C assigned to Area 2 and associated flow path was 0.45, which corresponds areas of primarily bare ground. |
| P = support practice factor (dimensionless) | 1.0 | There are no sediment and erosion controls in place on this portion of the property. |

The average annual erosion rate is based on the windows based RUSLE2 program (RUSLE2 License, version 2006-Jul-24).

Based on the calculations performed, the total PCB loading from the Amtrak Maintenance Facility Area 2 to the surface water body under current site conditions is 3,200 grams per year.

**Area 3: Western portion of the Property**

| RUSLE Factors | Values Provided | Explanation of Selection |
|---|---|---|
| R = rainfall-runoff erosivity index ($10^2$ ft-tonf-in/ac-hr) | 170 | An appropriate value for R for the site was determined from plots of Rainfall patterns for the Eastern U.S. (Wischmeier and Smith, 1978). |
| K = soil erodibility (0.01 tonf acre hr/acre ft-ton in) | 0.24 | The soil erodibility factor was chosen based on the information provided by the Phase II Remedial Investigation and Focused Feasibility Study of the Amtrak Maintenance Facility in Wilmington, DE. The geology section indicated that surface soils generally consisted of fine to coarse sand with cinder ash. |
| LS = topographic factor (dimensionless) | 0.140 | The slope length was estimated to 964 feet, which is the distance between the Area 3 centroid and the Eastern Drainage Ditch along the overland flow path. The associated slope (0.83 %) and slope length were used to calculate a topographic factor of 0.140 by the USDA windows based program. |
| C = cover/management factor (dimensionless) | 0.45 | The cover/management factor C assigned to the site and associated flow path was 0.45, which corresponds to surface cover of bare ground. |
| P = support practice factor (dimensionless) | 1.0 | There are no sediment and erosion controls in place on this portion of the property. |

The average annual erosion rate is based on the windows based RUSLE2 program (RUSLE2 License, version 2006-Jul-24).

Based on the calculations performed, the total PCB loading from the Amtrak Maintenance Facility Area 3 to the surface water body under current site conditions is 2,300 grams per year.

## Area 4: Southwest Potion of the Property

| RUSLE Factors | Values Provided | Explanation of Selection |
|---|---|---|
| R = rainfall-runoff erosivity index ($10^2$ ft-tonf-in/ac-hr) | 170 | An appropriate value for R for the site was determined from plots of Rainfall patterns for the Eastern U.S. (Wischmeier and Smith, 1978). |
| K = soil erodibility (0.01 tonf acre hr/acre ft-ton in) | 0.24 | The soil erodibility factor was chosen based on the information provided by the Phase II Remedial Investigation and Focused Feasibility Study of the Amtrak Maintenance Facility in Wilmington, DE. The geology section indicated that surface soils generally consisted of fine to coarse sand with cinder ash. |
| LS = topographic factor (dimensionless) | 0.280 | The slope length was estimated to 734 feet, which is the distance between the Area 4 centroid and the Eastern Drainage Ditch along the overland flow path. The associated slope (1.6 %) and slope length were used to calculate a topographic factor of 0.280 by the USDA windows based program. |
| C = cover/management factor (dimensionless) | 0.45 | The cover/management factor C assigned to the site and associated flow path was 0.45, which corresponds to surface cover of bare ground. |
| P = support practice factor (dimensionless) | 1.0 | There are no sediment and erosion controls in place on this portion of the property. |

The average annual erosion rate is based on the windows based RUSLE2 program (RUSLE2 License, version 2006-Jul-24).

Based on the calculations performed, the total PCB loading from the Amtrak Maintenance Facility Area 4 to the surface water body under current site conditions is 1,800 grams per year.

## Uncertainty Evaluation Associated with Overland Flow:

### Specific Areas and Degree of Uncertainty for the Amtrak Maintenance Facility

| | Samples Per Acre (site) | Chemical Data Quality* | Topography | Soil Type | Site Coverage | Map Quality | Distance to Discharge Points |
|---|---|---|---|---|---|---|---|
| **Site Specific Information** | ~9 | Method 8082** | Estimated using topography and data available | Detailed logs that are located within the area of concern | Based on aerial photography | Scaled Map / sketched drawings | 270 feet<br>52.6 feet<br>964 feet<br>734 feet |
| **Degree of Uncertainty** | Low | Low | Low to Moderate | Low | High | Moderate to High | High |

* Primary analysis used in historical samples
** Congener data was available

Areas of uncertainty concerning the Amtrak Maintenance Facility include the following: numerous samples with reported data were not located on any figures. In these instances BrightFields had to leave the data out of the assessment. In addition, there were some figures that could not be geo-referenced because of the low quality of the figure (Woodward-Clyde documents). Some of these sample locations had to be left out. Multiple interim remedial actions have been completed on the site in association with PCBs. These remedial actions were incorporated into the calculations as best as possible. With that said, this site did have some uncertainty associated with these remedial actions. There have been six removal actions completed onsite to remove PCB contaminated soil. In the 1984-1985 removal action there does not appear to be any proper identification of areas. The areas that BrightFields incorporated into the assessment came from approximations set forth by Secor in their Remedial Investigation and Focused Feasibility Study Work Plan. The other areas were defined more clearly, but when BrightFields tried to verify the amounts of soil removed, the identified areas and depths did not match the reported volumes. Some assumptions had to be made in conjunction with these areas as far as depths and sample depths. Also, not all samples had information pertaining to the groundwater depth observed in the boring. In these instances BrightFields had to infer groundwater depths based on surrounding information. In addition, access to the property was restricted so BrightFields used aerial photography and boring descriptions to estimate site surface cover. Also, the drainage patterns that BrightFields identified were not the same as the Secor defined drainage patterns. Based on these findings the overall uncertainty associated with the Amtrak Maintenance Facility site is **moderate**.

## GROUNDWATER DISCHARGE ANALYSIS

Groundwater discharge is based on the hydraulic conductivity of the soil, the groundwater gradient, and the cross-sectional area of the aquifer. A breakdown of the individual factors used in the Darcy equation is presented below.

PCBs were detected in groundwater, therefore no estimates were required. The groundwater concentrations indicate that there are relatively low concentrations of PCBs in groundwater in the middle of the site, with higher concentrations measured on the southwest and northeast sides on the property. The site was divided into three zones that included wells 6, 9, and 10 (Zone A), wells 13 and 14 (Zone B), and wells 1, 2, and 3 (Zone C). The was based on the groundwater contour maps from figures 11 and 12 of the Woodward-Clyde report (Woodward-Clyde, 1981).

### Input Factors:

A breakdown of the individual factors is presented below with a brief explanation of their choice.

**Zone A**

| Groundwater Transport Factors | Value Used | | Justification/Derivation of Value Used |
|---|---|---|---|
| | min | max | |
| K = Hydraulic Conductivity (ft/day) | 0.066 | 1.83 | Slug tests were performed in four of the wells on the Amtrak Maintenance Facility Property. The measured horizontal hydraulic conductivity ranged from $2.33 \times 10^{-5}$ to $6.45 \times 10^{-4}$ cm/sec. |
| I = Horizontal Groundwater Gradient | 0.0091 | 0.011 | Calculations of horizontal hydraulic gradients were derived from measurements conducted in July and August 1980. The site was divided into three zones based on PCB concentrations in the groundwater and on well placement. |
| Saturated Thickness (ft) | 3 | 12 | Based on the boring logs, the saturated thickness was approximately 3 to 12 feet. |
| Lateral Discharge Distance (ft) | 830 | 830 | The lateral discharge distance was chosen to be equal to the length of the PCB impacted area measured perpendicular to the groundwater flow. |
| A= Cross-Sectional Area (ft2) | 2,480 | 9,900 | Calculated from the saturated thickness and lateral discharge distance. |
| Groundwater PCB Concentration (ug/L) | 3.7 | 3.7 | The average PCB concentrations in unfiltered groundwater samples collected in July 1980 were used for each of the zones. The range of values from this area were 3.7 ug/L to 9.21 ug/L. |
| Distance to Discharge point (ft) | Directly adjacent | | Approximate distance from property boundary to closest surface water location. |

The PCB loading via groundwater discharge for Zone A is between 0.06 to 7.6 grams per year. Please see attached table for specific variables.

## Zone B

| Groundwater Transport Factors | Value Used | | Justification/Derivation of Value Used |
|---|---|---|---|
| | min | max | |
| K = Hydraulic Conductivity (ft/day) | 0.066 | 1.83 | Slug tests were performed in four of the wells on the Amtrak Maintenance Facility Property. The measured horizontal hydraulic conductivity ranged from $2.33 \times 10^{-5}$ to $6.45 \times 10^{-4}$ cm/sec. |
| I = Horizontal Groundwater Gradient | 0.01 | 0.013 | Calculations of horizontal hydraulic gradients were derived from measurements conducted in July and August 1980. The site was divided into three zones based on PCB concentrations in the groundwater and on well placement. |
| Saturated Thickness (ft) | 3 | 12 | Based on the boring logs, the saturated thickness was approximately 3 to 12 feet. |
| Lateral Discharge Distance (ft) | 1,463 | 1,463 | The lateral discharge distance was chosen to be equal to the length of the PCB impacted area measured perpendicular to the groundwater flow. |
| A= Cross-Sectional Area (ft2) | 4,390 | 17,600 | Calculated from the saturated thickness and lateral discharge distance. |
| Groundwater PCB Concentration (ug/L) | 0.024 | 0.024 | The maximum concentration observed in this area, 0.024 ug/L, was used in the calculations due to an insufficient amount of data. |
| Distance to Discharge point (ft) | Directly adjacent | | Approximate distance from property boundary to closest surface water location. |

The PCB loading via groundwater discharge for Zone B is between 0.0007 to 0.1 grams per year. Please see attached table for specific variables.

## Zone C

| Groundwater Transport Factors | Value Used | | Justification/Derivation of Value Used |
|---|---|---|---|
| | min | max | |
| K = Hydraulic Conductivity (ft/day) | 0.066 | 1.83 | Slug tests were performed in four of the wells on the Amtrak Maintenance Facility Property. The measured horizontal hydraulic conductivity ranged from $2.33 \times 10^{-5}$ to $6.45 \times 10^{-4}$ cm/sec. |
| I = Horizontal Groundwater Gradient | 0.0083 | 0.014 | Calculations of horizontal hydraulic gradients were derived from measurements conducted in July and August 1980. The site was divided into three zones based on PCB concentrations in the groundwater and on well placement. |
| Saturated Thickness (ft) | 3 | 12 | Based on the boring logs, the saturated thickness was approximately 3 to 12 feet. |
| Lateral Discharge Distance (ft) | 863 | 863 | The lateral discharge distance was chosen to be equal to the length of the PCB impacted area measured perpendicular to the groundwater flow. |
| A= Cross-Sectional Area (ft2) | 2,589 | 10,356 | Calculated from the saturated thickness and lateral discharge distance. |

| Groundwater Transport Factors | Value Used | | Justification/Derivation of Value Used |
|---|---|---|---|
| | min | max | |
| Groundwater PCB Concentration (ug/L) | 4.85 | 4.85 | The average PCB concentrations in unfiltered groundwater samples collected in July 1980 were used for each of the zones. The range of concentrations of PCBs reported in groundwater for this area was 1.83 to 10.9 ug/L. |
| Distance to Discharge point (ft) | Directly adjacent | | Approximate distance from property boundary to closest surface water location. |

The PCB loading via groundwater discharge for Zone C is between 0.07 to 13 grams per year. Please see attached table for specific variables.

**Mass Loading Via Groundwater Transport Result:**

The groundwater discharge is 160 to 25,000 L/day (attached Table A). The average detected PCB concentration in groundwater for each area of concern was used to calculate the groundwater concentrations for the loading estimate. The estimated minimum and maximum contaminant mass loading contributions are shown in the Table C in the groundwater transport calculations attachment, assuming that there are no contaminant losses due to degradation, dispersion, sorption, volatilization, etc.

The total PCB loading via groundwater discharge is between 0.1 and 21 grams per year (attached Table C).

**Uncertainty Analysis Associated with Groundwater Transport:**

**Specific Areas and Degree of Uncertainty for the Amtrak Maintenance Facility**

| | Groundwater PCB Concentration | Hydraulic Conductivity | Horizontal Groundwater Gradient | Saturated Thickness | Lateral Discharge Distance | Distance to Discharge point |
|---|---|---|---|---|---|---|
| **Site Specific Information** | Based on congener analysis in groundwater | Conductivity based on Aquifer Testing - Slug tests | Gradient based on few professionally surveyed wells and/or tidal influenced wells | High quality logs with consistent saturated thickness | High density sample data, good ground-water flow data | Directly adjacent |
| **Degree of Uncertainty** | Low | Low | Moderate | Low | Low | Low |

Based on this evaluation the overall uncertainty associated with the Amtrak Maintenance Facility is **low.**