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BASELINE RISK ASSESSMENT HUMAN HEALTH EVALUATION

7.1 INTRODUCTION

Section 300.430 of the National Oil and Contingency Plan (NCP 1990) states that the purpose of the remedial process for a contaminated Site is to implement remedies that reduce, control, or eliminate risks to human health and the environment. The mandate of the Superfund program is to protect human health and the environment from current and potential substance releases, as enforced in the NCP.

Under CERCLA and the Superfund process, a baseline risk assessment is used to evaluate the potential threats to public health and the environment from a Site in the absence of any remedial action. It identifies and characterizes the toxicological characteristics of the contaminants of concern, the potential exposure pathways, the potential human and environmental receptors, and the potential health impact a site may pose. The information obtained through risk assessment is used to assist in the evaluation of possible remedial measures to reduce risk at a site.

This baseline risk assessment (BRA) addresses the potential risks associated with the Saegertown Industrial Area Site (Site) under the "no-action" alternative. The no-action alternative assumes that no remedial actions will take place and no restrictions will be placed on future use of the Site.

The baseline risk assessment for the Site was performed consistent with the Risk Assessment Guidance for Superfund (RAGS, U.S. EPA 1989) and a supplemental update to the RAGS document (U.S. EPA, 1991).

The baseline risk assessment is based on the following major assumptions to estimate health risks:

- No remedial actions will take place
- There are no site access/use restrictions
- There are no groundwater use restrictions
- There is the potential for future development of the Site
- Contaminant concentrations in various media are assumed not to change over time

7.1.1 Overview Of Site Contamination

Based on an assessment of the nature and extent of contamination at the site, the main areas (refer to Drawing 60882-F8) and contaminant groups of concern, as well as contaminated media are as follows:

- Pond Area on former GATX property - VOCs, SVOCs, PCBs, and metals
  - Surface water
  - Sediment
  - Soil
  - Groundwater
  - Air (based on modeling results)
- Former Sludge Bed and Lagoon on former GATX property - SVOCs
  - Soil
- Lord Property - VOCs
  - Groundwater

Refer to Section 5 for a detailed description of the nature and extent of contamination for each area investigated during the RI, and Section 6 for a detailed description of the potential fate and transport of the contaminants.

7.1.2 Background

Previous sections of this RI Report provide descriptions of the Site location, history, physical characteristics (i.e., geology, hydrogeology, etc.) and sampling locations and media. Also included in previous sections is a discussion of the Site chemistry as it relates to sample locations, and chemical fate and migration.

Information presented in these previous sections has been used in the baseline risk assessment to assist in assessing public health risk. Reference to appropriate sections of the RI Report should be made for detailed discussions of the background information.

7.1.3 Organization

The baseline risk assessment is organized into the following sections:

- Identification of Chemicals of Potential Concern
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

7.1.3.1 Identification of Chemicals of Potential Concern - This component consists of a review of the data collected during the remedial investigation at the Site in view of data validity, chemical concentrations, media in which the chemicals have been detected, frequency of chemical detection, the toxic properties of the chemicals, the physical properties of each chemical as they relate to fate and migration potential, and the conditions of potential exposure to identified human receptors. Refer to Table 7-2 for the list of chemicals of potential concern by medium.

7.1.3.2 Exposure Assessment - This element of the baseline risk assessment identifies populations potentially exposed to Site contamination and evaluates the potential pathways (e.g., soil, sediment or surface water contact or ingestion, or inhalation of air) of contaminant exposure, as well as the magnitude and duration of their exposure through these pathways.

7.1.3.3 Toxicity Assessment - The toxicity assessment is a determination of the quantitative and qualitative relationship between the magnitude of exposure to chemicals of potential concern at the Site and the probability of occurrence of adverse health effects from that exposure.

7.1.3.4 Risk Characterization - This final element integrates the toxicological information for the chemicals of potential concern with estimated levels of exposure to arrive at an assessment of the potential health implications of site contamination.

7.1.4 General Scope and Approach of Assessment

This section summarizes the general complexity of this assessment (e.g., quantitative vs. qualitative evaluation) and an overview of the approach of the assessment.

7.1.4.1 Extent of Quantitative Risk Estimation - Where appropriate, health risks were quantitated in this human health risk assessment for each contaminated medium. For specific contaminated media, risks are not calculated for all potential pathways or routes of exposure, but a rationale is provided to explain why. In addition, where appropriate chemical fate and transport was taken into consideration, and modeling was performed, to assess impacts from contaminated media (e.g., soil) to those media that had not been sampled or were sampled using only field screening methods (e.g., air).

For a specific medium, such as soil, a number of potential pathways and routes of exposure may be possible. Some examples for soil are direct contact, incidental ingestion, fugitive emissions with subsequent inhalation of contaminated air, and bioaccumulation in plants with subsequent ingestion of contaminated plants. In this assessment, pathways and routes of exposure were assessed quantitatively for a particular medium (e.g., soil), when they appeared appropriate, based on the concentration and chemical properties of the contaminants present within the medium.

As a special case, where a route of direct exposure (e.g., ingestion) to a contaminated media (e.g., soil) was estimated to result in an unacceptable level of health risk for a specific population, other less direct means of exposure (e.g., contaminated homegrown vegetable consumption) to the medium are addressed qualitatively for that exposed population, rather than quantitatively. The rationale for this is that once a medium is known to pose an unacceptable level of health risk, other means of exposure to the medium would likely only increase the intensity (noncarcinogens) or probability (carcinogens) of the toxic effect. This approach is consistent with the intended use of the BRA as a tool to define those media that warrant consideration for remediation in the feasibility study.

7.1.4.2 Human Sub-Populations for Which Health Risks are Assessed - Risk are quantitated for potentially exposed humans under current land use conditions, and potential future land use conditions. Risks are quantitated for those potentially exposed subpopulations that would represent a reasonable maximally exposed population, rather than to each potentially exposed subpopulation. The reasonable maximally exposed (RME) subpopulation represents that subpopulation for reasons of their location, sensitivity, and/or lifestyle which are exposed to a medium or media more than other potentially exposed subpopulations. Because the probability of a potential health effect occurring in a population is proportional to the level of human exposure, this RME population is considered to be the most likely group potentially to be affected by contamination at the Site. For each medium, there is normally one to two subpopulations that best represent the RME populations for the population in the general site area. The RME populations selected for this risk assessment are:

- Current Land Use- Older children (trespassing) playing on-site, on-site workers, and off-site residents

- Future Land Use- On-site Residents

A rationale for the selection of each of these subpopulations will be provided later in this assessment (refer to section 7.3.1).

7.1.4.3 Segregation of Site for Risk Analysis - The Site was segregated into subunits for risk analysis. This appeared appropriate, because the characteristics and extent of contamination varied among areas on-Site and were generally defined by specific source areas (i.e., areas of potential concern). Although some contaminants are found in more than one subunit, contaminants have not been shown to migrate from a specific aource area in one subunit to another subunit. Each source area only affects that particular source unit. The following are the subunits which the Site was segregated into:

- SMC
- SCI
- GATX
- Lord

Two off-Site subunits were also included. The off-site subunits are:

- Public/Private Drinking Water Wells
- French Creek

For each subunit, its potential impact on human health was assessed separately, although where appropriate, risks were combined among subunits (e.g., drinking water wells and GATX). In addition, within each subunit when specific source areas (e.g., former Lord Impoundment) or hot spot areas (e.g., GATX pond) were identified, risks were quantitated separately for each area.

7.2 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

The identification of chemicals of potential concern at the Site involved a number of steps. These steps, as outlined in RAGS, have been used to arrive at a list of chemicals of potential concern, which were subsequently evaluated in the baseline risk assessment.

7.2.1 Chemical Analysis of Site Areas and Media

Chemical data was grouped by subunit, source area, and medium for risk analysis. Refer to Table 7-1 for a summary of the investigative samples used to represent each of these groups.

After evaluating the quality/validity of data obtained from the performing Contract Laboratory Program (CLP) laboratory, numerous chemicals were determined to be present in various media at the Site. TCL volatiles, semivolatiles, pesticides/PCBs, and TAL metals were detected in various media in specific areas of the Site.

Tentatively identified volatile and semivolatile compounds were also identified in media. Tentatively identified compounds (TICs), as their name implies, are identified as potentially being present at the Site. Confirmatory analysis for the presence of a TIC, and an accurate estimate of its concentration was not performed.

While TCL and TAL data are used in the quantitation of risks, TICs are not. Rather, TICs were used to qualitatively evaluate whether the concentration of a particular chemical group may have been underestimated in the final risk analysis.

When many TICs are detected within a particular medium, then it is noted in the Human Health Evaluation (Section 7.5.3) that the risk estimates calculated for the medium may underestimate the true health risk. On the other hand, when few or no TICs are detected within the medium, it is concluded that the chemicals considered in the risk analysis appropriately reflect those to which persons have the potential to be exposed. Therefore, the risk estimates in this case are not affected by uncertainty as to whether all chemicals of potential concern have been identified and considered in the risk assessment for the particular medium.

Refer to the summary tables in Appendices K through T for a presentation of the TCL and TAL chemicals detected in the designated areas/media at the Site along with their respective minimum, maximum, and arithmetic average concentration, and frequency of detection. Also provided is a listing of the TICs detected for each area/medium investigated.

The chemical analyses of samples were performed through the CLP and have been evaluated as to their usability in accordance with U.S. EPA guidance for validation of organic and inorganic analyses of environmental samples (U.S. EPA, 1988). Data used in the present risk assessment include unqualified data and data which represent estimated quantities (qualified J, L, or K). Positive detects of chemicals were included for consideration in the risk assessment, with the exception of when the chemical result was determined to be unusable or due to blank contamination. Unusable data is flagged with a validation qualifier of "R". Data associated with significant blank contamination are flagged with a "B". For a description of data use limitations, refer to Section 5.1 of this report.

7.2.2 Development of a Set of Chemical Data and Information for Use in the Risk Assessment.

The following describes the rationale for selection or exclusion of identified chemicals in the data set as chemicals of potential concern for further evaluation in the risk assessment. The process of identifying chemicals of potential concern and which samples to include in the evaluation, is an integrated procedure.

The purpose of selecting chemicals of potential concern for the risk assessment is to identify those chemicals present at the Site most likely to be of concern to human health and the environment. The selection process is also performed to eliminate from the risk assessment those chemicals that are associated with sampling or laboratory artifacts, and those chemicals existing at or below site-specific background concentrations at the Site. In this risk assessment, chemicals of potential concern have been selected based on an analysis of the data, and a highly conservative protocol.

It is important to note that the selection of a chemical as a chemical of potential concern does not necessarily indicate that it poses a health threat. The selection of a chemical only indicates a need to evaluate that chemical in the risk assessment process.

As suggested in RAGS, chemicals that exhibit the following characteristics are to be included in a set of chemical data and information for use in the baseline risk assessment:

- Positively detected in at least one CLP sample in a given medium. Positively detected chemicals include both unqualified results and results qualified as estimated, but with known identities (e.g., J-qualified TCL data)

- Determined to be present at the Site and not due to contamination introduced during sampling or analysis

- Determined to be the result of chemical releases from the Site and not natural background levels

- TICs associated with the Site

- Transformation products of chemicals demonstrated to be present.

The above criteria were applied to each of the media within each site area for all chemicals positively detected at the Site. Refer to Appendix U for detailed description of the protocol used to select chemicals of potential concern.

7.2.2.1 Selection Based on Data Validation - To assess whether or not a detected chemical was due to contamination introduced during sampling and analysis, method and field blanks were analyzed in a manner similar to investigative samples collected from the Site. The method and field blank results were then used in the validation of the investigative samples.

As a special case for this investigation, toluene was determined to be a field sampling contaminant associated with electrical tape used to seal some soil sample jars. Refer to Section 5.1 for a description of the problem, and a list of potentially affected samples. Toluene results in potentially affected samples were used for risk analysis along with unaffected results.

This was considered appropriate, because it could not be determined with certainty which samples had been affected, and to what extent. Utilizing this approach may over estimate the health risk associated with toluene exposure.

Positively detected chemicals not associated with field or laboratory contamination, or determined to be unusable for other reasons during data validation, were further screened to determine whether they were or were not Site-related.

7.2.2.2 Selection Based on Comparison to Site Specific Background - Contaminant concentrations in investigative samples were compared with contaminant concentrations detected in background samples to determine if a chemical is associated with the Site. Background is defined as samples collected in areas not known or anticipated to be affected by Site activities. Background samples were collected to represent natural background concentrations of analytes. Refer to Table 7-1 for a summary of the samples used to represent background conditions for each medium. The following is a summary of the location of each background sample, and a description of the sample location as it pertains to defining it as representative of background conditions.

Medium/Sample Location	Location Description
Soil Borings	
B11	Located in the Park in the northeast corner of site, uphill of surface water drainage from contaminated areas on-Site, and in an area historically farmed.
B12	Located at the east-central property boundary within an area historically farmed, and uphill of surface water drainage from contaminated areas on-Site.
B17	Located near the north-central property boundary, uphill of surface water drainage from contaminated areas on-Site.
Groundwater	
W1S, W1D, W3S, W3D, W6S, and W6D	Shallow and deep monitoring wells at these locations were considered to represent background because they are located upgradient of contaminated areas on-Site.

Medium/Sample Location	Location Description
French Creek Surface Water/Sediment	
SW1 and SD1	These sediment and surface water samples were collected approximately 800 ft upstream of the northern Site boundary.
Surface Soil	
SU3	This surface soil sample was collected in the northeastern corner of the Site in an abandoned farm field. The area is thickly vegetated, and mature trees are located near the sample location. The sample location is located uphill from contaminated areas on-Site.

The following describes the rationale for eliminating compounds from further consideration as chemicals of potential concern based on background levels. Naturally occurring concentrations of inorganics (metals) present in a matrix can be determined by collecting samples outside the affected area, or by comparison with values presented in literature. For sediments, soils, groundwater, and surface waters, concentrations of individual contaminants were compared to concentrations of background samples from the same or similar matrix collected on or near the Site.

The 95% upper confidence limit for the 0.95 quantile (i.e., percentile) for background samples was used to determine which metals appeared to be above background concentrations. Refer to Section 5.3 for a discussion of those chemicals that exceeded this statistical criteria. It should be noted that this statistical approach does not adhere to the normal U.S. EPA Region III Superfund guidance for conducting a Baseline Risk Assessment. Although this approach differs from the norm, a U.S. EPA Region III toxicologist has determined that the statistics used at the site will not significantly impact the outcome of the risk assessment. For this reason the statistical approach has been approved for use at the Saegertown Site.

The 0.95 quantile represents the background analyte concentration that 95% of all background samples are less than or equal to. In other words, if an analyte's concentration is greater than the 0.95 quantile value for background data, there is no greater than a 5% chance that the sample represents a background concentration, and a 95% chance that the concentration does not represent background. Since the 95% confidence limit was calculated for the quantile, there is only a 5% chance that the true 0.95 quantile for the background population would be greater than the calculated quantile. Refer to Section 5.2 for a discussion of the details of this calculation. Table 5-1 and 5-2 summarize the 0.95 quantiles for metals detected in soil borings and groundwater, respectively.

To determine if a sample result for soils/sediment or groundwater was indicative of background concentrations, the concentration of the contaminant in the investigative sample was compared to the background 0.95 quantile. If the concentration in the investigative sample was greater than the 0.95 quantile, the sample result was assumed to be site related.

In the case of surface soil, French Creek surface water, and French Creek sediment, a single background sample was collected. In these cases, a direct comparison was made with the data. If the sample result was substantively greater than background (i.e., approximately 2 times greater), the compound was assumed to be Site-related. Refer to Section 5.3 for a discussion of the analytical results by operable unit.

In the case of sediment samples collected on-Site in dry areas (e.g., former Lord impoundment area), no background sediment sample was collected. Instead, background soil boring samples were used to represent background. This approach is reasonable because the dry sediments collected actually represent soil more closely than true sediments deposited in surface water.

7.2.2.3 Screening for Tentatively Identified Compounds - Tentatively identified compounds, as mentioned previously, are not known to be detected in samples with certainty. Therefore, the risks to these chemicals was not assessed quantitatively, but rather their presence was used as a qualitative weight -of-evidence to determine in the final risk analysis whether health risks for a particular chemical group were potentially underestimated. Because the TICs are organic chemicals potentially associated with the Site (i.e., not detected in background samples), they were retained as chemicals of potential concern. Refer to Appendices K through T for a summary of the TICs in each medium within an operable unit.

7.2.2.4 Transformation Products - During the RI, transformation products of specific chemicals beyond the normal transformation products on the TCL, were not analyzed for. Those chemicals that are potential transformation products of chemicals present in a medium were retained as chemicals of potential concern.

7.2.2.5 Additional Screening Procedures Used to Reduce The Final List of Chemicals of Potential Concern.

Ubiquitous and nontoxic chemicals - Some metals are naturally present at high concentrations in a medium (e.g., aluminum in soils and sediments) or are considered essential nutrients and nontoxic (i.e., calcium, iron, magnesium, potassium and sodium). These contaminants were eliminated from further consideration as chemicals of potential concern at the Site.

Comparison to Area Specific Background Organic Chemical Concentrations. Most organic chemicals are natural, but in general, the list of TCL analytes represents chemicals that have been created anthropogenically (e.g., TCE), or although naturally occurring (e.g., PAHs), are created in greater quantities by anthropogenic sources (e.g., vehicular emission). Within background surficial soil, PAHs and a degradation product of DDT (i.e., DDE) were detected.

PAHs are naturally occurring chemicals formed due to the incomplete combustion of organic matter. For this reason, it is reasonable to detect low levels of PAHs in soils. Concentrations of PAH were similar between the background surficial soil sample and the soils collected at the SCI and in the former GATX rail siding area. For this reason, the risks associated with PAHs in these areas was not quantitated.

DDT and it degradation products DDE and DDD are found still in many areas where DDT was used as an agricultural insecticide. The background surficial soil was collected from a former farm field, and therefore, its presence in this sample is not surprising. Within the former Lord impoundment area, DDT degradation products were also detected. Since this area was farmed historically, and the area collected surface water drainage from other farmed fields, it is likely these detects reflect historical farm residues of DDT. DDT and its byproducts were not considered to be Site-related and the risks associated with this chemical were not quantitated.

7.2.2.6 Final List of Chemicals of Potential Concern - After applying the selection process, many chemicals detected at the Site were included in the risk assessment as chemicals of potential concern, because they were determined to be potentially related to past industrial Site activities. The final list of chemicals of potential concern are presented by medium and area within each operable unit in Table 7-2.

7.3 EXPOSURE ASSESSMENT

The exposure assessment is performed to identify actual and potential pathways by which human exposure to contaminated Site media might occur. The assessment considers factors such as the physical location of contaminated areas, the type of contamination and the populations which may come into contact with these areas. Exposure pathways are identified for two Site land use scenarios:

- pathways based on land use practices as they currently exist
- potential pathways based on land use changes which may occur in the future and result in additional types of exposure

Both current and future pathways which represent possible exposures were quantified in order to estimate the magnitude of daily contaminant exposure a population may incur. To accomplish this, assumptions pertaining to the exposed population were made such as, the nature of the individuals (child vs. adult), the rate of contact with the contaminated medium (e.g., adult consumes 2 liters of water daily), and the length of time the exposure is likely to occur (e.g., years vs. lifetime). These population variables were then integrated with chemical concentration data to calculate a level of exposure (or dose).

7.3.1 Characterization of Exposure Setting

The purpose of the following sections is to characterize the physical setting of the Site and surrounding area, and to characterize potentially exposed populations.

AR303519

7.3.1.1 Physical Setting - A detailed description of the physical setting of the Site is contained in Section 4 of this report. Refer to this section for a discussion of the following topics:

- Meteorology
- Soil Types
- Hydrology
- Water Supply
- Geology
- Hydrogeology

Refer to Section 8 for a description of the vegetation at the Site.

7.3.1.2 Potentially Exposed Populations - To determine populations that may potentially be exposed to Site-related contamination, current zoning and land use patterns were defined, and appropriate government officials were contacted to determine what future development plans were proposed for the Site area. Demographic information for the Borough population was also obtained. This information was used to determine populations who reasonably may be exposed to Site-related contamination under current and potential future land use conditions.

Zoning and Surrounding Land Uses. The Site is zoned Industrial **(i.e., M** 1) over the majority of the area, but a parcel of land in the northeastern corner of the Site is zoned single family **(i.e.,** R-1).

The land zoned industrial is currently used as an industrial park by a number of light industrial facilities. A master plan for the industrial park was developed, but since the Site was listed on the NPL, further development of the Site has not progressed, primarily because lending institutions will not finance new construction for a NPL Site. Based on the current zoning ordinance for the Saegertown Borough, a number of permitted uses and conditional uses exist for industrial property. Permitted land uses are those that are acceptable without additional approval by a Governing Body (e.g., Saegertown Borough). Conditional land uses are those predetermined land uses which may be allowed or denied by the Governing Body after recommendations by the Planning Commission in accordance with specific criteria (i.e., applications, review, criteria for approval, and performance standards) and provisions.

Permitted land uses for industrial property include light manufacturing, research laboratories, offices, warehousing, truck terminals, public buildings, agriculture, public utility structures, open land recreation, bakeries, greenhouses, animal hospitals, accessory uses, etc. Accessory uses include a broad range of permitted uses. Key accessory uses that are of concern to the risk assessment are foster homes, and under special circumstances, single family residences. Single family homes are considered as an accessory use in the M-1 Industrial District providing the dwelling is contained within, is part of, subordinate to and serves the principal permitted facility. An example of this condition is when an owner of a facility has his/her home located next to his/her business.

Conditional uses for industrial property include manufacturing, motels, gas stations, restaurants, industrial parks, commercial recreation, and shopping centers.

The land zoned single family in the northeast corner of the Site is currently used as a park and open green space.

The zoning of the land surrounding the Site includes single family, residential, industrial, and conservation. To the north of the Site, the land is zoned industrial west of Crawford Street, and single family east of Crawford Street. Presently, homes are present along Erie street just north of the Site at the base of a hill. Based on a conversation with the Borough zoning officer, in the near future, a 35-unit residential subdivision is planned for the property further north atop the hill.

Land to the east of the Site is primarily zoned single family, however a parcel to the southeast of the Site is also zoned industrial. Currently, multiple single family homes are located along Erie Street to the east of the on-Site park. The land east of the central portion of the Site is used as agricultural land. No future plans could be located for this area, although further residential development is possible.

To the south of the Site is conservation land which borders on Woodcock Creek. Permitted uses for this land is agriculture, open land recreation, parks, and accessory uses as described for industrially zoned property. Conditional uses are single-family dwellings, schools, churches, cemeteries, and public buildings. The property currently owned by Lord is used as open recreational land by Lord. The land is well vegetated and includes a baseball diamond. This property is within the 100-year floodplain of Woodcock Creek. A future plan for this land could not be located, but since the property is within a floodplain, its present use as open recreational land would be a likely future use. Building restrictions within the floodplain may deter the construction of buildings on this property, but fill could be brought in to raise the elevation of the land above the flood plain.

The land to the west of the Site is approximately one-half industrial and one-half residential. This area includes older residential housing and light manufacturing of the Saegertown Borough. The main populated area of the Borough extends from this area further west. A plan could not be located for this property in the future, but it will likely remain similar to its current use.

Population Information. The Site is located within the Saegertown Borough, which based on the 1990 census results has a population of 1066 persons. The majority of the population within the Borough is 17 years or older. The breakdown of the number of persons into arbitrary age brackets are as such:

Children 0-6 years old - 69 persons or 6.5% of the total population
Older Children 7-16 years old- 119 persons or 11% of the total population
Adults 17-64 years old- 593 persons or 56% of the total population
Elderly Adults > 65 years old- 285 persons or 27% of the total population

Relative Location of Populations with Respect to the Site - Under current land use conditions there are a number of potentially exposed populations either on-Site or off-Site. These include workers, residents, and subgroups of each of these populations. On-Site, the main population of concern would be workers who typically spend eight or more hours at their jobs, five days per week. Of the populations potentially exposed, on-Site workers typically spend the most time on-Site per week. However, their potential to be exposed to contaminated media is probably limited to exposure of air emissions from the pond area, since they work indoors.

Off-Site residents live directly adjacent to the Site along Erie Street. Additional residents live adjacent to the northwestern Site boundary. Children from these homes may visit the Site park, or other adjacent open green space. For those residents that do not access the Site, there is the potential that they would be exposed to air emissions that migrate off-Site from the pond.

Under future land use conditions, there is the potential based on current zoning, for residences to be present on-Site. This may include development of the park and open green space, the occasional inclusion of a home next to a proprietor's business, and foster homes for children. Therefore in the future, there is the potential for on-Site residents.

In addition, over the majority of the Site, there is the potential for continued use of the area as an industrial park with additional industrial expansion. This may include new industrial facilities or additions to already present facilities.

Subpopulations of Potential Concern. As mentioned in the introduction to this section, risks have been quantitated for those potentially exposed subpopulations that would represent a reasonable maximally exposed (RME) population, rather than to each potentially exposed subpopulation. The RME subpopulation represents a group of persons for reasons of their location, sensitivity, and/or lifestyle which are exposed to a medium or media more than other potentially exposed groups. The RME subpopulation is considered to be the most likely group potentially affected by contamination at the Site due to their potential level and frequency of exposure. Based on current or potential future land use conditions, the following subpopulations were considered to best represent the RME populations for the Site area:

- Current Land Use
  - older children playing/trespassing on-Site[1]
  - on-Site workers[2]
  - off-Site residents[3]
- Future Land Use
  - on-Site residents[3]

Of the three sub-populations identified above, older children playing on-Site were considered to have the greatest potential for exposure under current Site condition because of their exploratory nature. Also, because workers and off-Site residents are located near a potential source of air emissions a large portion of each week, it was considered appropriate to calculate health risks due to air exposures (from the pond) for these subpopulations.

Based on the potential for a residence to be located on-Site in the future, an on-Site resident subpopulation was considered in this assessment. An on-Site resident may have potential for exposure to media other populations probably would not be exposed to. Some examples would be contaminated homegrown vegetables from backyard gardens, groundwater, and subsurface soils that had been excavated while developing the residence. Because hypothetical on-Site residents may have the greatest potential exposure to each contaminated media,

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1. Trespasser - this individual is defined as an older child ages 7-16; a child, is referred to in the U.S. EPA Supplemental Guidance, as being between the ages of 1-6. The 10-year period to define an older child (age 7-16) was considered reasonable to represent the population and exposure duration of a Site trespasser. With the exception of body weight (40 kg - older child, 70 kg - adult), the same exposure characteristics (exposure assumptions) as adults have been applied to determine daily intake for the trespasser (e.g., soil ingestion rate of 100 mg/day).

2. On-Site Worker- this population is defined to be adults (i.e, persons 18 years or older). Consistent with the U.S. EPA Supplemental guidance, a worker is assumed to work at the same place of business for 25 years.

3. Off-site/On-Site Resident - this individual is characterized by assuming he/she lives in the area from birth through 30 years. This 30-year exposure duration is consistent with the RME approach defined by the U.S. EPA in their Supplemental Guidance (1991). Exposure may occur as a child, from birth to 6; older child, age 7 to 16; and as an adult, age 17 to 30.

risks to other possible subpopulations (e.g., future on-site workers) were not assessed under potential future land use conditions.

The following section will discuss the potential pathways of chemical exposure that have been quantitatively or qualitatively assessed for each of the subpopulations.

7.3.2 Selection of Exposure Pathways For Risk Assessment

A chemical exposure pathway describes the route taken by a chemical from its source in the environment, to contact with receptors. As such, each exposure pathway must include the following elements:

- A source and mechanism of chemical release to the environment
- An environmental transport medium (e.g., air, groundwater) for the released chemical
- A point of potential human contact with the contaminated medium (referred to as the exposure point)
- Receptor contact (e.g., ingestion of contaminated groundwater)

In general, exposure may occur when contaminants migrate from the Site to an exposure point (i.e., a location where receptors can come into contact with contaminants) or when a receptor comes into direct contact with waste or contaminated media at the Site. An exposure pathway is complete (i.e., exposure occurs) if there is a way for the receptor to take in contaminants through ingestion, inhalation, or dermal absorption of contaminated media. Only pathways considered to be complete were evaluated in this risk assessment.

The potential exposure pathways at the Site for each of the RME subpopulations were selected based on the potential contaminant migration pathways (Section 6) and the Site setting (Section 4). These potential exposure pathways were evaluated to determine whether they are complete or have the potential to be complete in the future. Current use of the Site and adjacent land and potential future land uses were considered in the analysis as discussed previously. The following section provides a rationale for inclusion or exclusion of potential exposure pathways under current and future land use conditions. Exposure pathways are summarized for each operable unit, and where applicable, for specific areas within an operable unit. A detailed rationale is not provided, unless it appeared necessary to better clarify why a specific pathway was included or excluded for risk analysis. In addition, under both current and potential future land use condition, it should be noted that unless otherwise specified, the following routes of exposure will be assessed (quantitatively or qualitatively) for the following media/pathways of exposure.

- Soil/sediment
  - ingestion (quantitative)
  - dermal contact (qualitative)

- Surface water
  - ingestion (quantitative)
  - dermal contact (quantitative)

- Groundwater
  - ingestion (quantitative)
  - dermal contact (quantitative)
  - inhalation (quantitative)

- Air (contamination as a result of soil, sediment, or surface water volatile emissions)
  - inhalation (quantitative)

- Vegetables
  - ingestion (qualitative)

Table 7-3 summarizes the pathways considered to be complete as a result of this analysis and have been retained for quantitative risk analysis.

7.3.2.1 Exposure Pathway Analysis- Current Land Use Conditions - The following is a summary of the rationale for inclusion or exclusion of a pathway from quantitative risk analysis under current land use conditions. Unless otherwise specified, it should be assumed that risks associated with the current land use pathways are assessed (quantitatively or qualitatively) only for on-Site trespassers. Refer to Table 7-3 for a summary of the exposure pathways considered to be complete, and the routes of exposure quantitated for each complete pathway.

GATX

Surface Soil/Sediment - Three areas on the GATX property indicated evidence of contamination: the pond area, former rail siding area and former sludge bed/lagoon area. The potential for soil/sediment exposure is described below for each area.

AR303525

Pond Area - Exposure to surficial sediments in the pond area was quantitatively assessed. The pond is currently fenced which should limit access to the area, but this access restriction was not considered when calculating health risks for this source area.

Former Rail Siding Area - Exposure to surficial soil in this area was quantitatively assessed since access to the area is not restricted. Vegetative cover exists which may limit exposure to the surficial soils.

Former Sludge Bed/Lagoon Area - Exposure to surficial soil in this area was quantitatively assessed because access to the area is not restricted. Vegetative cover exists which may limit exposure to the surficial soils.

Fugitive Dust - Based on work by Cowherd (1985), if an area is vegetated, fugitive dust will not be produced. Because vegetative conditions prevail on the former GATX property, fugitive dust would not be expected to be generated in quantities that would be an exposure concern. Therefore, this pathway was not quantitatively assessed.

Surface Water - Exposure to surface water in the pond area was quantitatively assessed. The pond is currently fenced, which should limit access to the area, but this access restriction was not considered when calculating health risks for this medium.

Groundwater - The facilities presently located on the property utilize municipal water and not contaminated groundwater beneath the property. For this reason, groundwater was not considered a current pathway of chemical exposure.

Volatile Air Emissions - Based on the level of volatile contaminants detected on the former GATX property, air emissions were not anticipated to pose a concern except for the pond area. In this area, soil/sediment contaminant concentrations are high and a noticeable odor is present at certain times of the year. For this reason, an evaluation of potential air emissions from the pond area was performed using models (refer to Appendix V for a description of the specific models used). The potential exists for migration of volatilized emissions to on-Site facilities and off-Site residences. Therefore, risks were also quantified for on-Site workers and off-Site residents, respectively.

Vegetables - Gardening and farming do not occur on the former GATX property, therefore this pathway was not quantitated under current Site conditions.

Lord

Surface Soil/Sediment - Exposure to surficial soil/sediment in the former impoundment area was quantitatively assessed. Access to the area is not restricted, although vegetative cover may limit exposure to the surficial sediments.

Fugitive Dust - Based on work by Cowherd (1985), if an area is vegetated, fugitive dust will not be produced. Because vegetative conditions prevail on the Lord property, fugitive dust would not be expected to be generated in quantities that would be an exposure concern. Therefore this pathway was not quantitatively assessed.

Surface Water - Surface water bodies are not present on the Lord property located on-Site.

Groundwater - The Lord facility presently utilizes municipal water and not contaminated groundwater beneath the property. For this reason, groundwater was not considered a current pathway of chemical exposure.

Volatile Air Emissions - Volatile chemicals were not detected in surface soil/sediment, therefore, this pathway was not quantitatively assessed under current Site conditions.

Vegetables - Gardening and farming do not occur on the Lord property, therefore, this pathway was not quantitated under current Site conditions.

SCI

Surface Soil - Surface soil data was not collected for this property, therefore exposure estimates/risks could not be quantitated. Based on the result of the SCI property soil gas screening, and available Site history, contamination of the Site surface soil with volatile contaminants would not be expected. On the other hand, very low concentrations of VOCs were detected in subsurface soil samples, and therefore, the possibility of surficial VOC contamination can not be completely ruled out. In addition, the presence of other chemical groups (metals, and non-volatile organics) in surficial soils were not assessed. A qualitative discussion of risks posed by the SCI facility soil will be included.

Fugitive Dust - Based on work by Cowherd (1985), if an area is vegetated, fugitive dust will not be produced. Because vegetative conditions prevail on SCI property, fugitive dust would not be expected to be generated in quantities that would be an exposure concern. Therefore this pathway was not quantitatively assessed.

Surface Water - There are no surface water bodies present on SCI property.

Groundwater - Groundwater contamination was not detected beneath the SCI property. In addition, the current facility located on the property utilizes municipal water which has not been impacted by the Site.

Volatile Air Emissions - Based on the result of the soil gas screening, contamination of the properties surface soil with volatile contaminants would not be expected. For this reason, this pathway was not quantitated.

Vegetables - Gardening and farming do not occur on the SCI property, therefore this pathway was not quantitated under current Site conditions.

SMC

Surface Soil/Sediment - Surface soil data was not collected for this property, therefore, exposure estimates/risks could not be quantitated. Surface soil samples for VOC analysis were not collected on the SMC property because, based on the result of the SMC property soil gas sampling, contamination of the Site surface soil with volatile contaminants would not be expected. In addition, contamination of surficial soil with other chemical groups was not anticipated and, therefore, laboratory analysis for other parameters was not conducted.

A single surficial sediment sample was collected in a drainage ditch which skirts the northern SMC property boundary. Low levels of benzoic acid (130 ug/kg), bis(2-ethylhexyl)phthalate (65 ug/kg), and Arochlor 1254 (260 ug/kg) were detected in this sample. Other organics were not detected, and metals were within background concentrations for soil (i.e., surface or subsurface). Based on the low concentration of these chemicals in the sample, the vegetative cover which may limit human contact with the sediment, and limited area of potential contamination, risks were not quantitated for this medium, because it was considered not to pose a health threat. In addition, this drainage ditch drains a large water shed to the northeast of the Site, and therefore, the presence of the chemicals in ditch sediment on the SMC property may not necessarily indicate that they are associated with the SMC facility.

Fugitive Dust - Based on work by Cowherd (1985), if an area is vegetated, fugitive dust will not be produced. Because vegetative conditions prevail on

AR303528

SMC property, fugitive dust would not be expected to be generated in quantities that would be an exposure concern. Therefore this pathway was not quantitatively assessed.

Surface Water - A surface water body is not present on the SMC property.

Groundwater - Groundwater monitoring was not performed on the SMC property, however, currently, the SMC facility is served by the Borough municipal water distribution system. Therefore, this pathway was not quantitatively assessed.

Volatile Air Emissions - Based on the result of the soil gas screening, contamination of the property surface soil with volatile contaminants would not be expected. For this reason, this pathway was not quantitated.

Vegetables - Gardening and farming do not occur on the SMC property, therefore, this pathway was not quantitated under current Site conditions.

Drinking Water Wells

Groundwater - Although historically, Saegertown Borough municipal well BW2 was contaminated with VOCs (trichloroethene, and tetrachloroethene), this well went back on-line after remediation had occurred. Based on the RI data, presently, the Saegertown Borough municipal wells and private wells sampled are not impacted by Site contamination; therefore, exposure estimates/risks were not quantitated for this operable unit.

With the exception of 1,1,1-trichloroethane (TCA) and phenol, organic analytes were not detected in well water. TCA was detected in both the upgradient (BW3 at 2-3 ug/L) and a downgradient municipal well (BW1 at 1 ug/L). These TCA concentrations are well below a health protective concentration (i.e., MCL=200 ug/L) for this chemical. Phenol was only detected in the upgradient municipal well BW3. Detected metals were present at concentrations less than background values, with the exception of iron and manganese. Metals were detected below federal drinking water standards (i.e., MCLs). For these reasons, concentrations of metals in drinking water would not pose a health concern.

French Creek

Surface water/sediment - Based on the analytical results, and fate and transport considerations, it was not concluded that the Site had impacted French Creek. For this reason, exposure estimates/health risks were not quantitated for this operable unit. With the exception of some metal concentrations, analytes were not detected above background concentrations in French Creek surface water or sediment. Although select metals were found to be elevated above upstream concentrations (background) in surface water and sediment (refer to section 5.3.6), elevated concentrations of metals are not uncommon in areas where a Creek receives urban runoff. For example, lead was found to be elevated in downstream sediment samples. This metal is commonly found in areas where urban run-off enters a water body, due to its use in automobile fuels, and as a main component in anticorrosive paints used on bridges. The Borough's storm sewers drain directly into French Creek, and a number of bridges span the Creek. In addition, for a number of years, a former waste water treatment plant discharged its treated waste water into French Creek. The former waste water treatment plant is located between the Site and the Creek. This is another potential source of metal contamination.

During the RI, downstream samples were collected in areas susceptible to urban runoff. Surface water and sediment samples SW2/SD2 and SW4/SD4 were located near bridges, while SW3/SD3 was collected near a storm sewer outfall. The main Site related contaminant group (PAHs) was not found to be elevated in French Creek sediment, but rather was detected at comparable concentrations in sediment samples collected upstream and downstream of the Site. Therefore, it could not be concluded that the Site was the source of the elevated contaminant concentrations detected in surface water or sediment.

7.3.2.2 Exposure Pathway Analysis- Future Land Use Conditions - The following is a summary of the rationale for inclusion or exclusion of a pathway from quantitative risk analysis under future land use conditions. It should be noted that soils referred to below represent the composite of all surface or subsurface soil (borings and auger probes), sediment, or test pit samples collected for a particular area within an operable unit. Samples collected from the subsurface were considered under future land use conditions, because it was considered possible that contaminated subsurface material could be excavated while constructing potential on-Site residences.

Risks have been quantitated for hypothetical on-Site residents for each exposure pathway which is considered to be complete within an operable unit, unless otherwise stated. Refer to Table 7-3 for a summary of the exposure pathways considered to be complete and the routes of exposure quantitated for each complete pathway.

GATX

Surface Soil/Sediment - Three areas on the GATX property indicated evidence of contamination; the Pond area, former rail siding area and former sludge bed/lagoon area. The potential for exposure is described below for each area.

Pond Area - Exposure to soil in the pond area was quantitatively assessed. Based on the typical layout of a residential lot, for purposes of this assessment, it was assumed that gardens (e.g., flower, vegetable and herb) would be present. In addition, vegetative cover was assumed to occur year round except in areas where gardens were present.

Former Rail Siding Area - Exposure to soil in the former rail siding area was quantitatively assessed. Based on the typical layout of a residential lot, for purposes of this assessment, it was assumed that gardens (e.g., flower, vegetable and herb) would be present. In addition, vegetative cover was assumed to occur year round except in areas where gardens may be present.

Former Sludge Bed/Lagoon Area - Exposure to soil in the former sludge bed/lagoon area was quantitatively assessed. Based on the typical layout of a residential lot, for purposes of this assessment, it was assumed that gardens (e.g., flower, vegetable and herb) would be present. In addition, vegetative cover was assumed to occur year round, except in areas where gardens may be present.

Fugitive Dust - Based on work by Cowherd (1985), if an area is vegetated, fugitive dust will not be produced. Because vegetative conditions will likely prevail on the former GATX property, fugitive dust would not be expected to be generated in quantities that would be an exposure concern. Therefore this pathway was not quantitatively assessed.

Surface Water - It was assumed that the pond area was drained during development. Therefore, this pathway was not retained for risk analysis.

Groundwater - Although groundwater use restrictions prohibit construction of a private drinking water well in the Saegertown Borough, it was assumed that hypothetical residents may construct a drinking water well in the contaminated sand and gravel aquifer.

Volatile Air Emissions - Based on the level of volatile contaminants at the Site, air emissions were not anticipated to pose a concern except for the pond area. In this area, concentrations of contaminants are high and a noticeable odor is present at certain times of the year. For this reason, the level of air emissions from the pond area were modeled.

Vegetables - Vegetable gardening was assumed to occur in contaminated garden soils on the former GATX property. This pathway was addressed qualitatively in light of the risk posed from other pathways of soil exposure.

Lord

Soil - Exposure to soil in the former impoundment area was quantitatively assessed. Based on the typical layout of a residential lot, for purposes of this assessment, it was assumed that gardens (e.g., flower, vegetable and herb) would be present. In addition, vegetative cover was assumed to exist year round on residential lots except where gardens may be present.

In the past, soils beneath a sump within the Lord facility were contaminated as a result of leakage from the sump. Sampling of the soils beneath the sump was not part of the RI, because the leaking sump was discovered after the Phase 2 Work Plan was written. Based on test results from a preliminary investigation (aside from the RI/FS), it was determined that the soils were contaminated primarily with tetrachloroethene and associated chlorinated ethenes. As a remedial response, the soils beneath the sump were removed. Based on HNu readings taken in the sump area after the removal, contaminated soil may remain. However any remaining contaminated soil would be present at depth of five feet or greater. For this reason, exposure to any potentially contaminated soils should not occur under future land use conditions.

Fugitive Dust - Based on work by Cowherd (1985), if an area is vegetated, fugitive dust will not be produced. Because vegetative conditions will likely prevail on the Lord property, fugitive dust would not be expected to be generated in quantities that would be an exposure concern. Therefore, this pathway was not quantitatively assessed.

Surface Water - Surface water bodies are not present within the on-Site Lord property.

Groundwater - Although groundwater use restrictions prohibit construction of a private drinking water well in the Saegertown Borough, it was assumed that residents may construct a drinking water well in the contaminated sand and gravel aquifer.

Volatile Air Emissions - Volatile chemicals were not detected in soil, therefore, this pathway was not quantitatively assessed.

Vegetables - Vegetable gardening was assumed to occur in garden soils in the former impoundment area on the Lord property. Based on the low potential for the metal or organic chemicals which were detected in soil to bioaccumulate in plants, this pathway was not assessed for this operable unit.

SCI

Soil - Exposure to SCI property soil was quantitatively assessed. Based on the typical layout of a residential lot, for purposes of this assessment, it was assumed that gardens (e.g., flower, vegetable and herb) would be present. In addition, vegetative cover was assumed to exist year round on residential lots except where gardens may be present. Refer to Table N2 within Appendix N2 for a summary of the contaminants detected in SCI property soil.

Fugitive Dust - Based on work by Cowherd (1985), if an area is vegetated, fugitive dust will not be produced. Because vegetative conditions will likely prevail on the SCI property, fugitive dust would not be expected to be generated in quantities that would be an exposure concern. Therefore, this pathway was not quantitatively assessed.

Surface Water - A surface water body is not present on the SCI property.

Groundwater - Groundwater contamination was not detected on the SCI property.

Volatile Air Emissions - Based on the result of the soil borings, volatile contaminants would not be expected to occur at concentrations that would lead to substantial levels of contaminant volatilization. Three volatile contaminants (i.e,. toluene, ethylbenzene, and xylene) were detected in subsurface soil samples. Toluene was detected in each sample (SSB02-06, SSB02-18, SSB06-04, and SSB16-08) at concentrations ranging from 3 to 25 ug/kg. Ethylbenzene was detected in a single sample (SSB02-06) at 1 ug/kg. Xylene was detected in samples SSB02-06 and SSB02-18 at 7 and 2 ug/kg, respectively. At such low concentrations, these contaminants would not appreciably volatilize because of the soils ability to retain these chemicals. For this reason, this pathway was not quantitated.

Vegetables - Vegetable gardening was assumed to occur in contaminated garden soils on the SCI property. This pathway was addressed qualitatively in light of the risk posed from other pathways of soil exposure.

SMC

Soil - Soil contamination was not detected at the SMC facility based on soil boring test results. Similar to current Site conditions, the isolated organic chemical detects in the ditch sediment were not considered to be a health concern. Therefore, risks to soils was not quantitative.

Fugitive Dust - Based on work by Cowherd (1985), if an area is vegetated, fugitive dust will not be produced. Because vegetative conditions will likely prevail on the SMC property, fugitive dust would not be expected to be generated in quantities that would be an exposure concern. Therefore, this pathway was not quantitatively assessed.

Surface Water - A surface water body is not present on the SMC property.

Groundwater - Groundwater monitoring was not performed on the SMC property, but groundwater is not anticipated to be contaminated based on groundwater flow patterns. Therefore, this pathway was not quantitatively assessed.

Volatile Air Emissions - Based on the results of the soil gas screening, contamination of the property surface soil with volatile contaminants would not be expected. For this reason, this pathway was not quantitated.

Vegetables - Vegetable gardening was assumed to occur in garden soils on the SMC property, but due to the lack of soil contamination, this pathway was not retained.

Drinking Water Wells

Groundwater - Based on the the location of on-Site groundwater contamination, and the direction of groundwater movement, off-Site contamination of groundwater is possible in the future. The direction of groundwater flow from the Site is towards French Creek. Based on the location and extent of on-Site groundwater contamination, in relation to the location of municipal wells, impact to municipal wells would not be anticipated in the future. The groundwater contamination would be expected to decrease as it moves downgradient. Impact to private wells located downgradient of contaminated Site groundwater is not expected because shallow groundwater probably discharges to French Creek (as discussed in Section 4.8.2), located between the Site and private wells. However, the possibility of contaminants migrating beyond French Creek can not be completely discounted at this time. Therefore, this pathway has been retained for qualitative assessment, based on the level of risk posed by the consumption of on-Site groundwater.

French Creek

As under current Site conditions, French Creek is not anticipated to pose a health threat to recreational users. Although groundwater is moving towards French Creek, and may some day result in discharge of contamination to the creek, the amount of discharge would likely be low, based on hydrogeologic characteristics described in Section 4.8.2, and French Creek water would likely dilute the discharge to nondetectable and nontoxic concentrations. For this reason, exposure to French Creek surface water or sediment was not retained as an exposure pathway of concern under future land use conditions.

7.3.3 Exposure Point Concentrations

RAGS requires that the concentration of contaminants in a given medium (e.g., soil, surface water, etc.) used to represent the exposure point concentration be derived by calculating the 95% upper confidence limit on the mean of sample concentrations (95% UCLM). If this value exceeds the maximum value identified, U.S. EPA (1989) directs that the maximum measured value be defaulted to as the exposure point concentration. This approach was used to calculate exposure point concentrations for each medium. The samples used to represent each medium within each operable is summarized in Table 7-1. In many instances, the 95% UCLM value was greater than the maximum concentration identified for these chemicals, because of the large degree of variability within the contaminant concentration data and small sample size. Therefore, in these cases, the maximum contaminant concentration was used to represent the exposure point concentration for these data. Refer to Appendix U for the methods used to calculate the 95% UCLM for each contaminant in a particular area and medium. Exposure point concentrations calculated for each area are summarized in Table 7-4.

7.3.3.1 Groundwater - Monitoring well analytical data were used directly to estimate potential exposures to on-Site residents from the contaminated aquifer. Of the wells sampled, only a subset of the wells were found to be contaminated. As a conservative measure, because the center of the groundwater plume was not known with certainty, the maximum concentration of each contaminant in the affected wells was used as the exposure point concentration. This approach is consistent with current U.S. EPA guidance (May 1991). Based on the observed rate of groundwater clean-up at municipal well BW2 (i.e., approximately 4 years) it is likely that over a 30-year period, such an assumption may overestimate the actual exposure point concentration that potential on-Site residents may receive.

Conversely, it is not known whether the levels of groundwater contamination have plateaued, and therefore, this assumption may not be as conservative as is assumed. To calculate future land use exposures, concentrations of contaminants in the aquifer were assumed to remain constant (i.e., steady-state conditions).

7.3.3.2 Soils, Surface Water, and Sediment - The lesser of the 95% UCLM or maximum chemical concentration detected in a particular group of soil, sediment, or surface water samples for an operable unit were used as human exposure estimates. Similar to groundwater, future exposures were based on steady-state conditions and again the lesser of the 95% UCLM or maximum value was used.

7.3.3.3 Air - Contaminant releases to air due to volatilization from the pond were modeled for this risk assessment. A baseline emission estimate was generated based on the exposure point concentrations calculated for contamination in pond sediment, soil borings, auger probes, and test pit samples. Two emission rate models were used in combination to assess the release of contaminants from pond surface water, and exposed/buried sludge. These emission rate models were obtained from the Superfund Exposure Assessment Manual (SEAM; U.S. EPA, 1987). A screening level dispersion model provided in SEAM was then applied to obtain downwind exposure point concentrations. For each receptor group (e.g., trespassers), the predicted air concentrations for 100m downwind of the pond area were used as exposure point concentrations. One hundred meters (100m) is the closest distance from the source area for which the model could calculate air concentrations, and, therefore, this distance was used by default for assessing on-Site residential exposure to pond area emissions. Refer to Appendix V for the complete details on the application of these models to arrive at exposure point estimates for contaminants released to air from these two sources (i.e., surface water, sludge) within the pond area.

Again, without the use of sophisticated predictive models, chemical concentrations used were assumed to remain at steady-state conditions for future land use exposure calculations.

7.3.4 Quantification of Human Exposure Estimates

Exposure is defined as the contact of an organism with a chemical or physical agent. Levels of exposure are quantified to allow comparison with exposure levels corresponding to adverse health effects. In this assessment, exposure (intake or dose) is normalized for time and body weight, and is expressed as mg chemical/kg body weight-day (mg/kg-d). Estimates of contaminant exposure can be derived using the following general equation:

$$\text{Contaminant Dose Estimate} = \text{Exposure Point Concentration} \times \text{Contact Rate} \times \text{Exposure Frequency and Duration} \times \frac{1}{\text{Body Weight}} \times \frac{1}{\text{Averaging Time}}$$

AR303536

The contaminant dose estimate may represent either an "administered" or "absorbed" dose. An administered dose refers to a contaminant exposure which occurs at an exchange boundary of an organism. For example, exposure via ingestion (drinking groundwater) is based on delivery of the contaminant to the gastrointestinal tract. Equations which estimate doses for some exposures incorporate a variable which accounts for absorption of the contaminant across the exchange boundary into the blood stream. This estimate is referred to as an "absorbed dose estimate." The distinction between administered and absorbed dose estimates is necessary for proper comparison with toxicity information, as is further described in the Toxicity Assessment (Section 7.4.2).

For each pathway and route of exposure there is a specific equation used to estimate chemical intake. The equations used for calculating estimates of chemical intake for each subpopulation are provided in Table 7-5.

7.3.4.1 Key Factors Which Determine the Magnitude of Chemical Exposure - The factors in the generic equation above were used to estimate intake, exposure point concentrations, contact rate, exposure frequency, exposure duration, and body weight. The exposure point concentration is an estimate of the concentration of the contaminant in a medium to which a person may be exposed. Contact rate is an estimate of the amount of a medium that a person ingests, contacts and inhales on a daily basis. The exposure frequency represents the number of days per year that a person is exposed to the contaminated media, while the exposure duration represents how many years a person is anticipated to be exposed to the medium. The body weight represents the average weight of the male and female population over the anticipated exposure duration.

An additional factor in the chemical exposure equation is "averaging time," which normalizes the chemical dose over a specified period of time. For chemicals which are potential carcinogens, dose estimates are normalized over a 70-year lifetime to allow comparison with toxicology information which is generated from studies in which the test species is exposed to the chemical over the majority of its lifetime. Dose estimates which are used to assess the non-cancer effects of chemicals are normalized over the period of exposure (defined as the exposure duration).

The following are examples of the application of the averaging time. Recently published national statistics on the number of years spent by an individual in a home estimated the 90th percentile duration to be 30 years (U.S. EPA, 1989). Thus, the averaging time for carcinogens versus noncarcinogens is 70 years and 30 years, respectively. There are instances where the exposure period is less than 30 years (e.g., child playing on-Site - 10 years). In these cases, the averaging time

AR303537

for carcinogens is still 70 years, however, noncarcinogenic effects of chemicals are normalized over the assumed exposure duration (e.g., 10 years).

A summary of the exposure factors used to calculate health risks are presented in Table 7-6 with a brief explanation of their source. The most recent U.S. EPA guidance states that actions at Superfund Sites should be based on an estimate of the "reasonable maximum exposure" expected to occur under both current and future land use conditions. The reasonable maximum exposure (RME) is defined as the "highest exposure that is reasonably expected to occur at a Site" (U.S. EPA, 1989). The intent of the reasonable maximum exposure is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possibilities. Each exposure factor has a range of possible values. In accordance with the guidance, this assessment has used values for the exposure factors that result in an estimate of the reasonable maximum exposure. The 90th or 95th percentile (i.e., quantile) value for the factor is normally used to approximate the RME estimate.

The following sections discuss the major exposure factors used to represent exposure to media. For each medium, a discussion of the applicable route-specific exposure factors is also included.

Groundwater/Surface Water Exposures
Exposure to contaminants through the use of groundwater as a water supply source from the contaminated aquifer was estimated for the ingestion, dermal absorption, and inhalation routes of exposure.

Ingestion This assessment follows the U.S. EPA's standard set of exposure assumptions to describe exposure through ingestion of drinking water (U.S. EPA, 1989). These assumptions include an ingestion rate of 2 liters per day for drinking water.

An ingestion rate of 0.05 L/hr (U.S. EPA, 1989) was used for incidental ingestion of surface water while wading in the pond. This value is normally used to assess the ingestion rate of surface water while swimming, but was used in this assessment as a conservative value.

Dermal Absorption Exposure through dermal absorption is a function of more variables than ingestion, and there is no standard set of exposure assumptions. The assumptions used in this assessment are based on recent U.S. EPA guidance and professional judgment.

Exposure via dermal absorption is a function of permeability of the skin, skin surface area exposed, and length of exposure. Chemical-specific permeability constants are used to assess the rate of passage of chemicals from water through the skin. Chemical-specific permeability constants are not available for all contaminants. Where they are not available, using an equation provided by the Environmental Criteria and Assessment Office (ECAO), they were estimated (ECAO 11-1-1991). Refer to Table 7-7 for the chemical-specific parameters used to calculate the dermal permeability constants, and Table 7-8 for the methods used to calculate the chemical- specific dermal permeability constants. It was assumed that dermal absorption of chemicals in water occurs through the use of groundwater while showering, and when people recreate on-Site and become exposed to pond surface water.

Inhalation Presently, there is no standard method for estimating the level of VOCs released from water use to household air. Typically, the amount of inhalation of VOCs while showering and grooming in the bathroom after showering is estimated to assess the risk from this pathway.

The methods used to model the VOC air concentrations while showering are provided in Appendix W. Inhalation of volatiles released from contaminated pond surface water was modeled, but emissions from this source were added to other pond area emissions and will be discussed further under air exposures.

Soil/Sediment Contact Exposures

Exposure to contaminants in soils and sediments were assumed to occur through dermal absorption and incidental ingestion. Populations considered in both current and future land use scenarios (e.g., trespassers, hypothetical on-Site residents) were considered to have some degree of soil exposure. The exposure variables have been adjusted accordingly based on the population exposed. For specific information regarding the exposure variables associated with each population and route of exposure refer to Table 7-6.

Incidental Ingestion Standard assumptions were used to calculate incidental ingestion of soil/sediment. Contact was assumed to occur 6 months per year when weather is conducive for on-site recreational activities. Standard ingestion rates of 200 mg soil/day and 100 mg soil/day were used for children (i.e., 1 to 6 years old), and older children and adults, respectively (U.S. EPA, 1989, 1991). When an exposed population was anticipated to ingest soil during both periods in their development, then a time-weighted soil ingestion rate was used.

The fraction of soil ingested from a contaminated area (FI) is used to determine the proportion of the soil ingested from a contaminated area each day. The soil ingestion rate used in this assessment reflects the amount of soil ingested outdoors, and dust ingested indoors by children each day over their approximately 16 waking hours.

Under current site conditions, for those days when children were on-Site, it was considered reasonable to assume that children would play four hours on-Site (4/16 or 1/4). Of the time spent on-Site, it was assumed that children spent 1/10th of their time in a specific contaminated area. Therefore, a FI of 1/40th (i.e., 1/4 x 1/10) was used to assess soil/sediment exposure **for each given area** under current land use conditions. Based on these assumptions the FI value (i.e., 1/40th) was derived for current land use conditions. It should be noted that the lower FI value used in this report deviates from that normally used by U.S. EPA Region III. The lower FI value was approved on a site-specific basis as appropriate for the Saegertown Site by U.S. EPA Region III, based on the reasons presented above.

Dermal Absorption As with dermal absorption of contaminants from water, there is no standard set of exposure assumptions for dermal absorption from soil or sediment. Dermal absorption of soil/sediment is a function of permeability of the skin, surface area exposed, soil/sediment deposition, and length of exposure. Estimates of the rate of absorption of chemicals from soil/sediment are not available for most contaminants so the method recommended by ECAO was used (U.S. EPA, 1991).

ECAO recommended conducting quantitative assessments of exposure for only the following compounds using the percent absorption estimates indicated:

- PCBs: 1-10 %
- DDT, DDD, DDE: 10-30%
- Cadmium: 0.1 %

For all other compounds, ECAO recommended the following qualitative approach:

Volatiles - Assume that dermal contact with these compounds in soil will not significantly increase risk over risks caused by other pathways of exposure to soil.

Other organics and inorganics - Assume that dermal contact with these compounds in soil may cause comparable risks to direct ingestion of the soil.

The above approaches were applied for exposure to soil and sediment at the Site.

Air Exposures
Based on current and future land-use conditions, it was assumed that fugitive dust emissions due to wind erosion would not likely result in a substantial pathway of human exposure due to vegetative cover on-Site. On the other hand, it is evident,

based on Site conditions, that contaminants are being released to ambient air from the pond area due to volatilization.

Inhalation. Based on current U.S. EPA guidelines (U.S. EPA 1991), 20 cubic meters per day is to be used as a reasonable worst case estimate for the inhalation rate for residents and workers. This estimate has been used for off-Site and on-Site residential exposure scenarios, and on-Site workers. For trespassers, activity-specific inhalation rates (m^3/hr) were used in conjunction with the time (hours) they were assumed to be on-Site to develop a daily inhalation rate (m^3/day) (refer to Table 7-6).

7.3.4.2 Calculated Chemical Exposure Estimates - Utilizing the exposure point concentrations (Table 7-4), exposure equations (Table 7-5), and population and medium specific exposure factors (Table 7-6), chemical exposure estimates were calculated. Refer to Appendix X for a summary of the chemical exposure estimates for each pathway.

7.4 TOXICITY ASSESSMENT

This section addresses the nature of the toxic effects which may result from exposure to the chemicals of potential concern. The risk assessment addresses two general types of toxicities which may result from chemical exposure; carcinogenic and noncarcinogenic effects. Because these two broad types of toxicity are assumed to be expressed through different biological mechanisms, the methods used to quantify these effects are different.

7.4.1 Dose-Response Relationship

The type, severity, and frequency of occurrence of a given toxic effect observed within a population (response) is a function of the magnitude of chemical exposure (dose). Different chemicals which produce similar toxicities within a species usually do so at different concentrations (i.e., have different toxic potencies). These relative differences in the dose-response relationships among chemicals are addressed in the risk assessment by considering "critical toxicity values" developed by the U.S. EPA. Critical toxicity values have been derived for potential noncarcinogenic effects and potential carcinogenic effects of the chemicals and are termed reference doses (RFD) and slope factors (SF), respectively.

Two sources of critical toxicity values were used. The primary source was the U.S. EPA's Integrated Risk Information System (IRIS) database. A secondary source of data was the Health Effects Assessment Summary Table (HEAST; U.S. EPA 1991c) published yearly by the U.S. EPA. Critical toxicity values were not available for some of the chemicals of potential concern. To establish those toxicity values, the Environmental Criteria and Assessment Office (ECAO) had been contacted to provide additional values and guidance, as appropriate. Refer to Table 7-8 for a summary of the toxicity values as well as their sources.

7.4.1.1 Noncarcinogenic Effects - Noncarcinogenic effects of chemicals are assumed to display a threshold phenomenon; i.e., effects are not observed below a given chemical concentration (threshold dose). Therefore, a health risk is thought to exist only if established threshold doses are exceeded.

Noncarcinogenic health effects include a variety of toxic effects on body systems such as renal toxicity (toxicity to the kidney), teratogenicity (damage to the developing fetus), and central nervous system disorders. In many cases, organisms have adaptive mechanisms that must be overcome before a toxic endpoint (effect) is manifested. The toxicity of a chemical is assessed through a review of toxic effects noted in short-term (acute) animal studies, long-term (chronic) animal studies, and epidemiological investigations.

The noncarcinogenic dose-response relationship is addressed in the toxicity assessment by considering RFDs, expressed in mg contaminant/kg body weight-day, which are levels of contaminants not expected to cause adverse health effects in humans, including sensitive subsets of the population. RFDs are generally estimated from No-Observed-Adverse-Effect-Levels (NOAEL), determined from animal studies, are the highest chemical dose which produce no adverse effects. Safety factors related to various assumptions made (e.g., animal to human extrapolation) are incorporated in the derivation of the values to result in a more health-protective estimation. These safety factors, cumulatively, may result in an extra margin of safety of up to a factor of 10,000. In general, the net result is that RFDs generate risk estimates which are biased toward over-estimation.

RFDs for some inorganic compounds are for specific forms (e.g., hexavalent and trivalent chromium). However, the chemical analyses performed do not report concentrations of specific forms, but rather give results in terms of "total" inorganic chemical. In such situations, it was assumed that unless otherwise known, the most toxic form is present and its RFD used.

7.4.1.2 Carcinogenic Effects - Presently, in the risk assessment process, all carcinogens are considered to have a dose-response relationship with no threshold. Thus, theoretically, any exposure is associated with some degree of risk.

The cancer potentials of carcinogens are known with varying degrees of certainty, depending on the amount and quality of scientific information available. The U.S. EPA has developed a system to review this information and to classify chemicals as to their likelihood of causing cancer. For example, this classification scheme distinguishes between chem s which are known human carcinogens (Group A) and chemicals which are pr ble human carcinogens (Group B), based on their cancer causing properties in animal studies. The dose-response relationship for an established or potential carcinogen is incorporated into the SF; a value expressed in $(mg/kg\text{-}d)^{-1}$, which is directly proportional to the cancer potency of the chemical.

7.4.2 Critical Toxicity Values and Toxicity Profiles

The critical toxicity values (RFDs and SFs) used in the present risk assessment are shown in Table 7-8. For each chemical, with the exception of PAHs, a chemical toxicity value (either noncancer or cancer) derived based on toxicity data specific to the chemical was used to assess its toxic potential. In the case of PAHs, the carcinogeneity of benzo (a) pyrene (B(a)P) is well documented. For most other potentially carcinogenic PAHs, the amount of available reliable cancer test data is too limited to derive a slope factor. For this reason, as a conservative measure, the slope factor for B(a)P is normally applied as a surrogate slope factor for other potentially carcinogenic PAHs. It should be noted that although this approach is still considered the standard by the U.S. EPA headquarters, the agency is considering a new approach which would utilize cancer potency estimates for other carcinogenic PAHs, relative to B(a)P's cancer potency. The latter approach has recently been adopted by U.S. EPA Region III after the draft BRA was submitted. For this reason the former approach was retained for use in this risk assessment. Toxicity values are generally based on the level of a chemical "administered" to a test animal. This situation does not account for the ability of the animal to absorb the compound into the blood stream. Toxicity values can be adjusted to account for this factor by incorporating an estimate of the level of absorption which is likely to occur. In the present risk assessment, it was necessary to adjust toxicity values based on "administered" doses to an "absorbed" dose basis, because contaminant dose estimates calculated for the dermal route of exposure provide an "absorbed" dose estimate. Thus, all contaminant dose estimates for all dermal exposure routes were compared to adjusted oral toxicity values to estimate health risk. The following equations were used to arrive at the adjusted toxicity value (RAGS, 1989):

Oral Reference Dose (Administered) x Oral Absorption Estimate = Dermal Reference Dose (absorbed)

Oral Slope Factor (Administered)/Oral Absorption Estimate = Dermal Slope Factor (absorbed)

Refer to Table 7-8 for the oral absorption estimates and dermal reference doses.

Toxicity values are based on a "critical" toxic effect in an animal. These are generally the most sensitive effects observed (those detected at lowest doses). The critical effects for the chemicals of potential concern are listed in Table 7-9. The uncertainty factor used to develop the reference dose and the U.S. EPA carcinogen classification for potential carcinogens are also summarized in Table 7-9.

7.5 RISK CHARACTERIZATION

In this section, estimates of contaminant exposure are compared with toxicity information to arrive at an estimate of potential human health risk. Two general types of toxicity endpoints are evaluated for chemicals of potential concern in this assessment; i.e., cancer and non-cancer effects. Because the assumptions related to how chemicals produce carcinogenic effects and noncarcinogenic toxicities differ, the methods employed to quantify these risks also differ, and are described below.

7.5.1 Procedures Used to Quantify Health Risk

The following sections summarize the methods used to quantitate risks for noncarcinogenic and carcinogenic effects, respectively.

7.5.1.1 Noncarcinogenic Effects - Estimating the risk of a non-cancer health effect was accomplished by calculating a hazard quotient (HQ) for each chemical, except lead (refer to section 7.5.1.2). The HQ for a chemical is calculated by dividing the estimated contaminant exposure dose estimate by the reference dose for the chemical as shown below:

$$\text{Hazard Quotient} = \frac{\text{Contaminant Dose Estimate (mg/kg-d)}}{\text{Reference Dose (mg/kg-d)}}$$

For a given exposure pathway, the HQs for all chemicals of potential concern are added to arrive at a total. This value is referred to as the hazard index (HI) for the exposure pathway. If the HI (or HQ) exceeds unity (1), there may be a potential health risk associated with exposure via the particular pathway (or chemical) evaluated.

It is generally thought that chemicals act additively when they affect the same organ system. Chemicals were segregated by organ system if the HI for a pathway exceeded 1, and no individual chemical had an HQ in excess of 1. Organ-specific HIs were then recalculated. If organ-specific HIs did not exceed unity, then it was concluded that it would be unlikely that the multiple chemical exposure would cause a health effect in the population.

7.5.1.2 Noncarcinogenic Effects- Lead. Lead has been the most studied toxic heavy metal because of its wide use and varied toxic end points. In general, toxic effects to humans for lead are associated with a given range of blood lead concentrations. The blood lead concentration range differs depending upon the age of the population (i.e., young children or adults). Young children are known to be the most sensitive subpopulation to lead exposure. For this assessment, the U.S. EPA's Lead Uptake/Biokinetic model (version 0.5) was used to predict blood lead concentrations in young children (i.e., ages 0 to 6) due to lead exposure from multiple media (e.g., soil, water).

The model provides default lead intakes and absorption parameters for air, diet, drinking water, soil and dust, and paint. It also provides a default maternal blood-lead concentration which is used to estimate the child's initial blood-lead concentration at birth. For each operable unit where lead was considered a chemical of potential concern, the model's default assumptions of lead exposure were applied except for those media (i.e., soil and groundwater) where Site-specific information was available. The following are the values used for specific operable units for groundwater and soil lead concentrations.

	Soil (mg/kg)	Groundwater (ug/L)
GATX		
- Sludge Area	150	1.5
- Pond Area	3,400	1.5
Lord		
- Impoundment Area	33	3.5

The above values, represent the exposure point concentration calculated for the specific area within the operable unit with the exception of the GATX lead groundwater concentration. One-half of lead's groundwater SQL (3 ug/L) was used to assess the exposure point concentration in this medium on the former GATX property, since it was not detected in groundwater in this area.

The model utilizes the estimates of lead intake from each medium, along with absorption estimates for each medium to predict the total absorbed dose of lead to an average individual. The absorbed dose estimates are used with information on the toxicokinetics of lead in the human body to estimate geometric mean blood-lead concentrations in children.

The resultant geometric mean blood-lead concentration calculated from a model run are compared to a blood lead concentration that is considered safe for children (i.e., 10 ug/deciliter (dl) : model default value). Using this safe blood lead concentration as an RfD, a HQ for lead can be calculated using the following equation.

$$\text{Hazard Quotient(HQ) -Lead} = \frac{\text{Modeled Blood Lead Concentration (ug/dl)}}{\text{Safe Blood Lead Concentration (ug/dl)}}$$

The HQs-lead were utilized like all other chemical HQs, however were not combined with the other HQ values to determine total pathway risks for a medium within an operable unit. Rather, the health risks associated with lead were discussed separately for applicable operable units, because the model predicts results only for children from birth to age six. It would be inappropriate, for example, to combine other chemical risks for trespassers (older children ages 7 to 16) with lead risks to younger children (birth to 6 years).

In addition to the HQ estimates, a quantitative assessment of the proportion of the population having blood-lead concentrations above the criteria value (i.e., 10 ug/dl) was assessed. This was accomplished by estimating the S-shaped distribution curve which relates the percentage of the population having a given blood-lead concentration. The distribution curve is predicted by using the estimated geometric mean (GM) blood-lead concentration from the model run, and an assumed geometric standard deviation (GSD) for blood-lead concentrations within the population. A GSD of 1.7 recommended by the U.S. EPA (Region III) was used for this assessment. A discussion of the model results are provided in the Public Health Evaluation (Section 7.5.3).

7.5.1.3 Carcinogenic Effects - The cancer risk (CR) value is an estimate of an individuals' lifetime likelihood of developing cancer over and above the existing background chance of developing cancer. A cancer risk of 1×10^{-6} (i.e., 1e-06), for example, may be interpreted as an increased risk of one in one million of developing cancer over a person's lifetime. This risk may also be interpreted on a population basis, to predict that one additional case of cancer may occur in a population of one million people.

The CR is estimated by multiplying the estimated contaminant dose by the slope factor for the chemical as shown below:

Cancer Risk = Estimated Contaminant Dose (mg/kg-d) x Slope Factor (kg-d/mg)

The CR associated with specific chemicals within an exposure pathway are assumed to be additive. Therefore, CR for individual chemicals are summed to arrive at a total exposure pathway CR. Risks have been added across pathways, and populations, as appropriate, to evaluate the maximum potential exposure of a population that is reasonably expected to occur from Site conditions.

7.5.2 Superfund EPA Health Risk Goals

The U.S. EPA has developed program goals for potential health risks estimated from exposure to contaminants at Superfund Sites. For chemicals which may cause non-cancer health effects, acceptable exposure levels are intended to represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (i.e., a HI of less than 1 or equal to 1). For known or suspected carcinogens, the $1x10^{-6}$ risk level is used by U.S. EPA as a "point of departure" for determining remediation goals. Risks at or below this point of departure are not considered to be of concern. Cancer risks which are between $1x10^{-6}$ and $1x10^{-4}$ may or may not be acceptable depending on other risk management factors (e.g., ARARs, nature of exposure, efficacy of treatment technologies, cost, and others) applicable to the Site.

7.5.3 Public Health Evaluation

Potential health risks were evaluated for contaminant exposures based on two land-use scenarios: current Site conditions and possible future Site conditions. As part of these evaluations, risks to groundwater, surface water, soil, sediment, and air (via contaminant volatilization from soils/sediments) were assessed. In addition, a number of potentially exposed populations were assessed based on their proximity to the Site (on-Site or off-Site) and the particular land use assumed (industrial (current) and residential (future)). The risks, based on the exposure assumptions and conditions provided in this assessment, are discussed below. Refer to Table 7-10 for a summary of health risks for each potentially exposed population by operable unit and medium based on current and potential future land use conditions. Refer to Appendix Y for chemical specific risk estimates.

7.5.3.1 Summary of Potential Health Risks Based on Current Land Use - Current land use health risks associated with exposure to contaminated Site media were evaluated for on-Site trespassers and workers, and off-Site residents for applicable operable units. Risks were quantitated for the following operable units under current Site conditions:

- GATX
- LORD

Risks were addressed qualitatively for the following operable units:

- SMC
- SCI
- Drinking Water Wells
- French Creek

AR303547

As referred to previously in this risk assessment, risks are based on hypothetical exposure scenarios and do not reflect actual risks. The risks quantified are approximations of potential health hazards that should be viewed as relative risks, rather than as actual risks. For example, the air concentrations used to calculate off-Site resident risks are modeled and likely to overestimate the actual concentrations of chemicals downwind of the Site.

The following is a presentation of potential health risk based on current land use conditions by operable unit.

GATX

Risks were estimated for potential exposure of on-Site workers, on-Site trespassers, and off-Site residents to media on the GATX property. The following is a summary of both the non-cancer and cancer risks associated with each potentially exposed population.

Summary of Potential Health Risks to Trespassers. Trespassers (older children playing on-Site) were assumed to be exposed to contaminants in several media at the Site. These media included air, surface water and sediment (i.e., dry and exposed) in the pond area, and surface soil in the rail siding and former sludge bed/lagoon areas.

The air risk estimates calculated for this pathway assume the trespasser would not live in close proximity to the Site. If the trespasser is a nearby resident, the air risks based on the off-Site residence scenario would be more applicable.

Table 7-10 provides a summary of hazard indices and cancer risks for this population. Tables Y-1 through Y-5 in Appendix Y contains chemical-specific, route-specific, and total pathway risks for each medium trespassers would potentially be exposed.

Based on current land use conditions, non-cancer health effects would not be expected to occur to trespassers, since the total HI ($9x10^{-2}$) was less than 1.

The cumulative cancer risk for an on-Site trespasser exceeded one-in-a-million due to the incidental ingestion of surficial sediment (CR= $5x10^{-5}$). The majority (94%) of the cancer risk was associated with ingestion of carcinogenic PAHs from the pond area sludge.

Dermal contact with pond sediment (i.e., dry and exposed) would approximately double the total risk (either non-cancer or cancer) estimate for the GATX pond area, based on the assumption that the risk due to dermal contact with sediment is equal to the risk associated with ingestion of sediment.. A large number of volatile and semivolatile TICs were detected in pond sediment, therefore, risk estimates may have been under estimated for this source area.

Other areas on the GATX property did not pose a noncarcinogenic or carcinogenic risk to trespassers, under current land use conditions.

Potential Health Risks to Off-Site Residents and On-Site Workers. Off-Site residents and on-Site workers were considered to be exposed only to contaminants released to air due to volatilization from the pond area under current land use conditions (i.e., not considered to be exposed to other media). Total pathway risks (non-cancer and cancer) are summarized in Table 7-10. Table Y-6 and Y-7 in Appendix Y contains chemical-specific, route-specific, and total pathway risks for the on-Site workers, and off-Site residents, respectively.

Based on current land use conditions, it was estimated that exposure to contaminated air would not pose a non-cancer health risk (i.e., HI<1). The HIs for on-site workers and off-site residents were $1x10^{-2}$ and $2x10^{-2}$, respectively.

On the other hand, it was estimated that exposure to contaminated air would pose an unacceptable level of cancer risk (i.e., CR$\geq$$1x10^{-6}$). The CR for on-site workers and off-site residents were $1x10^{-5}$ and $3x10^{-5}$, respectively.

Lord

Trespassers were assumed to be exposed to surficial sediments in the former impoundment area under current Site conditions. Table 7-10 provides a summary of hazard indices and cancer risks for this population. Table Y-8 in Appendix Y contains chemical-specific, route-specific, and total pathway risks for trespasser exposure to surficial sediments.

Based on current land use conditions, noncarcinogenic or carcinogenic health effects would not be expected to occur to trespassers on the Lord property. In assessing non-cancer or cancer risks for the trespasser scenario, none of the HIs or CRs for the exposure pathway exceeded 1 or $1x10^{-6}$, respectively. The total HI and cumulative CR assuming trespassers ingested surficial sediment was $1x10^{-4}$ and $4x10^{-11}$, respectively. Because these risk estimates are far less than their respective criteria of acceptability (i.e., HI=1 and CR= $1x10^{-6}$), the dermal exposure route would not be expected to be of concern. Therefore, under current land use conditions, the Lord property does appear to pose a health concern.

SMC

Health risks were qualitatively addressed for the SMC property, because based on the RI analytical results and area conditions, the SMC property did not appear to pose a health concern. Based on results of soil gas samples, surficial

AR303549

contamination of the Site by volatile constituents was not detected. No surface soils were collected for organic or inorganic analyses, but subsurface soils contained only trace levels of toluene, which was determined to be the result of field sampling contamination. Metals in these soil boring samples were representative of natural background concentrations. Based on the analytical data, soil contamination did not appear to be present on the SMC property. In addition, the surface soil on the SMC property is vegetated which will minimize the potential for exposure to surface soil. Based on this evidence, the property surface soil was not considered to pose a health concern.

A single sediment sample collected from a drainage ditch near the northern boundary of the SMC facility contained low levels of benzoic acid, bis(2-ethylhexyl)phthalate, and arochlor 1254. No other organic analytes were detected in this sample, and metals were within background levels for soils (i.e., either surface or soil borings). The drainage ditch sampled drains a large watershed to the northeast of the SMC facility, and therefore, the source of these constituents would be difficult to determine conclusively.

The area where the sediment sample was collected is thickly vegetated, and therefore, exposure to this medium would not be expected to be appreciable for either trespassers or on-Site workers. Because of the low concentrations of the contaminants detected, and the low potential for exposure to sediment, this medium was not considered to pose a health concern.

SCI

Under current land use conditions, the SCI property was not considered to pose a health concern. Contamination was not detected in groundwater, and soil gas sampling did not reveal an indication of surficial contamination by volatile chemicals. No surface soils were collected for organic or inorganic analyses, but subsurface soil boring samples were collected. In the individual soil samples collected at various depths from a single subsurface soil boring (SB02-06), low levels of ethylbenzene, toluene, and xylene and PAHs were detected. The concentrations of ethylbenzene, toluene, and xylene ranged from 1 to 25 ug/kg. Based on the low toxicity of these compounds and their detected concentrations, these chemicals would not be expected to pose a health threat. PAH concentrations in subsurface soils were comparable to concentrations of PAHs in background surface soil. In addition, the surface soil at the SCI property is vegetated which would minimize the potential for exposure to surface soils. For these reasons, it would not be expected that the SCI property would pose a health risk to on-Site workers, or potential trespassers above background for the Site area.

Drinking Water Wells
Under current land use conditions, the Saegertown Borough municipal wells and private wells sampled were not impacted by Site contamination, and therefore, risks were not quantitated for this operable unit.

French Creek
Based on the analytical results, and fate and transport considerations, it was not concluded that the Site had impacted French Creek, and for this reason health risks were not quantitated for this operable unit.

7.5.3.2 Summary of Potential Health Risks Based on Future Land Use. Future land-use health risks associated with exposure to contaminated Site media were evaluated for development of a residence on-Site. Health risks have been summarized by operable unit for the following media:

- GATX - Pond Area Soils and Air; Rail Siding and Sludge Bed/Lagoon Area Soils
- LORD - Former Impoundment Area Soils, Groundwater
- SCI - Soils

Risks were addressed qualitatively for the following operable units:

- SMC
- Drinking Water Wells
- French Creek

Risks are quantitated for both non-cancer and cancer effects. As explained in Section 7.5.1, non-cancer risks are discussed separately for lead, and all other chemicals, because of the different methods used to estimate risks for lead.

GATX
Health risk estimates were calculated for potential residents on the GATX property for the following exposure pathways:

- Groundwater exposure via oral, dermal, and inhalation exposure

- Inhalation of contaminant emissions released from the pond area due to volatilization

- Incidental-ingestion of contaminated soil in the pond, former rail siding, and sludge bed/lagoon areas

- Dermal contact with contaminated soil in the pond, former rail siding, and sludge bed/lagoon areas (qualitative assessment)

- Consumption of homegrown vegetables grown on contaminated soil in the pond, former rail siding, and sludge bed/lagoon areas (qualitative assessment).

Total pathway risks (non-cancer and cancer) are summarized in Table 7-10 for potential residents on the GATX property. Tables Y-10 through Y-14 in Appendix Y contain chemical-specific, route-specific, and total pathway risks for the potential on-Site residents.

Assuming the property is developed as a residential area in the future, it may pose a health hazard based on the assumed exposure conditions. The total HI and CR, assuming residents were exposed to all media in each area of the property were 20 and $1x10^{-1}$, respectively.

The majority of the non-cancer risk was associated with incidental ingestion of soil from the pond area (HI=20). The non-cancer risks associated with the former sludge bed/lagoon area (HI=2) and property groundwater (HI=2) were also above 1.

The majority of the cancer risk was also associated with incidental ingestion of soil from the pond area (0.3). The cancer risks associated with ingestion of soils in the former sludge bed/lagoon area (CR= $4x10^{-3}$) inhalation of air from the pond area ($3x10^{-5}$), and domestic use of groundwater ($6x10^{-6}$) were also above one-in-a-million.

Based on the level of volatile and semivolatile contaminants (e.g., PAHs) detected in the pond and former sludge bed/lagoon areas, additional levels of risk may be incurred by residents due to direct soil contact and ingestion of contaminated homegrown vegetables. In addition, a number volatile and semivolatile TICs were detected in these areas, therefore, the calculated exposure point concentration and resultant risk estimates for some groups of chemicals may have been underestimated. Therefore, the risks estimates for these areas may have been underestimated.

The rail siding area did not pose either a non-cancer or cancer risk based on the quantitative risk estimates. Based on the low HI and CR estimates calculated for ingestion of rail siding area soils, the dermal pathway of exposure would not be expected to pose a health concern. In addition, based on the concentration of contaminants detected above Site-specific background concentrations within the rail siding area, and their low potential to bioaccumulate, consumption of homegrown vegetables would not be anticipated to be pose a health concern. Lastly, very few TICs were detected within the former rail area. Therefore, the risk estimates quantitated for the former rail area would not be expected to have been underestimated.

The following is a summary of the key chemicals and routes of exposure contributing the majority of the cancer and non-cancer risk for pathways of concern:

		Major Chemicals (% of total pathway risk)	
Pathway	Major Route	Cancer	Non-cancer
Pond Sediment	Oral	PAHs (98%)	Trichlorobenzene (10%) Naphthalene (39%) Mercury (33%)
Sludge Bed/Lagoon Soil	Oral	PAHs (97%)	Trichlorobenzene(16%) Naphthalene (54%) Arsenic (5%)
Pond Air	Inhalation	Trichloroethene (48%) Benzene (39%) Tetrachloroethene (6%) 1,1,2-Trichloroethane (5%)	HI<1
Groundwater	Oral	Benzene (45%) Tetrachloroethene(34% 1,4-Dichlorobenzene (16%)	Antimony (24%) Manganese (74%)

In addition to the above risk estimates, non-cancer risks were calculated for lead exposure associated with soil ingestion in the former sludge bed/lagoon area and pond area using the U.S. EPA's Lead Uptake/Biokinetic Model. Ingestion of soil-lead in the former sludge bed/lagoon area was not estimated to pose a health concern. The modeled average blood-lead concentration for children (birth to 6 years old) was 2.6 ug/dl (i.e., HQ=0.2), and the percentage of children potentially exceeding the blood-lead criteria concentration of 10 ug/dl was very low (i.e., 0.6%). On the other hand, ingestion of soil-lead in the pond area was estimated to pose a health concern. The modeled average blood-lead concentration for children was 30.5 ug/dl (HQ=3), and nearly all (98%) children exposed to pond soil would exceed the acceptable blood-lead criteria.

Lord

Health risk estimates were calculated for potential residents on the Lord property for the following exposure pathways:

- Groundwater exposure via oral, dermal, and inhalation exposure
- Incidental ingestion of soil in the former impoundment area
- Dermal contact with soil in the former impoundment area (qualitative assessment)
- Consumption of homegrown vegetables grown in the former impoundment area soils (qualitative assessment)

Total pathway risks (non-cancer and cancer) are summarized in Table 7-10 for potential residents living in homes on the Lord property. Tables Y-15 through Y-16 in Appendix Y contain chemical-specific, route-specific, and total pathway risks for the potential on-Site residents.

Assuming the property is developed as a residential area in the future, it may pose a health hazard based on the assumed exposure conditions. The total HI and CR, assuming residents were exposed to all media, were 7 and 0.02, respectively.

The non-cancer and cancer risk was associated with exposure to contaminated groundwater. The non-cancer and cancer risk estimates for groundwater exposure were 7 and 0.02, respectively. The primary contaminants contributing to the non-cancer risk estimate were 1,2-dichloroethene (24%), and tetrachloroethene (54%). The primary contaminant contributing to the cancer risk estimate was vinyl chloride (96%).

Ingestion of impoundment area soils was not estimated to pose a health risk to residents. Based on the low HI and CR estimates for ingestion of impoundment area soils, the dermal pathway of exposure would not be expected to pose a health concern. Based on the chemicals detected in impoundment soils above Site-specific background levels, and their low potential to bioaccumulate in plants, homegrown vegetable consumption would not be expected to pose a health concern. Also, very few TICs were detected in impoundment soil, and therefore, the exposure point concentrations and resultant risks calculated would not be expected to have been underestimated.

In addition to the above risk estimates, non-cancer risks were calculated for lead exposure as a result of ingestion of contaminated groundwater using the U.S. EPA's Lead Uptake/Biokinetic Model. Based on this assessment, ingestion of groundwater-lead was not determined to pose a health concern. The modeled average blood-lead concentration for children (birth to 6 years old) was 1.3 ug/dl (i.e., HQ=0.2) and the percentage of children potentially exceeding the blood-lead criteria concentration of 10 ug/dl was very low (i.e., 0.08%).

SCI

Health risk estimates were calculated for potential residents on the SCI property for the following exposure pathways:

- Incidental ingestion of SCI property soils
- Dermal contact with SCI property soils (qualitative assessment)
- Consumption of homegrown vegetables grown in SCI property soils (qualitative assessment)

Total pathway risks (non-cancer and cancer) are summarized in Table 7-10 for potential residents living in homes on the SCI property. Table Y- 9 in Appendix Y contains chemical-specific, route-specific, and total pathway risks for the potential on-Site residents.

Assuming the property is developed as a residential area in the future, ingestion of SCI property soils was not quantitatively estimated to pose a health risk to residents. Based on the low HI and CR estimates for SCI property soils, the dermal pathway of exposure would not be expected to pose a health concern. In addition, the chemicals detected in SCI property soils above background concentrations have a low potential to bioaccumulate in plants. Therefore, homegrown vegetable consumption would not be expected to pose a health concern. Also, very few TICs were detected in SCI property soil, and therefore, the exposure point concentrations and resultant risks calculated would not be expected to have been underestimated.

SMC

As under current land use conditions, the SMC property was not considered to pose a health risk under potential future land use conditions. Subsurface soil contamination was not detected at the SMC facility, therefore, other potential media impacts (e.g., groundwater contamination due to leaching of subsurface contamination) would not occur.

Drinking Water Wells

Based on the the location on-Site groundwater contamination, and direction of groundwater movement, off-Site contamination of groundwater is possible in the future. Municipal wells would not be anticipated to be impacted in the future, but select private wells in the path of the contaminant plumes have the potential to be impacted in the future. The concentration of groundwater contamination would be expected to decrease as it moves downgradient towards the private wells and it is likely that groundwater contaminants would discharge to French Creek before reaching the private wells. Therefore, risks posed to off-Site residents would be expected to be lower than for on-Site residents. This may pose an unacceptable level of health risk since the level of cancer risk on-Site is quite high. The magnitude of the future risk potentially posed by groundwater contamination for a particular group of private well users, will increase as the distance from the plume decreases.

French Creek

As under current Site conditions, French Creek is not anticipated to pose a health threat to recreational users under future Site conditions. Although groundwater is moving towards French Creek and may some day result in discharge of contamination to the Creek, the amount of discharge would likely be low, compared to the flow rate of the Creek, which would dilute the discharge to nondetectable and nontoxic concentrations. For this reason, recreational use of French Creek was not considered to pose a health concern in the future.

7.5.4 Uncertainties in the Risk Assessment Process

The risk assessment process incorporates numerous assumptions and is therefore associated with a great deal of uncertainty. Thus, calculated risk estimates are not to be construed to necessarily represent actual risks. Proper interpretation of health risk values requires consideration of the uncertainties and assumptions involved in the risk calculations.

The risk assessment uses hypothetical scenarios and conservative assumptions to quantify potential risks for current and future land uses which may or may not reflect actual risks. For instance, a trespasser is assumed to come on Site and be exposed to contaminants in several media. In reality, the behavior patterns of children (and conditions for Site trespass) near the Site are unknown, but Site trespass likely occurs to a far lesser extent than what was assumed for this risk assessment (i.e., the exposure assumptions overestimate Site risks).

In addition, it is not known with certainty what the Site will be used for in future. Estimates of exposure to media were used to assess health risks by making assumptions of what the Site and area around the Site may be used for in the future. For example, the groundwater calculations are based on the maximum concentrations of contaminants currently present in groundwater. This would likely overestimate the groundwater risks to future on-Site residents. Therefore, the risks calculated for groundwater are based on extremely conservative assumptions, the results of which should be viewed on a relative risk basis, rather than on an actual risk basis.

Assumptions are applied in each step of the process, including Site contaminant characterization, exposure assessment, toxicity assessment, and risk characterization. These assumptions may over- or under-estimate risks. Examples of some key uncertainty factors and assumptions applied in the risk assessment are described below, as well as indications of their biases.

- Assume Site is fully characterized. The presence of areas of contamination not identified may result in an underestimation of Site risks. This is the case for surface soils in operable units (e.g., SCI) within the Site where no data was collected during the RI.

- Assume identified chemicals are associated with the majority of Site health risks. The presence of highly toxic compounds not analyzed for or tentatively identified compounds for which little toxicity information exists may result in an underestimation of Site risks.

- Evaluating potential current and future risks (e.g., private well users and future residents) without consideration of the likelihood with which these scenarios may occur over estimates actual risks.

- Toxicity values may overestimate risk. Reference doses incorporate conservative uncertainty factors, and cancer slope factors estimate upper bound 95th percentile values.

- Risks/doses within an exposure route are assumed to be additive. This may result in an over- or underestimation of risk, because using this approach does not take into account antagonistic or synergistic chemical interactions.

- Critical toxicity values derived primarily from animal studies may over- or underestimate risk. There is a fundamental uncertainty in extrapolating animal toxicity data to humans. Several factors may introduce the uncertainty, including differences in species chemical absorption characteristics, pharmacokinetics, target organ sensitivity, etc.

- Behavioral patterns cannot be predicted with certainty. The Exposure Assessment Section identifies numerous assumptions that are applied to characterizing populations and their potential for exposure to Site contaminants. Exposure assumptions are conservative and likely overestimate risk. For example, drinking the water from the contaminated aquifer instead of utilizing clean municipal water.

- Models used to predict environmental fate and transport of contaminants may over- or underestimate risk. The air pathway models used have inherent uncertainty in their theoretical ability to accurately predict air concentrations of contaminants. For example, the air emission and air dispersion models used are conservative and overpredict the concentration of contaminants in air expected under actual Site conditions.

- Other major assumptions used in the risk assessment that would tend to overestimate Site risks include:
  - No remedial actions will take place and no restrictions will be placed on future land use of the Site.
  - There are no groundwater use restrictions.
  - There is the potential for future development of the Site.
  - Contaminant concentrations in various media are assumed to remain constant over time (as was noted previously for this assumption, this may result in an over- or underestimation of exposure. Assuming steady-state conditions does not account for future releases of unmitigated source materials (e.g., to groundwater) that may occur over time, nor does it account for source depletion and attenuation of materials through environmental fate and transport processes).

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ECOLOGICAL ASSESSMENT

8.1 INTRODUCTION

An ecological investigation of the Saegertown Industrial Area Site was performed as part of the RI. In addition, information concerning archaeological or historical resources in the Site area was researched, but none was found. The purposes of the investigation were to describe the ecological features of the Site area and to assess potential effects of Site contaminants on local ecological populations. The ecological assessment is based on analytical results of media of ecological concern, including surface waters and sediments of French Creek and the pond on the former GATX property, and shallow soils in the Site area. Chemical analyses are supplemented by observations of habitats, fauna, and flora in the Site area, inspection of potential wetland areas, and contact with state and federal agencies regarding endangered resources. A wetland/ecological delineation of any areas which could be affected by the selected site remedy will be required during the remedial design.

The ecological assessment includes the Site as described in Section 1.2 of this report and other areas in the Site vicinity, including French and Woodcock Creeks, and land within the Saegertown Borough. Borough areas include primarily residential land west of the Erie Lackawanna Railroad elevated grade, the industrial area of the Site, and rural residential, open, undeveloped fields, cultivated farmland, and woods. Riparian areas include the eastern bank of French Creek and the northern bank of Woodcock Creek.

8.2 METHODS

The Ecological Assessment was developed according to guidance provided by the U.S. EPA in the following references:

U.S. Environmental Protection Agency, 1989a. Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference. EPA/600/3-89/013.

AR303559

U.S. Environmental Protection Agency, 1989b. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), EPA/540/1-89/002. (RAGS, Vol. I)

U.S. Environmental Protection Agency, 1989c. Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, EPA/540/1-89/001. (RAGS, Vol. II)

The Site description was developed by observation of Site areas by a field biologist. Site observations were supplemented by species lists of mammals, birds, reptiles, and amphibians obtained from the U.S. Fish and Wildlife Services (U.S. F&WS) for the Erie National Wildlife Refuge, approximately 10 miles southeast of the Site. Many of these species may visit or live within the Site area. Information concerning endangered and threatened species was provided by the U.S. F&WS and by PADER.

Observations of the streams in the Site area, French Creek and Woodcock Creek, were included in the Ecological Assessment. Observations were supplemented by limited sampling for benthic macroinvertebrates according to a modification of U.S. EPA Rapid Bioassessment Protocol II (U.S. EPA, 1989d). The bioassessments of the streams were performed as a description of the creek habitats, rather than as an attempt to discern pollution sources. Information concerning fisheries was provided by the Pennsylvania Fish Commission.

Potential wetlands at the Lord Corporation were investigated according to the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation, 1989). Dominance of vegetation types in the potential wetland areas was noted by field observation, as were indications of wetland hydrology. A hand operated screw-type soil probe was used to collect soil samples to a depth of greater than 18 in. for examination for soil wetland indicators.

The Ecological Assessment addresses Site contaminants that likely represent the greatest hazard to biological populations, based on greatest toxicity or greatest detected concentration. The Ecological Assessment includes an evaluation of risk to ecological populations from the Site, based on the effects of selected Site contaminants to species representative of the Site area.

8.3 ECOLOGICAL DESCRIPTION

The Site area is generally rural around the Saegertown Borough, a small urban community. The Borough includes residential/commercial and industrial areas.

8.3.1 Site Description

The Site is comprised of four industrial properties:

Saegertown Manufacturing Corporation (SMC). The SMC area (approximately 9.53 acres) is the northernmost part of the industrial area, bounded by railroad tracks on the west, on the south by SCI, on the east by the slope of a hill and Crawford Street, and open ground on the north. The SMC property consists of a large manufacturing building, manicured lawns on the south, east, and north, asphalt parking on the north, and a thin (approximately 30 ft wide) band of tall grasses and herbaceous vegetation on the west. The Erie Lackawanna Railroad grade is not pronounced in elevation in this area. Northwest of the SMC lawn is a hill or mound, covered with tall grasses and herbaceous vegetation. Typical tall grass species include foxtail, quack grass, and switch grass, among other species. Herbaceous vegetation prominent in August 1991 includes common ragweed, Canada goldenrod, mullein, milkweed, burdock, wild carrot, and Canada thistle, among other species. Scientific names for cited species are included in Appendix Z-1.

The northern part of the SMC area is a continuation of the habitat to the north and northeast, primarily a crab grass hill and slope. This area provides habitat for some field mammal species, primarily rodents. The woods adjacent to the northern and northeastern sides of this area provide additional habitat for forest mammal species. Mammals potentially occurring in the Saegertown area are included in Appendix Z-2.

A small stand (approximately 6 ft diameter) of wetland vegetation, including cattails, softstem bulrush, and sedges, occurs in the drainage swale at the base of the hill northeast of SMC. The remainder of the swale and adjacent lawn and slope are mowed grasses. A soil probe was not able to penetrate beyond 6 in. into the brown silty-sand soil in five attempts, probably due to gravel. The soil type is Wyoming gravelly sandy loam according to the Soil Survey of Crawford County, Pennsylvania (U.S. Soil Conservation Service, 1979). This area is not considered a wetland based on the lack of a wetland soil indicator. Although a soil sample could not be obtained, the hand auger refusal supports the SCS observation that this is a gravelly area.

Spectrum Control, Inc. (SCI). The SCI area (approximately 6.94 acres) is bounded by Crawford and Erie Streets on the east and south, respectively, the railroad grade (approximately 15 ft high) on the west, with a fringe of herbaceous vegetation, and on the north by SMC. SCI consists of two buildings and two sheds, asphalt and gravel parking areas, and lawns. The SCI area presents little potential habitat for wildlife due to the development of the property.

General American Transportation Corporation (GATX). The former GATX property (approximately 62.44 acres) occupies the central part of the Site. It is bordered on the north by Erie Street, on the south by State Route 198, and on the west by the Erie Lackawanna Railroad grade. The eastern side is formed by a drainage ditch that intermittently carries stormwater to Woodcock Creek. Manufacturing or maintenance buildings are on the northern, southern, and southeastern parts of this area, with mowed lawns around them.

A pond, which has a fringe of wetland vegetation, is located on the southern part of the former GATX property. The pond is surrounded by a 6-ft high chainlink fence, with a second fence around an additional part of the low area.

In August 1991, the pond contained little water, only a few isolated pools (Appendix Z-8.-Photographs 1 and 2). Vegetation closest to the pond on its northern and western sides consisted of a dense bed of spike rush, with plants 6 to 8 in. high. On the outside perimeter of this spike rush occurred green bulrush, smartweed, and reed canary grass. A few red maple, red osier dogwood, upland grasses, and common ragweed occurred on higher elevations within the fenced area, including on the southern and eastern banks of the pond. Species present around the pond are included in Appendix Z-1. Based on the unvegetated area of the pond, the average water appears to cover approximately 0.47 acre. The vegetation around the pond appears to cover approximately 1.83 acres. This appears to be the extent of the wetland area.

In April 1992, the pond contained more water than it had six months earlier, with the open water covering approximately one half acre (Appendix Z-8, Photographs 3 and 4). Much of the spike rush was inundated at this time.

Other parts of the former GATX property include a public park consisting mostly of manicured lawn (4.93 acres) in the northeastern part, agricultural fields in the southeastern part (11.02 acres) near Multi-Plastics, Inc., and a gravel-based materials storage yard (3.09 acres) west of the Borough maintenance building. The remaining portion of the area (approximately 23.24 acres) consists of old field vegetation. This area includes most of the southwestern portion of the area and part of the northwestern and east central portions. Common plant species observed in this area are included in Appendix Z-1.

The old field area provides good habitat for a variety of small mammals and songbirds. Of the species listed in Appendix Z-2, many are likely to live or visit the area. With woodland habitat to the north and stream and limited wetland habitat to the south, the old field habitat likely supports partial use by species usually found in other areas. Wetland habitat available to wildlife throughout the year is the riverine wetland (R2OWH, see Appendix Z-5) associated with

Woodcock and French Creeks. This habitat is primarily a wooded or scrub band along both banks of Woodcock Creek and in a few areas along French Creek. The wetland habitat is typically 5 to 100 ft in width, but is not highly disturbed by human traffic. Mammals likely to use the area include rodents, shrews, moles, rabbits, woodchucks, and deer. Bird species frequenting the area are likely to be many. The U.S. EPA RPM has reported observation of a large number of animal burrows in the open field portions of the former GATX property, as well as many white-tail rabbits. The burrows are likely rabbit and/or woodchuck burrows. The GATX pond is available to waterfowl on a seasonal basis when sufficient standing water (but without complete ice cover) is present to allow landings and takeoffs. When sufficient water is present, the pond and its adjacent wetland could provide habitat for birds, small mammals, reptiles, amphibians, and invertebrates. At the time when Warzyn observed the pond wildlife was not observed. During a U.S. Fish and Wildlife Service visit, birds were observed.

Lord Corporation (Lord). Lord occupies the southern part of the Site, covering approximately 29.31 acres. The plant buildings and equipment, asphalt driveways and parking lots, and manicured lawns within a cyclone fence occupy approximately 23.70 acres. Most of the remaining part of the Lord area, south and east of the fence, is a short cut grassy field.

There are three stands of herbaceous, shrub, and tree vegetation on the southern side of the southern fenced perimeter of Lord. Vegetation and soils of these areas, designated A, B, and C on Drawing 60882-F15, are listed in Appendix Z-3. These areas do not appear to be wetlands, based on the soils, which appear to be fill soils. The native soils in this area are Pope loam and Plano silt loam, which are not considered hydric soils by the Crawford County office of the U.S. Soil Conservation Service (United States Department of Agriculture, 1979). Areas A and B appear to receive rainfall runoff and snow melt from impervious areas, based on the presence of discharge pipes feeding into these areas. Although some of the species listed in Appendix Z-3 are classified as facultative wetland or facultative (FACW or FAC) by the U.S. F&WS, the dominant species in the vegetated areas are not wetland species. In August 1991, by number of stems, common red raspberry was dominant in Area A, Canada golden rod and Joe-pye weed (FAC) in Area B, and Canada golden rod in Area C. These vegetated areas are not delineated as wetlands based on Warzyn field observations because they do not meet the criterion of having wetland soils.

8.3.2 Surrounding Area Description

The area around the Site is urban to the west and rural to the east. The area between the Erie Lackawanna Railroad grade (western Site boundary) westward to French Creek is urban, with little undeveloped land from north of the Borough southward to Woodcock Creek. West of French Creek, the land is rural with farms in the valley of Wolf Run, a tributary of French Creek, and wooded on the steep slopes rising above the French Creek valley. East of the Site, the area is rural except for a small residential subdivision east along Erie Street. Other areas are farmed or wooded.

The urban area of the Saegertown Borough is characterized by older (pre-1960) houses, small grassed yards, and mature hardwood tress (sugar maple, oak). Commercial establishments are located among the residences, except for a few clusters of stores or shops. Vegetation is not usually present around these establishments.

Other developed areas in the Site vicinity include a newer (post-1960) residential subdivision (Saegertown Heights) east off of Erie Street, the Borough wastewater treatment plant south of Woodcock Creek, and the manicured lawns on off-Site Lord and east of local Route 20141. Lesser developed areas include agricultural lands east of the Site and south, across Woodcock Creek, and west, across French Creek, from the Site. Short-grassed hillsides are northeast of the SMC property and northeast of the Multi-Plastics plant.

Terrestrial vertebrate species potentially occurring in the Site area are included in Appendix Z-2. These lists were developed from those provided by the U.S. F&WS as occurring at the Erie National Wildlife Refuge, approximately 10 miles southeast of the Site. Some of the habitats present at the Erie National Wildlife Refuge are likely to also be found in the Site area.

8.3.3 Prime Farmland

Prime Farmlands are designated by the U.S. Soil Conservation Service based on soil types. Some other soil types are considered Additional Farmland of State Importance by that Agency.

Within a 1-mile radius of the Site, approximately 30 percent of the land coverage is designated as Prime Farmland, mostly soils of the classification Po (Pope loam) and HvA (Haven silt loam) (see Figure 2). Approximately a third of this Prime Farmland, or 10% percent of the total land within the 1-mile radius area, is within the urban developed area of the Saegertown Borough. Much of the rest of the Prime Farmland is southeast of the Saegertown Borough. Approximately 30 percent of the land within the 1-mile radius of the Site is listed as Additional Farmland of State Importance. The soil types under this heading include CaC (Cambridge silt loam) and VnB (venango silt loam). Much of the Prime Farmland and the Additional Farmland of Statewide Importance was used as farmland, according to 1973 aerial photographic coverage of the area. Land that was not used for farming at that time was mostly urban property of the Saegertown Borough, with smaller areas being wooded.

Within a 2-mile radius of the Site, there is little additional Prime Farmland. Approximately 10 percent of the entire area within the 2-mile radius is designated as Prime Farmland, mostly of the soil types already described for the 1 mile radius land. Prime Farmlands between 1 and 2 miles from the Site are mostly to the northwest, along Wolf Run, and to the southeast along Woodcock Creek, from the site. Although there is little additional Prime Farmland in the 1-mile to 2-mile radius from the Site, much (approximately 50 percent) of this land is Additional Farmland of Statewide Importance. Soil types of this Additional Farmland of Statewide Importance are the same as those within the 1-mile radius receiving this designation. This Additional Farmland of Statewide Importance is distributed in all directions around the Site area within the 1-mile to 2-mile radius. According to the aerial photography of 1973, much of this land is farmed, although there are large areas of wooded property within the radius.

8.3.4 Floodplains

Portions of the Site and the surrounding area are within the 100-year floodplain of French Creek or Woodcock Creek defined by the Federal Emergency Management Agency (FEMA) (see Appendix Z-4). The French Creek 100-year floodplain is approximately 1,500 ft wide, mostly on the eastern bank of the creek. The western bank of the creek consists of high elevations near the channel of the creek. The eastern side of the creek has a fairly broad floodplain, approximately 1/2 mile in width. A 100-year flood results in a river channel depth of approximately 19 to 20 ft in French Creek. In Woodcock Creek, the 100-year flood channel depth is approximately 6 to 12 ft in the Saegertown Borough.

Portions of the Site are included within the 100-year floodplain. These areas are near State Route 198 in the southern portion of the Site. On the northern side of State Route 198 is a small area long the western side of the Site that is within the 100-year floodplain. This area drains to the west, under the State Route 198 railroad trestle, directly toward French Creek. Approximately 60% of the site area south of State Route 198 is within the 100-year floodplain. This area is subject to flooding from Woodcock Creek, but in an area of Woodcock Creek that is controlled by French Creek.

Most of the remainder of the Saegertown Borough that is within the 100-year floodplain is located on the western side of the Erie Lackawanna railroad tracks. The area within the 100-year floodplain includes approximately 60% of the residential and commercial area of the Borough. Other areas of the borough within the 100-year floodplain are west of the Site area, along Woodcock Creek. These areas are mostly undeveloped, except by farms.

8.3.5 Wetlands

Few designated wetlands are located in the Site area. The U.S. Fish and Wildlife Service Wetland Inventory Map (see Appendix Z-5) includes the following types of possible wetland designations in the Site area:

- POWZ - Palustrine, Open Water, Saturated/Semi-permanent/Seasonal
- PSS1A - Palustrine, Scrub/Shrub, Broadleaf Deciduous, Temporary
- PSS1E - Palustrine, Scrub/Shrub, Broadleaf Deciduous, Seasonally Saturated
- R2OWH - Riverine, Lower Perennial, Open Water, Permanent
- L1OWH - Lake, Limnetic, Open Water, Permanent.

There are ten locations marked with the POWZ designation in the Site area. These designations include the open water of small ponds, of less than 1 acre in size. Wetland vegetation is not denoted around the margins of these ponds on the Wetland Inventory Map. There are four locations designated PSS1A, one of which also includes forest vegetation. These areas are along small streams that flow into French Creek. These wetlands are designated temporary, which suggests they may be overflow areas of their drainage streams. Three of these PSS1A areas are northeast of the Saegertown RI/FS Site, across French Creek. The other PSS1A location is south of Woodcock Creek. The area designated PSS1E is a small pocket of less than one acre, indicated as temporary or seasonal, on an upland approximately 1/2 mile west of French Creek.

The open water (OW) designated areas have unknown bottom composition. The locations designated R2OWH include French and Woodcock Creeks. Streamside wetlands are not designated along these two creeks within the study area. The L1OWH designation is given to a reservoir approximately 2 1/2 miles northwest of the Site. This reservoir discharges to Brookhouser Creek, which flows into Wolf Run, a tributary that discharges into French Creek on the western side of Saegertown. Wetland areas are not designated around the perimeter of this reservoir.

The Wetland Inventory Map indicates few wetlands in the Saegertown area. This assessment contrasts with the Soil Conservation Service list of area wetland soils. Most of the soils designated as wetland, or hydric, are associated with streams or intermittent discharge paths in the Site area. There are also a few larger areas designated as having wetland soils, most of which are forested. The presence of steep terrain in much of the Site area may preclude the establishment of wetlands in larger areas. Most of the wetlands soils may be in small strips, which usually are inundated, and do not allow the establishment of appreciable wetland fringe or emergent vegetation.

Most of the floodplain and other stream valleys have already been developed with urban areas or farms. This development may have reduced the areas of potential wetlands within the floodplain to small areas.

Closer to the Site, wetlands are not designated on the Wetland Inventory Map. French Creek and Woodcock Creek have well-defined banks for much of their lengths in the Site area, limiting potential wetlands associated with these streams. As shown in Drawing 60882-F15, an area of approximately 2.18 acres on the western side of French Creek north and south of South Street is a palustrine, emergent, seasonally wet (PEMC) wetland. A lobe of bottomland adjacent to Woodcock Creek, south of the Lord Corporation, is a palustrine, emergent/forested seasonally wet (PEM/FOC) wetland of approximately 3.62 acres. Classifications are based on field observations according to Cowardin, et al. (1979).

8.3.6 Aquatic Resources

Aquatic resources in the Site area include Woodcock Creek and French Creek. Woodcock Creek is impounded approximately 4 miles upstream of the Site area by a U.S. Army Corps of Engineers dam. Downstream, from the dam to its discharge into French Creek southwest of the Site, Woodcock Creek is a meandering stream of approximately 30 to 40 ft width, and 1 to 2 ft depth. The creek is classified by the Pennsylvania Fish Commission as a cold water stream, containing typical coldwater fish species such as trout species and white suckers.

French Creek has its origin approximately 35 miles northeast of the Site, and runs from north to south on the western side of Saegertown. It discharges into the Allegheny River approximately 30 miles southeast of Saegertown. In the Saegertown area, French Creek is approximately 200 ft wide and varies in depth from 6 in. to 3 ft during period of late summer, low water. French Creek is classified as a warm water fishery by the Pennsylvania Fish Commission. Typical game species include small mouth bass, walleye, bluegill, and northern pike. Carp and various sucker and bullhead species comprise other large fishes in the Creek.

Sampling of invertebrate populations was performed at several location in Woodcock Creek and French Creek to assess the biological habitats of these streams. Dipnet and kick sampling was performed in available habitats at each location for a period of one-half hour. Samples were field sorted, and organisms were identified to family taxonomic level. Results are presented in Appendix Z-6. Diversities are expressed as the number of families present at each location.

Sampling station locations are shown on Drawing 60882-F16. A description of the locations and their available habitats is as follows:

- WC1 Woodcock Creek at local route 20141 has a sand, gravel, and rubble bottom, with some vegetation from the banks growing into the stream (reed canary grass) or hanging over the stream (shrub branches), providing additional habitat. The southern bank is low in places, with reed canary grass and jewel weed; otherwise, the banks are 1 to 2 ft high. The stream is well, but not completely, shaded. Pools are not present in the immediate area. Habitats sampled include rubble/sand bottom, overhanging vegetation and leaf packs, and short emergent grasses.

- WC2 Woodcock Creek at a natural dam 500 ft downstream of WC1 has a sand, gravel, and rubble bottom, with little aquatic vegetation or plant debris. There is some wood on and near the dam, with a silty stream edge on the northern bank in one location, and some overhanging shrubs in places. A field tile from the lawn to the north appears to drain in this area. The stream is approximately 1 to 2 ft in depth. The southern bank is approximately 1 ft high and well defined; the northern bank is more gradually sloped, approximately 1/2 to 3 ft high. The stream is well to heavily shaded. Habitats sampled include a rubble/sand bottom, overhanging vegetation and leaf packs, submerged wood, silty sand and gravel, and the pool bottom upstream of the dam.

- WC3 Woodcock Creek approximately 1,800 ft downstream of WC1 has as rubble and sand and gravel bottom, with a small area of emergent vegetation (grasses) and few areas of overhanging shrubs. The stream is 1 1/2 to 3 ft deep. The northern bank has a shallow inlet with a silt and clay bottom from the lawn area and field tile from Lord property. The northern bank is less than 3 ft high; the southern bank appears to be a sandy soil, vegetated with grasses, and 3 to 6 ft high. Most of the stream is unshaded. Habitats sampled include rubble/sand bottom, sand and gravel area, overhanging vegetation, and the rubble pool bottom.

- WC4 Woodcock Creek near its discharge into French Creek has a rubble, silty-sand bottom with many pieces of scrap metal from railroad track repair/replacement (metal plates, hooks, spikes). Emergent or overhanging vegetation is not present. The stream is one-half to 1 1/2 ft in depth. The northern bank is steep, approximately 3 ft high and vegetated with shrubs; the southern bank is very steep, greater than 6 ft high, and vegetated with mature hardwood trees. The stream is mostly shaded. Pools are not present in this area. Habitats sampled include a rubble/sand bottom, emergent grasses, and the stonewall of the railroad tressel.

- FC1 French Creek approximately 200 ft downstream of the mouth of Woodcock Creek has a rubble/sand bottom, with areas of submergent vegetation (water celery, curly leaf pondweed, and coontail). The creek here is less than 2 ft deep. The eastern bank is extremely gradual, with shrubs and hardwood trees further from the water edge. The western bank is steeply sloped, up to 6 ft high, and bare. The creek water level appeared to be 1 to 2 ft lower than normal conditions in late August 1991. Habitats sampled include a rubble/sand bottom, submergent vegetation, submergent wood, and pools.

- FC2 French Creek 60 ft downstream of the South Street bridge (same as SW03/SD03, approximately 20 ft downstream of the storm sewer outfall) has a rubble, sand, and silt bottom. Aquatic vegetation is not present in the immediate area. The stream is 1 1/2 to 3 ft deep. The eastern bank is steep (approximately 15 ft high), with a shelf approximately 1 ft above the water level, vegetated with upland grasses, herbaceous species, and trees (willows). The western bank is also steeply sloped, more wooded than the eastern bank. The eastern two-thirds of the stream is unshaded; the western third is shaded by the willows. Habitats sampled include a rubble/sand bottom, pool (with a rubble/sand bottom), and submerged wood.

- FC3 French Creek approximately 60 ft upstream of the South Street bridge (same as SW02/SD02) has a rubble/sand bottom, with areas of submergent vegetation (coontail, water celery, and curly leaf pondweed). The stream is less than 2 ft deep in this area. The eastern bank is steep (approximately 15 ft high), with a shelf 1 to 2 ft above the stream level, vegetated with grasses and herbaceous plants and trees (willows). The western bank is sloped, and well shaded by large trees. Habitats sampled include a rubble/sand bottom, submergent vegetation, and sand bottom.

The table in Appendix Z-6 indicates a similar number of families identified at the various stations sampled (15 to 20 families). This result suggests a uniformity to the benthic habitat availability in the Creeks. A lack of suppression of the number of families does not indicate an influence by chemical contamination. Available habitats were sampled at the creek stations. Some stations containing microhabitats, are described in the preceding paragraphs. These microhabitats were not present or were very limited, at other stations. This variable may be a greater influence on the number of reported macroinvertebrate families than the influence of potential chemical contaminants (U.S. Environmental Protection Agency, 1989d).

8.3.7 Special Designated Areas

Maps of the U.S. National Park Service, Fish and Wildlife Service, and PADER do not indicate federal or state wild or recreational properties in the Site area. The U.S. Army Corps of Engineers maintains Woodcock Creek Lake, a flood control and recreational reservoir of 15,250 acre-ft on Woodcock Creek, approximately 2.3 miles upstream (east) of the Site.

A 5-acre county park, Colonel Crawford County Park, is located on the south side of State Route 198 on the western bank of French Creek. A small public park (approximately 1.8 acres), consisting of a boat launch on French Creek and a parking lot, is located southwest of the Site. Islands in the Creek are wooded and undeveloped.

8.3.8 Threatened and Endangered Species

The potential presence of threatened or endangered species in the Site area was investigated by requesting the U.S. F&WS and PADER provide records of occurrences or sightings of such species from their natural diversity inventory. Responses from those agencies are included in Appendix Z-7.

Federally listed or proposed threatened or endangered species are not known to exist in the Site area based on agency responses included in Appendix Z-7, except for occasional transient species. State threatened or endangered species were not reported as occurring on the Site based on agency responses included in Appendix Z-7. The following state listed species occur or may occur in French and/or Woodcock Creeks:

- Fish: Etheostoma maculatum, spotted darter - endangered
  Etheostoma tippecanoe, tippecanoe darter - endangered
  Ichthyomyzon bdellium, Ohio lamprey-threatened
  Ichthyomyzon greeleyi, mountain brook lamprey-threatened
- Plants: Potamogeton richardsonii red-head pondweed-endangered

Darters found during the stream investigation include the rainbow darter (Etheostoma caeruleum) and the banded darter (Etheostoma zonale), but not the above-mentioned endangered species. Several aquatic plants were observed in French Creek (see Appendix Z-1), but the red head pondweed was not.

8.4 ECOLOGICAL MEDIA OF CONCERN

Sampling and analysis of Site media have indicated areas of contamination by organic and inorganic chemicals (see Section 5). Of the media sampled and analyzed, the following are of ecological concern:

- French Creek surface water
- French Creek sediment
- GATX Pond water
- GATX Pond sediment
- Shallow (≤ 4 ft depth) soils from Site areas

Shallow soils include soils collected from borings, auger probes, test pits, and three samples initially designated sediments, but which were collected in areas not usually inundated or classified as wetlands (SD07, SD08, SD09). Maximum values detected in Site media were compared with maximum background values (see Table 8-1). Maximum concentrations in Site samples two times those in background samples were assessed as potentially being of concern or requiring further evaluation. This is the approach used in U.S. EPA guidance documents (U.S. EPA, 1989b) Single occurrences of a contaminant, especially in the part per billion range, were not heavily weighed in evaluation of chemicals of concern.

Some metals, including calcium, iron, magnesium, potassium, and sodium, are not considered further as contaminants of concern. These metals are considered nutrients in mammalian systems (RAGS, vol. 1, U.S. EPA, 1989a), and are not considered hazards except in very high doses.

8.4.1 Background

Background samples were collected from media comparable to Site media. Surface water and sediment samples were collected from an upstream French Creek location for comparison with these media further downstream and with surface water and sediments from the pond on the former GATX property. Shallow soil samples were collected from areas on the eastern part of the Site, remote from industrial activities, for comparison with other shallow soil samples. Results of the background samples represent conditions in relatively undisturbed areas. A detailed discussion of site background conditions is presented in Section 5.2.

8.4.2 French Creek

Media sampled in French Creek include surface water and sediments. Samples were collected upstream and downstream of a Borough stormwater discharge outfall and downstream of the Site area prior to dilution from Woodcock Creek. Organic compounds were not detected in French Creek surface waters. Antimony, detected in one sample, and chromium and silver in two samples, were not detected in the background surface water sample. Iron was detected in one surface water sample at a concentration greater than two times the background concentration.

The acute ambient water quality criterion (AWQC, U.S. EPA, 1986) for silver of 4.1 ug/L was exceeded in two of the French Creek surface water samples (SW02-01 and SW03-01). These excesses do not appear related to Site contaminants because silver was detected in only one other sample, from the GATX pond sediments. AWQC for other parameters were not exceeded.

Each of the French Creek sediment samples, including the background sample, contained chloroform. One of the downstream samples contained greater than two times the background concentration. The background sediment sample and the downstream sediment samples contained low concentrations of semivolatile compounds, especially PAHs. Concentrations in the downstream samples do not appear to be different from those of the background sample for these parameters. Several metals (arsenic, calcium, lead, and magnesium) were detected in one or more downstream sediments at a concentration greater than two times the background concentration. The elevated arsenic and chloroform concentrations occurred once, in the sample collected downstream of the Borough storm sewer outlet; the elevated lead concentration occurred once at the U.S. 19 bridge, and may be a result of past use of lead-based paints on the bridge or automobile exhaust. Nickel was detected at two downstream locations, but not upstream of the Site area; thallium was detected in one downstream location only, at low concentration. Contaminants detected in French Creek sediments are likely a result of receipt of urban discharges, but are not necessarily linked to the Site.

Guidance for developing sediment quality criteria (SQC) is currently not defined. U.S. EPA has developed the equilibrium partitioning method for use for some hydropholic organic compounds, especially PCBs and PAHs, whereby concentrations of these materials in sediment pore water in equilibrium with sediments are compared to AWQC. An unpublished U.S. EPA document (U.S. EPA, 1988) has suggested the following values for sediments containing 1%

organic carbon:

- Fluoranethene 18,800 ug/kg
- Pyrene 13,100 ug/kg
- Benzo(a)anthracene 13,200 ug/kg
- Benzo(a)pyrene 10,600 ug/kg
- PCB 14 ug/kg

Values for these parameters for French Creek sediments (Table 8-1, columns 4 and 5) are approximately 0.01 of the U.S. EPA values for SQC, suggesting little potential hazard to the creek sediments. Concentrations of these parameters for the GATX pond sediments (Table 8-1, column 6) are approximately 100 times the U.S. EPA values, suggesting a concern for the pond sediments as a biological habitat.

8.4.3 SMC

Media of ecological concerns sampled at SMC include shallow soils. Arochlor 1254, a PCB, was detected at the CRDL in one surface soil sample. Other chemicals of concern were not detected at this facility.

8.4.4 SCI

Media of ecological concern at SCI are shallow soils. Chemicals analyzed from soil samples at this location did not exceed two times the concentrations detected in background samples.

8.4.5 GATX Pond Area

The GATX Pond area includes the pond, wetlands, and shallow soils around it. Pond surface water contained few contaminants; only TCE, PCE, and zinc were detected in the low part per billion range. Other chemicals were not detected in pond water at greater than two times the surface water concentration found in the upstream French Creek sample (SW01).

Sediments and shallow soils contained large concentrations of contaminants, including most metals and PAHs, at greater than two times the background concentrations. VOCs, other semivolatile compounds, and PCBs not detected in background samples were detected in concentrations in the part per million range in sediments and shallow soils in this area.

8.4.6 Former GATX Lagoon and Sludge Bed

Shallow soils were sampled in this area as representative of the medium of ecological concern. Several volatile and semivolatile compounds not detected in background samples were present in the part per million range in soils of this area.

PAHs and metals, also in the part per million range, occurred at concentrations greater than two times background concentrations.

8.4.7 Other GATX Areas

For other GATX areas, excluding the pond and the former sludge bed and lagoon, soils were sampled and analyzed as a medium of ecological concern. Toluene was detected in one sample at approximately three times the background concentration. Other chemicals were detected at less than two times the background concentrations.

8.4.8 Lord

Shallow soil samples south of the Lord facility were sampled as media of ecological concern. The pesticides 4,4'-DDT and 4,4'-DDE were detected at concentrations greater than two times background concentration. These concentrations may be a residue from past land use for agriculture, prior to plant construction in 1962. Benzoic acid, phenol, and selenium, not detected in background soils, were also detected in Lord shallow soils. Phenol and selenium were each detected once at a concentration in the part per billion range. Benzoic acid was detected twice, in the part per million range. Several metals, including chromium, copper, mercury, and zinc, were detected at concentrations from two to four times background concentration maximum values.

8.4.9 Summary

Chemicals of concern vary depending on the area of the Site sampled. Chemicals of concern in French Creek, on the SMC and SCI properties, and in part of the GATX area were detected infrequently and at relatively low concentrations. Occurrence of macroinvertebrate families in French and Woodcock Creeks did not appear to be appreciably different among sampling stations, such that differences in numbers of families may be attributable to the available microhabitats, rather than to potential chemical contaminants.

Numerous contaminants, including VOCs, SVOCs, metals, and cyanide, were detected in the areas of the GATX pond and the former lagoon and sludge bed soils. These contaminants will be further discussed. Contaminants detected south of the Lord plant, including benzoic acid and four heavy metals, may not be a result of Site operations, but occurred at greater than two times background concentration in more than one sample. These occurrences will be further discussed in this Ecological Assessment.

8.5 EXPOSURE ASSESSMENT

8.5.1 Exposure Pathways

Biological populations are potentially exposed to Site contaminants. Potential exposure pathways for plant and animal populations on the Site and in the surrounding habitats are included in Table 8-2.

Creek Habitat - Populations of fauna and flora in French Creek are not likely exposed to contaminants from the Site. Although the potential exists for discharge of contaminated groundwater present beneath Lord to French Creek, it is unlikely measurable concentrations would be present in the creek because of the dilution that would occur in the creek.

Terrestrial Habitat - In the Site terrestrial habitats, plant root systems penetrate surficial soils. This process allows potential exposure to Site contaminants in shallow soils where contaminants are present. As indicated by Table 8-3, PCBs, PAHs, and metals are not readily absorbed by terrestrial vegetation. However, the large concentrations of some of the contaminants in soils in the GATX pond and former lagoon and sludge bed areas result in elevated exposure concentrations. Contaminants may be transferred to herbivores, such as small rodents or songbirds, by feeding of these species. A more likely pathway of contaminant movement in the ecological system is uptake of contaminants from the soil by soil invertebrates (e.g., earthworms, insect larvae), and consumption of those species, with incidental ingestion of soil, by small mammals and birds. Carnivorous animals, such as foxes, are not likely to be affected by the Site, because the limited size of the Site and the extent of its human disturbance likely result in limited, if any, use of the Site by such species.

GATX Pond Aquatic Habitat - In August 1991, the open water of the pond was limited to a few (3 to 4) small (less than 100 sq ft) shallow (less than 2 in. deep) pools. Macroscopic aquatic organisms, even air breathing aquatic insects, were not observed. The high organic content of the pond sediment appears to prevent colonization by rooted macrophytes or invertebrate species. Although the potential source of exposure (contaminants) is in the pond sediments, the receptor population is not present. At wetter times of the year, surface water habitat may be available due to a greater water depth and inundation of soils/sediments that do not appear to have a high organic content.

Exposure pathways may be present, when open water is present, as discussed in the following paragraphs. Few contaminants were detected in pond water, and at low concentrations. The pond water is not likely to represent a medium of concern as a source of drinking water for vertebrates, a source of direct contact by waterfowl, nor a culture medium for possibly floating vegetation (e.g., duckweed).

The primary medium of concern for pond exposure pathways is the pond sediments. In areas devoid of vegetation in August 1991, the pond sediments consisted of an organic sludge with a firm surface crust (which may explain the lack of vegetation in this area). Pathways of ecological exopsure may be present in areas covered by vegetation, especially the area of spike rush nearest the most contaminated sediments.

The hydrophobic nature of most of the contaminants detected in the GATX pond sediments suggests the primary potential route of contaminant transfer is directly from the sediment to the biota. One of the potential contaminant pathways available for the pond area is: sediment ❊spike rush ❊ waterfowl. Although transfer factors from soils/sediments to plants are typically low (≤0.088, see Table 8-3), the high concentrations of PAHs, PCBs, and some metals in the pond sediments may allow uptake of these contaminants by spike rush. The seeds of many species of spike rush, as well as smartweed (also near the open part of the pond) can be a food source for waterfowl.

Another potential exposure pathway includes small mammals that have access to the pond: sediment ❊ rooted plants (e.g., spike rush, smartweed) ❊ small mammals ❊ red fox. A chainlink fence surrounds the pond, but this barrier likely restricts only larger mammals, such as white tail deer.

Another potential pathway may include the direct uptake of contaminants by aquatic insects recruited from off-site sources: sediment ❊ insect larvae ❊ emerged insects ❊ frogs ❊ snakes and small mammals. This pathway may also include consumption of aquatic forms of the insects by waterfowl.

8.5.2 Populations of Concern

The primary populations of concern include plant and animal species exposed to Site soils, especially those with access to the areas of the GATX pond and the former lagoon and sludge bed. Site terrestrial habitats likely support small mammal populations, including various species of field rats, mice, voles, rabbits, shrews, moles, and woodchucks that live on the ground or burrow into or through it. Because many of these species are rodents, exposure effects noted for the laboratory rat are applied to assess effects on Site small mammal populations. Assessment values are described for a burrowing rodent, which could apply to several species. For the burrowing rodent, incidental ingestion of soil (from feeding, burrowing, grooming) and consumption of surface water (GATX pond) are assumed to be the primary routes of exposure. Exposure by consumption of plants in the contaminated areas is a minor source of exposure, based on the transfer factors listed in Table 8-3.

8.5.3 Exposure Concentrations

Maximum shallow soil concentrations of Site contaminants (Table 8-1, Columns 10, 11, and 13) will be considered as the concentrations to which species of small mammals are exposed at the GATX pond, former lagoon and sludge bed, and Lord terrestrial areas. Exposure calculations and assumptions are included in Table 8-4. Exposure to small mammals, whose entire range may be limited to contaminated areas in a worst case scenario, are presented as daily intakes in Table 8-5, including incidental ingestion of soils, consumption of plant material in contaminated areas, and consumption of water from the GATX pond.

8.6 TOXICITY ASSESSMENT

Toxicity measurements for chemicals detected in contaminated Site soils are taken from laboratory studies on mammals. Toxicity values for chemicals detected at the Site are presented in Table 8-6. Where available, doses that describe the onset of lethality (LD) or lethality to 50% of a test population (LD) are included to demonstrate relative toxicity of Site chemicals. These parameters are based on single exposures to the test species, and are not directly comparable to chronic, or long-term, exposures.

Table 8-6 also contains lowest observed adverse effect levels (LOAELs), where available. This parameter represents the lowest chronic dose that produces an adverse response in a test population. The LOAEL values may be used as populations endpoints for the chemicals of concern because these concentrations may result in physiological changes that may affect the ability of a population of a species to maintain itself and compete in the environment. The LOAELs are taken from Health Effects Assessment Summary Tables (HEAST-U.S. EPA, 1991) rather than the Integrated Risk Information System (IRIS-U.S. EPA, 1991) because the IRIS values are updated to substitute data on human effects for those on small mammal effects. The LOAELs derived from animal data are more appropriate for the ecological assessment than are the human data.

Most animal species have sufficiently short lifespans so that long-term disease, such as cancer, is not in evidence in localized populations to the extent that it affects population densities. Information concerning the presence of specific endangered species, for which cancer effects may need to be addressed to protect a limited number of individuals, indicates that such species are not present at the Site. Therefore, the potential for cancer effects on animal species is not addressed in the ecological assessment.

8.7 RISK CHARACTERIZATION

Doses of contaminants to which target populations are exposed are compared with reference toxic doses to generate hazard quotients (HQs: HQ=Exposure Value/LOAEL). HQ values greater than 1 indicate the dose to which a population is exposed is likely to result in a threshold effect, if the LOAEL is used in place of the reference toxic dose. An HQ less than 1 indicates the population is not likely at risk. HQ values for a species of small mammal exposed to soils at the GATX pond, the GATX former lagoon/sludge bed area, and Lord soils are presented in Table 8-7.

HQ values for the Lord soils are low (all less than 1), indicating little potential for contamination to affect small mammal populations there. For chemicals for which LOAELs are not available, exposure concentrations (in ug/kg/day) are much smaller values than the LD or LD values (in mg/kg), so that a build-up in an animal's body to an acute dosage is not likely.

HQ values exceed 1 for a few SVOCs at the GATX areas, which suggests that these chemicals (naphthalene at the GATX pond area soils and hexachlorobutadine and hexachlorobenzene at the former lagoon/sludge bed area) may affect populations of small mammals in these areas. Other chemicals detected in large concentrations in soils from these areas may have an effect on Site populations; however, LOAELs for these contaminants for small mammals are not available. These contaminants may include lead, PCBs, and some of the PAHs.

The areas of greatest potential for chemical exposure are the former GATX pond area and the area of the former GATX sludge lagoon. The types of contaminants are the same for these areas, and include VOCs, PAHs and other SVOCs, PCBs, and metals. The concentrations of contaminants vary between the two areas. Pathways of chemical uptake include:

- absorption from soils and sediments directly into biota, either into rooted plants or by direct contact

- incidental consumption of soils by soil- or sediment-dwelling animals.

Some contaminants, such as VOCs, are not readily taken up from soils/sediments by biota. Others, including many heavy metals, are biocentrated from the environment, but are not greatly biomagnified through an ecological food chain. Other contaminants, such as PCBs and some PAHs, are likely to be biomagnified through levels of an ecological food chain.

The greatest likely risk is represented by a small mammal with a limited range that includes only the approximately 2.3 acres of the former GATX pond and associated fringe vegetation. For a larger carnivore, such as a red fox, biomagnification of some contaminants (especially PAHs and PCBs) may occur, however, because the fox feeds over a range that includes more than the former GATX pond area, it will be exposed to uncontaminated prey as well as to prey from the former GATX pond area. The extent to which the fox is exposed to a greater contaminant concentration, based on the animal's position in the food chain, is modified by its exposure to uncontaminated prey from other parts of its range.

8.8 SUMMARY AND CONCLUSIONS

An Ecological Assessment was performed for the Site. The Site includes SMC, SCI, and the Lord Corporation, which are in operation, and property formerly owned by GATX. Most of the Site is occupied by buildings, paved areas, and lawns. Undeveloped Site areas are limited to coarse lawns north of SMC and south of the Lord southern fence line, old field areas mostly on the former GATX property, and a pond on the GATX property. The only Site wetland is the one around the GATX pond.

The Site area includes the urban Saegertown Borough and less developed land. The commercial/residential urban area is to the west of the Site. Some rural residences, farmland, and woods lie to the north, east, and south of the Site. Aquatic resources in the area include French Creek, with a warm water fishery, and Woodcock Creek, with a cold water fishery. A survey of benthic macroinvertebrate families indicates similar habitats between the creeks in the Saegertown area.

Chemicals of ecological concern for the Site were assessed by media in the Site area. Site contaminants of concern were limited to the GATX pond soils/sediments, the former GATX lagoon/sludge bed soils, and soils south of Lord. Contaminants addressed in these areas include VOCs, PAHs and other SVOCs, PCBs/pesticides, and heavy metals. Contaminants of ecological importance did not occur above twice the background concentrations at the SMC or SCI properties, in outlying GATX property areas, or in French Creek.

An exposure scenario for burrowing mammals was developed. Exposure concentrations for chemicals of concern were developed based on incidental consumption of maximum concentrations of contaminants detected in Site soils through eating plant material, burrowing, and grooming, through uptake from plants grown on Site soils, and through drinking of water from the GATX pond.

The exposure concentrations were compared with toxicological doses producing initial effects likely to affect the health of small mammals (LOAEL values). The resulting hazard quotients indicate little potential for concern from the Lord soils. One SVOC compound (naphthalene) at the former GATX pond and two (hexachlorobutadiene, hexachlorobenzene) at the former lagoon/sludge bed had hazard quotients that suggested potential problems to a small mammal population.

Several other chemicals of concern, including lead, PCBs, and several PAHs, were available at potentially high dosages, but could not be properly assessed because appropriate LOAEL values are not available. Without toxicological information from literature sources, these chemicals cannot be assessed quantitatively; however, locations of elevated concentrations of these chemicals are the same as those of maximum concentrations of chemicals for which quantitative assessments were possible, namely areas of the former GATX pond and lagoon/sludge bed.

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REMEDIAL ACTION OBJECTIVES

The potential hazard posed by the Site which caused its ranking and listing on the National Priorities List (NPL) was related to the detection of VOCs, specifically trichloroethene and 1,1,1-trichloroethane, in Borough water supply well BW2 on June 18, 1980 (see Drawing 60882-F1 for well location). Possible trace trichloroethene was also found in Borough well BW1, but subsequent sampling by PADER and a consulting firm (Moody and Associates, Inc.) established that trichloroethene was present only in Borough well BW2. No contamination was found in Borough wells BW3 and BW4. Borough well BW2 was temporarily removed from service and used as an extraction well to remove contaminated groundwater. In March 1984, Borough well BW2 was returned to service due to a reduction in trichloroethene and 1,1,1-trichloroethane concentrations so that the well met drinking water standards.

Although Borough well BW2 was returned to service, the previously conducted investigations indicated that VOCs were present in the groundwater within the area of influence of the well. Previous studies at the Site also indicated that VOCs were present in the soils around the former sludge lagoon and pond on the former GATX property. Sampling and analysis conducted during this investigation did not detect VOCs in the groundwater at the SMC or SCI properties. Groundwater sampling and analysis at Lord detected VOCs at concentrations that do represent a potential concern. However, based upon groundwater flow direction (flow at Lord is generally parallel to flow near Borough well BW2 [i.e., toward French Creek to the west]) and the distance from Borough well BW2 (greater than 2,400 ft), groundwater contamination at the western boundary of the Lord property is not related to the previously detected contamination in Borough well BW2. The source(s) of VOCs detected in the groundwater at monitoring well W7S (located on the western boundary of Lord property [see Drawing F10]) appears to be on the Lord property. Low levels (1 to 5 ug/L) of VOCs were detected at three monitoring wells located on the former GATX property.

Previous investigations indicated that there may be a potential for metals contamination in the groundwater based upon analytical results. Prior samples were not filtered and RI analytical results of filtered and unfiltered groundwater samples confirmed that the majority of inorganic constituents in the groundwater are associated with the suspended, not the dissolved, solids component. RI groundwater analytical results for filtered samples are below maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) (see Table 4-26).

Based upon current Site conditions, previous analytical data, and data collected during the RI, the primary remedial action objectives are:

Media	Primary Remedial Action Objective
Groundwater	Reduce the potential for human ingestion/dermal contact with groundwater on Lord property having a cancer risk greater than 10^{-4} to 10^{-6}, and/or a hazard index greater than 1. The goal of any remedy is that it will be protective of groundwater, consistent with ARARs.
Surface Water	Avoid discharge of contaminated groundwater detected on Lord property to French Creek
Soils/Sludge	Reduce the potential for ingestion/direct contact with on-Site soils/sludge on the former GATX property having a cancer risk greater than 10^{-4} to 10^{-6}, and/or a hazard index greater than 1. Decrease the potential for groundwater contamination which could result from infiltration of precipitation through residual soils/sludge.
Air	Reduce the potential for inhalation of contaminated air related to the former GATX pond such that the cancer risk is reduced below 10^{-4} to 10^{-6}

Additional remedial action objectives may be developed, based upon ARARs and To Be Considered (TBC) criteria developed as part of the FS. Currently, remedial action objectives associated with the SMC property, SCI property, Borough or private water supply wells, and French Creek are not anticipated.

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TABLES

TABLE 1-1

LIST OF ACRONYMS AND ABBREVIATIONS
SAEGERTOWN INDUSTRIAL AREA SITE RI

Acronym	Description
AOC	Administrative Order by Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing Materials
ATV	All Terrain Vehicle
BETX	Benzene, Ethylbenzene, Toluene, and Xylene
BRA	Baseline Risk Assessment
CDI	Chronic Daily Intake
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CR	Cancer Risk
CLP	Contract Laboratory Program
ECAO	Environmental Criteria and Assessment Office
CRQL	Contract Required Quantitation Limit
EM	Electromagnetic
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
GATX	General American Transportation Corporation
HAD	Health Assessment Document
HEA	Health Effects Assessment
HEAST	Health Effects Assessment Summary Table
HEED	Health and Environmental Effects Document
HEEP	Health and Environmental Effects Profile
HI	Hazard Index
HQ	Hazard Quotient
I.D.	Inner Diameter
IRIS	Integrated Risk Information System
LOAEL	Lowest Observed Adverse Affect Level
Lord	Lord Corporation
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
NCP	National Contingency Plan
NOAEL	No Observed Adverse Effect Level
NOEL	No Observed Effect Level
NPL	National Priorities List
PADER	Pennsylvania Department of Environmental Resources
PCB	Polychlorinated Biphenyls
PID	Photoionization Detector
PQL	Practical Quantitation Limit

Acronym	Description
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
RAGS	Risk Assessment Guidance for Superfund
RD	Referenced Dose
RI	Remedial Investigation
RPD	Relative Percent Difference
SARA	Superfund Amendments and Reauthorization Act
SCI	Spectrum Control Inc.
SDWA	Safe Drinking Water Act
SEAM	Superfund Exposure Assessment Manual
SF	Slope Factor
Site	Saegertown Industrial Area Site
SMC	Saegertown Manufacturing Corporation
SQL	Sample Quantitation Limit
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBC Criteria	To Be Considered Criteria
TCL	Target Compound List
TDS	Total Dissolved Solids
TIC	Tentatively Identified Compound
TOC	Total Organic Carbon
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WEG	Water Elevation Gauge

Table 2-1

MAXIMUM CONTAMINANT LEVELS AND CONTAMINANT LEVEL GOALS
Saegertown Industrial Area Site RI

Chemical	Maximum[a] Contaminant Level (MCL) (ug/L)	Proposed Maximum Contaminant Level (MCL) (ug/L)	Maximum[b] Contaminant Level Goal (MCLG) (ug/L)	Proposed Maximum Contaminant Level Goal (MCLG) (ug/L)
Arsenic	50	--	--	--
Asbestos	7 million fibers/liter	--	7 million fibers/liter	--
Antimony	--	10/5[(f)]	--	3.0
Barium	1,000	2,000	1,000	2,000
Benzene	5.0	--	0	--
Beryllium	--	1.0	--	0
Bromodichloromethane	100[c]	--	--	--
Bromoform	100[c]	--	--	--
Cadmium	5.0	--	5.0	0
Chloride	250,000[e]	--	--	--
Carbon Tetrachloride	5.0	--	0	--
Chlorobenzene	100	--	0	--
Chloroform	100[c]	--	--	--
Chromium, Total	100[d]	--	100	--
Copper	1,000[e]	--	--	--
Cyanide, total	--	200	--	200
Adipates [Di(ethylhexhy)adipate]	--	500	--	500
Dalapon	--	200	--	200
Dichloromethane(methylene chloride)		5.0	--	0
Dinoseb	--	7.0	--	7.0
Diguat	--	20	--	20
Endothall	--	100	--	100
Endrin	--	2.0	--	2.0
Glyphosate	--	700	--	700
Hexachlorobenzene	--	1.0	--	0
Hexachlorocyclopentadiene(Hex)	--	50	--	50
Oxanyl (Vydate)	--	200	--	200
PAH's [Benzo(a)pyrene]	--	0.2	--	0
Phyhalates[Di-ethylhexyl)phthalate]		4.0	--	0
Picloram	--	500	--	500
Simazine	--	1.0	--	1.0
1,2,4-Trichlorobenzene	--	9.0	--	9.0
1,1,2-Trichlorethane	--	5.0	--	3.0
2,3,7,8-TCDD(Dioxin)	--	$5x10^{-5}$	--	0
1,2-Dichlorobenzene	600	--	600	--

Table 2-1
(Continued)

Chemical	Maximum[a] Contaminant Level (MCL) (ug/L)	Proposed Maximum Contaminant Level (MCL) (ug/L)	Maximum[b] Contaminant Level Goal (MCLG) (ug/L)	Proposed Maximum Contaminant Level Goal (MCLG) (ug/L)
1,4-Dichlorobenzene	75	--	75	--
1,2-Dichloroethane	5.0	--	0	--
1,1-Dichloroethene	7.0	--	7.0	--
Cis-1,2-Dichloroethene	70	--	70	--
Trans-1,2-Dichloroethene	100	--	100	--
1,2-Dichloropropane	5.0	--	0	--
Ethylbenzene	700	--	700	--
Iron	300[e]	--	--	--
Lead	50	--	--	--
Manganese	50[e]	--	--	--
Methylene Chloride	--	5.0	--	0
Mercury	2.0	--	2.0	--
Nitrate	10,000	--	10,000	--
Nitrite	1,000	--	1,000	--
Nickel	--	100	--	100
Bis(2-ethylhexyl)phthalate	--	--	--	0
Diethylphthalate	--	--	--	0
Selenium	50	--	50	--
Silver	50, 100[e]	--	--	--
Sulfate	250,000[e]	400,000/500,000[f]	--	400,000/500,000[f]
Tetrachloroethene	5.0	--	0	--
Thallium	--	1/2[f]	--	0.5
Toluene	1,000	--	1,000	--
1,1,1-Trichloroethane	200	--	200	--
Trichloroethene	5.0	--	0	--
Vinyl Chloride	2.0	--	0	--
Xylenes, total	10,000	--	10,000	--
Zinc	5,000[e]	--	--	--
o-Dichlorobenzene	600	--	600	--
1,2-Dichloropropane	5.0	--	0	--
Monochlorobenzene	100	--	100	--
Styrene	100	--	100	--
Alachlor	2.0	--	0	--
Atrazine	3.0	--	3.0	--
Carbofuran	40	--	40	--
Chlorodane	2.0	--	0	--
1,2-Dibromo-3-Chloropropane (DBCP)		--	0	--
2,4-D	71/100	--	70	--
Ethylene dibromide (EDB)	0.05	--	0	--

Table 2-1
(Continued)

Chemical	Maximum[a] Contaminant Level (MCL) (ug/L)	Proposed Maximum Contaminant Level (MCL) (ug/L)	Maximum[b] Contaminant Level Goal (MCLG) (ug/L)	Proposed Maximum Contaminant Level Goal (MCLG) (ug/L)
Heptachlor	0.4	--	0	--
Heptachlor epoxide	0.2	--	0	--
Lindane	0.2	--	0.2	--
Methoxychlor	40	--	40	--
Polychlorinated biphenyls (PCBs) as decachlorobiphenyl	0.5	--	0	--
Toxaphene	3.0	--	0	--
2,4,5-TP (Silvex)	50	--	50	--
Acrylamide	Treatment Technique	--	0	--
Epichlorohydrin	Treatment Technique	--	0	--

Notes:

a Safe Drinking Water Act and National Primary Drinking Water Regulations Primary and Secondary Maximum Contaminant Levels-MCLs (40 CFR 141). Enforceable standards set as close to MCLGs as feasible and are based on treatment technologies and cost.
b Maximum Contaminant Level Goals (40 CFR 141.50). Non-enforceable health goals. Previously named RMCLs.
c Based on 100 ug/L total trichloroethane standard.
d The MCL for Chromium VI is 50 micrograms per liter (ug/L).
e Represents the Secondary Maximum Contaminant Level based upon the Safe Drinking Water Act and National Primary Drinking Water Regulations. (These are based on criteria such as taste and odor.)
(f) Alternate MCL options proposed
-- No MCL or MCLG exists

[CHI 601 83m]
60882.27-Table 2-1
TJM/mp/AJS

TABLE 3-1
Summary of Monitoring Well Construction Details
Saegertown Industrial Area Site RI

Well Number	Completion Date	Coordinates North	East	Ground Elevation	TOIC Elevation	Total Depth	Well/Screen Materials	Screen Length	Slot Size	Stratigraphy at Screen	Top of Seal Depth	Top of Seal Elev	Top of Sand Pack Depth	Top of Sand Pack Elev	Screen Interval Depth			Screen Interval Elev		
W1S	12/13/90	7059	3839	1128.7	1128.26	21.1	Sch 40 PVC	10	0.01	S+G/Silty F Sand	7.2	1121.5	9.0	1119.7	11.1	to	21.1	1117.6	to	1107.6
W1D	12/18/90	7057	3855	1129.2	1128.57	50.0	Sch 40 PVC	5	0.01	Silty F Sand/Shale	39.5	1089.7	42.5	1086.7	45.0	to	50.0	1084.2	to	1079.2
W2S	12/09/90	6916	3185	1119.8	1121.87	18.0	Sch 40 PVC	10	0.01	F to C S+G/Clay	4.4	1115.4	6.0	1113.8	8.0	to	18.0	1111.8	to	1101.8
W2D	12/08/90	6926	3184	1119.9	1121.74	42.5	Sch 40 PVC	5	0.01	F to C Silty S&G	28.0	1086.4	34.5	1085.4	37.5	to	42.5	1082.4	to	1077.4
W3S	12/05/90	6179	3697	1122.6	1124.40	14.9	Sch 40 PVC	10	0.01	F Sand and F to C S&G	1.8	1120.8	3.0	1119.6	5.0	to	15.0	1117.6	to	1107.6
W3D	12/06/90	6181	3688	1122.5	1124.44	43.2	Sch 40 PVC	5	0.01	F Sand and F to C S&G	35.9	1086.6	37.5	1085.0	38.2	to	43.2	1084.3	to	1079.3
W4S	12/19/90	5681	2961	1113.8	1115.82	18.9	Sch 40 PVC	10	0.01	F to C S&G	4.5	1109.3	6.5	1107.3	8.9	to	18.9	1104.9	to	1094.9
W4D	12/19/90	5690	2961	1113.8	1115.82	42.4	Sch 40 PVC	5	0.01	Silt and F Sand	32.0	1081.8	33.9	1079.9	37.4	to	42.4	1076.4	to	1071.4
W5S	12/11/90	5053	3550	1115.7	1117.91	17.6	Sch 40 PVC	10	0.01	Silty F to C S&G	3.4	1112.3	5.4	1110.3	7.6	to	17.6	1108.1	to	1098.1
W5D	12/10/90	5046	3549	1115.7	1118.02	42.9	Sch 40 PVC	5	0.01	Silty F Sand and F to C S&G	28.0	1087.7	33.0	1082.7	37.9	to	42.9	1077.8	to	1072.8
W6S	12/07/90	4684	4133	1124.5	1126.81	21.1	Sch 40 PVC	10	0.01	F to C S&G/F Sand	7.0	1117.5	9.0	1115.5	11.1	to	21.1	1113.4	to	1103.4
W6D	12/08/90	4696	4127	1124.3	1126.80	50.9	Sch 40 PVC	5	0.01	Silty F Sand	41.5	1082.8	42.5	1081.8	45.9	to	50.9	1078.4	to	1073.4
W7S	12/12/90	4285	2702	1106.2	1108.80	14.1	Sch 40 PVC	10	0.01	M to C S&G	2.0	1104.2	3.0	1103.2	4.1	to	14.1	1102.1	to	1092.1
W7D	12/12/90	4295	2705	1106.2	1108.27	39.5	Sch 40 PVC	5	0.01	Silty F to C S&G	29.0	1077.2	31.3	1074.9	34.5	to	39.5	1071.7	to	1066.7
W8S	12/08/90	3955	2793	1105.0	1107.26	14.9	Sch 40 PVC	10	0.01	Silty F to C S&G	2.0	1103.0	3.0	1102.0	4.9	to	14.9	1100.1	to	1090.1
W8D	12/08/90	3952	2800	1105.2	1107.47	37.8	Sch 40 PVC	5	0.01	Silty F S&G	27.0	1078.2	29.0	1076.2	32.8	to	37.8	1072.4	to	1067.4
W9S	12/08/90	6194	3045	1115.0	1117.29	17.7	Sch 40 PVC	10	0.01	F to C S&G	4.0	1111.0	6.0	1109.0	7.7	to	17.7	1107.3	to	1097.3
W9D	12/08/90	6203	3045	1115.1	1117.59	46.1	Sch 40 PVC	5	0.01	F to C S&G	33.0	1082.1	38.7	1076.4	41.1	to	46.1	1074.0	to	1069.0
W10I	9/7/91	4916	3660	1118.2	1119.54	27.3	Sch 40 PVC	5	0.01	F to C Sand	16.0	1102.2	19.9	1098.3	22.2	to	27.3	1090.9	to	1096.0
W11S	9/7/91	4522	2920	1107.6	1106.94	16.2	Sch 40 PVC	10	0.01	F to C Sand	3.7	1104.8	3.7	1103.9	6.0	to	16.2	1091.4	to	1101.6
GATX1	1980	4823	3952	1120.7	1121.95	50.2	4 inch PVC	NA	NA	NA	NA		NA		?	to	50.2	?	to	1070.5

TABLE 3-1
(continued)

Well Number	Completion Date	Coordinates North	Coordinates East	Ground Elevation	TOIC Elevation	Total Depth	Well/Screen Materials	Screen Length	Slot Size	Stratigraphy at Screen	Top of Seal Depth	Top of Seal Elev	Top of Sand Pack Depth	Top of Sand Pack Elev	Screen Interval Depth	Screen Interval Elev
GATX2	1980	5252	3003	1111.3	1113.49	18.9	4 inch PVC	NA	NA	NA	NA		NA		? to 18.9	? to 1092.4
GATX3	1980	5687	3566	1113.8	1116.24	35.3	4 inch PVC	NA	NA	NA	NA		NA		? to 35.3	? to 1078.6
GATX4S	1980	5858	3353	1112.9	1114.99	22.8	4 inch PVC	NA	NA	NA	NA		NA		? to 22.8	? to 1090.1
GATX4D	1980	5858	3353	1112.9	1114.95	47.0	4 inch PVC	NA	NA	NA	NA		NA		? to 47	? to 1065.9
GATX5	1980	6202	3173	1114.9	1115.91	42.7	4 inch PVC	NA	NA	NA	NA		NA		? to 42.7	? to 1072.2
SMC1	6/18/79	6991	3242	1122.5	1125.13	22.6	4 inch PVC	17.5	NA	S&G	NA		NA		9.5 to 27.0	1113.0 to 1069.0
SMC3	11/17/81	6959	3457	1123.3	1125.14	42.9	4 inch PVC	36.0	NA	Clay & Gravel	NA		NA		10.0 to 46.0	1113.3 to 1069.0
SCI East	NA	6857	3419	1121.4	1122.41	25.7	4 inch PVC	NA	NA	NA	NA		NA		NA	NA
SCI West	NA	6727	3232	1121.90	1123.90	26.0	4 inch PVC	NA	NA	NA	NA		NA		NA	NA

Notes:
Elevation = Elevation in Feet MSL, USGS Datum
TOIC = Elevation referenced from Top Of Inner well Casing
Depths in Feet below ground surface
Sch = Schedule
Screen Length in Feet
Slot Size in Inches
Stratigraphic Abbreviations: S&G = Sand and Gravel, F = Fine, M = Medium, C = Coarse
NA - Not Available

SAEGWEL/TJM/sjb/DAP

AR303590

TABLE 3-2
Summary of Well Development Data
Saegertown Industrial Area Site RI

Well Number	Date Developed	Well Depth	Water Level	Column Length	One Volume	Volume Purged	Field Parameters pH	Temp	Sp Cond	Color	Odor	Water Turbidity
W1S	1/2/91	21.10	8.61	12.49	2.05	28.0	7.50	12.0	250	Brown	None	Murky
W1D	1/2/91	47.80	8.81	38.99	6.39	23.5	8.43	13.0	283	Gray	None	Murky
	1/11/91 (*)	49.30	13.12	36.18	5.93	12.0	8.52	7.0	328	Gray	None	Turbid
W2S	12/20/90	20.00	14.34	5.66	0.93	15.0	6.75	10.4	445	Gray	None	Turbid
W2D	12/21/90	44.36	13.89	30.47	5.00	80.0	6.27	11.0	280	Brown	None	Turbid
W3S	1/3/91	14.80	4.97	9.83	1.61	20.0	6.92	6.4	151	Brown	None	Turbid
W3D	1/3/91	45.00	5.32	39.68	6.51	78.0	8.24	7.0	344	Gray	None	Murky
W4S	1/4/91	20.85	9.04	11.81	1.94	24.0	7.62	8.0	447	Brown	None	Turbid
W4D	1/4/91	44.40	9.49	34.91	5.73	65.0	8.56	8.4	299	Gray	None	Cloudy
W5S	1/4/91	19.65	11.25	8.40	1.38	16.5	7.30	7.1	221	Brown	None	Turbid
W5D	1/4/91	44.90	8.39	36.51	5.99	66.0	8.40	6.5	349	Brown	None	Murky
W6S	1/3/91	22.20	15.27	6.93	1.14	14.0	7.68	9.0	390	Brown	None	Turbid
W6D	1/3/91	51.90	16.15	35.75	5.86	72.0	7.86	10.0	396	Gray	None	Cloudy
W7S	12/22/90	17.10	6.30	10.80	1.77	24.0	6.62	13.5	360	Brown	None	Turbid
W7D	12/22/90	41.00	5.90	35.10	5.76	30.0	8.02	13.5	322	Gray	None	Turbid
	1/10/91	42.58	9.40	33.18	5.44	24.0	8.72	11.5	308	Gray	None	Turbid
	1/11/91	42.57	9.53	33.04	5.42	9.0	8.70	11.2	318	Gray	None	Turbid
W8S	12/21/90	17.20	5.24	11.96	1.96	26.0	5.80	10.3	371	Brown	None	Turbid

TABLE 3-2

(continued)

Well Number	Date Developed	Well Depth	Water Level	Column Length	One Volume	Volume Purged	Field Parameters pH	Temp	Sp Cond	Color	Odor	Water Turbidity
W8D	12/21/90	39.10	5.49	33.61	5.51	10.5	6.31	11.3	413	Gray	None	Turbid
	1/10/91 (*)	41.03	7.98	33.05	5.42	13.0	8.33	9.3	493	Gray	None	Turbid
	1/11/91	41.05	8.35	32.70	5.36	8.5	8.20	8.1	476	Gray	None	Turbid
W9S	12/19/90	20.20	10.04	10.16	1.67	25.0	6.46	9.9	437	Brown	None	Turbid
W9D	12/19/90	48.90	10.38	38.52	6.32	80.0	7.37	9.6	345	Brown	None	Turbid
W10I	9/11/91	28.65	17.75	10.90	1.74	60.0						
	214PM						6.80	11.0	235	Dark Brown	None	Turbid
	230PM						6.82	10.0	215	Dark Brown	None	Turbid
	244PM						6.93	9.5	205	Dark Brown	None	Turbid
	255PM						6.90	9.0	190	Dark Brown	None	Turbid
	306PM						6.86	9.0	190	Dark Brown	None	Turbid
	319PM						6.90	10.0	185	Dark Brown	None	Turbid
W11S	9/11/91	15.30	7.54	8.50	1.36	70.0						
	940AM						6.85	20.0	455	Brown	None	Turbid
	1005AM						7.19	20.5	420	Brown	None	Turbid
	1029AM						7.03	20.5	405	Brown	None	Turbid
	1043AM						7.12	21.5	390	Brown	None	Turbid
	1058AM						7.06	21.0	390	Brown	None	Turbid
	1113AM						7.06	22.0	395	Brown	None	Turbid
	1127AM						7.04	22.0	390	Brown	None	Turbid

Notes:
Well Depth and Water Level in Feet Below Inner Well Casing
Column of water in well in Feet
Volumes in Gallons
Temp = Temperature in Degrees Celsius
Sp Cond = Specific Conductivity in umhos; Adjusted to 25 Degrees Celsuis
(*) = Surge Block Used

SAEG WD.XLS/TJM/sjb/DAP

TABLE 3 - 3
IONIZATION POTENTIALS FOR TARGET COMPOUND LIST VOCs
SAGERTOWN INDUSTRIAL AREA
SITE RI

Parameter	Ionization Potential (eV)
Chloromethane	11.28
Bromomethane	10.53
Vinyl Chloride	9.995
Chloroethane	10.98
Methylene chloride	11.35
Acetone	9.69
Carbon Disulfide	10.08
1,1-Dichloroethene	*
1,1-Dichloroethane	11.06
1,2-Dichloroethene	9.65
Chloroform	11.42
1,2-Dichloroethane	11.12
2- Butanone	9.53
1,1,1-Trichloroethane	*
Carbon tetrachloride	11.47
Vinyl Acetate	9.19
Bromodichloromethane	*
1,2-Dichloropropane	10.87
cis-1,3-Dichloropropene	*
Trichloroethene	9.45
Dibromochloromethane	10.59
1,1,2-Trichloroethane	11.00
Benzene	9.245
trans-1,3 - Dichloropropene	*
Bromoform	10.51
4-Methyl-2-pentanone	9.30
2-Hexanone	9.34
Tetrachloroethene	9.32
1,1,2,2-Tetrachloroethane	11.10
Toluene	8.82
Chlorobenzene	9.07
Ethylbenzene	8.76
Styrene	8.47
0 - Xylene	8.56
M - Xylene	8.56
P - Xylene	8.445

Notes:

1. An asterik (*) indicates parameter ionization potential could not be found.
2. Ionization potentials are based on NIOSH Pocket Guide to Chemical Hazards, June 1990, and the U.S. EPA Hazardous Site Control Division OVA/HNu Field Manual for Survey Mode Operations.

table3.xls/ACC/KAW

Table 4-1

Private Water Supply Information
Saegertown Industrial Area Site RI

Warzyn Well No.(1)	PADER Well No. (2)	Information Source	Well Owner (3)	Well Depth (feet)	Casing Length (feet)	Depth to Rock (feet)	Formation
PW1	2016	(4)	C. Ishman	120	32	32	Shale
PW2	2015	(4)	D. Ferguson	70	70	Unknown	Gravel
PW3	1617	(4)	Saegertown Sportman	125	29.6	18	Shale
PW4	1290	(4)	Ralph Dwight	87	52	49	Unknown
PW5	1675	(4)	E. Lenhart	142	70	19	Shale
PW6	--	(5)	Saegertown Beverage	Unknown	Unknown	Unknown	Unknown
PW7	1695	(4)	T. Copeland	52(8)	52	Unknown	Gravel
PW8	1273	(4)	Bill Seay	80	24.6	15	Shale
PW9	1620	(4)	Lewis Wright	85	29.3	24	Shale
PW10	1621	(4)	Harold Nowris	90	22.6	10	Shale
PW11	189	(4) (5)	Marilyn Wilson (6)	Unknown	Unknown	Unknown	Unknown
PW12	--	(5)	Mrs. Wilson	(6)	Unknown	Unknown	Unknown
PW13	--	(5)	John Murphy	(6)	Unknown	Unknown	Unknown
PW14	--	(5)	Unknown (red brick house)	(6) Unknown	Unknown	Unknown	Unknown
PW15	--	(5)	Unknown (mobile home)	(6)	Unknown	Unknown	Unknown
PW16	--	(5)	Unknown (vacant white house)	(6) Unknown	Unknown	Unknown	Unknown
PW17	--	(5)	Crawford County Home	(6,9)	Unknown	Unknown	Unknown
PW18	--	(7)	Chester Morfenski	Unknown	Unknown	Unknown	Unknown
PW19	--	(7)	Ronald Hagerty	Unknown	Unknown	Unknown	Unknown
PW20	--	(7)	Hazel Fernberg	Unknown	Unknown	Unknown	Unknown
PW21	--	(7)	Art (Albert?) Rundel	Unknown	Unknown	Unknown	Unknown
PW22	--	(7)	Richard Sunback	Unknown	Unknown	Unknown	Unknown
PW23	--	(7)	Charles Bruckner	Unknown	Unknown	Unknown	Unknown
PW24	--	(7)	Linda Wilson	Unknown	Unknown	Unknown	Unknown
PW25	--	(7)	Ron Haskins	Unknown	Unknown	Unknown	Unknown
PW26	--	(7)	Gene Roberts	Unknown	Unknown	Unknown	Unknown

[illegible] 4-1
(continued)

PW27	--	(7)	George & Jean Lang	Unknown	Unknown	Unknown	Unknown
PW28	--	(7)	Donald Martin	Unknown	Unknown	Unknown	Unknown
PW29	--	(7)	Doris Mosier	Unknown	Unknown	Unknown	Unknown
PW30	--	(7)	Nancy Porter	Unknown	Unknown	Unknown	Unknown
PW31	--	(7)	Chalmer/Evelyn Jordan	Unknown	Unknown	Unknown	Unknown

Notes:

(1) See Figure 3 for well location

(2) Refer to Appendix F3 for additional information on PADER water supply well data base

(3) Well owner identified based on information provided by PADER or Borough of Saegertown

(4) PADER Bureau of Topographic and Geologic Survey

(5) Borough of Saegertown

(6) The Borough of Saegertown reports that this cluster of six houses located along Route 198 are served by private water supply wells. PADER has records for only one well at this location. Additional information on well ownership and construction is not available from the Borough or PADER.

(7) Well location identified based on Warzyn drive-by survey and telephone calls to homeowners.

(8) PADER reports PW7 is 52 feet deep. Owner stated well is 95 feet deep.

(9) Crawford County Home is now served by Borough water supply system.

TABLE 4-2
Results of Physical Soil Analyses
Saegertown Industrial Area Site RI

Sample Number	Sample Depth (ft)	Date Sampled	Unified Soils Classification System (USCS)	Gravel %	Sand %	Silt %	Clay %	LL	PI
SC-SSB2-6	4-6	12/7/90	Brown Fine-Coarse SAND and GRAVEL, Little Silt, Trace Clay (SW-SM/GW-GP)	48.2	43.9	5.3	2.6		
SC-SSB2-18	16-18	12/7/90	Gray-Brown SILT, Some Clay, Trace Sand (ML)	0.4	4.2	70.5	24.9		
GA-SSB3-6	4-6	12/7/90	Gray-Brown SILT, Some Sand and Clay, Little Gravel (ML)	6.9	26.3	47.3	19.5		
GA-SSB3-10	8-10	12/7/90	Brown Fine-Coarse SAND and GRAVEL, Little Silt, Trace Clay (SW-SM/GW-GP)	54.8	36.2	5.1	3.9		
GA-SSB4-4	2-4	12/11/90	Brown-Black Fine-Coarse GRAVEL, Some Sand and Silt, Little Clay (GM)	35.0	34.8	22.8	7.4		
GA-SSB4-8	6-8	12/11/90	Brown Fine-Coarse GRAVEL, Some Sand, Little Silt and Clay (GP-GM)	64.0	27.5	4.3	4.2		
GA-SSB5-4	2-4	12/18/90	Gray-Brown Clayey Fine-Coarse SAND, Some Silt and Gravel (SC)	18.5	32.1	34.2	15.2	32	14
GA-SSB6-2	0-2	12/18/90	Gray-Brown Lean CLAY, Little Sand (CL)	0.3	8.9	59.0	31.8	38	18
GA-SSB6-4	2-4	12/18/90	Gray-Brown Lean CLAY, Some Sand Little Gravel (CL)	9.8	21.7	50.3	18.2	30	10
GA-SSB7-2	0-2	12/9/90	Brown-Black Silty Fine-Coarse SAND, Little Clay and Gravel (SM)	10.7	40.5	37.0	11.8		

TABLE 4-2
(continued)

Sample Number	Sample Depth (ft)	Date Sampled	Unified Soils Classification System (USCS)	Gravel %	Sand %	Silt %	Clay %	LL	PI
GA-SSB7-4	2-4	12/9/90	Gray-Brown SILT, Some Sand and Clay, Trace Gravel (ML)	3.0	28.8	50.3	17.9	23	3
GA-SSB8-6	4-6	12/11/90	Black and Gray SILT, Some Clay and Sand, Trace Gravel (ML)	1.2	26.6	43.1	29.1		
GA-SSB8-12	10-12	12/11/90	Gray Silty Fine-Medium SAND, Some Clay, Trace Gravel (SM)	4.3	55.6	26.6	13.5		
GA-SSB8-12 DUP	10-12	12/11/90	Gray Silty Fine-Medium SAND, Some Clay, Trace Gravel (SM)	3.0	60.4	24.3	12.3		
GA-SSB9-4	2-4	12/10/90	Brown Silty Fine-Medium SAND, Trace Clay (SM)	0.0	57.9	37.4	4.7		
GA-SSB9-8	6-8	12/10/90	Brown Fine-Coarse SAND and GRAVEL, Some Silt, Trace Clay (SM/GM)	43.0	43.3	10.5	3.2		
LO-SSB10-4	2-4	12/12/90	Brown Fine-Coarse SAND, Some Silt, Little Clay and Gravel (SM)	6.9	62.1	24.0	7.0		
SA-SSB11-4	2-4	12/9/90	Brown Fine-Coarse GRAVEL, Some Sand, Silt and Clay (GM)	57.8	29.9	6.2	6.1		
SA-SSB11-4 DUP	2-4	12/9/90	Brown Fine-Coarse GRAVEL, Some Sand, Silt and Clay (GM)	47.5	19.6	16.5	16.4		
SA-SSB11-10	8-10	12/9/90	Brown Fine-Coarse SAND, Some Gravel and Silt, Little Clay (SM)	33.3	41.1	19.2	6.4		

TABLE 4-2
(continued)

Sample Number	Sample Depth (ft)	Date Sampled	Unified Soils Classification System (USCS)	Gravel %	Sand %	Silt %	Clay %	LL	PI
GA-SSB12-4	2-4	12/9/90	Brown Fine-Coarse SAND and GRAVEL, Little Silt, Trace Clay (SP-SM/GP-GM)	40.7	50.3	5.1	3.9		
GA-SSB12-8	6-8	12/9/90	Brown Fine-Coarse SAND and GRAVEL, Trace Silt and Clay (SP-SM/GP-GM)	40.4	53.6	3.3	2.7		
GA-SSB13-4	2-4	12/9/90	Brown Sandy SILT, Little Clay and Gravel (ML)	6.3	41.6	44.5	7.6		
GA-SSB13-12	10-12	12/9/90	Brown Fine-Coarse SAND and GRAVEL, Little Silt, Trace Clay (SW-SM/GW-GM)	46.5	44.5	6.3	2.7		
GA-SSB14-2	0-2	12/9/90	Brown-Black Silty Fine-Coarse SAND, Some Gravel, Little Clay (SM)	23.5	32.6	35.9	8.0		
GA-SSB14-6	4-6	12/9/90	Brown Fine-Coarse GRAVEL, Some Sand,	54.7	31.6	8.0	5.7		
GA-SSB15-4	2-4	12/12/90	Brown Fine-Coarse SAND, Some Gravel and Silt, Little Clay (SM)	27.7	54.5	12.6	5.2		
GA-SSB15-6	4-6	12/12/90	Brown Sandy SILT, Little Clay, Trace Gravel (ML)	4.7	35.6	48.6	11.1		
SC-SSB16-4	2-4	12/10/90	Brown Fine-Coarse SAND, Little Gravel and Silt, Trace Clay (SP-SM)	8.4	82.7	5.9	3.0		
SC-SSB16-4 DUP	2-4	12/10/90	Brown-Black Fine-Coarse SAND, Some Gravel, Silt and Clay (SM)	21.6	46.5	19.5	12.4		

TABLE 4-2
(continued)

Sample Number	Sample Depth (ft)	Date Sampled	Unified Soils Classification System (USCS)	Gravel %	Sand %	Silt %	Clay %	LL	PI
SC-SSB16-8	6-8	12/10/90	Brown Fine-Coarse SAND and GRAVEL, Little Silt, Trace Clay (SW-SM/GW-GM)	46.3	45.2	5.9	2.6		
SA-SSB17-4	2-4	12/9/90	Brown Sandy SILT, Little Clay (ML)	0.3	44.0	44.7	11.0		
SA-SSB17-10	8-10	12/9/90	Brown Fine-Coarse GRAVEL, Some Sand, Little Silt and Clay (GW-GM)	59.2	33.9	3.5	3.4		
SM-SSB18-6	4-6	12/13/90	Brown Sandy SILT, Little Clay (ML)	0.0	40.6	51.2	8.2		
SM-SSB18-10	8-10	12/13/90	Brown Fine-Coarse SAND, Some Gravel, Silt and Clay (SM)	31.7	44.0	12.2	12.1		
SM-SSW1D-44	42-44	12/18/90	Gray SILT, Some Sand and Gravel, Little Clay (ML)	23.9	24.3	41.1	10.7		
SC-SSW2D-18	16-18	12/7/90	Gray Lean CLAY, Trace Sand and Gravel (CL)	1.0	2.9	67.6	28.5	35	18
SC-SSW2D-44	42-44	12/8/90	Brown Fine-Medium SAND, Little Silt, Trace Clay (SP-SM)	0.0	90.1	7.1	2.8		
GA-SSW3D-10	8-10	12/5/90	Brown Fine-Coarse SAND and GRAVEL, Little Silt, Trace Clay (SP-SM/GP)	40.1	52.1	5.5	2.3		
GA-SSW3D-44	42-44	12/6/90	Gray-Brown Fine-Coarse SAND, Some	27.5	38.2	25.8	8.5		

TABLE 4-2
(continued)

Sample Number	Sample Depth (ft)	Date Sampled	Unified Soils Classification System (USCS)	Gravel %	Sand %	Silt %	Clay %	LL	PI
GA-SSW4D-4	2-4	12/19/90	Brown-Black Lean CLAY, Some Sand, Little Gravel (CL)	11.3	28.3	41.0	19.4	31	14
GA-SSW4D-34	32-34	12/19/90	Gray Clayey Fine GRAVEL, Some Sand and Silt (GC)	40.0	30.9	19.0	10.1	23	10
GA-SSW5D-16	14-16	12/10/90	Brown Fine-Coarse GRAVEL, Some Sand, Little Silt, Trace Clay (GW-GM)	62.4	30.2	5.8	1.6		
GA-SSW5D-40	38-40	12/10/90	Brown Fine-Coarse SAND and GRAVEL, Some Silt, Trace Clay (SM/GM)	37.2	38.6	20.2	4.0		
GA-SSW6D-18	16-18	12/5/90	Brown SILT, Some Sand, Little Clay (ML)	0.2	19.0	75.4	5.4		
GA-SSW6D-50	48-50	12/6/90	Gray-Brown SILT, Little Sand and Clay, Trace Gravel (ML)	1.3	9.1	82.8	6.8		
LO-SSW7D-18	16-18	12/11/90	Brown Silty Fine-Coarse SAND, Some Gravel, Little Clay (SM)	21.1	43.5	30.3	5.1		
LO-SSW7D-26	24-26	12/11/90	Gray and Brown SILT, Some Sand, Little Clay and Gravel (ML)	7.2	30.0	54.8	8.0		
LO-SSW8D-6	4-6	12/12/90	Brown Silty Fine-Coarse SAND, Some Gravel, Little Clay (SM)	13.1	51.2	29.4	6.3		
LO-SSW8D-36	34-36	12/12/90	Gray Fine-Coarse GRAVEL, Some Sand and Silt, Little Clay (GM)	41.5	27.0	25.7	5.8	23	8

TABLE 4-2
(continued)

Sample Number	Sample Depth (ft)	Date Sampled	Unified Soils Classification System (USCS)	Gravel %	Sand %	Silt %	Clay %	LL	PI
GA-SSW9D-14	12-14	12/7/90	Brown Fine-Coarse SAND and GRAVEL, Trace Silt and Clay (SP-GP)	48.8	46.6	2.6	2.0		
GA-SSW9D-46	44-46	12/8/90	Brown Fine-Coarse SAND and GRAVEL, Little Silt, Trace Clay (SP-SM/GP-GM)	41.5	48.6	7.8	2.1		
GA-SSW10I-14	26-27	9/6/91	Gray Coarse-Fine SAND, Some Gravel and Silt, Little Clay	23.5	45.8	23.8	5.1		
LO-SSW11S-14	13-14.5	9/7/91	Brown Fine-Coarse SAND, Some Gravel, Little Silt, Trace Clay	26.1	67.1	5.8	1.0		

Notes:
LL = Liquid Limit (The water content of the sample when it has a shear strength of 1 g/sq.cm)
PI = Plasticity Index (The range in water content between the liquid limit and the plastic limit)
DUP = Duplicate sample
Sample depth in feet below ground surface

SG_GEO/TJM/ajs/DAP

TABLE 4-3
Top Of Bedrock Elevation Data
Saegertown Industrial Area Site RI

Boring/Well Number	Surface Elevation	Depth to Bedrock	Bedrock Elevation
B18A	1141.2	27.5	1113.7
W1D	1129.2	46.5	1082.7
W2D	1119.9	46.0	1073.9
W5D	1115.7	47.8	1067.9
W7D	1106.2	40.5	1065.7
W9D	1115.1	49.8	1065.3

Notes:
Elevations in ft MSL, USGS Datum
Depth in ft below ground surface

SG_BEDRX/TJM/ajs

Table 4-4
Results of Shallow Auger Probe Drilling
Saegertown Industrial Area Site RI

Auger Probe Number	Sludge Interval	Sludge Thickness	HNu Measurement	Comments
AP 1	3.5-6.0	2.5	3.0-10.0	
AP 2	NP	0.0	0.0	
AP 3	NP	0.0	0.0	
AP 4	4.5-6.0	1.5	1.0-3.0	
AP 5	1.5-4.0	2.5	7.0	
AP 6	NP	0.0	0.0	
AP 7	NP	0.0	0.0	
AP 8	NP	0.0	0.0	
AP 9	2.0-5.0	>3	3.0	
AP 10	NP	0.0	0.0	
AP 11	NP	0.0	0.0	
AP 12	NP	0.0	0.0	
AP 13	NP	0.0	0.0	
AP 14	NP	0.0	0.0	
AP 15	NP	0.0	0.0	
AP 16	NP	0.0	0.5	
AP 17	2.0-5.0	3.0	3.0	
AP 18	NP	0.0	0.0	
AP 19	2.0-4.0	2.0	0.5	
AP 20	2.0-4.0	2.0	3.0	
AP 21	NP	0.0	1.0	
AP 22	NP	0.0	1.0	
AP 23	NP	0.0	0.5	
AP 24	4.5-6	1.5	0.5	
AP 25	NP	0.0	0.0	
AP 26	3.5-7.0	3.5	5.0	
AP 27	NP	0.0	0.0	
AP 28	3.0-6.0	3.0	4.0	
AP 29	NP	0.0	0.0	
AP 30	4.0-5.0	>1	1.0	
AP 31	4.0-5.0	>1	1.0	
AP 32	NP	0.0	0.0	
AP 33	NP	0.0	0.0	
AP 34	2.5-4.0	1.5	3.0	
AP 35	3.0-5.0	>2	50.0	
AP 36	NP	0.0	4.0	
AP 37	NP	0.0	10.0	
AP 38	NP	0.0	7.0	
AP 39	1.5-3.0'	1.5	40.0	
AP 40	2.0-4.0	2.0	10.0	
AP 41	2.0-4.0	2.0	20.0	
AP 42	NP	0.0	0.0	
AP 42A	2.5-4.0	1.5	6.0	

Table 4-4
(continued)

Auger Probe Number	Sludge Interval	Sludge Thickness	HNu Measurement	Comments
AP 43	NP	0.0	2.0	
AP 43A	NP	0.0	2.0	
AP 44	NP	0.0	0.0	
AP 45	NP	0.0	0.0	
AP 46	NP	0.0	1.0	
AP 47	NP	0.0	0.0	
AP 48	3.5-5.5	2.0	0.0	Wet Sewage Odor
AP 49	NP	0.0	0.0	
AP 50	NP	0.0	0.0	
AP 51	NP	0.0	3.0-5.0	
AP 52	0-0.5	0.5	--	
AP 53	NP	0.0	0.5	
AP 54	NP	0.0	0.0	
AP 55	NP	0.0	0.0	
AP 56	NP	0.0	0.0	
AP 57	NP	0.0	.5-3.0	Black asphaltic substance at surface.
AP 58	NP	0.0	0.0	
AP 59	NP	0.0	0.0	
AP 60	1.5-4.0	2.5	20.0	
AP 61	NP	0.0	2.0-5.0	Material from 2 to 5 feet was oily
AP 62	NP	0.0	0.0	Material from 2 to 5 feet was oily
AP 63	NP	0.0	0.0	
AP 64	NP	0.0	0.0	
AP 65	0-3.5	3.5	2.0-3.0	
AP 66	NP	0.0	1.0-3.0	
AP 67	NP	0.0	0.5	
AP 68	1.0-7.0	6.0	10.0-30.0	
AP 69	2.0-6.0	4.0	10.0-50.0	
AP 70	NP	0.0	20.0-25.0	
AP 71	2.0-3.0	1.0	30.0-50.0	
AP 72	NP	0.0	1.0-2.0	
AP 73	NP	0.0	1.0-2.0	
AP 74	NP	0.0	0.0	
AP 75	0-1.5	1.5	0.5	
AP 76	NP	0.0	0.0	
AP 77	NP	0.0	0.0	
AP 78	NP	0.0	0.0	
AP 79	NP	0.0	0.0	
AP 80	0-0.5	0.5	0.0	
AP 81	NP	0.0		No HNu measurements recorded.
AP 82	1.0-5.0	>4.0	20.0	
AP 83	2.0-5.0	>3.0	8.0	
AP 84	NP	0.0	0.0	

Table 4-4
(continued)

Auger Probe Number	Sludge Interval	Sludge Thickness	HNu Measurement	Comments
AP 85	NP	0.0	0.0	
AP 86	NP	0.0	0.0	
AP 86X	2.0-2.5	>0.5	1.5	
AP 87	NP	0.0	0.0	
AP 88	NP	0.0	0.0	
AP 88X	2.0-2.5	0.5	7.0	
AP 89	NP	0.0		No HNu measurements recorded.
AP 90	NP	0.0	0.0	

NP indicates that sludge was not present.

APROBE.XLS/AJS/DAP

TABLE 4-5
Groundwater and Surface Water Elevation Data
Saegertown Industrial Area Site RI

	Data Location	Total Well Depth (ft)	Reference Elevation (USGS)	Depth to Water 2/2/91	Water Elevation 2/2/91	Depth to Water 4/24/91	Water Elevation 4/24/91	Depth to Water 8/21/91	Water Elevation 8/21/91	Depth to Water 9/27/91	Water Elevation 9/27/91
Groundwater Monitoring Wells	W1S	20.68	1128.26	13.33	1114.93	13.02	1115.24	16.46	1111.80	16.69	1111.57
	W1D	49.33	1128.57	10.06	1118.51	10.60	1117.97	14.68	1113.89	16.00	1112.57
	W2S	20.05	1121.87	13.96	1107.91	14.42	1107.45	Dry	Dry	Dry	Dry
	W2D	44.30	1121.74	13.80	1107.94	14.26	1107.48	20.90	1100.84	22.42	1099.32
	W3S	16.75	1124.40	8.54	1115.86	6.25	1118.15	Dry	Dry	Dry	Dry
	W3D	45.15	1124.44	9.30	1115.14	7.29	1117.15	18.66	1105.78	19.98	1104.46
	W4S	20.87	1115.82	9.56	1106.26	9.65	1106.17	15.00	1100.82	16.07	1099.75
	W4D	44.40	1115.82	9.98	1105.84	10.75	1105.07	15.45	1100.37	16.54	1099.28
	W5S	19.84	1117.91	8.51	1109.40	7.53	1110.38	15.44	1102.47	16.59	1101.32
	W5D	45.20	1118.02	8.53	1109.49	7.61	1110.41	15.54	1102.48	16.64	1101.38
	W6S	23.40	1126.81	15.29	1111.52	13.76	1113.05	22.48	1104.33	Dry	Dry
	W6D	53.40	1126.80	15.95	1110.85	14.75	1112.05	23.03	1103.77	23.78	1103.02
	W7S	16.65	1108.80	8.18	1100.62	7.46	1101.34	11.68	1097.12	12.23	1096.57
	W7D	41.57	1108.27	7.80	1100.47	7.18	1101.09	10.98	1097.29	11.33	1096.94

TABLE 4-5

(continued)

Data Location	Total Well Depth (ft)	Reference Elevation (USGS)	Depth to Water 2/2/91	Water Elevation 2/2/91	Depth to Water 4/24/91	Water Elevation 4/24/91	Depth to Water 8/21/91	Water Elevation 8/21/91	Depth to Water 9/27/91	Water Elevation 9/27/91
W8S	17.15	1107.26	7.02	1100.24	6.34	1100.92	10.07	1097.19	10.45	1096.81
W8D	40.05	1107.47	6.76	1100.71	6.02	1101.45	9.13	1098.34	9.76	1097.71
W9S	20.02	1117.29	10.24	1107.05	10.36	1106.93	16.24	1101.05	17.42	1099.87
W9D	48.60	1117.59	10.53	1107.06	10.67	1106.92	16.59	1101.00	17.77	1099.82
W10I	27.30	1119.54	-	-	-	-	-	-	18.01	1101.53
W11S	16.20	1106.94	-	-	-	-	-	-	7.52	1099.42
GATX1	51.15	1121.95	10.81	1111.14	9.35	1112.60	18.64	1103.31	19.80	1102.15
GATX2	21.05	1113.49	7.18	1106.31	7.05	1106.44	11.56	1101.93	12.43	1101.06
GATX3	37.55	1116.24	6.36	1109.88	5.42	1110.82	13.54	1102.70	14.73	1101.51
GATX4S	25.85	1114.99	6.58	1108.41	8.13	1106.86	13.24	1101.75	14.41	1100.58
GATX4D	49.05	1114.95	6.75	1108.20	6.40	1108.55	13.25	1101.70	14.41	1100.54
GATX5	43.60	1115.91	8.56	1107.35	8.72	1107.19	14.81	1101.10	15.99	1099.92
SMC1	25.28	1125.12	-	-	17.21	1107.91	Dry	Dry	Dry	Dry
SMC3	44.78	1125.14	-	-	16.10	1109.04	23.61	1101.53	-	-
SCI-East	26.67	1122.41	13.69	1108.72	14.12	1108.29	21.27	1101.14	22.67	1099.74

TABLE 4-5
(continued)

	Data Location	Total Well Depth (ft)	Reference Elevation (USGS)	Depth to Water 2/2/91	Water Elevation 2/2/91	Depth to Water 4/24/91	Water Elevation 4/24/91	Depth to Water 8/21/91	Water Elevation 8/21/91	Depth to Water 9/27/91	Water Elevation 9/27/91
	SCI-West	28.00	1123.90	15.80	1108.10	16.24	1107.66	23.02	1100.88	24.55	1099.35
Surface Water	WEG1		1116.92	3.31	1113.61	3.02	1113.90	-	-	Dry	Dry
	WEG2		1104.24	3.34	1100.90	3.93	1100.31	-	-	Dry	Dry
	WEG2A		1117.46	-	-	17.00	1100.46	-	-	17.15	1100.31
	WEG3		1114.22	1.71	1112.51	0.87	1113.35	-	-	Dry	Dry
	WEG4		1124.17	22.20	1101.97	20.44	1103.73	-	-	Couldn't Find	
	WEG5		1101.42	4.10	1097.32	2.61	1098.81	-	-	5.2	1096.22
	WEG5A		1115.45	17.8	1097.65	16.31	1099.14	-	-	19.1	1096.35

Notes:
Reference elevation for monitoring wells is top of inner well casing
GW = Ground water elevation in ft MSL, USGS Datum
- Not Measured

SG_GWEL.XLS/AJS/DAP

AR303608

TABLE 4-6
Horizontal Groundwater Gradients
Saegertown Industrial Area Site RI

Water Table Wells

	Flow Path 1		Flow Path 2		Flow Path 3		Flow Path 4	
	W1S	**W2S**	**W3S**	**W4S**	**W5S**	**W7S**	**W6S**	**W8S**
Flow Path Length	675 ft		1090 ft		1160 ft		1530 ft	
Water Elevation								
February 2, 1991	1114.93	1107.91	1115.86	1106.26	1109.40	1100.62	1111.52	1100.24
April 24, 1991	1115.24	1107.45	1118.15	1106.17	1110.38	1101.34	1113.05	1100.92
August 21, 1991	1111.80	Dry	Dry	1100.82	1102.47	1097.12	Dry	1097.19
September 27,1991	1111.57	Dry	Dry	1099.75	1101.32	1096.57	Dry	1096.81
Elevation Difference (dH)								
February 2, 1991		7.02 ft		9.60 ft		8.78 ft		11.28 ft
April 24, 1991		7.79 ft		11.98 ft		9.04 ft		12.13 ft
August 21, 1991		--		--		5.35 ft		-- ft
September 27,1991		--		--		4.75 ft		-- ft
Horizontal Gradient								
February 2, 1991		0.010		0.009		0.008		0.007
April 24, 1991		0.012		0.011		0.008		0.008
August 21, 1991		--		--		0.005		--
September 27,1991		--		--		0.004		--

TABLE 4-6
(continued)

Deeper Wells

	Flow Path 1		**Flow Path 2**		**Flow Path 3**		**Flow Path 4**	
	W1D	**W2D**	**W3D**	**W4D**	**W5D**	**W7D**	**W6D**	**W8D**
Flow Path Length	680 ft		1090 ft		1125 ft		1520 ft	
Water Elevation								
February 2, 1991	1118.51	1107.94	1115.14	1105.84	1109.49	1100.47	1110.85	1100.71
April 24, 1991	1117.97	1107.48	1117.15	1105.07	1110.41	1101.09	1112.05	1101.45
August 21, 1991	1113.89	1100.84	1105.78	1100.37	1102.48	1097.29	1103.77	1098.34
September 27,1991	1112.57	1099.32	1104.46	1099.28	1101.38	1096.94	1103.02	1097.71
Elevation Difference (dH)								
February 2, 1991		10.57 ft		9.30 ft		9.02 ft		10.14 ft
April 24, 1991		10.49 ft		12.08 ft		9.32 ft		10.60 ft
August 21, 1991		13.05 ft		5.41 ft		5.19 ft		5.43 ft
September 27,1991		13.25 ft		5.18 ft		4.44 ft		5.31 ft
Horizontal Gradient								
February 2, 1991		0.016		0.009		0.008		0.007
April 24, 1991		0.015		0.011		0.008		0.007
August 21, 1991		0.019		0.005		0.005		0.004
September 27,1991		0.019		0.005		0.004		0.003

Notes:
Groundwater elevation in feet MSL, USGS Datum

SG_GWGRD/TJM/sjb/DAP

TABLE 4-7
Vertical Groundwater Gradients
Saegertown Industrial Area Site RI

Well Number	2/2/91 Groundwater Elevation	2/2/91 Vertical Gradient	4/24/91 Groundwater Elevation	4/24/91 Vertical Gradient	8/21/91 Groundwater Elevation	8/21/91 Vertical Gradient	9/27/91 Groundwater Elevation	9/27/91 Vertical Gradient
W1S	1114.93	-0.108	1115.24	-0.081	1111.8	-0.069	1111.57	-0.033
W1D	1118.51		1117.97		1113.89		1112.57	
W2S	1107.91	-0.001	1107.45	-0.001	Dry		Dry	
W2D	1107.94		1107.48					
W3S	1115.86	0.021	1118.15	0.028	Dry		Dry	
W3D	1115.14		1117.15					
W4S	1106.26	0.013	1106.17	0.034	1100.82	0.017	1099.75	0.018
W4D	1105.84		1105.07		1100.37		1099.28	
W5S	1109.4	-0.003	1110.38	0.007	1102.47	0.	1101.32	-0.002
W5D	1109.49		1110.14		1102.48		1101.38	
W6S	1111.52	0.019	1113.05	0.027	Dry		Dry	
W6D	1110.85		1112.05					
W7S	1100.62	0.005	1101.34	0.008	1097.12	-0.006	1096.57	-0.014
W7D	1100.47		1101.09		1097.29		1096.94	
W8S	1100.24	-0.015	1100.92	-0.017	1097.19	-0.042	1096.81	-0.033
W8D	1100.71		1101.45		1098.34		1097.71	
W9S	1107.05	0.	1106.93	0.	1101.05	0.002	1099.87	0.002
W9D	1107.06		1106.92		1101		1099.82	

Notes:
Negative value indicates upward gradient
Positive value indicates downward gradient
Groundwater elevations are in feet MSL.

SG_VGRD.XLS/AJS/___

TABLE 4-8
Results of In-Situ Hydraulic Conductivity Tests
Saegertown Industrial Area Site RI

Well Number	Test Method	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/min)	Geometric Mean (cm/sec)	Geometric Mean (ft/min)
W1D	Bailer	7.7E-05	1.5E-04		
W1D	Bailer	5.8E-05	1.1E-04	6.7E-05	1.3E-04
W2D	Pressure	3.0E-03	5.9E-03		
W2D	Bailer	1.4E-02	2.8E-02	6.5E-03	1.3E-02
W3D	Pressure	7.3E-03	1.4E-02		
W3D	Bailer	1.4E-02	2.7E-02	1.0E-02	2.0E-02
W4D	Pressure	1.5E-03	2.9E-03		
W4D	Bailer	1.7E-03	3.4E-03	1.6E-03	3.1E-03
W5D	Pressure	3.7E-02	7.3E-02	NA	NA
W6D	Bailer	1.1E-04	2.2E-04		
W6D	Bailer	1.4E-04	2.7E-04	1.2E-04	2.4E-04
W7D	Pressure	3.5E-04	6.8E-04		
W7D	Bailer	2.1E-04	4.1E-04	2.7E-04	5.3E-04
W8D	Bailer	6.2E-05	1.2E-04	NA	NA
W9D	Pressure	2.2E-03	4.3E-03		
W9D	Bailer	6.8E-01	1.3E-02	3.9E-02	7.6E-03

Notes:
Bailer Method refers to water level drawdown by manual bailing.
Pressure Method refers to water level drawdown by pressurized air.
Hydraulic conductivity calculations based on the Bouwer and Rice Method.

SGSLUG.XLS/TJM/cb

TABLE 4-9
Hydraulic Conductivity Estimates Based on Grain Size
Saegertown Industrial Area Site RI

Well Number	Representative Grain Size Sample	Depth Interval	D10	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/min)
W1S	SM-SSB18-6	4-6 ft	0.0188	3.5E-04	7.0E-04
W2S	SC-SSB2-6	4-6 ft	0.1314	1.7E-02	3.4E-02
W3S	GA-SSW3D-10	8-10 ft	0.1738	3.0E-02	5.9E-02
W4S	GA-SSB4-8	6-8 ft	0.1318	1.7E-02	3.4E-02
W5S	GA-SSW5D-16	14-16 ft	0.2304	5.3E-02	1.0E-01
W6S	GA-SSW6D-18	16-18 ft	0.0116	1.3E-04	2.6E-04
W7S	LO-SSW7D-18	16-18 ft	0.0141	2.0E-04	3.9E-04
W8S	LO-SSW8D-6	4-6 ft	0.0139	1.9E-04	3.8E-04
W9S	GA-SSW9D-14	12-14 ft	0.0285	8.1E-04	1.6E-03
W10I	GA-SSW10I-26	24-26 ft	0.0133	1.8E-04	3.5E-04
W11S	LO-SSW11S-14	12-14 ft	0.1799	3.2E-02	6.4E-02

Notes:
Grain size data including D10 values are included in Appendix G.
Hydraulic conductivity was calculated by Hazen equation (pg. 350, Freeze and Cherry, 1979)

SG_HYDCO.XLS/TJM/cb/DAP

TABLE 4-10
Estimated Average Linear Groundwater Flow Velocities
Saegertown Industrial Area Site RI

Well Number	Permeability (cm/sec)	Flow Direction	Horizontal Gradient	Groundwater Velocity (feet/year)
W1S	3.53E-04	West	0.013	24
	3.53E-04		0.026	47
W1D	6.66E-05	West	0.025	9
	6.66E-05		0.030	10
W2S	1.73E-02	West	0.010	931
	1.73E-02		0.002	179
W2D	6.53E-03	West	0.016	524
	6.53E-03		0.011	372
W3S	3.02E-02	West	0.009	1375
	3.02E-02		0.008	1250
W3D	1.00E-02	West	0.009	440
	1.00E-02		0.006	310
W4S	1.74E-02	West	0.005	450
	1.74E-02		0.003	270
W4D	1.59E-03	West	0.005	41
	1.59E-03		0.005	41
W5S	5.31E-02	WSW	0.007	1923
	5.31E-02		0.003	824
W5D	3.71E-03	WSW	0.007	134
	3.71E-03		0.004	77
W6S	1.34E-04	WSW	0.007	5
	1.34E-04		0.004	3
W6D	1.24E-04	WSW	0.007	4
	1.24E-04		0.005	3
W7S	1.99E-04	WSW	0.008	8
	1.99E-04		0.001	1
W7D	2.08E-04	WSW	0.008	9
	2.08E-04		0.005	5
W8S	1.93E-04	WSW	0.008	8
	1.93E-04		0.001	1
W8D	6.24E-05	WSW	0.008	3
	6.24E-05		0.005	2

TABLE 4-10
(continued)

Well Number	Permeability (cm/sec)	Flow Direction	Horizontal Gradient	Groundwater Velocity (feet/year)
W9S	8.13E-02	West	0.005	2102
	8.13E-02		0.003	1261
W9D	3.86E-02	West	0.005	1000
	3.86E-02		0.007	1400
W10I	3.20E-02	WSW	0.005	828
W11S	1.80E-04	WSW	0.003	3

Notes:
1. The permeability values for the shallow wells are based on grain size distribution data. The permeability values for the deep wells are based on the field hydraulic conductivity tests.
2. Horizontal gradients were estimated based on data collected on 2/21/91 and 9/27/91, respectively.
3. The first row for each well presents the data for 2/21/91 and the second row presents data for 9/27/91. Wells W10I and W11S were installed during Phase 2; no data exists for 2/21/91.
4. The velocities shown are based on an assumed porosity of 0.2.

SG_GWVEL.XLS/AJS/DAP

TABLE 5-1
Key to Analytical Data Appendices
Saegertown Industrial Area Site

	Appendix												
	K	L				M	N	O	P	Q	R	S
			GATX									
Sample Matrix/ Property or Unit	Background Data	Site-Wide	Sludge Bed/ Lagoon Area	Pond Area	Former Railcar Siding Area	Lord	SCI	SMC	French Creek	Private Wells	Borough Wells	Drilling Water/ Blanks
Groundwater	K1	L1	--	--	-	M1	N1	--	--	Q	R	S
Subsurface Soils	K2	--	L2	L4	L7	M2	N2	O1	--	--	--	--
Sediments	K3	--	--	L5	--	M3	--	O2	P1	--	--	--
Surface Soils	K4	--	L3	--	L8	--	--	--	-	--	--	--
Surface Water	K5	--	--	L6	--	--	--	--	P2	--	--	--

ajs/saegdata/gep

Table 5-2

STATISTICAL SUMMMARY OF BACKGROUND SOIL DATA

Saegertown Industrial Area Site RI/FS

PARAMETER	Observed Range mg/kg	AVERAGE	STANDARD DEVIATION	# Sample Locations n	95% UCL 0.95 QUANTILE mg/kg	EASTERN U.S. CONCENTRATIONS Mean mg/kg	Observed Range mg/kg	STD	n	K	95% UCL 0.95 QUANTILE mg/kg
Aluminum (MG/KG)	6,180 - 10,000	7,888	1,278	6	12,600	33,000	7,000 - 100,000	28700	477	1.763	84,000
Arsenic (MG/KG)	6.9 - 14.5	10.3	3.04	6	21.6	4.8	0.1 - 73	2.56	527	1.763	9.3
Barium (MG/KG)	28.3 - 60.6	42.2	10.5	6	81.0	290	10 - 1,500	2.35	541	1.763	290
Calcium (MG/KG)	570 - 2,470	1,346	704	6	3,960	3,400	100 - 280,000	30800	514	1.763	58,000
Chromium, total (MG/KG)	5.5 - 11.1	7.72	1.89	6	14.7	33	1 - 1,000	2.6	541	1.763	38
Cobalt (MG/KG)	6.3 - 11.7	9.2	1.84	6	16.0	5.9	0.3 - 70	2.57	533	1.763	10
Copper (MG/KG)	7.9 - 21.9	14.0	4.81	6	31.9	13	1 - 700	2.8	533	1.763	18
Iron (MG/KG)	12,600 - 24,900	18,583	4,897	6	36,800	14,000	100 - 100,000	28700	540	1.763	65,000
Lead (MG/KG)	9.9 - 14	11.1	1.61	6	17.1	14	10 - 300	1.95	541	1.763	17
Magnesium (MG/KG)	1,640 - 2,720	2,122	439	6	3,750	2,100	50 - 50,000	35500	528	1.763	64,700
Manganese (MG/KG)	260 - 741	550	178	6	1,210	260	2 - 7,000	3.82	540	1.763	270
Nickel (MG/KG)	11.5 - 17.1	14.7	1.84	6	21.5	11	5 - 700	2.64	540	1.763	16
Potassium (MG/KG)	431 - 957	684	214	6	1,480	12,000	50 - 37,000	7500	537	1.763	25,000
Selenium (MG/KG) *	0.67 - 0.67	0.301	0.181	1	0.973	0.3	0.1 - 3.9	2.44	534	1.763	4.6
Thallium (MG/KG) *	0.74 - 0.99	0.605	0.273	4	1.62		-				
Zinc (MG/KG)	32.5 - 59.4	45.8	10.9	6	86.1	40	5 - 2,900	2.11	482	1.763	44

95% Upper Confidence Limit of the 0.95 Quantile is calculated as (Average + (STD Dev * K) where K=3.711, for alpha=0.05 and n=6. (Gilbert, R.O., 1987. Statistical Methods for Environmental Pollution Monitoring, p.134)

Statistical Analysis of metal concentrations in the Eastern United States (east of 96th meridian) (Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S. Geological Survey Paper 1270, 1984.) provided as a comparison. Site background levels fall within expected ranges for eastern soils.

* Selenium and Thallium were not detected in any background samples. A value of 1/2 the sample quantitation limit is used for the non-detect samples, as detailed below.

SAMPLE	SELENIUM DETECT	SELENIUM DL	SELENIUM 0.5SQL/VALUE	THALLIUM DETECT	THALLIUM DL	THALLIUM 0.5SQL/VALUE
SSB11-10		0.452	0.226	0.74	0.678	0.74
SSB11-10		0.472	0.236	0.78	0.708	0.78
SSB12-04		0.46	0.23	0.47	0.69	0.47
SSB12-08	0.67	0.472	0.67	0.99	0.708	0.99
SSB17-04		0.464	0.232		0.65	0.325
SSB17-10		0.42	0.21		0.646	0.323
	AVG =		0.301		AVG =	0.605
	STD =		0.181		STD =	0.273
	95% UCL =		0.973		95% UCL =	1.619

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[saegertown.2020]bkdsb.w20
JAH/jah/MWK

Table 5-3

STATISTICAL SUMMARY OF BACKGROUND GROUNDWATER DATA

Saegertown Industrial Area Site RI/FS

	Concentration or 1/2 Sample Quantitation Limit						Statistical Summary					Background Value
Parameter	GA-GWW06D-01	GA-GWW06S-01	AVERAGE SA-GWW01D-	AVERAGE SA-GWW01S-	AVERAGE SA-GWW03D-	SA-GWW03S-01	MINIMUM	MAXIMUM	# Locations Sampled	AVERAGE	STD	95% UCL .95 QUANTILE
Arsenic (UG/L)	5.3	1	1	1	11.65	1	1	11.65	6	3.49	4.35	19.6
Barium (UG/L)	52	10	81.5	57	101.5	5	5	101.5	6	51.17	38.25	193
Calcium (UG/L)	41100	49800	14500	73000	42050	16200	14,500	73,000	6	39,442	21,933	121,000
Cobalt (UG/L)	5	5	5	5	5	5	5	5	6	5.00	0.00	5.00
Iron (UG/L)	10	10	10	26	10	10	10	26	6	12.67	6.53	36.9
Magnesium (UG/L)	7940	6540	3745	13150	9845	3290	3,290	13,150	6	7,418	3,750	21,300
Manganese (UG/L)	212	5	28.5	580.5	135	5	5	581	6	161	222	983
Potassium (UG/L)	2190	1370	2165	1925	1025	940	940	2,190	6	1,603	564	3,700
Silver (UG/L)	5	5	5	7.5	5	5	5	7.5	6	5.42	1.02	9.20
Sodium (UG/L)	3760	2310	55950	22400	11350	2750	2,310	55,950	6	16,420	20,834	93,700
Zinc (UG/L)	5	5	9	10.5	5	5	5	10.5	6	6.58	2.50	15.9

All values in ug/L.

Many metals were not detected in all background samples. Values are either the detected concentration or 1/2 the sample quantitation limit for the non-detected analyte. For samples GWW01D, GWW01S, and GWW03D, analyzed during both sampling rounds, results for the two rounds were averaged.

95% Upper Confidence Limit of the 0.95 Quantile is calculated as (Average + (STD Dev * K) where K for p=0.95 and alpha=0.05 is 3.711.
(Gilbert, R.O., 1987. Statistical Methods for Environmental Pollution Monitoring, p.134)

[Saegertown.2020]BKDGW.w20
12/5/91
JAH/jah/MWK

Table 5-4
Results of Temporary Well Point Sampling
Saegertown Industrial Area Site RI

	Sample Location	Sample Depth	Sample Elev. Interval	PCE (2,3)	TCE	Total 1,2-DCE	1,1,1-TCA	Benzene	Ethyl-benzene	Toluene	Xylene	Total Ethenes	Total VOCs
	W7S	10.	1105.	106	21	15	58				NA	142	200
Phase 2	WP 1	10.	1095.9	44	44	15	33				NA	103	136
Temporary		24.	1081.9								NA	0	0
Well Points (1)		30.	1075.9								NA	0	0
	WP 2	12.	1094.2	96	20	23	66				NA	139	205
	WP 3	12.	1094.8	99	15	15	36				NA	129	165
	WP 4	12.	1095.3	135	25	319	6				NA	479	485
	WP 5	12.	1095.5		16				22		NA	16	38
		11.	1096.5	73	48	35	32				NA	156	188
	WP 6	12.	1095.3	39	242	1125					NA	1406	1406
		20.	1087.3	88	65	64					NA	217	217
	WP 7	12.	1097.1								NA	0	0
		14.	1093.3								NA	0	0
	WP 8	12.	1098.1								NA	0	0
	WP 9	12.	1098.7								NA	0	0
	WP 10	14.	1092.3								NA	0	0
	WP 11	14.	1092.6								NA	0	0
	WP 12	14.	1093.6	622	93	302					NA	1017	1017
	WP 13	14.	1093.1		159	32					NA	191	191
	WP 14	14.	1093.7	73	36	72					NA	181	181
	WP 15	14.	1093.8	165	107	511					NA	783	783
	WP 16	14.	1094.9			26					NA	26	26
	WP 17	14.	1093.9	531	209	36					NA	776	776
	WP 18	12.	1098.								NA	0	0
	WP 19	20.	1098.2								NA	0	0
		27.	1091.2							24	NA	0	24
	WP 20	20.	1097.2								NA	0	0
		27.	1090.2		35	22					NA	57	57
	WP 21	20.	1095.8								NA	0	0
		27.	1088.8								NA	0	0
	WP 22	20.	1097.9								NA	0	0
		27.	1090.9		41						NA	41	41
		35.	1082.9								NA	0	0

Table 5-4
(continued)

	Sample Location	Sample Depth	Sample Elev. Interval	PCE (2,3)	TCE	Total 1,2-DCE	1,1,1-TCA	Benzene	Ethyl-benzene	Toluene	Xylene	Total Ethenes	Total VOCs
	WP 23	20.	1097.3					29	52	52	NA	0	133
		27.	1090.3								NA	0	0
	WP 24	14.	1097.								NA	0	0
	WP 25	15.	1096.3	48	43	70					NA	161	161
	WP 26	13.	1097.4								NA	0	0
	WP 27	13.	1096.3								NA	0	0
	WP 28	12.	1097.6								NA	0	0
		13.	1096.6								NA	0	0
	WP 29	27.	1088.1								NA	0	0
Remcor	E-2	13.	1098.	69	740	NA	1			<200	<820	809	810
Sampling		20.	1091.	30	15	NA	35			<32	<160	45	80
Points (4)	E-4	20.	1091.	5100	3600	NA	150			<1600	<8200	8700	8850
	E-10	13.	1098.	30	2	NA	0.1			<4	570	32	602.1
		20.	1091.	100	20	NA	0.4			38	3000	120	3158.4
	W-3	14.	1097.	19000	1100	NA	38			180	15000	20100	35318
		20.	1091.	100000	9800	NA	75			<3300	<16000	109800	109875
	W-7	13.	1098.	94	60	NA	40			<410	<2100	154	194

(1) Samples collected by Warzyn and John Mathes Associates Inc. (Mathes) from temporary well points during August 1991. Analyses were performed by Mathes using a field gas chromatograph.

(2) Abbreviations: PCE-tetrachloroethene; TCE-trichloroethene; NA-not analyzed.

(3) Where duplicate samples were analyzed, the highest value is reported.

(4) Samples collected by Remcor , Inc. (Remcor) from temporary well points during October 1991. Analyses were performed by Remcor using a field gas chromatograph.

GWSCRN.XLS/AJS/DAP

Table 6-1

Solubility Data for Primary Soil Contaminants Saegertown Industrial Area Site RI

Compound	Water Solubility (mg/l)[1]	Log Poct[1]
VOCs		
Trichloroethene	1100	2.38
Tetrachloroethene	150	2.60
Benzene	1750	2.12
Ethylbenzene	152	3.15
Toluene	535	2.73
Xylenes	198	3.26
SVOCs		
Acenaphthene	3.42	4.00
Anthracene	0.0450	4.45
Benzo(a)anthracene	0.00570	5.60
Benzo(a)pyrene	0.00120	6.06
Carbazole	NA	3.29
Chrysene	0.00180	5.61
Dibenzofuran	10	4.12
Fluoranthene	0.206	4.90
Fluorene	1.69	4.20
Methyl Naphthalene	24.6	3.86
Naphthalene	31.7	3.30
Pyrene	.132	4.88

Note:
1. Data from U.S. EPA (October 1986), Verschueren (1983), and Montgomery and Welkom (1990).

[CHI 601 83d]
MSR/njt/DAP

Table 6-2

Theoretical Contaminant Velocities
Through Upper Aquifer
Saegertown Industrial Area Site RI

Compound	Water Solubility (mg/l)[1]	Koc (ml/gm)[1]	Rf[2]	Contaminant Velocity (ft/yr)[3]
Tetrachloroethene	150	364	14.89	0.54
Trichloroethene	1100	126	5.81	1.38
Vinyl Chloride	2670	57	3.17	2.52
1,2-Dichloroethene	6300	59	3.25	2.46
1,1-Dichloroethene	2250	65	3.48	2.30
1,1,1-Trichloroethane	1500	152	6.80	1.18

Notes:

1. Data taken from U.S. EPA (October 1986).

2. $Rf = 1 + \frac{(Koc)(Foc)(Psoil)}{Nsoil}$

   Where: Foc = 0.65% (6500 mg/kg) from aquifer matrix sample LO-SS11S-14; Nsoil is assumed to be 0.30 based on grain size analysis and data presented in Dragun (Figure 2.2); and Psoil is assumed to be 1761 kg/m^3 (1.761 gms/ml).

3. Contaminant Velocity = Groundwater Velocity/Rf

   Where: The maximum groundwater velocity = 8 feet/year from Table 4-9 for monitoring wells W7S, W8S, and W11S.

[CHI 601 83d]
MSR/njt/DAW

TABLE 7-1

SUMMARY OF SAMPLES BY OPERABLE UNIT AND MEDIUM

Saegertown Industrial Area Site RI

GATX GROUNDWATERS

GA-GWW04D-01	01-FEB-91
GA-GWW04D-02	24-SEP-91
GA-GWW04S-01	01-FEB-91
GA-GWW04S-02	24-SEP-91
GA-GWW05D-01	30-JAN-91
GA-GWW05D-02	25-SEP-91
GA-GWW05D-91	30-JAN-91
GA-GWW05S-01	30-JAN-91
GA-GWW05S-02	25-SEP-91
GA-GWW09D-01	31-JAN-91
GA-GWW09D-02	24-SEP-91
GA-GWW09S-01	31-JAN-91
GA-GWW09S-02	24-SEP-91
GA-GWW10I-02	25-SEP-91

GATX FORMER SLUDGE BED & FORMER LAGOON

Surface Soils	
GA-SU01-02	10-SEP-91
GA-SU01-92	10-SEP-91
GA-SU02-02	10-SEP-91
Subsurface Soils	
GA-SSAP84-03	09-SEP-91
GA-SSAP85-03	09-SEP-91
GA-SSB03-06	07-DEC-90
GA-SSB03-08	10-DEC-90
GA-SSB03-10	07-DEC-90
GA-SSAP83-04	08-SEP-91
GA-SSAP83-04DUP	08-SEP-91
GA-SSAP86-04	09-SEP-91
GA-SSAP87-03	09-SEP-91
GA-SSB04-04	11-DEC-90
GA-SSB04-06	11-DEC-90
GA-SSB04-08	11-DEC-90
GA-SSB04-10	11-DEC-90

GATX FORMER RAIL AREA

Surface Soils	
GA-SSB06-02	18-DEC-90
GA-SSB14-02	09-DEC-90
Subsurface Soils	
GA-SSB05-04	18-DEC-90
GA-SSB06-04	18-DEC-90
GA-SSB13-04	09-DEC-90
GA-SSB13-12	09-DEC-90
GA-SSB14-06	09-DEC-90
GA-SSB15-04	10-DEC-90
GA-SSB15-06	10-DEC-90

GATX POND AREA

Sediments	
GA-SD05-01	24-JAN-91
GA-SD06-01	24-JAN-91
Soil Auger Probes	
GA-SSAP82-03	08-SEP-91
GA-SSAP88-03	09-SEP-91
GA-SSAP89-04	09-SEP-91
GA-SSAP90-04	09-SEP-91
Soil Borings	
GA-SSB07-02	09-DEC-90
GA-SSB07-04	09-DEC-90
GA-SSB08-04	11-DEC-90
GA-SSB08-06	11-DEC-90
GA-SSB08-10	11-DEC-90
GA-SSB08-10DUP	11-DEC-90
GA-SSB09-04	10-DEC-90
GA-SSB09-08	10-DEC-90
Test Pits	
GA-TP01-04	09-JAN-91
GA-TP02-07	09-JAN-91
GA-TP03-02	09-JAN-91
GA-TP03-02DUP	09-JAN-91
GA-TP04-02	10-JAN-91
Surface Water	
GA-SW05-01	24-JAN-91
GA-SW05-91	24-JAN-91
GA-SW06-01	24-JAN-91

LORD GROUNDWATERS

LO-GWW07D-01	30-JAN-91
LO-GWW07D-02	26-SEP-91
LO-GWW07S-01	30-JAN-91
LO-GWW07S-02	26-SEP-91
LO-GWW08D-01	30-JAN-91
LO-GWW08D-02	26-SEP-91
LO-GWW08S-01	30-JAN-91
LO-GWW08S-02	26-SEP-91
LO-GWW11S-02	24-SEP-91
LO-GWW11S-92	24-SEP-91

LORD FORMER IMPOUNDMENT

Sediments	
LO-SD07-01	24-JAN-91
LO-SD07-91	24-JAN-91
LO-SD08-01	24-JAN-91
Soil Borings	
LO-SSB10-02	12-DEC-90
LO-SSB10-04	12-DEC-90

SCI GROUNDWATERS

SC-GWW02D-01	31-JAN-91
SC-GWW02D-02	24-SEP-91
SC-GWW02S-01	29-JAN-91

SCI SOIL BORINGS

SC-SSB02-06	07-DEC-90
SC-SSB02-18	07-DEC-90
SC-SSB16-04	10-DEC-90
SC-SSB16-04DUP	10-DEC-90
SC-SSB16-08	10-DEC-90

BORROUGH WELLS

SA-BW01-01	22-JAN-91
SA-BW01-02	26-SEP-91
SA-BW02-01	22-JAN-91
SA-BW02-02	25-SEP-91
SA-BW03-01	22-JAN-91
SA-BW03-02	26-SEP-91
SA-BW03-91	22-JAN-91
SA-BW03-92	26-SEP-91

PRIVATE WELLS

SA-PW06-01	23-JAN-91
SA-PW06-02	26-SEP-91
SA-PW18-02	03-OCT-91

SMC FACILITY

Soil Borings	
SM-SSB01-04	10-DEC-90
SM-SSB01-06	10-DEC-90
SM-SSB01-14	10-DEC-90
SM-SSB18-06	13-DEC-90
SM-SSB18-10	13-DEC-90
Sediments	
SA-SD09-01	24-JAN-91

BACKGROUND SAMPLES

Groundwater	
SA-GWW01D-01	29-JAN-91
SA-GWW01D-02	23-SEP-91
SA-GWW01S-01	29-JAN-91
SA-GWW01S-02	23-SEP-91
SA-GWW01S-91	29-JAN-91
GA-GWW03D-01	29-JAN-91
GA-GWW03S-01	29-JAN-91
SA-GWW03D-02	25-SEP-91
SA-GWW03D-92	25-SEP-91
GA-GWW06D-01	30-JAN-91
GA-GWW06S-01	30-JAN-91
Soil Borings	
SA-SSB11-04	09-DEC-90
SA-SSB11-04DUP	09-DEC-90
SA-SSB11-10	09-DEC-90
GA-SSB12-04	09-DEC-90
GA-SSB12-08	09-DEC-90
SA-SSB17-04	09-DEC-90
SA-SSB17-10	09-DEC-90
Surface Soil	
GA-SU03-02	10-SEP-91
French Creek Surface Water	
SA-SW01-01	23-JAN-91
French Creek Sediment	
SA-SD01-01	24-JAN-91

FRENCH CREEK

Sediments	
SA-SD02-01	24-JAN-91
SA-SD02-91	24-JAN-91
SA-SD03-01	24-JAN-91
SA-SD04-01	24-JAN-91
Surface Waters	
SA-SW02-01	24-JAN-91
SA-SW02-91	24-JAN-91
SA-SW03-01	23-JAN-91
SA-SW04-01	23-JAN-91

TRIP AND FIELD BLANKS

GA-GWFB02-01	31-JAN-91
GA-GWTB05-01	30-JAN-91
GA-GWTB06-01	31-JAN-91
GA-GWTB07-01	31-JAN-91
GA-GWTB08-01	01-FEB-91
GA-SWTB03-01	24-JAN-91
LO-GWTB04-01	30-JAN-91
SA-GWFB01-01	29-JAN-91
SA-GWFB01-02	24-SEP-91
SA-GWFB02-02	25-SEP-91
SA-GWTB01-01	29-JAN-91
SA-GWTB01-02	23-SEP-91
SA-GWTB02-02	24-SEP-91
SA-GWTB03-01	29-JAN-91
SA-GWTB03-02	25-SEP-91
SA-PWTB01-01	22-JAN-91
SA-PWTB02-01	23-JAN-91
SA-PWTB04-02	26-SEP-91
SA-PWTB10-02	03-OCT-91
SA-SWTB01-01	23-JAN-91
SA-SWTB02-01	24-JAN-91

This list includes all samples collected during Round 1 and Round 2, including field duplicates, blanks, and background samples. Field duplicate samples are not included in Risk Assessment calculations. Surface Soil/Sediment samples were used to estimate current land use exposure point concentrations for a specific area within an operable unit. A combination of surface soil, sediment, soil boring, auger probe, and test pit samples for a specific area within an operable unit were used to estimate future land use exposure point concentrations for soil. Sample descriptions used include the following codes:

SSAP = Soil Auper Probe	SD = Sediment	GW = Groundwater Well	-01 = Round 1	D = Deep Well	TB = Trip Blank
SSB = Soil Boring	SU = Surface Soil	PW = Private Well	-02 = Round 2	S = Shallow Well	FB = Field Blank
TP = Test Pit	SW = Surface Water	BW = Borrough Well	-91 = Field Duplicate		

[Saegertown.2020]Samples.w20 JAH/jah/MWK

AR303623

TABLE 7-2

SUMMARY OF CHEMICALS OF POTENTIAL CONCERN
BY OPERABLE UNIT AND MEDIUM

Saegertown Industrial Area Site RI

Parameter	GATX GW	LORD GW	GATX SLUDGE AREA SURF SOILS	GATX SLUDGE AREA ALL SOILS	GATX RAIL SIDING SURF. SOILS	GATX RAIL SIDING ALL SOILS	GATX POND SURF. SED.	GATX POND ALL SOILS	LORD SURF. SED.	LORD ALL SOILS	SCI ALL SOILS
Vinyl chloride		X									
1,1-Dichloroethene		X									
1,1-Dichloroethane		X									
1,2-Dichloroethene (trans)		X		X							
Chloroform								X			
2-Butanone				X							
1,1,1-Trichloroethane		X						X			
1,2-Dichloropropane				X							
Trichloroethene	X	X		X			X	X			
1,1,2-Trichloroethane							X	X			
Benzene	X			X			X	X			
4-Methyl-2-pentanone				X							
Tetrachloroethene	X	X		X			X	X			
1,1,2,2-Tetrachloroethane							X	X			
Toluene				X	X	X	X	X		X	X
Chlorobenzene				X			X	X			
Ethylbenzene				X			X	X			X
Styrene				X			X	X			
Xylenes (mixed)		X		X			X	X			X
Phenol		X					X	X			
1,3-Dichlorobenzene								X			
1,4-Dichlorobenzene	X			X			X	X			
1,2-Dichlorobenzene				X			X	X			
2-Methylphenol							X	X			
4-Methylphenol							X	X			
2,4-Dimethylphenol							X	X			
Benzoic Acid					X	X		X			
1,2,4-Trichlorobenzene				X			X	X			
Naphthalene			X	X			X	X			X
Hexachlorobutadiene				X			X	X			
2-Methylnaphthalene			X	X			X	X			X
Acenaphthylene			X	X			X	X			
Acenaphthene			X	X			X	X			X
Dibenzofuran			X	X			X	X			X
2,4-Dinitrotoluene							X	X			
Diethylphthalate	X										
Fluorene			X	X			X	X			X
Hexachlorobenzene				X			X	X			
Phenanthrene			X	X		X	X	X			X
Anthracene			X	X			X	X			X

AR300524

TABLE 7-2

SUMMARY OF CHEMICALS OF POTENTIAL CONCERN
BY OPERABLE UNIT AND MEDIUM

Saegertown Industrial Area Site RI

Parameter	GATX GW	LORD GW	GATX SLUDGE AREA SURF SOILS	GATX SLUDGE AREA ALL SOILS	GATX RAIL SIDING SURF. SOILS	GATX RAIL SIDING ALL SOILS	GATX POND SURF. SED.	GATX POND ALL SOILS	LORD SURF. SED.	LORD ALL SOILS	SCI ALL SOILS
Di-n-butylphthalate							X	X			
Fluoranthene			X	X		X	X	X			X
Pyrene			X	X		X	X	X			X
Butylbenzylphthalate			X	X				X			
Benzo(a)anthracene (c)			X	X		X	X				X
Chrysene (c)			X	X		X	X	X			X
bis(2-ethylhexyl)phthalate				X			X	X			
Di-n-octyl Phthalate							X	X			
Benzo(b)fluoranthene (c)			X	X		X	X	X			X
Benzo(k)fluoranthene (c)			X	X		X	X	X			X
Benzo(a)pyrene (c)			X	X			X	X			X
Indeno(1,2,3-cd)pyrene (c)			X	X			X	X			X
Dibenz(a,h)anthracene (c)			X	X			X	X			X
Benzo(g,h,i)perylene (c)			X	X			X	X			X
Carbazole			X	X				X			
Total Carcinogenic PAHs			X	X		X	X	X			X
Total Noncarcinogenic PAHs			X	X		XB	X	X			XB
Heptachlor epoxide		X									
4,4'-DDE									X	X	
4,4'-DDT										X	
Total PCBs				X			X	X			
Aluminum		XNT			XNT	XNT	XNT	XNT	XNT	XNT	
Antimony	X	X						X			
Arsenic				X		X	X	X			
Barium		X	X	X	X	X	X	X	X	X	
Cadmium (food/soil)							X	X			
Calcium			XNT	XNT		XNT	XNT	XNT			
Chromium VI			X	X	X	X	X	X	X	X	
Cobalt		X					X	X			
Copper				X		X	X	X	X	X	
Iron	XNT						XNT	XNT			
Lead		X	X	X			X	X			
Magnesium			XNT	XNT				XNT			
Manganese	X	X		X				X			
Mercury		X	X	X			X	X	X	X	
Nickel				X			X	X			
Potassium		XNT					X	XNT			
Selenium							X	X			
Silver							X	X			

AR303625

TABLE 7-2

SUMMARY OF CHEMICALS OF POTENTIAL CONCERN
BY OPERABLE UNIT AND MEDIUM

Saegertown Industrial Area Site RI

Parameter	GATX GW	LORD GW	GATX SLUDGE AREA SURF SOILS	GATX SLUDGE AREA ALL SOILS	GATX RAIL SIDING SURF. SOILS	GATX RAIL SIDING ALL SOILS	GATX POND SURF. SED.	GATX POND ALL SOILS	LORD SURF. SED.	LORD ALL SOILS	SCI ALL SOILS
Sodium				XNT				XNT			
Thallium							X	X			
Vanadium					X	X	X	X	X	X	
Zinc	X		X	X	X	X	X	X	X	X	
Cyanide	X			X			X	X			

Note:
If a medium is not listed for a particular operable unit, it means there were not chemicals of potential concern detected in that medium. The exception to this rule is the GATX Pond Area. All organic chemicals of potential concern in the GATX pond for soils or sediments are also considered chemicals of potential concern in air.

GW = Groundwater
BW = Borrough Well
Surf. Soils = Surface Soils
Surf. Sed. = Surficial Sediments
All Soils = A combination of surface soils, sediments, soil borings, auger probes and test pits
X = Chemical was detected (organics) or detected above natural background concentrations (inorganics) in a particular medium.
XNT = Element was detected above natural background, but is an essential nutrient and essentially nontoxic. Therefore, it was not included as a chemical of potential concern.
XB = Organic chemical concentration was representative of site specific background concentrations, therefore, it was not considered as a chemical of potential concern.

[Saegertown.2020]CPC.w20
JAH/jah/MWK
1/8/92

Table 7-3

Summary of Exposure Pathways and Routes
to be Quantitatively Assessed
Saegertown Industrial Area Site RI

Operable Unit	Receptor	Source Area	Exposure Pathway	Exposure Routes: Inhalation	Ingestion	Dermal
-----Current Land Use Conditions-----						
GATX	Trespasser	Former Sludge Area	Surface Soils	---	X	---
GATX	Trespasser	Former Rail Siding Area	Surface Soils	---	X	---
GATX	Trespasser	Pond	Surface Sediment	---	X	---
GATX	Trespasser	Pond	Surface Water	---	X	X
GATX	Trespasser	Pond	Air	X	---	---
GATX	On-Site Workers	Pond	Air	X	---	---
GATX	Off-Site Residents	Pond	Air	X	---	---
Lord	Trespasser	Former Impoundment	Surface Sediments	---	X	---
-----Future Land Use Conditions----- Residential Use						
SCI	On-Site Resident	General(2)	Soils(1)	---	X	---

Table 7-3
(Continued)

Operable Unit	Receptor	Source Area	Pathway	Exposure Routes: Inhalation	Ingestion	Dermal
GATX	On-Site Resident	Sludge Area	Soils(1)	---	X	---
GATX	On-Site Resident	Former Rail Siding Area	Soils(1)	---	X	---
GATX	On-Site Resident	Pond	Soils(1)	---	X	---
GATX	On-Site Resident	Pond	Air	X	---	---
GATX	On-Site Resident	Pond	Groundwater	X	X	X
Lord	On-Site Resident	Former Impoundment	Soil(1)	---	X	---
Lord	On-Site Resident	Sump	Groundwater	X	X	X

FOOTNOTES:

1. Both surface soil/sediment and subsurface soil data are used in combination to represent potential levels of contaminant exposure.

MWK/vlr/KJD
[mad-403-43a]
60882.30

TABLE 7-4

EXPOSURE POINT CONCENTRATIONS BY OPERABLE UNIT AND MEDIUM

Saegertown Industrial Area Site RI
Saegertown, Pennnsylvania

Parameter	GATX GW (mg/L)	LORD GW (mg/L)	GATX SLUDGE AREA SURF. SOILS (mg/kg)	GATX SLUDGE AREA ALL SOILS (mg/kg)	GATX RAIL SIDING SURF. SOILS (mg/kg)	GATX RAIL SIDING ALL SOILS (mg/kg)	GATX POND SURF. SOILS (mg/kg)	GATX POND ALL SOILS (mg/kg)	LORD SURF. SED (mg/kg)	LORD ALL SOILS (mg/kg)	SCI ALL SOILS (mg/kg)	GATX AMBIENT AIR (mg/m3)
Vinyl chloride		7.7e-01										
1,1-Dichloroethene		2.5e-03										
1,1-Dichloroethane		3.0e-03										
1,2-Dichloroethene (trans)		9.8e-01		3.9e-02								
Chloroform								1.7e-01				4.0e-06
2-Butanone				9.8e-03								
1,1,1-Trichloroethane		2.8e-02						1.0e-03				1.7e-08
1,2-Dichloropropane				7.2e-03								
Trichloroethene	1.0e-03	2.2e-01		8.7e-01			6.1e+02	6.1e+02				5.8e-03
1,1,2-Trichloroethane							4.3e+01	4.3e+01				1.8e-04
Benzene	5.0e-03			2.6e-01			4.0e+01	2.1e+02				2.8e-03
4-Methyl-2-pentanone				2.0e-03								
Tetrachloroethene	3.0e-03	1.1e+00		1.5e+00			1.5e+03	1.5e+03				3.9e-03
1,1,2,2-Tetrachloroethane							2.7e+01	2.7e+01				1.7e-05
Toluene				1.2e+00	4.6e-02	4.9e-02	4.4e+01	2.3e+02		3.0e-03	2.5e-02	8.2e-04
Chlorobenzene				2.4e+01			1.7e+02	1.7e+02				2.5e-04
Ethylbenzene				4.4e+01			2.7e+01	2.7e+01			1.0e-03	2.2e-05
Styrene				2.3e-01			2.2e+01	2.2e+01				1.3e-05
Xylenes (mixed)		1.0e-03		2.3e+00			9.5e+01	2.1e+02			7.0e-03	2.5e-04
Phenol		3.0e-03					1.5e+02	9.7e+02				4.4e-05
1,3-Dichlorobenzene								2.1e-01				5.5e-08
1,4-Dichlorobenzene	3.0e-03			2.3e+02			1.2e+03	1.2e+03				1.6e-04
1,2-Dichlorobenzene				4.4e+02			5.2e+02	5.8e+01				6.7e-06
2-Methylphenol							7.0e+01	3.8e+02				1.1e-05
4-Methylphenol							1.8e+02	1.1e+03				1.5e-05
2,4-Dimethylphenol							1.5e+02	4.3e+02				2.9e-06
Benzoic Acid					7.6e-02	7.6e-02		6.3e+02				7.2e-03
1,2,4-Trichlorobenzene				2.4e+02			1.5e+03	1.5e+03				4.7e-05
Naphthalene			1.4e-01	2.4e+03			5.9e+03	1.7e+04			1.6e-01	4.7e-07
Hexachlorobutadiene				1.8e+02			3.1e+02	3.6e+01				7.2e-06
2-Methylnaphthalene			7.8e-02	8.0e+02			4.0e+03	6.9e+03			5.7e-02	4.1e-05
Acenaphthylene			2.0e-01	1.4e+02			4.4e+02	1.6e+03				4.5e-06
Acenaphthene			9.8e-02	4.9e+02			2.8e+03	4.3e+03			5.2e-01	6.4e-07
Dibenzofuran			3.5e-01	5.7e+02			3.4e+03	5.2e+03			3.0e-01	9.8e-06
2,4-Dinitrotoluene							1.0e+02	1.1e+01				5.9e-09
Di[illegible]ylphthalate	1.0e-03											
Fluorene			1.6e-01	9.7e+02			5.5e+03	7.3e+03			4.7e-01	4.9e-07
Hexachlorobenzene				4.2e+01			2.0e+02	2.4e+01				2.5e-11
Phenanthrene			2.0e+00	1.8e+03		4.5e-02	2.6e+04	2.6e+04			3.5e+00	1.6e-06
Anthracene			4.6e-01	3.0e+03			7.0e+04	7.0e+04			7.3e-01	1.2e-06

TABLE 7-4

EXPOSURE POINT CONCENTRATIONS BY OPERABLE UNIT AND MEDIUM

Saegertown Industrial Area Site RI
Saegertown, Pennnsylvania

Parameter	GATX GW (mg/L)	LORD GW (mg/L)	GATX SLUDGE AREA SURF. SOILS (mg/kg)	GATX SLUDGE AREA ALL SOILS (mg/kg)	GATX RAIL SIDING SURF. SOILS (mg/kg)	GATX RAIL SIDING ALL SOILS (mg/kg)	GATX POND SURF. SOILS (mg/kg)	GATX POND ALL SOILS (mg/kg)	LORD SURF. SED (mg/kg)	LORD ALL SOILS (mg/kg)	SCI ALL SOILS (mg/kg)	GATX AMBIENT AIR (mg/m3)
Di-n-butylphthalate							1.9e+02	2.3e+01				1.8e-11
Fluoranthene			4.4e+00	6.4e+02		1.6e-01	4.9e+03	8.2e+03			3.3e+00	3.4e-09
Pyrene			3.0e+00	5.1e+02		1.1e-01	4.1e+03	8.2e+03			3.0e+00	1.7e-09
Butylbenzylphthalate			1.2e-01	1.2e-01								
Benzo(a)anthracene (c)			2.3e+00	1.7e+02		5.5e-02	2.2e+03	3.1e+03			1.1e+00	5.3e-12
Chrysene (c)			1.8e+00	2.1e+02		6.8e-02	3.3e+03	1.3e+04			1.0e+00	6.4e-12
bis(2-ethylhexyl)phthalate				2.7e+00			1.8e+02	5.3e+01				2.8e-11
Di-n-octyl Phthalate							1.0e+02	1.1e+01				5.7e-12
Benzo(b)fluoranthene (c)			3.8e+00	1.3e+02		1.2e-01	1.5e+03	4.0e+03			1.3e+00	1.5e-10
Benzo(k)fluoranthene (c)			3.8e+00	1.3e+02		1.2e-01	7.3e+02	4.0e+03			4.3e-01	1.5e-10
Benzo(a)pyrene (c)			2.0e+00	2.1e+02			1.1e+03	1.9e+03			1.1e+00	7.9e-13
Indeno(1,2,3-cd)pyrene (c)			1.0e+00	4.6e+01			4.0e+02	7.7e+02			5.1e-01	5.4e-15
Dibenz(a,h)anthracene (c)			3.8e-01	3.1e-01			1.4e+02	3.0e+02			5.4e-02	2.1e-15
Benzo(g,h,i)perylene (c)			1.0e+00	7.1e+01			3.6e+02	7.8e+02			5.0e-01	5.7e-15
Carbazole			1.8e-01	1.3e+03				1.3e+04				8.8e-07
Total Carcinogenic PAHs			1.6e+01	9.7e+02		3.6e-01	9.7e+03	2.8e+04			6.0e+00	5.7e-09
Heptachlor epoxide		6.0e-06										
4,4'-DDE									8.0e-02	8.0e-02		
4,4'-DDT										7.0e-02		
Total PCBs				1.1e+00			3.3e+01	8.3e+02				3.1e-09
Aluminum												
Antimony	5.3e-03	5.1e-03						1.2e+01				
Arsenic				1.7e+01		1.6e+01	8.3e+02	1.5e+02				
Barium		2.7e-01	9.1e+01	9.1e+01	1.1e+02	9.2e+01	6.9e+02	3.3e+02	1.2e+02	1.2e+02		
Cadmium (food/soil)							2.5e+01	9.2e+00				
Calcium												
Chromium VI			1.6e+01	1.0e+02	1.6e+01	1.4e+01	5.8e+02	1.5e+02	2.2e+01	2.2e+01		
Cobalt		1.0e-02					3.1e+00	1.7e+01				
Copper				3.6e+01		2.7e+01	3.2e+02	3.1e+02	7.0e+01	7.0e+01		
Iron												
Lead		3.5e-03	1.5e+02	1.5e+02	2.5e+01	3.6e+01	3.4e+03	3.4e+03	3.3e+01	3.3e+01		
Magnesium												
Manganese	4.1e+00	2.4e+00		1.2e+03				8.8e+02				
Mercury		2.9e-04	2.6e-01	1.5e+00			3.1e+02	3.1e+02	2.2e-01	2.2e-01		
Nickel				2.0e+01			1.5e+02	5.0e+01				
Potassium												
Selenium							2.5e+01	1.1e+01				
Silver							4.0e+00	1.8e+00				
Sodium												

TABLE 7-4

EXPOSURE POINT CONCENTRATIONS BY OPERABLE UNIT AND MEDIUM

Saegertown Industrial Area Site RI
Saegertown, Pennnsylvania

Parameter	GATX GW (mg/L)	LORD GW (mg/L)	GATX SLUDGE AREA SURF. SOILS (mg/kg)	GATX SLUDGE AREA ALL SOILS (mg/kg)	GATX RAIL SIDING SURF. SOILS (mg/kg)	GATX RAIL SIDING ALL SOILS (mg/kg)	GATX POND SURF. SOILS (mg/kg)	GATX POND ALL SOILS (mg/kg)	LORD SURF. SED (mg/kg)	LORD ALL SOILS (mg/kg)	SCI ALL SOILS (mg/kg)	GATX AMBIENT AIR (mg/m3)
Thallium							5.9e+00	9.0e+00				
Vanadium					1.8e+01	1.5e+01	2.9e+01	1.7e+01	2.1e+01	2.1e+01		
Zinc	1.7e-02		2.5e+02	6.2e+02	8.6e+01	7.7e+01	6.3e+03	6.3e+03	2.5e+02	2.5e+02		
Cyanide	1.2e-02			1.5e+01			5.8e+00	1.2e+01				

Note:
This table presents a summary of exposure point concentrations for chemicals of potential concern for each operable unit and medium. See Appendix U for an explanation of the selection and calculation process used to derive these values.

GW = Groundwater
BW = Borrough Well
Surf. Soils = Surface Soils
Surf. Sed. = Surficial Sediments
All Soils = A combination of surface soils, sediments, soil borings, auger probes and test pits

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Table 7-5

Equations Used for Quantitation of Exposure Estimates
Saegertown Industrial Area Site RI

Inhalation of Volatile Chemicals

$$\text{Intake (mg/kg-day)} = \frac{CA \times IR \times ET \times EF \times ED}{BW \times AT}$$

CA = Contaminant concentration in air (mg/m^3)
IR = Inhalation rate (m^3/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged--days)

Incidental Ingestion of Contaminants in Soil or Sediment

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

CS = Chemical concentration in soil (mg/kg)
IR = Ingestion rate (mg soil/day)
CF = Conversion factor (kg/mg)
FI = Fraction ingested from contaminated source (unitless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged--days)

Table 7-5
(Continued)

Incidental Ingestion of Contaminants in Surface Water

$$\text{Intake (mg/kg-day)} = \frac{CW \times CR \times ET \times EF \times ED}{BW \times AT}$$

CW = Chemical concentration in water (mg/L)
CR = Contact rate (L/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged--days)

Dermal Absorption of Chemicals from Surface Water

$$\text{Absorbed dose (mg/kg-day)} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

CW = Chemical concentration in water (mg/L)
SA = Skin surface area available for contact (cm^2)
PC = Chemical-specific dermal permeability constant (cm/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
CF = Volumetric conversion factor for water (L/cm^3)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged--days)

Table 7-5
(Continued)

Inhalation of Volatiles Released from Groundwater While Showering

$$\text{Intake (mg/kg-day)} = \frac{CA \times IR \times ET \times EF \times ED}{BW \times AT}$$

CA = Contaminant concentration in air (mg/m^3)
IR = Inhalation rate (m^3/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged--days)

Ingestion of Contaminants in Groundwater

$$\text{Intake (mg/kg-day)} = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

CW = Contaminant concentration in water (mg/L)
IR = Ingestion rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged--days)

Table 7-5
(Continued)

Dermal Absorption of Chemicals in Groundwater While Showering

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

CW = Chemical concentration in water (mg/L)
SA = Skin surface area available for contact (cm^2)
PC = Chemical-specific dermal permeability constant (cm/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (day/year)
ED = Exposure duration (years)
CF = Volumetric conversion factor for water (L/cm^3)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged--days)

NOTES:

The equations presented were used to calculate chemical intakes or absorbed doses for the pathway and route of exposure indicated. Refer to Table 7-4 for the exposure point concentrations (e.g., CS, CA, etc.), and Table 7-6 for the exposure factors (e.g., EF, BW, etc.) used in conjunction with these equations to quantitate exposure estimates.

Table 7-6

Summary of Exposure Factors for Risk Estimation
Saegertown Industrial Area Site RI

	Trespasser	On-Site Worker	Off-Site Resident	On-Site Resident
Receptor Characteristics				
Age Bracket (years)	7 to 16	>18	birth to 30	birth to 30
Body Weight (kg)	40(a)	70(f)	59(c)	59(c)
Exposure Duration (years)	10(b)	25(f)	30(d)	30(d)
Averaging Time (days)				
Noncancer Type Effects	3,650	9,125	10,950	10,950
Cancer Type Effects	25,550	25,550	25,550	25,550
Chemical Characteristics				
Dermal Permeability Factor (cm/hr)	Chem. specific see Table 7-8	Chem. specific see Table 7-8	Chem. specific see Table 7-8	Chem. specific see Table 7-8
Dermal Absorption Estimates (unitless)	Chem. specific see Table 7-8	Chem. specific see Table 7-8	---	---
Inhalation Absorption Estimates (unitless)	100%	100%	100%	100%
Oral Absorption Estimates (unitless)	Chem. specific see Table 7-8	Chem. specific see Table 7-8	Chem. specific see Table 7-8	Chem. specific see Table 7-8
Medium Specific Characteristics				
Air — Source Area(s)	GATX	GATX	GATX	GATX
Air Inhalation Rate	1.2m^3/hr(e)	20m^3/day(f)	20m^3/day (f)	20m^3/day (f)
Exposure Time (hrs/day)	4(b)	9(s)	24(b)	24(b)
Exposure Frequency (days/year)	52(h)	250(f)	350(f)	350(f)
Soil/Sediment — Source Area(s)	GATX, LORD, SMC	---	---	SCI, GATX, LORD, SMC
Skin surface area available for contact (cm^2)	1,490(g)	---	---	7,900 cm^2 (p)
Soil/Sediment Ingestion Rate (mg/day)	100(f)	---	---	120(q)
Soil/Sediment to Skin Adherance Factor (mg/cm^2)	1.45(t)			1.45(t)
Fraction Ingested from Contaminated source (unitless)	1/40(i)	---	---	1
Exposure Frequency (days/year)	52 (h)	---	---	350(f)

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Table 7-6
(Continued)

		Trespasser	On-Site Worker	Off-Site Resident	On-site Resident
Groundwater(m)	Source Area(s)	---	GATX, Lord	GATX, Lord	GATX
Ingestion Rate (L/day)		---	1(f)	2(f)	2(f)
Skin surface area available for contact (cm^2)		---	---	18,150(n)	18,150(n)
Exposure Time (i.e., while bathing) (hours/day)		---	---	0.2(o)	0.2(o)
Exposure Frequency (days/year)		---	250(f)	350(f)	350(f)
Surface Water	Source Area(s)	Pond		---	---
Contact Rate (L/hour)		0.05 (j)	---	---	---
Exposure Time (hours/day)		1.0 (k)	---	---	---
Skin Surface Area available for contact (cm^2)		7,940 (l)	---	---	---
Exposure Frequency (days/year)		52(h)	---	---	---

Footnotes

a. 50th percentile time weighted average body weight for older children ages 7 to 16 years old (U.S. EPA, 1989).

b. Professional judgement

c. 50th percentile time weighted average body weight from birth to 30 years old (i.e., 6 of 30 years at 15 kg + 24 of 30 years at 70 kg (U.S. EPA, 1991a)).

d. National upper-bound time at one residence (U.S. EPA, 1991a).

e. It was assumed that while on-Site 50% heavy activity and 50% light activity was performed. Therefore, the average of these two activity specific inhalation rates (U.S. EPA 1989) were used.

f. RAGS supplemental guidance (U.S. EPA, 1991).

g. 50th percentile surface area for childrens hands and feet (U.S. EPA, 1989), time weighted value for ages 7 to 16 years old.

h. Assumed 2 days per week during six months (i.e., 26 weeks) of the year when weather is conducive for on-Site recreational activities (i.e., 2 days/week x 26 weeks/year = 52 days/year).

i. Assumed that child spent 1/4 of their waking hours (16) on-Site, and that they spent 1/10 of there time on-Site in a specific area where soil or sediment was contaminated (i.e., 1/4 x 1/10 = 1/40). The 1/10 value was assumed to be a reasonable worst case estimate based on the small area of soil/sediment contamination detected within an area compared to the total area of the Site.

j. Value provided for swimming (U.S. EPA, 1989).

k. Assumed based on professional judgement and information on activity patterns for children provided in the Exposure Factor Handbook (U.S. EPA, 1989).

Table 7-6
(Continued)

l. 50th percentile surface area for childrens hands, legs and feet (U.S. EPA 1989); time weighted value for ages 7 to 16 years old.

m. Inhalation of volatile contaminants while showering with contaminated groundwater was assessed utilizing a predictive model. Refer to Appendix W for the specific exposure assumptions used for estimating the intake of chemicals while showering.

n. 50th percentile total surface area for persons (U.S. EPA, 1989) time weighted from birth to 30 years old.

o. 90th percentile value for length of shower (U.S. EPA, 1989).

p. 50th percentile surface area for hands, arms, feet and legs (U.S. EPA, 1989); time weighted value for persons from birth to 30 years old.

q. Time weighted soil ingestion rate for person from birth to 30 years old (U.S. EPA, 1991).

r. Average adult inhalation rate for light activity level (e.g., most domestic work, and conducting minor indoor repairs); (U.S. EPA, 1989).

s. Assumed that work day would be 9 hours long (8 hours work +1 hour lunch).

t. Soil to skin adherance factor for potting soil to hands (U.S. EPA, 1989).

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TABLE 7-7

SUMMARY OF PHYSICAL AND CHEMICAL PROPERTIES OF CHEMICALS OF POTENTIAL CONCERN

Saegertown Industrial Area Site RI

COMPOUND	MW (g/mole)	Solubility (mg/L)	Koc (ml/g)	Log Kow (ml/g)	VP (mm Hg)
Vinyl Chloride	6.30e+01	2.67e+03	5.70e+01	5.70e+01	2.66e+03
1,1-Dichloroethene	9.70e+01	2.25e+03	6.50e+01	1.84e+00	6.00e+02
1,1-Dichloroethane	9.90e+01	5.50e+03	3.00e+01	1.79e+00	1.82e+02
1,2-Dichloroethane	9.90e+01	8.52e+03	1.40e+01	1.48e+00	6.40e+01
Chloroform	1.19e+02	8.20e+03	3.10e+01	1.97e+00	1.51e+02
2-Butanone	7.20e+01	2.68e+05	4.50e+00	2.60e-01	7.75e+01
1,1,1-Trichloroethane	1.33e+02	1.50e+03	1.52e+02	2.50e+00	1.23e+02
1,2-Dichloropropane	1.13e+02	2.70e+03	5.10e+01	2.00e+00	4.20e+01
Trichloroethene	1.31e+02	1.10e+03	1.26e+02	2.38e+00	5.79e+01
1,1,2-Trichloroethane	1.33e+02	4.50e+03	5.60e+01	2.47e+00	3.00e+01
Benzene	7.80e+01	1.75e+03	8.30e+01	2.12e+00	9.52e+01
4-Methyl-2-Pentanone	1.00e+02	1.70e+04	2.05e+01	8.75e-01	6.00e+00
Tetrachloroethene	1.66e+02	1.50e+02	3.64e+02	2.60e+00	1.78e+01
1,1,2,2-Tetrachloroethane	1.68e+02	2.90e+03	1.18e+02	2.39e+00	5.00e+00
Toluene	9.20e+01	5.35e+02	3.00e+02	2.73e+00	2.81e+01
Chlorobenzene	1.13e+02	4.66e+02	3.30e+02	2.84e+00	1.17e+01
Ethylbenzene	1.06e+02	1.52e+02	1.10e+03	3.15e+00	7.00e+00
Styrene	1.04e+02	3.00e+02	1.89e+02	2.64e+00	5.00e+00
Total Xylenes	1.06e+02	4.66e+02	3.30e+02	3.26e+00	1.00e+01
Phenol	9.40e+01	9.30e+04	1.42e+01	1.46e+00	3.41e-01
1,3-Dichlorobenzene	1.47e+02	1.23e+02	1.70e+03	3.60e+00	2.28e+00
1,4-Dichlorobenzene	1.47e+02	7.90e+01	1.70e+03	3.60e+00	1.18e+00
1,2-Dichlorobenzene	1.47e+02	1.00e+02	1.70e+03	3.60e+00	1.00e+00
2-Methylphenol	1.08e+02	3.00e+04	5.00e+02	1.97e+00	2.40e-01
4-Methylphenol	1.08e+02	3.00e+04	5.00e+02	1.97e+00	1.10e-01
2,4-Dimethylphenol	1.22e+02	4.60e+03 b	4.20e+01	2.36e+00	5.90e-02
Benzoic acid	1.22e+02	2.90e+03	5.44e+01	1.90e+00	9.52e+01
1,2,4-Trichlorobenzene	1.81e+02	3.00e+01	9.20e+03	4.30e+00	2.90e-01
Naphthalene	1.28e+02	3.20e+01	6.49e+02	3.45e+00	2.60e-04
Hexachlorobutadiene	2.61e+02	1.50e-01	2.90e+04	4.78e+00	2.00e+00
2-Methylnaphthalene	1.42e+02	2.70e+01	7.12e+02	3.43e+00	5.90e-02
Acenaphthylene	1.52e+02	3.93e+00	2.50e+03	3.70e+00	2.90e-02
Acenaphthene	1.54e+02	3.42e+00	4.60e+03	4.00e+00	1.55e-03
Dibenzofuran	1.70e+02	2.10e+01	8.20e+02	3.51e+00	2.00e-02
2,4-Dinitrotoluene	1.82e+02	2.40e+02	4.50e+01	2.00e+00	5.10e-03
Diethylphthalate	2.22e+02	8.96e+02	1.42e+02	2.50e+00	3.50e-03
Fluorene	1.16e+02	1.69e+00	7.30e+03	4.20e+00	7.10e-04
Hexachlorobenzene	2.85e+02	6.00e-03	3.90e+03	5.23e+00	1.09e-05
Phenanthrene	1.78e+02	1.00e+00	1.40e+04	4.46e+00	6.80e-04
Anthracene	1.78e+02	4.50e-02	1.40e+04	4.45e+00	1.95e-04
Di-n-butylphthalate	2.78e+02	1.30e+01	1.70e+05	5.60e+00	1.00e-05
Fluoranthene	2.02e+02	2.06e-01	3.80e+04	4.90e+00	5.00e-06
Pyrene	2.02e+02	1.32e-01	3.80e+04	4.88e+00	2.50e-06
Butylbenzylphthalate	3.12e+02	2.90e+00	2.43e+03	4.15e+00	8.60e+06
Benzo(a)anthracene	2.28e+02	5.70e-03	1.38e+06	5.60e+00	2.20e-08
Chrysene	2.28e+02	1.80e-03	2.00e+05	5.61e+00	6.30e-09
bis(2-Ethylhexyl)phthalate	3.91e+02	2.85e-01 a	6.92e+02	4.91e+00	8.60e+06
Di-n-octylphthalate	3.91e+02	2.85e-01 a	6.92e+02	4.91e+00	8.60e+06
Benzo(b)fluoranthene	2.52e+02	1.40e-02	5.50e+05	6.06e+00	5.00e-07
Benzo(k)fluoranthene	2.52e+02	4.30e-03	5.50e+05	6.06e+00	5.10e-07
Benzo(a)pyrene	2.52e+02	1.20e-03	5.50e+06	6.06e+00	5.60e-09
Indeno(1,2,3-cd)pyrene	2.76e+02	5.30e-04	1.60e+06	6.50e+00	1.00e-10
Dibenz(a,h)anthracene	2.78e+02	5.00e-04	3.30e+06	6.80e+00	1.00e-10
Benzo(g,h,i)perylene	2.76e+02	7.00e-04	1.60e+06	6.51e+00	1.03e-10
Carbazole	1.67e+02	1.69e+00 i	7.30e+03 i	3.29e+00	7.10e-04
Heptachlor Epoxide	3.89e+02	3.50e-01	2.20e+02	2.70e+00	3.00e-04
4,4-DDT	3.55e+02	5.00e-03	2.43e+05	6.19e+00	5.50e-06
4,4-DDE	3.18e+02	4.00e-02	4.40e+06	7.00e+00	6.50e-06
PCBs	3.28e+02	3.10e-02	5.30e+05	5.63e+00	7.70e-05

TABLE 7-7

SUMMARY OF PHYSICAL AND CHEMICAL PROPERTIES OF CHEMICALS OF POTENTIAL CONCERN

Saegertown Industrial Area Site RI

TIC FOOTNOTES
a = value unavailable, estimated using butylbenzylphthalate
b = value unavailable, estimated using 2,4-dichlorophenol
c = value unavailable, estimated using benzene
d = value unavailable, estimated using 2-naphthylamine
e = value unavailable, estimated using DDT
f = value unavailable, estimated using dieldrin
g = value unavailable, estimated using diphenylamine
h = value unavailable, estimated using diphenyl ether
i = value unavailable, estimated using fluorene

Definitions of chemical properties:

Water Solubility is the maximum concentration of a chemical that dissolves in pure water at a specific temperature and pH. Values are given for a neutral pH and a temperature range of 20 degrees C. The rate at which a chemical is leached from a waste by infiltrating precipitation is a function of its solubility in water. The more soluble compounds are expected to be leached much more readily and rapidly than less soluble chemicals. The water solubilities presented in the literature indicate that, in general, the volatile organic chemicals are more water soluble than the many semivolatile organic compounds (e.g., PAHs, PCBs).

Vapor pressure (VP) provides an indication of the rate at which a chemical in its pure state volatilizes. Values are given for a temperature range of 20 to 30 degrees C. VP is of primary significance where environmental interfaces such as surface soil/air and surface water/air occur. Volatilization is not as important when evaluating groundwater and subsurface soils. Chemicals with higher vapor pressures are expected to enter the atmosphere more readily than chemicals with lower vapor pressures. Vapor pressures for monocyclic aromatic (toluene) and chlorinated aliphatics (TCE) are generally many times higher than vapor pressure for phthalate esters (bis(2-ethylhexyl)phthalate), polynuclear aromatic hydrocarbons (PAHs), and pesticides.

Organic Carbon Partition Coefficient (Koc) is a measure of the tendency for organics to be adsorbed by soil and sediment and is expressed as:

$$Koc = \frac{\text{mg chemical adsorbed/kg organic carbon}}{\text{mg chemical dissolved/liter of solution}}$$

The Koc is chemical specific and is largely independent of soil properties. In general, the Koc is inversely related to its environmental mobility. Koc is either determined experimentally or estimated as follows:

$$Koc = (-0.55 * \text{Log } S) + 3.64$$ where S is water solubility in mg/L

The Octanol/Water Partition Coefficient (Kow) is defined as the ratio of the equilibrium concentration C of a dissolved substance in a two-phase system consisting of two largely immiscible solvents, in this case n-octanol and water:

$$Kow = \frac{C \text{ octanol}}{C \text{ water}}$$

The Kow is ideally dependent only upon temperature and pressure. It is a constant without dimensions, and is given in the form of its logarithm to base ten (log Kow). It is useful as a means to predict soil adsorption, biological uptake and biomagnification. Values are either determined experimentally, or where not available, estimated as follows:

$$Kow = 4.5 - (0.75 * \text{Log } S)$$ where S is water solubility in mg/L

Values were obtained from the following sources:

TABLE 7-7

SUMMARY OF PHYSICAL AND CHEMICAL PROPERTIES OF CHEMICALS OF POTENTIAL CONCERN

Saegertown Industrial Area Site RI

U.S. EPA Superfund Public Health Evaluation Manual (SPHEM), 1986

Verschueren, K. Handbook of Environmental Data on Organic Chemicals. Van Nostrand Reinhold Co., New York, 1983.

Weast, R.C. (ed) Handbook of Chemistry and Physics 54th Edition. CRC Press, Cleveland, 1973.

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[SAEGERTOWN.2020]Table7-7.w20

TABLE 7-8

CHEMICAL TOXICITY VALUES AND ABSORPTION ESTIMATES USED FOR RISK QUANTIFICATION

Saegertown Industrial Area Site RI

Chemical	Chronic Reference Dose (mg/kg-d)					Slope Factor $(mg/kg-d)^{-1}$					Chemical Absorption Estimate (unitless)			Dermal Permeability Constant	
	Inhalation		Oral		Dermal	Inhalation		Oral		Dermal	Oral		Dermal	(cm/hr)	
Vinyl chloride	ND		ND		ND	3.0e-01	6	1.9e+00	H	1.9e+00	0.91	19	0.30	7.0e-03	6
1,1-Dichloroethene	ND	2	9.0e-03	I	9.0e-03	1.2e+00	H	6.0e-01	I	6.0e-01	1.00	12	0.30	9.9e-03	E
1,1-Dichloroethane	1.0e-01	H	1.0e-01	H	1.0e-01	ND		ND		ND	1.00	19	0.30	8.9e-03	E
1,2-Dichloroethene (trans)	ND		2.0e-02	H	1.9e-02	ND		ND		ND	1.00	19	0.30	1.0e-02	6
Chloroform	ND	2	1.0e-02	I	1.0e-02	8.1e-02	H	6.1e-03	I	6.1e-03	1.00	19	0.30	9.0e-03	E
2-Butanone	9.0e-02	H2	5.0e-02	H1	2.5e-02	ND		ND		ND	0.50		0.30	5.0e-03	C
1,1,1-Trichloroethane	3.0e-01	H2	9.0e-02	I2	9.0e-02	ND		ND		ND	1.00	12	0.30	1.8e-02	E
1,2-Dichloropropane	ND	D	ND		ND	ND		6.8e-02	H	1.4e-01	0.50		0.30	1.0e-02	E
Trichloroethene	ND		ND		ND	1.7e-02	H	1.1e-02	H	1.1e-02	1.00	18	0.30	1.5e-02	E
1,1,2-Trichloroethane	ND		4.0e-03	I	2.0e-03	5.7e-02	H	5.7e-02	I	1.1e-01	0.50		0.30	1.7e-02	E
Benzene	ND	2	ND	2	ND	2.9e-02	H1	2.9e-02	I	5.8e-02	0.90	19	0.30	1.1e-01	C
4-Methyl-2-pentanone	2.0e-02	H2	5.0e-02	H1	2.5e-02	ND		ND		ND	0.50		0.30	2.0e-03	E
Tetrachloroethene	ND		1.0e-02	I	1.0e-02	3.3e-03	6	5.1e-02	H	5.1e-02	1.00	18	0.30	1.3e-02	E
1,1,2,2-Tetrachloroethane	ND		ND	2	ND	2.0e-01	H	2.0e-01	I	2.1e-01	1.00	16*	0.30	9.0e-03	E
Toluene	2.0e+00	H2	2.0e-01	I	2.0e-01	ND		ND		ND	0.99	12	0.30	1.0e+00	C
Chlorobenzene	5.0e-03	H2	2.0e-02	I	6.0e-03	ND		ND		ND	0.13	19	0.30	4.0e-02	6
Ethylbenzene	2.9e-01	I	1.0e-01	I	5.0e-02	ND		ND		ND	0.92	19	0.30	1.4e+00	C
Styrene	ND		2.0e-01	I2	1.8e-01	2.0e-03	H	3.0e-02	H	3.3e-02	0.90	20	0.30	6.7e-01	C
Xylenes (mixed)	8.6e-02	H2	2.0e+00	I	1.0e+00	ND		ND		ND	0.92	19	0.30	8.0e-02	6
SEMIVOLATILES															
Phenol	ND		6.0e-01	I	5.4e-01	ND		ND		ND	0.98	19	0.30	8.2e-03	C
1,3-Dichlorobenzene	ND	D	ND		ND	ND		ND		ND	0.50		0.30	6.0e-02	E
1,4-Dichlorobenzene	2.0e-01	H2	ND		ND	ND		2.4e-02	H	2.4e-02	1.00	19	0.30	6.0e-02	6
1,2-Dichlorobenzene	4.0e-02	H	9.0e-02	I	4.5e-02	ND		ND		ND	0.50		0.30	6.0e-02	6
2-Methylphenol	ND		5.1e-02	I	4.1e-02	ND		ND		ND	0.80	13	0.30	1.6e-02	C
4-Methylphenol	ND		ND	I1	4.0e-02	ND		ND		ND	0.80	13	0.30	1.8e-02	C
2,4-Dimethylphenol	ND		2.0e-02	I	1.0e-02	ND		ND		ND	0.50		0.30	1.1e-01	C
Benzoic Acid	ND		4.0e+00	I	3.0e+00	ND		ND		ND	0.95	17	0.30	7.0e-03	6
1,2,4-Trichlorobenzene	3.0e-03	H	1.3e-03	H1	6.6e-04	ND		ND		ND	0.50		0.30	1.7e-01	E
Naphthalene	ND		4.0e-03	H2	3.4e-03	ND		ND		ND	0.84	18	0.30	7.0e-02	6
Hexachlorobutadiene	ND		2.0e-03	I	1.0e-03	7.8e-02	I	7.8e-02	I	1.6e-01	0.50		0.30	1.2e-01	E
2-Methylnaphthalene	ND		ND		ND	ND		ND		ND	0.50		0.30	7.0e-02	E
Acenaphthylene	ND	D	ND	1	ND	ND		ND		ND	0.50		0.30	9.5e-02	E
Acenaphthene	ND		6.0e-02	I	3.0e-02	ND		ND		ND	0.50		0.30	1.5e-01	E
Dibenzofuran	ND	D	ND		ND	ND		ND		ND	0.50		0.30	5.4e-02	E
2,4-Dinitrotoluene	ND	D1	ND		ND	ND		6.8e-01	H1	1.4e+00	0.50		0.30	3.9e-03	E
Diethylphthalate	ND		8.0e-01	I	4.0e-01	ND		ND		ND	0.50		0.30	1.1e-05	C

TABLE 7-8

CHEMICAL TOXICITY VALUES AND ABSORPTION ESTIMATES USED FOR RISK QUANTIFICATION

Saegertown Industrial Area Site RI

Chemical	Chronic Reference Dose (mg/kg-d)			Slope Factor $(mg/kg\text{-}d)^{-1}$			Chemical Absorption Estimate (unitless)		Dermal Permeability Constant
	Inhalation	Oral	Dermal	Inhalation	Oral	Dermal	Oral	Dermal	(cm/hr)
Fluorene	ND	4.0e-02 I	2.0e-02	ND	ND	ND	0.50	0.30	3.6e-01 E
Hexachlorobenzene	ND	8.0e-04 I	4.0e-04	1.6e+00 H	1.6e+00 I	3.2e+00	0.50	0.30	1.6e-04 C
Phenanthrene	ND D	ND 1	ND 1	ND	ND	ND	0.50	0.30	2.3e-01 E
Anthracene	ND	3.0e-01 I	1.5e-01	ND	ND	ND	0.50	0.30	2.3e-01 E
Di-n-butylphthalate	ND 1	1.0e-01 I	9.0e-02	ND	ND	ND	0.90 14	0.30	2.3e-06 C
Fluoranthene	ND	4.0e-02 I	2.0e-02	ND	ND	ND	0.50	0.30	4.0e-01 6
Pyrene	ND	3.0e-02 I	1.5e-02	ND	ND	ND	0.50	0.30	3.3e-01 E
Butylbenzylphthalate	ND	2.0e-01 I	1.8e-01	ND	ND	ND	0.90 21	0.30	2.1e-02 E
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	0.50	0.30	7.3e-01 E
Chrysene	ND D	ND	ND	ND	ND	ND	0.50	0.30	7.5e-01 E
bis(2-ethylhexyl)phthalate	ND	2.0e-02 I	5.0e-03	ND	1.4e-02 I	5.6e-02	0.25 19	0.30	5.7e-06 C
Di-n-octyl Phthalate	ND	2.0e-02 H	1.0e-02	ND	ND	ND	0.50	0.30	2.4e-02 E
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	0.50	0.30	1.1e+00 E
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	0.50	0.30	1.1e+00 E
Benzo(a)pyrene	ND	ND	ND	ND H6	ND H6	ND	0.50	0.30	1.1e+00 E
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	0.50	0.30	1.6e+00 E
Dibenz(a,h)anthracene	ND	ND	ND	ND	ND	ND	0.50	0.30	2.6e+00 E
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	0.50	0.30	1.7e+00 E
Carbazole	ND	ND	ND	ND	2.0e-02	ND	0.50	0.30	4.0e-02 E
Total Carcinogenic PAHs	ND	ND	ND	6.1e+00 3	1.2e+01 3	2.3e+01	0.50	0.30	1.1e+00 E
PESTICIDE/PCB									
Heptachlor epoxide	ND	1.3e-05 I	6.5e-06	9.1e+00 H	9.1e+00 I	1.8e+01	0.70 19*	0.30	1.5e-03 6
4,4'-DDE	ND	ND	ND	ND	3.4e-01 I	3.8e-01	0.90 19	0.30	1.8e-01 6
4,4'-DDT	ND	5.0e-04 I	2.5e-04	3.4e-01 H	3.4e-01 I	6.8e-01	0.50	0.30	3.0e-01 6
PCB	ND	ND	ND	ND	7.7e+00 H	2.6e+01	0.30 12	0.08 22	5.3e-01 6
METALS									
Aluminum	ND	ND	ND	ND	ND	ND	0.05	0.01	1.0e-03
Antimony	ND	4.0e-04 I	2.0e-05	ND	ND	ND	0.01 6	0.01	1.0e-03
Arsenic	ND	3.0e-04 I	9.5e-04	5.0e+01 H	1.8e+00 6	1.9e+00	1.00 6	0.01	1.0e-03
Barium	1.0e-04 H	7.0e-02 I	3.5e-03	ND	ND	ND	0.05	0.01	1.0e-03
Cadmium (water)	ND 2	5.0e-04 I	3.5e-05	6.1e+00 H1	ND	ND	0.07 19	0.01	1.0e-03
Cadmium (food/soil)	ND 2	1.0e-03 I	7.0e-05	6.1e+00 H1	ND	ND	0.07 19	0.01	1.0e-03
Calcium	ND	ND	ND	ND	ND	ND	0.05	0.01	1.0e-03
Chromium III	2.0e-06 H	1.0e+00 H	5.0e-01	ND	ND	ND	0.04 19	0.01	2.1e-03 7
Chromium VI	2.0e-06 H2	5.0e-03 I	2.5e-03	4.1e+01 H1	ND	ND	0.11 19	0.01	2.1e-03 7
Cobalt	ND	ND	ND	ND	ND	ND	0.97 19	0.01	4.0e-04 6
Copper	ND	ND	ND	ND	ND	ND	0.97 19	0.01	1.0e-03

TABLE 7-8

CHEMICAL TOXICITY VALUES AND ABSORPTION ESTIMATES USED FOR RISK QUANTIFICATION

Saegertown Industrial Area Site RI

Chemical	Chronic Reference Dose (mg/kg-d)					Slope Factor $(mg/kg\text{-}d)^{-1}$				Chemical Absorption Estimate (unitless)			Dermal Permeability Constant	
	Inhalation		Oral		Dermal	Inhalation		Oral	Dermal	Oral		Dermal	(cm/hr)	
Iron	ND		ND		ND	ND		ND	ND	0.10	12	0.01	1.0e-03	
Lead	ND		ND	1	ND	ND		ND	ND	0.50	11	0.01	4.0e-06	6
Magnesium	ND		ND		ND	ND		ND	ND	0.30		0.01	1.0e-03	
Manganese	1.1e-04	I	1.0e-01	I	4.0e-03	ND		ND	ND	0.03	14	0.01	1.0e-03	
Mercury	8.6e-05	H2	8.6e-05	H2	4.5e-05	ND		ND	ND	0.15	19	0.01	1.0e-03	
Nickel	ND	2	2.0e-02	I	2.0e-03	8.4e-01	4	ND	ND	0.10	12	0.01	1.0e-03	
Potassium	ND		ND		ND	ND		ND	ND	0.05		0.01	1.0e-03	
Selenium	ND		5.0e-03	I	ND	ND		ND	ND	0.97	19	0.01	1.0e-03	
Silver	ND		ND	I1	3.0e-04	ND		ND	ND	0.10	23	0.01	6.0e-04	6
Sodium	ND		ND		ND	ND		ND	ND	0.05		0.01	1.0e-03	
Thallium	ND		7.0e-05	H	3.5e-06	ND		ND	ND	1.00	24	0.01	1.0e-03	
Vanadium	ND		7.0e-03	H2	3.5e-04	ND		ND	ND	0.01	20	0.01	1.0e-03	
Zinc	ND		2.0e-01	H2	6.0e-02	ND		ND	ND	0.30	19	0.01	1.0e-03	
Cyanide	ND		2.0e-02	I	1.4e-02	ND		ND	ND	0.17	12	0.01	1.0e-03	

TABLE 7-8

CHEMICAL TOXICITY VALUES AND ABSORPTION ESTIMATES USED FOR RISK QUANTIFICATION

Saegertown Industrial Area Site RI

Notes:

Toxicity values were obtained from the U.S. EPA's Integrated Risk Information System (IRIS), U.S. EPA's "Health Effects Assessment Summary Tables" (HEAST, Annual FY-1991), and information provided by U.S.EPA Environmental Criteria Assessment Office (ECAO). Toxicity values for the TIC groupings are values for the representative compounds.

Chemical specific oral and dermal absorption were provided by ECAO; specific references are given below. In the absence of chemical specific values, it was assumed that the oral absorption efficiency for organic compounds and metals was 50 % and 5 %, respectively. The dermal absorption estimates were assumed to be 30% for organic compounds and 1.0 % for metals. The oral and dermal absorption estimates are presented as unitless values where 1.0 represents 100 % (complete) absorption. Chemical-specific dermal permeability constants were obtained from the U.S. EPA "Superfund Exposure Assessment Manual" (SEAM) 1988, or the ECAO. As required by the U.S.EPA, when chemical-specific information is not available, default values were estimated (E) using the following equation:

$$\text{Log DPC} = -2.72 + 0.71 \log \text{Kow} - 0.0061 \text{ MW}$$

Where
DPC = Dermal Permeability Constant
Kow = Octanol/Water Partition Coefficient
MW = Molecular Wieght

Reference Doses and Slope Factors designated for the dermal route of exposure are not provided in the U.S. EPA information sources, but were calculated from corresponding values for the oral route of exposure. These values are used to calculate risks associated with chemical dose estimates based on an absorbed (in contrast to an administered) level of chemical. All chemical dose estimates for the dermal route of exposure are based on absorbed chemical levels. The following relationships were used to derive dermal toxicity values:

Oral Reference Dose (administered) x Oral Absorption Estimate = Dermal Reference Dose (absorbed)
Oral Slope Factor (administered) / Oral Absorption Estimate = Dermal Slope Factor (absorbed)

FOOTNOTES - (listed to the right of the value)

I = Verified in IRIS 5/15/91
H = Values from HEAST FY-1991
D = "Data inadequate for quantitative risk assessment" (HEAST); applies to all RfDs for this compound.
ND = Value not determined for this compound.
C = Values from Interim Guidance for Dermal Exposure Assessment. (OHEA-E-367, 3/91, Review Draft)
E = Value estimated
S = Values from the Superfund Environmental Assessment Manual (EPA/540/1-88/001) Table A-4.
1 = Value withdrawn by IRIS pending further review.
2 = Compound under IRIS review.
3 = Total carcinogenic PAHs; RfDs and SF values from Benzo[a]pyrene used.
4 = Nickel slope factor for nickel refinery dust.
5 = IRIS not queried for this compound
6 = Values from ECAO Technical Support Center.
7 = Baranowska-Dutkiewic, B., 1981. Absorption of Hexavalent Chromium in Man. Arch. Toxicol., 47: 47-50.
8 = Value for endosulfan used for endosulfan sulfate.
Chemical Absorption notes:
11 = U.S.EPA Technical Support Document 1990, based on lead uptake biokinetic model
12 = Health Effects Assessment (HEA), 1984
13 = Health & Environmental Effects Profile (HEEP), 1985
14 = Drinking Water Criteria Document (DWCD), 1986

TABLE 7-8

CHEMICAL TOXICITY VALUES AND ABSORPTION ESTIMATES USED FOR RISK QUANTIFICATION

Saegertown Industrial Area Site RI

15 = Health & Environmental Effects Document (HEED), 1986
19 = Drinking Water Health Advisory (DWHA), 1987
17 = Health & Environmental Effects Document (HEED), 1987
18 = Health Effects Assessment (HEA), 1988
19 = Agency for Toxic Substances & Disease Registry (ATSDR), 1988, 1989
20 = Health Effects Assessment (HEA), 1987, 1989
21 = Health & Environmental Effects Document (HEED), 1989
22 = Memorandum from K.A. Hammerstrom (ORD/OHEA/EAG) to L. Woodruff (Reg. X), 11-26-90
23 = Amdient Water Quality Criteria Document (AWQCD), 1980
24 = Toxicology and Biological Monitoring of Metals in Humans (Carson, et al., 1986)
Dermal Permeability Constant Default Values:
    Inorganics - water (1.0e-03), (ECAO, 1991)

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Table 7-9

SUMMARY OF TOXICITY INFORMATION FOR CHEMICALS OF POTENTIAL CONCERN

Saegertown Industrial Area Site RI

Chemical of Potential Concern	Chronic Reference Dose				Slope Factor			
	Inhalation		Oral		Inhalation		Oral	
	Species/Effect of Concern	Uncertainty Factor (1)	Species/Effect of Concern	Uncertainty Factor (1)	Species/Tumor Site	Weight of Evidence	Species/Tumor Site	Weight of Evidence (2)
TARGET COMPOUND LIST								
VOLATILES								
Vinyl chloride	--/--	--	--	--	rat/liver	A	rat/lung	A
1,1-Dichloroethene	--/--	--	rat/liver lesions	1000	mouse/kidney	C	rat/adrenal	C
1,1-Dichloroethane	cat/kidney damage	1000	rat/none	1000	--/--	C	rat/hemangiosarcoma	C
1,2-Dichloroethene (trans)	--/--	--	mouse/increased serum alkaline phophatase	100	--/--	--	--/--	--
Chloroform	--/--	--	dog/liver lesions	1000	mouse/liver	B2	rat/kidney	B2
2-Butanone (methyl ethyl ketone)	rat/CNS	1000	rat/fetotoxicity	1000	--/--	--	--/--	D
1,1,1-Trichloroethane	guinea pig/ hepatotoxicity	1000	guinea pig/ hepatotoxicity	1000	--/--	--	--/--	--
1,2-Dichloropropane	(data inadequate for quantitative risk assessments)				--/--	B2	mouse/liver	B2
Trichloroethene	--/--	--	--/--	--	mouse/lung	B2	mouse/liver	B2
1,1,2-Trichloroethane	--/--	--	mouse/clinical chemistry alterations	1000	mouse/liver	C	mouse/liver	C

Table 7-9
(continued)

Chemical of Potential Concern	Chronic Reference Dose				Slope Factor			
	Inhalation		Oral		Inhalation		Oral	
	Species/Effect of Concern	Uncertainty Factor (1)	Species/Effect of Concern	Uncertainty Factor (1)	Species/Tumor Site	Weight of Evidence	Species/Tumor Site	Weight of Evidence (2)
Benzene	--/--	--	--/--	--	human/leukemia	A	human/leukemia	A
4-Methyl-2-pentanone	rat/liver & kidney effects	1000	rat/liver & kidney effects	1000	--/--	--	--/--	--
Tetrachloroethene	--/--	--	mouse/hepato-toxicity	1000	rat, mouse/ leukemia, liver	B2	mouse/liver	B2
1,1,2,2-Tetrachloroethane	--/--	--	--/--	--	mouse/liver	C	mouse/liver	C
Toluene	human/CNS effects eyes, nose irritation	100	rat/CNS effects	1000	--/--	--	--/--	--
Chlorobenzene	rat/liver & kidney effects	10,000	dog/liver & kidney effects	1000	--/--	--	--/--	--
Ethylbenzene	--/--	--	rat/hepatotoxicity, & nephrotoxicity	1000	--/--	--	--/--	--
Styrene	--/--	--	dog/red blood cell & liver effects	1000	rat/leukemia	B2	mouse/lung & bronchi	B2
Xylenes (mixed)	human/CNS effects, nose & throat irritation	100	rat/hyperactivity, decreased body weight & increased mortality at higher dosage	100	--/--	--	--/--	--
SEMIVOLATILES								
Phenol	--/--	--	rat/reduced fetal body weight	100	--/--	--	--/--	--
1,3-Dichlorobenzene	--/--	--	--/--	--	--/--	--	--/--	--
1,4-Dichlorobenzene	rat/liver & kidney effect	1000-	--/--	--	--/--	B2	mouse/liver	B2

Table 7-9
(continued)

Chemical of Potential Concern	Chronic Reference Dose				Slope Factor			
	Inhalation		Oral		Inhalation		Oral	
	Species/Effect of Concern	Uncertainty Factor (1)	Species/Effect of Concern	Uncertainty Factor (1)	Species/Tumor Site	Weight of Evidence	Species/Tumor Site	Weight of Evidence (2)
1,2-Dichlorobenzene	rat/decreased body weight gain	1000	rat/liver effects	1000	--/--	--	--/--	--
2-Methylphenol	--/--	--	rat/reduced body weight gain, neurotoxicity	1000	--/--	--	--/--	--
4-Methylphenol	--/--	--	rat/reduced body weight gain, neurotoxicity	1000	--/--	--	--/--	--
2,4-Dimethylphenol	--/--	--	mouse/neurological signs & hematological changes	3000	--/--	--	--/--	--
Benzoic Acid	--/--	--	human/irritation, malaise	1	--/--	--	--/--	--
1,2,4-Trichlorobenzene	rat/increased uroporphyrin	100	rat/porphyria	100	--/--	--	--/--	--
Naphthalene	--/--	--	rat/ocular & internal lesions	10,000	--/--	--	--/--	--
Hexachlorobutadiene	--/--	--	rat/kidney toxicity	100	rat/kidney	C	rat/kidney	C
2-Methylnaphthalene	--/--	--	--/--	--	--/--	--	--/--	--
Acenaphthylene	--/--	--	--/--	--	--/--	--	--/--	--
Acenaphthene	--/--	--	mouse/hepato-toxicity	3000	--/--	--	--/--	--
Dibenzofuran	--/--	--	--/--	--	--/--	--	--/--	--

Table 7-9
(continued)

Chemical of Potential Concern	Chronic Reference Dose				Slope Factor			
	Inhalation		Oral		Inhalation		Oral	
	Species/Effect of Concern	Uncertainty Factor (1)	Species/Effect of Concern	Uncertainty Factor (1)	Species/Tumor Site	Weight of Evidence	Species/Tumor Site	Weight of Evidence (2)
2,4-Dinitrotoluene	--/--	--	--/--	--	--/--	B2	--/--	B2
Diethylphthalate	--/--	--	rat/reduced terminal body weight	1000	--/--	--	--/--	--
Fluorene	--/--	--	mouse/hematological changes	3000	--/--	--	--/--	--
Hexachlorobenzene	--/--	--	rat/liver & hemato-logic effects	100	hamster/liver	B2	hamster/liver	B2
Phenanthrene	--/--	--	--/--	--	--/--	--	--/--	--
Anthracene	--/--	--	mouse/no effects	3000	--/--	--	--/--	--
Di-n-butylphthalate	--/--	--	rat/mortality	1000	--/--	--	--/--	--
Fluoranthene	--/--	--	mouse/nephropathy, liver weight changes, hematological changes	3000	--/--	--	--/--	--
Pyrene	--/--	--	mouse/renal effects	3000	--/--	--	--/--	--
Butylbenzylphthalate	--/--	--	rat/effects on body weight gain, testes, liver, kidney	1000	--/--	--	--/--	C
Benzo(a)anthracene(c)	--/--	--	--/--	--	--/--	B2	--/--	B2
Chrysene(c)	--/--	--	--/--	--	--/--	B2	--/--	B2
bis(2-ethylhexyl)phthalate	--/--	--	guinea pig/increas-ed relative liver weight	1000	--/--	B2	--/--	B2

Table 7-9
(continued)

Chemical of Potential Concern	Chronic Reference Dose: Inhalation: Species/Effect of Concern	Chronic Reference Dose: Inhalation: Uncertainty Factor (1)	Chronic Reference Dose: Oral: Species/Effect of Concern	Chronic Reference Dose: Oral: Uncertainty Factor (1)	Slope Factor: Inhalation: Species/Tumor Site	Slope Factor: Inhalation: Weight of Evidence	Slope Factor: Oral: Species/Tumor Site	Slope Factor: Oral: Weight of Evidence (2)
Di-n-octyl Phthalate	--/--	--	rat/elevated kidney & liver weights	1000	--/--	--	--/--	--
Benzo(b)fluoranthene(c)	--/--	--	--/--	--	--/--	B2	--/--	B2
Benzo(k)fluoranthene(c)	--/--	--	--/--	--	--/--	B2	--/--	B2
Benzo(a)pyrene(c)	--/--	--	--/--	--	hamster/respiratory tract	B2	mouse/stomach	B2
Ideno(1,2,3-cd)pyrene(c)	--/--	--	--/--	--	--/--	B2	--/--	B2
Dibenz(a,h)anthracene(c)	--/--	--	--/--	--	--/--	B2	--/--	B2
Benzo(g,h,i)perylene	--/--	--	--/--	--	--/--	--	--/--	--
Carbozole	--/--	--	--/--	--	--/--	B2	mouse/liver	B2
Total-Carcinogenic PAHs(3)	--/--	--	--/--	--	hamster/respiratory tract	B2	mouse/stomach	B2
PESTICIDE/PCB								
Heptachlor epoxide	--/--	--	--/--	--	mouse/liver	B2	mouse/liver	B2
4,4'-DDE	--/--	--	--/--	--	--/--	--	mouse, hamster/ liver	B2
4,4'-DDT	--/--	--	rat/liver lesions	100	mouse, rat/ liver	B2	mouse, rat/ liver	B2
Polychlorinated biphenyls (PCBs)	--/--	--	--/--	--	--/--	--	rat/liver	B2

Table 7-9
(continued)

Chemical of Potential Concern	Chronic Reference Dose				Slope Factor			
	Inhalation		Oral		Inhalation		Oral	
	Species/Effect of Concern	Uncertainty Factor (1)	Species/Effect of Concern	Uncertainty Factor (1)	Species/Tumor Site	Weight of Evidence	Species/Tumor Site	Weight of Evidence (2)
TARGET ANALYTE LIST								
METALS								
Aluminum	Data Inadequate	--	--/--	--	--/--	--	--/--	--
Antimony	--/cancer	--	rat/reduced life span, altered blood chemistries	1000	--/--	--	--/--	--
Arsenic	--/cancer	--	human/keratosis & hyperpigmentation	1	human/respiratory tract	A	human/skin	A
Barium	--/fetotoxicity	100	rat/increased blood pressure	100	--/--	--	--/--	--
Cadmium (food/soil) (4)	--/--	--	human/cancer, renal damage	10	human/respiratory tract	B1	--/--	--
Calcium	--/--	--	--/--	--	--/--	--	--/--	--
Chromium III	--/--	--	rat/hepatotoxicity	1000	--/--	--	--/--	--
Chromium VI	--/cancer	--	rat/not defined	500	human/lung	A	--/--	--
Cobalt	--/--	--	--/--	--	--/--	--	--/--	--
Copper	--/--	--	human/local GI irritation	--	--/--	--	--/--	--
Iron	Data inadequate	--	--/--	--	--/--	--	--/--	--
Lead	--/CNS effects	--	--/CNS effects	--	--/--	B2	--/--	B2
Magnesium	--/--	--	--/--	--	--/--	--	--/--	--

Table 7-9
(continued)

Chemical of Potential Concern	Chronic Reference Dose				Slope Factor			
	Inhalation		Oral		Inhalation		Oral	
	Species/Effect of Concern	Uncertainty Factor (1)	Species/Effect of Concern	Uncertainty Factor (1)	Species/Tumor Site	Weight of Evidence	Species/Tumor Site	Weight of Evidence (2)
Manganese	human/CNS	100	rat/reproductive	100	--/--	--	--/--	--
Mercury	human/neurotoxicity	30	rat/kidney effects	1000	--/--	--	--/--	--
Nickel	--/cancer	--	rat/reduced body & organ weight	300	human/respiratory tract	A	--/--	--
Potassium	--/--	--	--/--	--	--/--	--	--/--	--
Selenium	--/--	--	--/--	--	--/--	--	--/--	--
Silver	--/--	--	human/argyria	2	--/--	--	--/--	--
Sodium	--/--	--	--/--	--	--/--	--	--/--	--
Thallium	--/--	--	rat/increased SGOT & serum LDH levels, alopecia	3000	--/--	--	--/--	--
Vanadium	--/--	--	rat/none observed	100	--/--	--	--/--	--
Zinc	--/--	--	rat/weight loss, thyroid effects & myelin degeneration	500	--/--	--	--/--	--
Cyanide	--/--	--	rat/weight loss, thyroid effects & myelin degeneration	500	--/--	--	--/--	--

NOTES:

1) A reference dose (RFD) is derived from a pertinent toxicity study(s), and is an estimate of the "safe" level of chemical intake over a set length of exposure (e.g., chronic) for humans. Many assumptions must be made when predicting this "safe" chemical intake level (i.e., RFD) from a laboratory study. Uncertainty factors (UFs) are applied when estimating the RFD for the following reasons.

- A UF of 10 is used to account for variation in the general population and is intended to protect sensitive subpopulations (e.g., elderly, children).

Table 7-9
(continued)

- A UF of 10 is used when extrapolating from animal data to humans. This factor is intended to account for the interspecies variability between humans and other mammals.
- A UF of 10 is used when a RFD is derived from a subchronic instead of a chronic toxicity study.
- A UF of 10 is used when a lowest adverse effect level (LOAEL) is used instead of a no adverse effect level (NOAEL) to derive a RFD. This factor is intended to account for the uncertainty associated with extrapolating from toxic levels of chemical exposure (i.e., LOAEL) to nontoxic levels of chemical exposure (i.e., NOAEL).

In certain cases, a modifying factor (MF) is used to account for further uncertainty associated with the toxicity study used to develop the RFD. The MF may vary from >0 to 10.

The uncertainty factors presented in this table represent the product of all the uncertainty factors (and modifying factors) used to derive the RFD (e.g., 10x10x10 = 1000).

2) This code represents the U.S. EPA weight-of-evidence classification system for carcinogenicity for chemicals. The following is a description of the classification by group.

Group	Description
A	Known human carcinogen
B1 or B2	Probable human carcinogen
	B1 indicates that limited human data on the carcinogenicity of the chemical are available.
	B2 indicates sufficient evidence of carcinogenicity in animals and inadequate or no evidence of carcinogenicity in humans exists.
C	Possible human carcinogen
D	Not classifiable as to human carcinogenicity
E	Evidence of noncarcinogenicity for humans

Table 7-9
(continued)

3) The slope factor for benzo(a)pyrene was used to represent the *carcinogenic potential* of the carcinogenic polynuclear aromatic hydrocarbons (PAHs).

4) Toxicity values have been developed separately for ingestion of cadmium in water and cadmium ingestion with solids (i.e., food or soil).

5) The information in this table was summarized from U.S. EPA's "Health Effects Assessment Summary Tables" (Fiscal Year - Annual, 1991).

LEGEND

-- = information not available

data inadequate = presently, toxicity data is inadequate for reference dose or slope factor derivation.

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Table 7-10

Summary of Risk Estimates By Type of Land Use, Operable Unit, Potentially Exposed Population and Medium

Saegertown Industrial Area Site RI

Current Land Use Conditions

Table Index	Medium	Hazard Index by Route				Cancer Risk by Route			
		Dermal	Oral	Inhalation	Total	Dermal	Oral	Inhalation	Total
	Exposed Population: On-site Trespasser (children) - GATX								
Y-1	Sludge Area Surface Soil	---	7e-05	---	7e-05	---	2e-07	---	2e-07
Y-2	Rail Area Surface Soil	---	7e-05	---	7e-05	---	---	---	---
Y-3	Pond Surface Sediment	---	9e-02	---	9e-02	---	5e-05	---	5e-05*
Y-4	Pond Surface Water	---	4e-05	---	4e-05	---	3e-09	---	3e-09
Y-5	Pond Air	---	---	1e-03	1e-03	---	---	5e-07	5e-07
	Total Risk				9e-02				5e-05
	Exposed Population: On-site Worker - GATX								
Y-6	Pond Air	---	---	1e-02	1e-02	---	---	1e-05	1e-05*
	Total Risk				1e-02				1e-05
	Exposed Population: Off-site Residents - GATX								
Y-7	Pond Air	---	---	2e-02	2e-02	---	---	3e-05	3e-05*
	Total Risk				2e-02				3e-05
	Exposed Population: On-site Trespasser (children) - Lord								
Y-8	Impoundment Surface Sed.	---	1e-04	---	1e-04	---	4e-11	---	4e-11
	Total Risk				1e-04				4e-11

Future Land Use Conditions

Table Index	Medium	Dermal	Oral	Inhalation	Total	Dermal	Oral	Inhalation	Total
	Exposed Population: On-site Residents - SCI								
Y-9	Property Soils	---	3e-07	---	3e-07	---	---	---	---
	Total Risk				3e-07				---

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(Continued)

Table Index	Medium	Hazard Index by Route				Cancer Risk by Route			
		Dermal	Oral	Inhalation	Total	Dermal	Oral	Inhalation	Total
	Exposed Population: On-site Residents - GATX								
Y-10	Sludge Area Soils	---	2e+00	---	2e+00*	---	4e-03	---	4e-03*
Y-11	Rail Siding Soils	---	1e-01	---	1e-01	---	3e-05	---	3e-05*
Y-12	Pond Soils	---	2e+01	---	2e+01*	---	3e-01	---	3e-01*
Y-13	Pond Air	---	---	2e-02	2e-02*	---	---	3e-05	3e-05*
Y-14	Pond Groundwater	8e-02	2e+00	3e-05	2e+00*	1e-07	5e-06	1e-06	6e-06*
	Total Risk				2e+01				3e-01
	Exposed Populations: On-site Residents - Lord								
Y-15	Impoundment Soils	---	3e-02	---	3e-02	---	4e-08	---	4e-08
Y-16	Sump Groundwater	7e-02	7e+00	2e-03	7e+00*	3e-05	2e-02	1e-03	2e-02*
	Total Risk				7e+00				2e-02

Footnote:

* = denotes that exposure to this medium may be a health concern for the exposed population.
NA = not applicable because no carcinogens were selected as chemicals of potential concern in medium.
ND = not determined because inhalation reference doses were not available.
--- = not considered applicable for specific pathway.

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TABLE 8-1

Maximum Values of Chemical Detected in Media of Ecological Concern
Saegertown Industrial Area Site RI

	(1) French Cr. Background Surface Water	(2) French Cr. Surface Water	(3) GATX Pond Surface Water	(4) French Cr. Background Sediment	(5) French Cr. Sediment	(6) GATX Pond Sediment	(7) Shallow Site Soil Background	(8) SMC Shallow Soils	(9) SCI Shallow Soils	(10) GATX Pond Area Shallow Soils	(11) GATX Pond Lagoon Sludge Bed Soils	(12) Other GATX Area Shallow Soils	(13) Lord Corp. Shallow Soils
METALS													
Aluminum	83	ND	ND	5,570,000	6,040,000	21,900,000	11,000,000	8,760,000	6,850,000	12,400,000	9,240,000	15,200,000	14,500,000
Antimony	ND	101	ND	ND	ND	ND	ND	ND	ND	15,100	ND	ND	ND
Arsenic	ND	ND	ND	5,900	17,400	830,000	13,500	10,100	8,800	134,000	21,000	22,400	8,900
Barium	25	31	14	42,100	33,300	690,000	82,800	55,900	45,000	248,000	90,800	110,000	124,000
Cadmium	ND	ND	ND	ND	ND	24,900	ND	ND	ND	8,300	ND	ND	ND
Calcium	24,900	27,000	14,000	1,960,000	14,600,000	10,900,000	2,470,000	1,160,000	661,000	18,900,000	38,000,000	4,600,000	3,950,000
Chromium	ND	11	ND	7,800	6,600	576,000	11,100	9,000	5,900	174,000	72,800	16,200	22,300
Cobalt	ND	ND	ND	ND	ND	3,100	9,200	3,800	3,500	19,500	5,600	8,900	6,800
Copper	ND	ND	ND	9,600	12,300	324,000	16,900	16,000	12,000	168,000	29,500	33,600	69,900
Iron	229	828	ND	11,900,000	16,800,000	49,700,000	21,700,000	17,800,000	17,300,000	220,000,000	20,600,000	27,100,000	27,100,000
Lead	ND	ND	ND	10,500	50,900	3,410,000	34,300	16,400	14,100	2,910,000	149,000	52,200	33,400
Magnesium	4,660	4,940	2,840	1,480,000	2,990,000	2,830,000	2,510,000	2,390,000	1,910,000	4,770,000	9,530,000	2,670,000	2,500,000
Manganese	34	40	ND	577,000	325,000	294,000	871,000	884,000	625,000	1,200,000	651,000	969,000	497,000
Mercury	ND	ND	ND	ND	ND	305,000	80	ND	ND	5,900	420	ND	220
Nickel	ND	ND	ND	ND	8,700	152,000	17,100	13,100	14,200	42,300	15,800	18,700	16,700
Potassium	1,120	1,160	1,120	892,000	538,000	1,640,000	792,000	523,000	639,000	1,220,000	1,010,000	1,210,000	1,340,000
Selenium	ND	ND	ND	ND	ND	24,600	ND	ND	ND	5,300	ND	ND	570
Silver	ND	14	ND	ND	ND	4,000	ND	ND	ND	ND	ND	ND	ND
Sodium	5,220	5,860	4,540	ND	ND	ND	ND	ND	ND	4,770,000	ND	ND	ND
Thallium	ND	ND	ND	ND	830	5,900	970	650	ND	25,300	840	1,400	ND
Vanadium	ND	ND	ND	ND	ND	29,400	14,000	15,400	ND	14,100	11,100	18,000	20,700
Zinc	ND	ND	28	40,300	52,600	6,340,000	78,100	43,200	42,100	1,620,000	254,000	86,200	248,000
Cyanide	ND	ND	ND	ND	ND	5,800	ND	ND	ND	25,000	16,000	ND	ND
VOLATILES													
1,2-dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	ND	ND
chloroform	ND	ND	ND	ND	80	ND	ND	ND	ND	2,000	ND	ND	ND
1,1,1-tri-chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	ND	ND
1,2-dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11	ND	ND
trichloroethene	ND	ND	3	ND	ND	610,000	ND	ND	ND	39,000	870	ND	ND
1,1,2-trichloroethane	ND	ND	ND	ND	ND	43,000	ND	ND	ND	ND	ND	ND	ND
benzene	ND	ND	ND	ND	ND	40,000	ND	ND	ND	210,000	420	ND	ND
tetrachloroethene	ND	ND	2	ND	ND	1,500,000	ND	ND	ND	30,000	1,500	ND	ND

TAB
(Continued)

	(1) French Cr. Background Surface Water	(2) French Cr. Surface Water	(3) GATX Pond Surface Water	(4) French Cr. Background Sediment	(5) French Cr. Sediment	(6) GATX Pond Sediment	(7) Shallow Site Soil Background	(8) SMC Shallow Soils	(9) SCI Shallow Soils	(10) GATX Pond Area Shallow Soils	(11) GATX Pond Lagoon Sludge Bed Soils	(12) Other GATX Area Shallow Soils	(13) Lord Corp. Shallow Soils
1,1,2,2-tetrachloroethane	ND	ND	ND	ND	ND	27,000	ND	ND	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND	44,000	17	5	5	230,000	1,200	49	3
chlorobenzene	ND	ND	ND	ND	ND	170,000	ND	ND	ND	14,000	24,000	ND	ND
ethylbenzene	ND	ND	ND	ND	ND	27,000	3	ND	ND	25,000	44,000	ND	ND
styrene	ND	ND	ND	ND	ND	22,000	ND	ND	ND	2,700	230	ND	ND
xylenes	ND	ND	ND	ND	ND	95,000	3	ND	ND	210,000	2,300	ND	ND
PESTICIDES/PCBs													
Dieldrin	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND	ND	ND	4.3	ND	ND	ND	ND	ND	80
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	70
alpha chlordane	ND	ND	ND	ND	ND	ND	0.44	ND	ND	ND	ND	ND	ND
gamma chlordane	ND	ND	ND	ND	ND	ND	0.39	ND	ND	ND	ND	ND	ND
Arochlor 1260	ND	ND	ND	ND	ND	33,000	ND	ND	ND	830,000	ND	ND	ND
Arochlor 1254	ND	ND	ND	ND	ND	ND	ND	260	ND	ND	ND	ND	ND
SEMI-VOLATILES													
Phenol	ND	ND	ND	ND	ND	150,000	ND	ND	ND	970,000	ND	ND	65
1,4-dichlorobenzene	ND	ND	ND	ND	ND	1,200,00	ND	ND	ND	250	230,000	ND	ND
1,2-dichlorobenzene	ND	ND	ND	ND	ND	520,000	ND	ND	ND	ND	440,000	ND	ND
2-methylphenol	ND	ND	ND	ND	ND	70,000	ND	ND	ND	380,000	ND	ND	ND
4-methylphenol	ND	ND	ND	ND	130	180,000	ND	ND	ND	1,100,000	ND	ND	ND
2,4-dimethylphenol	ND	ND	ND	ND	ND	150,000	ND	ND	ND	430,000	ND	ND	ND
benzoic acid	ND	ND	ND	ND	53	ND	ND	130	ND	630,000	NA	76	25,000
1,2,4-trichlorobenzene	ND	ND	ND	ND	ND	1,500,000	ND	ND	ND	ND	240,000	ND	ND
naphthalene	ND	ND	ND	ND	ND	5,900,000	330	ND	ND	17,000,000	2,400,000	ND	ND
hexachloro-butadiene	ND	ND	ND	ND	ND	310,000	ND	ND	ND	ND	180,000	ND	ND
2-methyl-naphthalene	ND	ND	ND	ND	ND	4,000,000	140	ND	ND	6,900,000	800,000	ND	ND
acenaphthylene	ND	ND	ND	ND	ND	440,000	73	ND	ND	1,600,000	140,000	ND	ND
acenaphthene	ND	ND	ND	ND	ND	2,800,000	85	ND	ND	4,300,000	490,000	ND	ND
dibenzofuran	ND	ND	ND	ND	ND	3,400,000	120	ND	ND	5,200,000	570,000	ND	ND
2,4-dinitro-toluene	ND	ND	ND	ND	ND	100,000	ND	ND	ND	ND	ND	ND	ND
fluorene	ND	ND	ND	ND	ND	5,500,000	180	ND	ND	7,300,000	970,000	ND	ND

TABLE 8-1
(Continued)

	(1) French Cr. Background Surface Water	(2) French Cr. Surface Water	(3) GATX Pond Surface Water	(4) French Cr. Background Sediment	(5) French Cr. Sediment	(6) GATX Pond Sediment	(7) Shallow Site Soil Background	(8) SMC Shallow Soils	(9) SCI Shallow Soils	(10) GATX Pond Area Shallow Soils	(11) GATX Pond Lagoon Sludge Bed Soils	(12) Other GATX Area Shallow Soils	(13) Lord Corp. Shallow Soils
hexachloro-benzene	ND	ND	ND	ND	ND	200,000	57	ND	ND	610	50,000	ND	ND
phenanthrene	ND	ND	ND	58	75	26,000,000	700	ND	ND	16,000,000	1,800,000	45	ND
anthracene	ND	ND	ND	ND	61	70,000,000	630	ND	ND	45,000,000	3,000,000	ND	ND
di-n-butylphthalate	ND	ND	ND	62	ND	190,000	ND	ND	ND	ND	ND	ND	ND
fluoranthene	ND	ND	ND	99	170	4,900,000	800	ND	ND	8,200,000	640,000	160	59
pyrene	ND	ND	ND	90	150	4,100,000	740	ND	ND	8,200,000	510,000	110	ND
butylbenzyl-phthalate	ND	ND	ND	ND	ND	ND	51	ND	ND	ND	120	ND	ND
benzo(a)-anthracene	ND	ND	ND	54	91	2,200,000	460	ND	ND	3,100,000	170,000	55	ND
chrysene	ND	ND	ND	ND	82	3,300,000	430	ND	ND	13,000,000	210,000	68	ND
bis(2-ethylhexyl) phthalate	ND	ND	ND	82	65	180,000	ND	65	ND	3,400	ND	ND	110
di-n-octylphthalate	ND	ND	ND	ND	ND	100,000	ND	ND	ND	ND	ND	ND	ND
benzo(b) fluoranthene	ND	ND	ND	73	110	1,500,000	1,000	ND	ND	4,000,000	130,000	120	ND
benzo(k) flouranthene	ND	ND	ND	73	ND	730,000	1,000	ND	ND	4,000,000	130,000	120	ND
benzo(a)pyrene	ND	ND	ND	ND	71	1,100,000	320	ND	ND	1,900,000	210,000	ND	ND
ideno(1,2,3-cd)-pyrene	ND	ND	ND	ND	ND	400,000	260	ND	ND	770,000	71,000	ND	ND
dibenz(a,h)-anthracene	ND	ND	ND	ND	ND	140,000	ND	ND	ND	300,000	380	ND	ND
benzo(g,h,i)-perylene	ND	ND	ND	ND	ND	360,000	280	ND	ND	780,000	71,000	ND	ND

Notes:

(1) from SW01-01
(2) from SW02-01, SW03-01, SW04-01
(3) from SW05-01, SW06-01
(4) from SD-01-01
(5) from SD02-01, SD03-01, SD04-01
(6) from SD05-01, SD06-01
(7) from SSB11-04, SSB12-04, SSB17-04, SU03-02
All values are in ug/L or ug/kg.

(8) from SD09-01, SSB01-04, SSB01-06
(9) from SSB16-04
(10) from SSAP82-03, SSAP88-03, SSAP89-04, SSAP90-04, SSB07-02, SSB07-04, SSB08-04, SSB09-04, TP01-04, TP03-02, TP04-02
(11) from SU01-02, SU02-02, SSAP83-04, SSAP84-03, SSAP85-03, SSAP86-04, SSAP87-03
(12) from SSB05-04, SSB06-02, SSB06-04, SSB13-04, SSB14-02, SSB15-04
(13) from SSB10-02, SD07-01, SD08-01

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TABLE 8-2

Potential Ecological Exposure Pathways
Saegertown Industrial Area Site RI

Potential Source (Environmental Medium)	Exposure Point	Route of Contaminant Uptake	Exposed Population	Exposure Potential
Surface water	French Creek	Direct contact	Fish, algae, macrophytes, aquatic birds, macroinvertebrates, reptiles	Low, contaminants do not appear site related.
		Ingestion	Fish, aquatic birds, macro-invertebrates, reptiles	Low, contaminants do not appear site related.
Sediment	French Creek	Direct contact	Macrophytes, macroinvertebrates	Low, contaminants do not appear to be site related.
Biota	French Creek	Biomagnification	Fish, small mammals, reptiles, aquatic birds	Low, contaminants are not present in large concentrations.
Surface water	GATX Pond	Direct contact	macrophytes, algae, macroinvertebrates, aquatic birds, reptiles	Low, little contamination is present in pond water.
		Ingestion	Fish, aquatic birds, macroinvertebrates	Low, little contamination is present in pond water.
Sediment	GATX Pond	Direct contact	Macrophytes, macroinvertebrates, amphibians	High, some organics and metals bioaccumulate and biomagnify.
Biota	GATX Pond	Biomagnification	Small mammals, birds	High, some organics and metals bioaccumulate and biomagnify.
Soil	Terrestrial Habitats	Direct contact	Small mammals, reptiles, soil invertebrates	High in some areas, some organics and metals bioaccumulate and biomagnify.
		Ingestion	Small mammals, reptiles	High in some areas, some organics and metals bioaccumulate and biomagnify.
		Biomagnification	Small mammals, birds, reptiles	High in some areas, some organics and metals bioaccumulate and biomagnify.

TABLE 8-3

Soil-To-Plant Translocation Factors for PCBs, PAHs, and Metals
Saegertown Industrial Area Site RI

Chemical	Plant	Transfer Factor	References
PCBs	Leafy Vegetables	0.00	Researchers have shown that PCBs
	Fruits	0.00	are not accumulated by plants
	Legumes	0.00	(Pal et al, 1980; Moza et al, 1979).
	Potatoes	0.01	some soil adherence on crop.
	Carrots/beets	0.01	
PAHs	Leafy Vegetables	0.035	Conner, 1984
	Fruits	0.003	Kolar et al, 1975
	Legumes	0.035	Assumed lettuce value
	Potatoes	0.005	Kolar et al, 1975
	Carrots/beets	0.026	Conner, 1984
	Average	0.021	
Cadmium	Leafy Vegetables	0.067	Dowdy and Larson, 1985 MacLean, 1976 John et al, 1972 John, 1973
	Fruits	0.011	Dowdy and Larson, 1975 Bingham et al, 1975 MacLean, 1976 Wiersma et al, 1986
	Legumes	0.042	Dowdy and Larson, 1975 Bingham et al, 1975 John, 1973
	Potatoes	0.050	Dowdy and Larson, 1975 Bingham et al, 1975 MacLean, 1976
	Carrots/beets	0.088	Dowdy and Larson, 1975 Bingham et al, 1975 MacLean, 1976 John, 1973
	Average	0.052	
Chromium	Leafy Vegetables	0.0009	Keefer et al, 1986
	Fruits	0.0008	Keefer et al, 1986
	Legumes	0.0004	Keefer et al, 1986
	Potatoes	0.0005	Harris et al, 1981
	Carrots/beets	0.0004	Keefer et al, 1986
	Average	0.0006	

TABLE 8-3
(Continued)

Chemical	Plant	Transfer Factor	References
Copper	Leafy Vegetables	0.014	Lucas, 1945 Dowdy and Larson, 1975 Furr et al, 1981
	Fruits	0.0015	Dowdy and Larson, 1975 Furr et al, 1976 Sterret et al, 1982
	Legumes	0.0043	Dowdy and Larson, 1975 Bradford et al, 1975 Furr et al, 1976 Latterell et al, 1981 Furr et al, 1981
	Potatoes	0.046	Dowdy and Larson, 1975 Furr et al, 1976
	Carrots/beets	0.0097	Dowdy and Larson, 1975 Lucas, 1945 Furr et al, 1976 Furr et al, 1981
	Average	0.013	
Lead	Leafy Vegetables	0.00055	Dowdy and Larson, 1975
	Fruits	0.000018	Wiesma et al, 1986
	Legumes	0.00028	Dowdy and Larson, 1975
	Potatoes	0.00025	Wiersma et al, 1986
	Carrots/beets	0.0018	Dowdy and Larson, 1975
	Average	0.0006	
Mercury	Leafy Vegetables	0.0065	Wiersma et al, 1986
	Fruits	0.00048	Wiersma et al, 1986
	Legumes	--	No data
	Potatoes	0.0048	Wiersma et al, 1986
	Carrots/beets	0.0016	Wiersma et al, 1986
	Average	0.0033	
Zinc	Leafy Vegetables	0.015	Lag and Elskokaragl, 1978 Davies and White, 1981
	Fruits	0.015	Lag and Elskokarag, 1978 Harris et al, 1981
	Legumes	0.015	Lag and Elskokarag, 1978 Harris et al, 1981
	Potatoes	0.012	Lag and Elskokarag, 1978 Harris et al, 1981
	Carrots/beets	0.014	Lag and Elskokarag, 1978 Davies and White, 1981 Crews and Davies, 1985
	Average	0.014	

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TABLE 8-4

Calculation of Daily Intakes For Burrowing Mammals
Saegertown Industrial Area Site RI

Burrowing Mammals Daily Intakes[1]

Soil and Sediment-Ingestion

$$DI_s = \frac{CS \times IR \times CF \times FI}{BW}$$

DI_s = Daily Intake, mg/kg/day from soil
CS = Soil or Sediment Chemical Concentration, mg/kg
IR = Soil or Sediment Ingestion Rate, 750 mg Soil or Sediment/day
CF = Conversion Factor, 10^{-6} kg/mg
FI = Fraction Ingested from Contaminated Area, 1 (i.e., 100%)
BW = Body Weight, 0.250 kg

Plant Material - Ingestion

$$DI_p = \frac{CS \times BAF \times IR_p \times CF \times FI}{BW}$$

DI_p = Daily Intake, mg/kg/day from plants
CS = Soil or Sediment Chemical Concentration, mg/kg
BAF = Soil/Sediment to Plant Bioaccumulation factor, unitless
IR_p = Plant ingestion rate, 14,250 mg leafy or tuber/root material/day
CF = Conversion factor, 10^{-6} kg/mg
FI = Fraction Ingested from Contaminated Area, 1(i.e., 100%)
BW = Body Weight, 0.250 kg

Surface Water-Ingestion

$$DI_w = \frac{CW \times CR}{BW}$$

DI_w = Daily Intake, mg/kg/day from water
CW = Surface Water Chemical Concentration, mg/L
CR = Surface Water Consumption Rate, 0.025 L/day
BW = Body Weight, 0.250 kg

Total DI = $DI_s+DI_p+DI_w$

Footnote:

1. The exposure factors (e.g., IR, BW, CR) were based on the size and feeding habits of an adult male rat. It was assumed that a rat diet consisted of 5% soil or sediment by weight (i.e., 750 mg soil or sediment). The average rat weighs 0.250 kg, and eats 15 grams food and drinks 25 ml of water per day (from U.S. DHHS, 1983).

2. The soil/sediment to plant bioaccumulation factors (BAF) used to estimate plant concentrations of chemicals of potential concern are the averages from Table 8-3 from available data. The value for PAHs was applied to other semivolatile compounds. Volatile compounds and other metals are assumed to not bioaccumulate.

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TABLE 8-5

Daily Intake Exposure Values for Small Mammals
Saegertown Industrial Area Site RI

Metals	Total Daily Intake (ug/kg/day) GATX Pond Area	GATX Former Lagoon Sludge Bed	Lord Corp.
Antimony	45.3	ND	ND
Arsenic	402	63	26.7
Barium	745	274	372
Cadmium	49.5	ND	ND
Chromium	528	221	68
Copper	628	110	262
Lead	8830	452	101
Mercury	18.8	1.4	0.7
Nickel	126.9	47.4	50.1
Selenium	15.9	ND	ND
Thallium	75.9	ND	ND
Zinc	6153	967	0.84
Cyanide	75	48	ND
Volatiles			
1,2-Dichloroethene	ND	0.48	ND
Chloroform	6	ND	ND
1,1,1-Trichloroethane	0.003	ND	ND
1,2-Dichloropropane	ND	0.03	ND
Trichloroethene	117	2.6	ND
1,1,2-Trichloroethane	ND	ND	ND
Benzene	630	1.26	ND
Tetrachloroethene	90.2	4.5	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND
Toluene	690	3.6	0.01
Chlorobenzene	42	72	ND
Ethylbenzene	75	132	ND
Styrene	8.1	0.69	ND
Xylenes	630	6.9	ND

Total Daily Intake (ug/kg/day)

Metals	GATX Pond Area	GATX Former Lagoon Sludge Bed	Lord Corp.
Pesticides/PCBs			
4,4'-DDE	ND	ND	0.24
4,4'-DDT	ND	ND	0.21
Arochlor 1260	2963	ND	ND
Semivolatiles			
Phenol	4071	ND	0.27
1,4-Dichlorobenzene	0.75	690	ND
1,2-Dichlorobenzene	ND	1320	ND
2-Methylphenol	1595	ND	ND
4-Methylphenol	4617	ND	ND
2,4-Dimethylphenol	1805	ND	ND
Benzoic acid	2644	ND	105
1,2,4-Trichlorobenzene	ND	1007	ND
Naphthalene	71,349	10,073	ND
Hexachlorobutadiene	ND	755	ND
2-Methyl-naphthalene	28,959	3,358	ND
Acenaphthylene	6715	588	ND
Acenaphthene	18,047	2,056	ND
Dibenzofuran	21,824	2,392	ND
Fluorene	30,638	4071	ND
Hexachlorobenzene	2.6	210	ND
Phenanthrene	67,152	7,555	ND
Anthracene	188,865	12,591	ND
Fluoranthene	34,415	2,686	0.2
Pyrene	34,415	2,140	ND
Butylbenzylphthalate	ND	1.8	ND
Benzo(a)anthracene	13,011	713	ND
Chrysene	54,561	881	ND
Bis(2-ethylhexyl)phthalate	14.3	ND	0.5
Benzo(b)fluoranthene	16,788	546	ND
Benzo(k)flouranthene	16,788	546	ND
Benzo(a)pyrene	7,974	881	ND
Ideno(1,2,3-cd)-pyrene	3232	298	ND
Dibenz(a,h)anthracene	1259	1.6	ND
Benzo(g,h,i)perylene	3274	298	ND

NOTES:

1. Calculation for total daily intake is presented in Table 8-4.
2. ND = not detected at this location.

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TABLE 8-6

Toxicity Endpoints for Mammalian Species
Saegertown Industrial Area Site RI

	Toxicity Values[1]			Lowest Observed Adverse Effect Level (LOAEL) Values[2]			
	Value (mg/kg)	Species	Effect/Route	Threshold Effect	Species	Route	Dose (mg/kg/day)
Metals							
Antimony	1,000	Rat	LD_{LO}/ipr [3]	Reduced lifespan	Rat	Drinking water	0.35
Arsenic	10	Guinea pig	LD_{LO}/ipr	NA[3]			
Barium	70	Mouse	LD_{LO}/oral	Increased blood pressure	Rat	Drinking water	5.1
Cadmium	70	Rabbit	LD_{LO}/oral	NA			
Chromium	250	Mouse	LD_{LO}/oral	Not specified	Rat	Drinking Water	2.4
Copper	60	Dog	LD_{LO}/oral	NA			
Lead	300	Dog	LD_{LO}/oral	NA			
Mercury	62	Mouse	LD_{50}/oral[3]	NA			
Nickel	5	Guinea pig	LD_{LO}/oral	Reduced body and organ weight	Rat	Oral	5
Selenium	NA[3]			Mortality	Rat	Oral	0.41
Thallium	50	Guinea pig	LD_{LO}/oral	Increased SGOT and serum LDH	Rat	Oral	0.2
Zinc	976	Rabbit	LD_{LO}/oral	NA			
Cyanide	3	Mouse	LD/$_{50}$/ipr	Weight loss	Rat	Oral	10.8
Volatiles							
1,2-Dichloroethene	NA			Increased serum alkaline phosphatase	Mouse	Drinking water	17
Chloroform	500	Rabbit	LD_{LO}/oral	Liver lesions	Dog	Oral	12.9
1,1,1-Trichloroethane	750	Dog	LD_{50}/oral	Hepatotoxicity	Guinea pig	Oral	90
1,2-Dichloropropane	860	Mouse	LD_{50}/oral	NA			
Trichloroethene	2402	Mouse	LD_{50}/oral	NA			
1,1,2-Trichloroethane	500	Dog	LD_{50}/oral	Clinical chemistry alterations	Mouse	Drinking Water	3.9
Benzene	2000	Dog	LD_{LO}/oral	NA			
Tetrachloroethene	4000	Dog	LD_{LO}/oral	Hepatotoxicity	Mouse	Oral	14
1,1,2,2-Tetrachloroethane	200	Rat	LD_{50}/oral	NA			
Toluene	5000	Rat	LD_{50}/oral	Changes in liver and kidney weight	Rat	Oral	223
Chlorobenzene	2830	Rabbit	LD_{50}/oral	Liver and kidney effects	Dog	Oral	27.3
Ethylbenzene	3500	Rat	LD_{50}/oral	Hepatotoxicity and nephrotoxicity	Rat	Oral	97.1
Styrene	316	Mouse	LD_{50}/oral	Red blood cell and liver effects	Dog	Oral	200
Xylenes	5000	Rat	LD_{LO}/oral	Decreased body weight	Rat	Oral	179

	Toxicity Values(1)			Lowest Observed Adverse Effect Dose Values(2)			
	Value (mg/kg)	Species	Effect/Route	Threshold Effect	Species	Route	Dose (mg/kg/day)
Pesticides/PCBs							
4,4'-DDE	NA			NA			
4,4'-DDT	250	Cat	LD_{LO}/oral	Liver lesions	Rat	Oral	0.05
Arochlor 1260	1315	Rat	LD_{50}/oral	NA			
Semivolatiles							
Phenol	420	Rabbit	LD_{LO}/oral	Reduced fetal body weight	Rat	Oral	60
1,4-Dichlorobenzene	500	Rat	LD_{50}/oral	NA			
1,2-Dichlorobenzene	500	Rat	LD_{50}/oral	Liver effects	Rat	Oral	89
2-Methylphenol	121	Rat	LD_{50}/oral	Reduced body weight gain	Rat	Oral	50
4-Methylphenol	207	Rat	LD_{50}/oral	Reduced body weight gain	Rat	Oral	50
2,4-Dimethylphenol	NA			Neurological signs	Mouse	Oral	50
Benzoic acid	2000	Rabbit	LD_{LO}/oral	NA			
1,2,4-Trichlorobenzene	756	Rat	LD_{50}/oral	Increased liver to body weight ratio	Rat	Oral	20
Naphthalene	400	Dog	LD_{LO}/oral	Decreased body weight gain	Rat	Oral	35.7
Hexachlorobutadiene	NA			Kidney Toxicity	Rat	Oral	0.2
2-Methylnaphthalene	4360	Rabbit	LD_{50}/oral	NA			
Acenaphthylene	NA			NA			
Acenaphthene	NA			Hepatotoxicity	Mouse	Oral	175
Dibenzofuran	NA			NA			
Fluorene	NA			Hematological changes	Mouse	Oral	125
Hexachlorobenzene	10,000	Rat	LD_{50}/oral	Liver and hematological effects	Rat	Oral	0.08
Phenanthrene	700	Mouse	LD_{50}/oral	NA			
Anthracene	NA			No effect	Mouse	Oral	1000
Fluoranthene	2000	Rat	LD_{50}/oral	Liver weight changes	Mouse	Oral	125
Pyrene	NA			Renal effects	Mouse	Oral	75
Butylbenzylphthalate	13,750	Rat	LD_{50}/unk(3)	Effects on body weight gain	Rat	Oral	159
Benzo(a)anthracene	10	Mouse	LD_{L}/ivn(3)	NA			
Chrysene	NA			NA			
Bis(2-ethylhexyl)phthalate	31	Rat	LD_{50}/oral	Increased relative liver weight	Guinea pig	Oral	19
Benzo(b)fluoranthene	NA			NA			
Benzo(k)flouranthene	NA			NA			
Benzo(a)pyrene	50	Rat	LD_{50}/scu(3)	NA			
Ideno(1,2,3-cd)pyrene	NA			NA			
Dibenz(a,h)-anthracene	10	Mouse	LD_{LO}/ivn	NA			
Benzo(g,h,i)-perylene	NA			NA			

1. From Sax, 1984.
2. From U.S. EPA, 1991.
3. LD_{50} = Lethal dose to 50% of test population
   LD_{LO} = Lowest lethal dose to test population
   NA = Information not available
   ipr = Intraperitoneal exposure
   irn = Intravenous exposure
   scu = Subcutaneous exposure
   unk = Unspecified exposure

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TABLE 8-7

Risk Estimates to Small Mammals from Site Contaminants
Saegertown Industrial Area Site RI

	GATX Pond Area			GATX Former Lagoon/Sludge Bed			Lord Corp.		
	Exposure Value CDI from Table 8-5 (ug/kg/day)	Toxicity Endpoint LOAEL from Table 8-6 (mg/kg/day)	Hazard Quotient	Exposure Value CDI from Table 8-5 (ug/kg/day)	Toxicity Endpoint LOAEL from Table 8-6 (mg/kg/day)	Hazard Quotient	Exposure Endpoint CDI from Table 8-5 (ug/kg/day)	Toxicity Endpoint LOAEL from Table 8-6 (mg/kg/day)	Hazard Quotient
Metals									
Antimony	45.3	0.35	0.1	ND	0.35	0	ND	0.35	0
Arsenic	402	NA	--	63	NA	--	26.7	NA	--
Barium	745	5.1	0.1	274	5.1	0.05	372	5.1	0.07
Cadmium	49.5	NA	--	ND	NA	--	ND	NA	--
Chromium	528	2.4	0.2	221	2.4	0.09	68	2.4	0.03
Copper	628	NA	--	110	NA	--	262	NA	--
Lead	8830	NA	--	452	NA	--	101	NA	--
Mercury	18.1	NA	--	1.4	NA	--	0.7	NA	--
Nickel	126.9	5	0.03	47.4	5	0.009	50.1	5	0.01
Selenium	15.9	0.41	0.04	ND	0.41	0	ND	0.41	--
Thallium	75.9	0.2	0.4	ND	0.2	--	ND	0.2	0
Zinc	6153	NA	--	967	NA	--	0.84	NA	--
Cyanide	75	10.8	0.007	48	10.8	0.004	ND	10.8	0
Volatiles									
1,2-dichloroethene	ND	17	0	0.48	17	0.00003	ND	17	0
Chloroform	6	12.9	0.0005	ND	12.9	0	ND	12.9	0
1,1,1-trichloroethane	0.003	90	3e-08	ND	90	0	ND	90	0
1,2-Dichloropropane	ND	NA	--	0.03	NA	--	ND	NA	--
Trichloroethene	117	NA	--	2.6	NA	--	ND	NA	--
1,1,2-Trichloroethane	ND	3.9	--	ND	3.9	0	ND	3.9	0
Benzene	630	NA	--	1.26	NA	--	ND	NA	--
Tetrachloroethene	90.2	14	0.006	4.5	14	0.0003	ND	14	0
1,1,2,2-Tetrachloroethane	ND	NA	--	ND	NA	--	ND	NA	--
Toluene	690	223	0.003	3.6	223	0.00002	0.01	223	4e-08
Chlorobenzene	42	27.3	0.002	72	27.3	0.003	ND	27.3	0
Ethylbenzene	75	97.1	0.00004	132	97.1	0.001	ND	97.1	0
Styrene	8.1	200	0.0006	0.69	200	3e-06	ND	200	0
Xylenes	630	179	0.004	6.9	179	0.00003	ND	179	0

	GATX Pond Area			GATX Former Lagoon/Sludge Bed			Lord Corp.		
	Exposure Value CDI from Table 8-5 (ug/kg/day)	Toxicity Endpoint LOAEL from Table 8-6 (mg/kg/day)	Hazard Quotient	Exposure Value CDI from Table 8-5 (ug/kg/day)	Toxicity Endpoint LOAEL from Table 8-6 (mg/kg/day)	Hazard Quotient	Exposure Endpoint CDI from Table 8-5 (ug/kg/day)	Toxicity Endpoint LOAEL from Table 8-6 (mg/kg/day)	Hazard Quotient
Metals									
Pesticides/PCBs									
4,4'-DDE	ND	NA	--	ND	NA	--	0.24	NA	--
4,4'-DDT	ND	0.05	0	ND	0.05	0	0.21	0.05	0.004
Arochlor 1260	2963	NA	--	ND	NA	--	ND	NA	--
Semivolatiles									
Phenol	4071	60	0.07	ND	60	--	0.27	60	4e-06
1,4-dichlorobenzene	0.75	NA	--	690	NA	--	ND	NA	--
1,2-dichlorobenzene	ND	89	0	1320	89	0.01	ND	89	0
2-methylphenol	1595	50	0.03	ND	50	0	ND	50	0
4-methylphenol	4617	50	0.09	ND	50	0	ND	50	0
2,4-dimethylphenol	1805	50	0.04	ND	50	0	ND	50	0
Benzoic acid	2644	NA	--	ND	NA	--	105	NA	--
1,2,4-Trichlorobenzene	ND	20	0	1007	20	0.05	ND	20	0
Naphthalene	71,349	35.7	2.0	10,073	35.7	0.3	ND	35.7	0
Hexachlorobutadiene	ND	0.2	0	755	0.2	4	ND	0.2	0
2-Methylnaphthalene	28,959	NA	--	3358	NA	--	ND	NA	--
Acenaphthylene	6715	NA	--	588	NA	--	ND	NA	--
Acenaphthene	18,047	175	0.1	2056	175	0.01	ND	175	0
Dibenzofuran	21,824	NA	--	2392	NA	--	ND	NA	--
Fluorene	30,638	125	0.2	4071	125	0.03	ND	125	0
Hexachlorobenzene	2.6	0.08	0.03	210	0.08	3	ND	0.08	0
Phenanthrene	67,152	NA	--	7555	NA	--	ND	NA	--
Anthracene	188,865	1000	0.2	12,591	1000	0.01	ND	1000	0
Fluoranthene	34,415	125	0.3	2686	125	0.02	0.2	125	2e-06
Pyrene	34,415	75	0.5	2140	75	0.03	ND	75	0
Butylbenzylphthalate	ND	159	0	1.8	159	1e-05	ND	159	0
Benzo(a)anthracene	13,011	NA	--	713	NA	--	ND	NA	--
Chrysene	54,561	NA	--	881	NA	--	ND	NA	--
Bis(2-ethylhexyl)phthalate	14.3	19	0.0008	ND	19	--	0.5	19	0.00003
Benzo(b)fluoranthene	16,788	NA	--	546	NA	--	ND	NA	--
Benzo(k)flouranthene	16,788	NA	--	546	NA	--	ND	NA	--
Benzo(a)pyrene	7974	NA	--	881	NA	--	ND	NA	--
Ideno(1,2,3-cd)pyrene	3232	NA	--	298	NA	--	ND	NA	--
Dibenz(a,h)anthracene	1259	NA	--	1.6	NA	--	ND	NA	--
Benzo(g,h,i)perylene	3274	NA	--	298	NA	--	ND	NA	--

NOTES:

Hazard Quotient = Exposure Value/Toxicity Endpoint/10^3 ug/mg
ND = Not detected in area samples
NA = Value not available
- = Hazard quotient cannot be calculated.

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FIGURES

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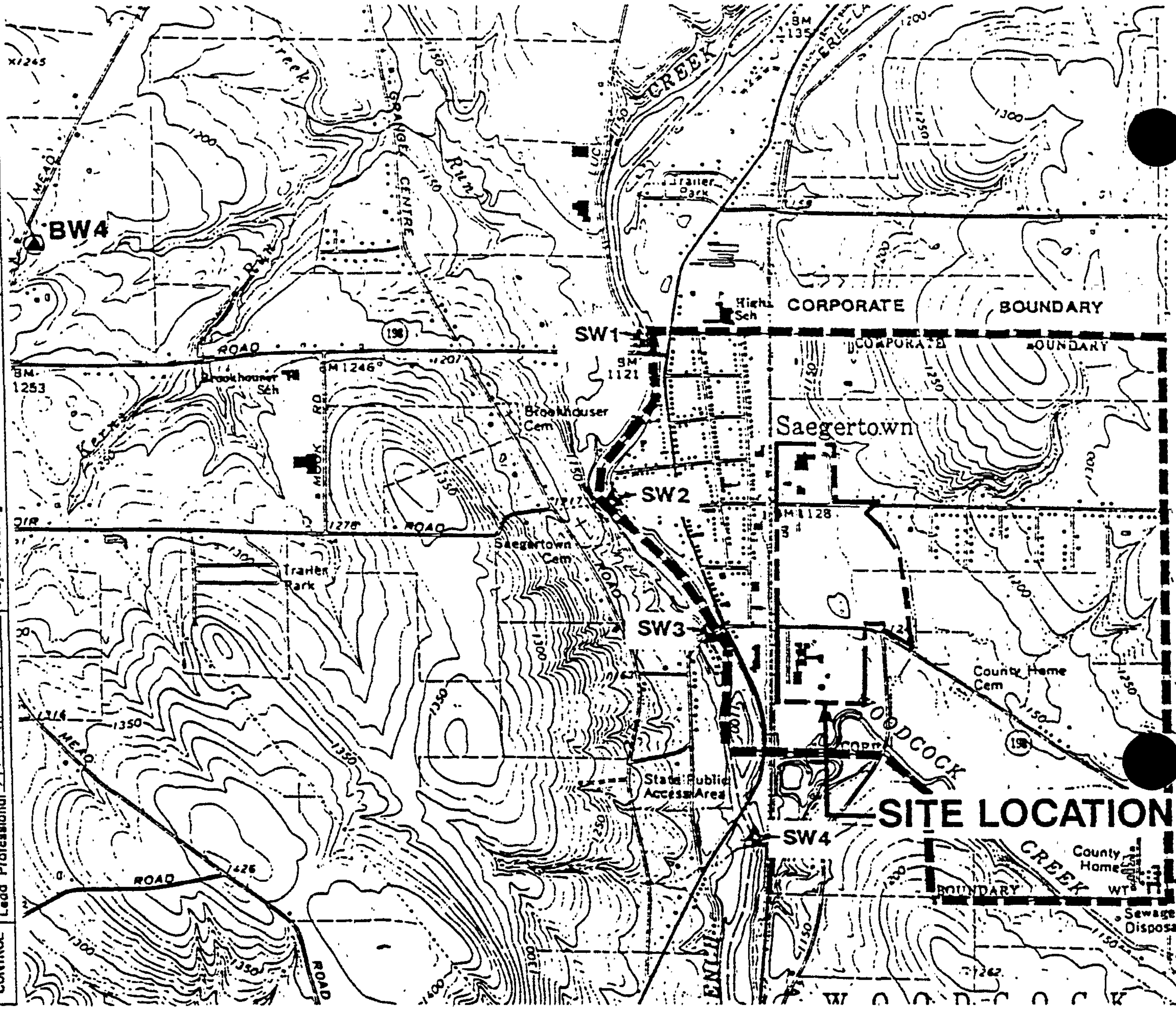


LEGEND

SW1 — PROPOSED SURFACE WATER/SEDIMENT SAMPLING LOCATION AND NUMBER

4 — BOROUGH WATER SUPPLY WELL LOCATION AND NUMBER (APPROXIMATE)

north

0 2000 4000

SCALE IN FEET

NOTES

1. SITE LOCATION MAP DEVELOPED FROM THE MEADVILLE, PENNSYLVANIA 7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLE MAP DATED 1968, PHOTOREVISED 1973.

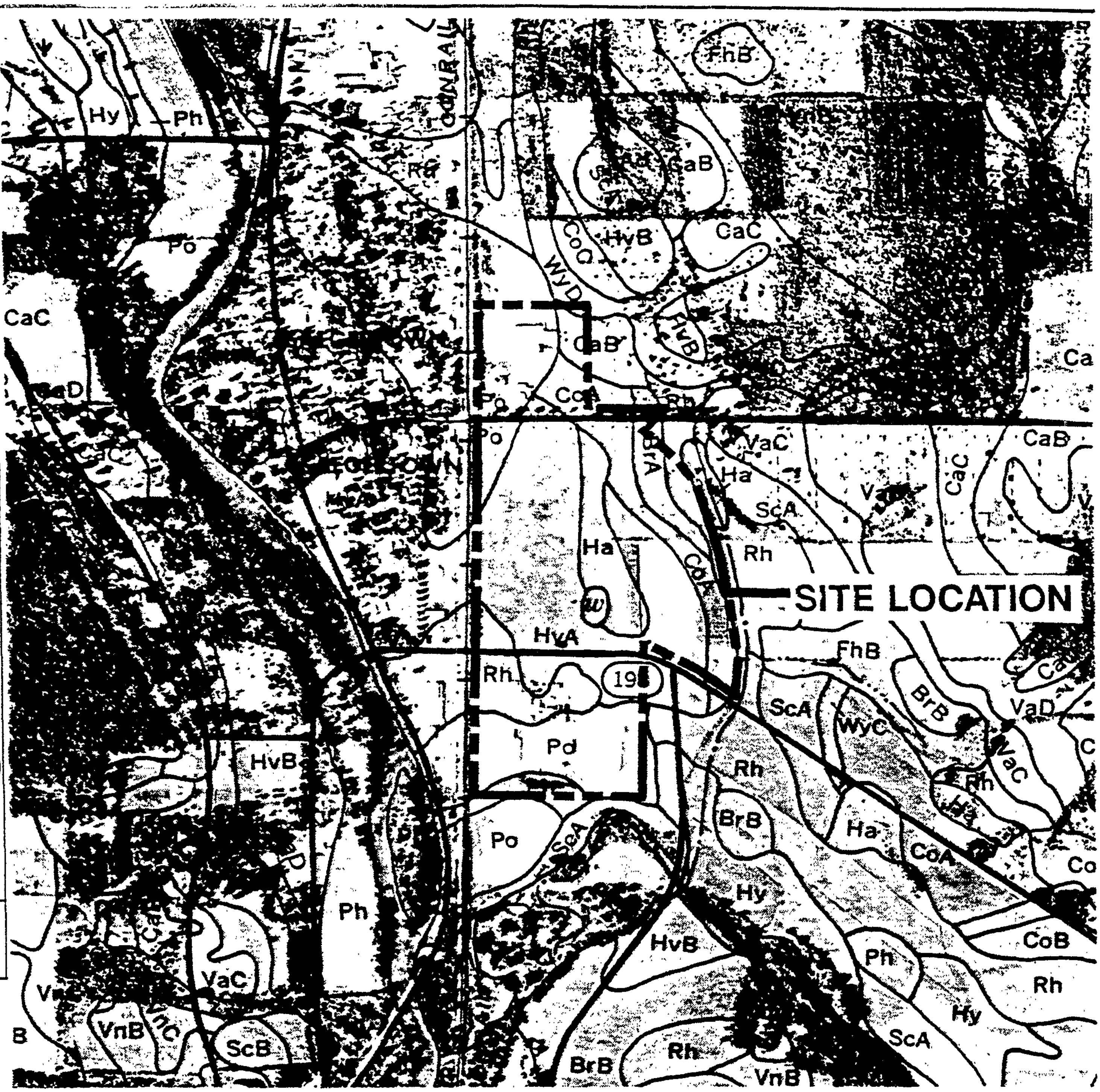
FIGURE 1

Developed By: AJS — Drawn By: DLL	SITE LOCATION MAP	Drawing Number 60882
Approved By: Alan J Schmidt — Date: 1-10-92	REMEDIAL INVESTIGATION/FEASIBILITY STUDY SAEGERTOWN INDUSTRIAL AREA SITE SAEGERTOWN, PENNSYLVANIA	WARZYN
Reference:		
Revisions:		

WARZYN INC.

Quality Control: Graphic Standards D. LINDSLEY; Lead Professional A. SCHMIDT; Technical Review; Project Manager G. PARKER; Management Review; Other

AR303675



LEGEND

- Ha HALSEY SILT LOAM
- Hva HAVEN SILT LOAM
- Po POPE LOAM
- Rh RED HOOK LOAM
- COA CHENANGO GRAVELLY SILT LOAM
- CaB CAMBRIDGE SILT LOAM
- ScA SCIO SILT LOAM

NOTES

1. SURFICIAL SOILS MAP DEVELOPED FROM THE SOIL SURVEY OF CRAWFORD COUNTY, PENNSYLVANIA, PUBLISHED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE, DATED MAY 1979.

0 1000 2000
SCALE IN FEET

north

FIGURE 2

Developed By: AJS Drawn By: DLL
Approved By: Alan J. Schmidt Date: 1-10-92
Reference:
Revisions:

SURFICIAL SOILS MAP

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAEGERTOWN INDUSTRIAL AREA SITE
SAEGERTOWN, PENNSYLVANIA

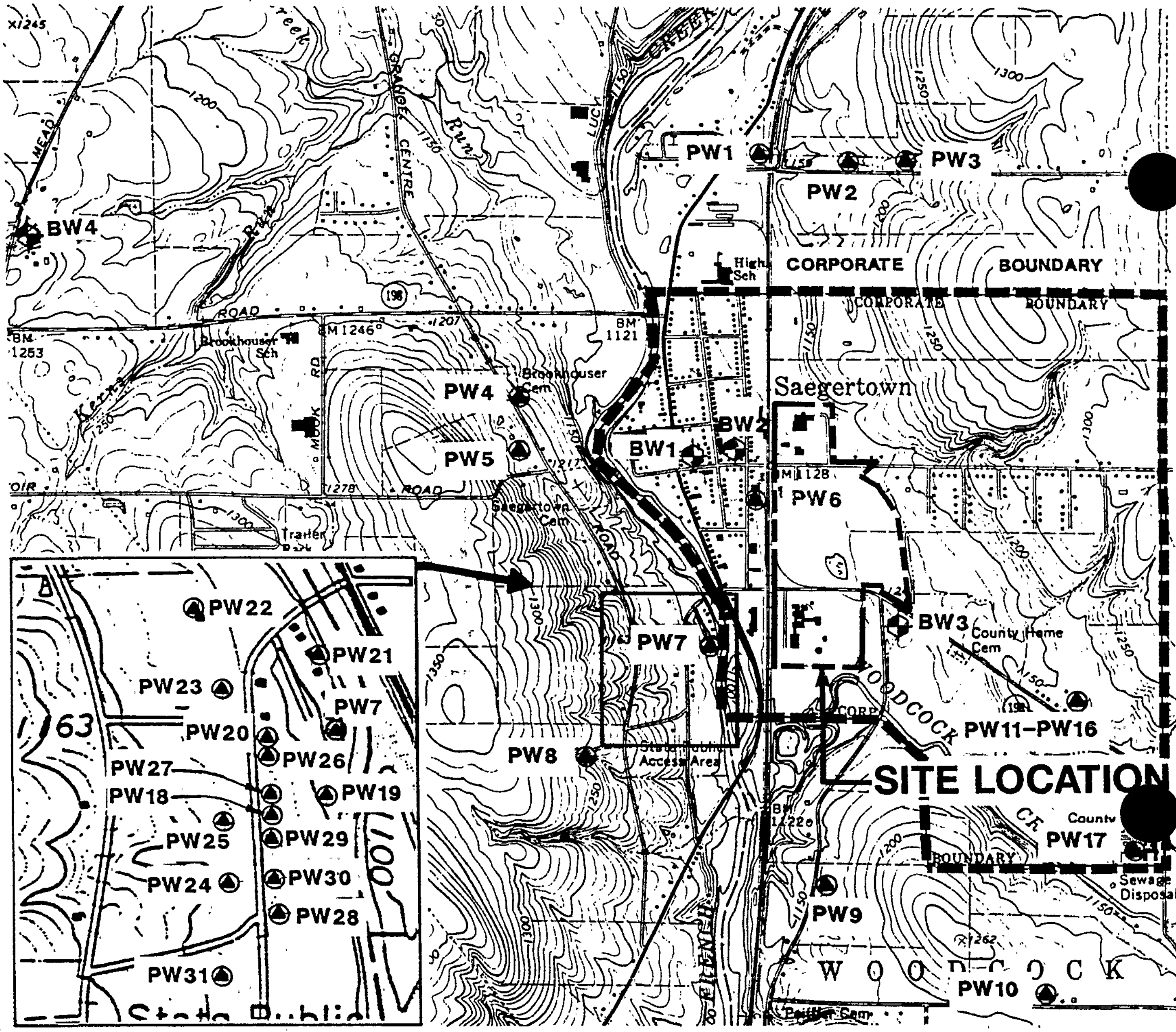
Drawing Number 60882 A10

WARZYN

WARZYN INC.

QUALITY CONTROL — Graphic Standards; Lead Professional: LINDSLEY / SCHMIDT; Technical Review; Project Manager: G. PARKER; Management; Other

Management Review	
Other	
Technical Review	G. PARKER
Project Manager	
Graphic Standards	D. LINDSLEY
Lead Professional	A. SCHMIDT
QUALITY CONTROL	



LEGEND

PW1 — PRIVATE WATER SUPPLY WELL LOCATION AND NUMBER (APPROXIMATE)

BW2 — BOROUGH WATER SUPPLY WELL LOCATION AND NUMBER (APPROXIMATE)

NOTES

1. SITE LOCATION MAP DEVELOPED FROM THE MEADVILLE, PENNSYLVANIA 7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLE MAP DATED 1968, PHOTOREVISED 1973.

north

0 2000 4000

SCALE IN FEET

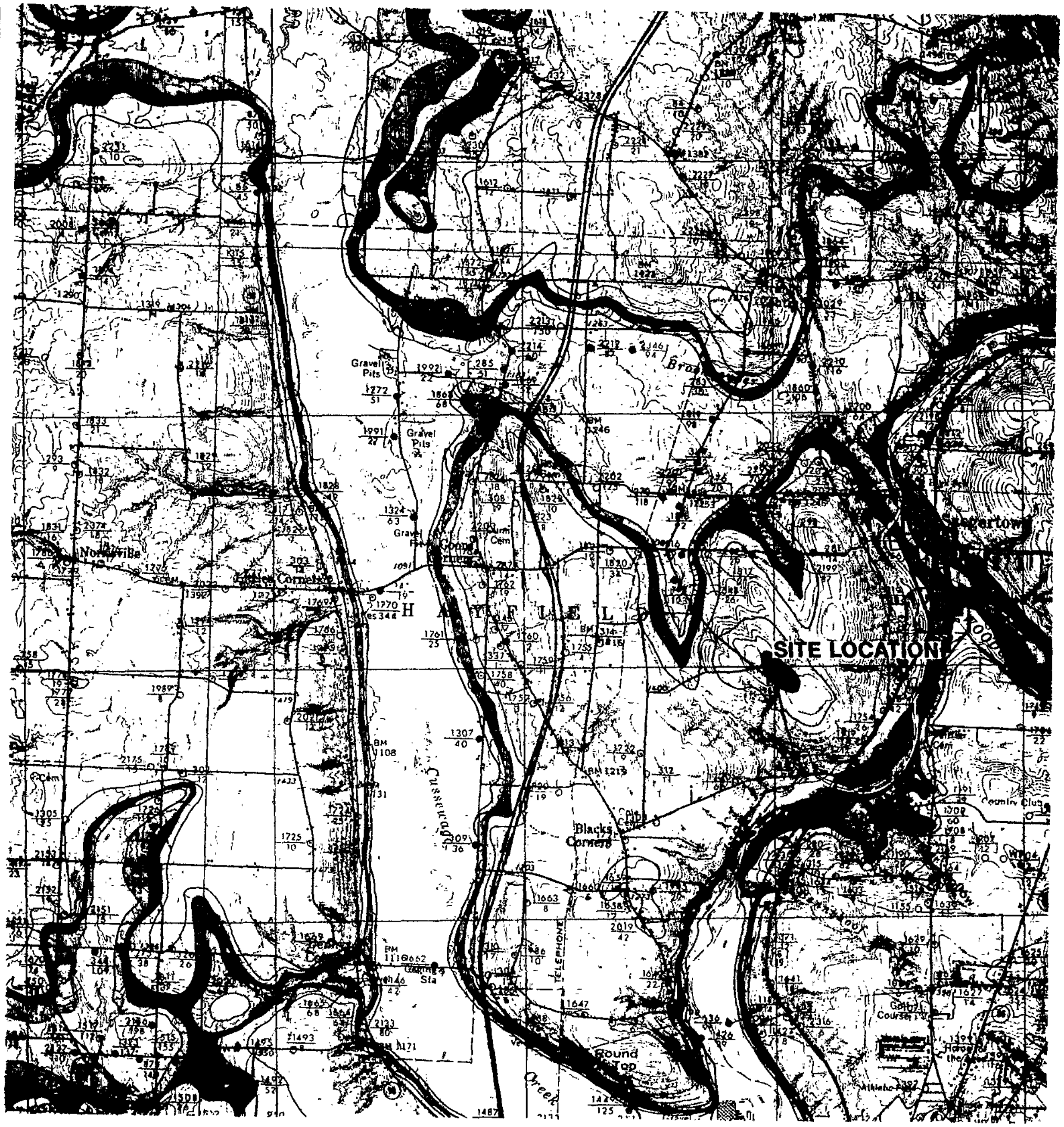
FIGURE 3

Developed By: AJS Drawn By: DLL	WATER SUPPLY WELL LOCATION MAP	Drawing Number 60882
Approved By: Alan J Schmidt Date: 1-10-92	REMEDIAL INVESTIGATION/FEASIBILITY STUDY SAEGERTOWN INDUSTRIAL AREA SITE SAEGERTOWN, PENNSYLVANIA	WARZYN
Reference:		
Revisions:		

WARZYN INC.

AR303677

QUALITY CONTROL | Graphic Standards D. Lindsley | Lead Professional | Technical Review | Project Manager A. Schmidt | Management Review G. Parker | Other



EXPLANATION

THICKNESS OF GLACIAL DEPOSITS, IN FEET

Includes recent alluvium in stream valleys. The maximum thickness is about 500 feet.

	Thickness (feet)	Yield
TILL	0-25	LOW YIELDS
TILL / OUTWASH	25-50	HIGH YIELDS
OUTWASH	50-75	HIGH YIELDS
OUTWASH	75-100	HIGH YIELDS
OUTWASH	>100	HIGH YIELDS

WATER-BEARING CHARACTER OF GLACIAL DEPOSITS

Till generally covers the uplands; outwash is found in small valleys and on flanks of valleys; central parts of major valleys are generally filled with silt and clay. Iron concentrations range widely and are excessive in many areas.

Till is generally a poor aquifer. One fifth of the wells yield less than 3 gpm; two thirds yield less than 10 gpm; the highest reported yield is 20 gpm.

Outwash is the highest yielding aquifer. Only a few wells yield less than 3 gpm; one fifth yield more than 25 gpm; one tenth yield more than 50 gpm; 13 wells are reported to yield at least 700 gpm; the highest reported yield is 2,050 gpm.

SYMBOLS

Well finished in bedrock
Well finished in glacial drift

Upper number identifies well. Lower number is depth to bedrock or depth of well finished in glacial drift, in feet below land surface.

DISTRIBUTION OF GLACIAL DRIFT

NOTES

1. BASE MAP DEVELOPED FROM THE MAP SHOWING THICKNESS OF GLACIAL DEPOSITS AND LOCATIONS OF WELLS IN WESTERN CRAWFORD COUNTY, PENNSYLVANIA (SCHINER AND GALLAHER, 1979).

north

0 4000 8000
SCALE IN FEET

AR303678

FIGURE 4

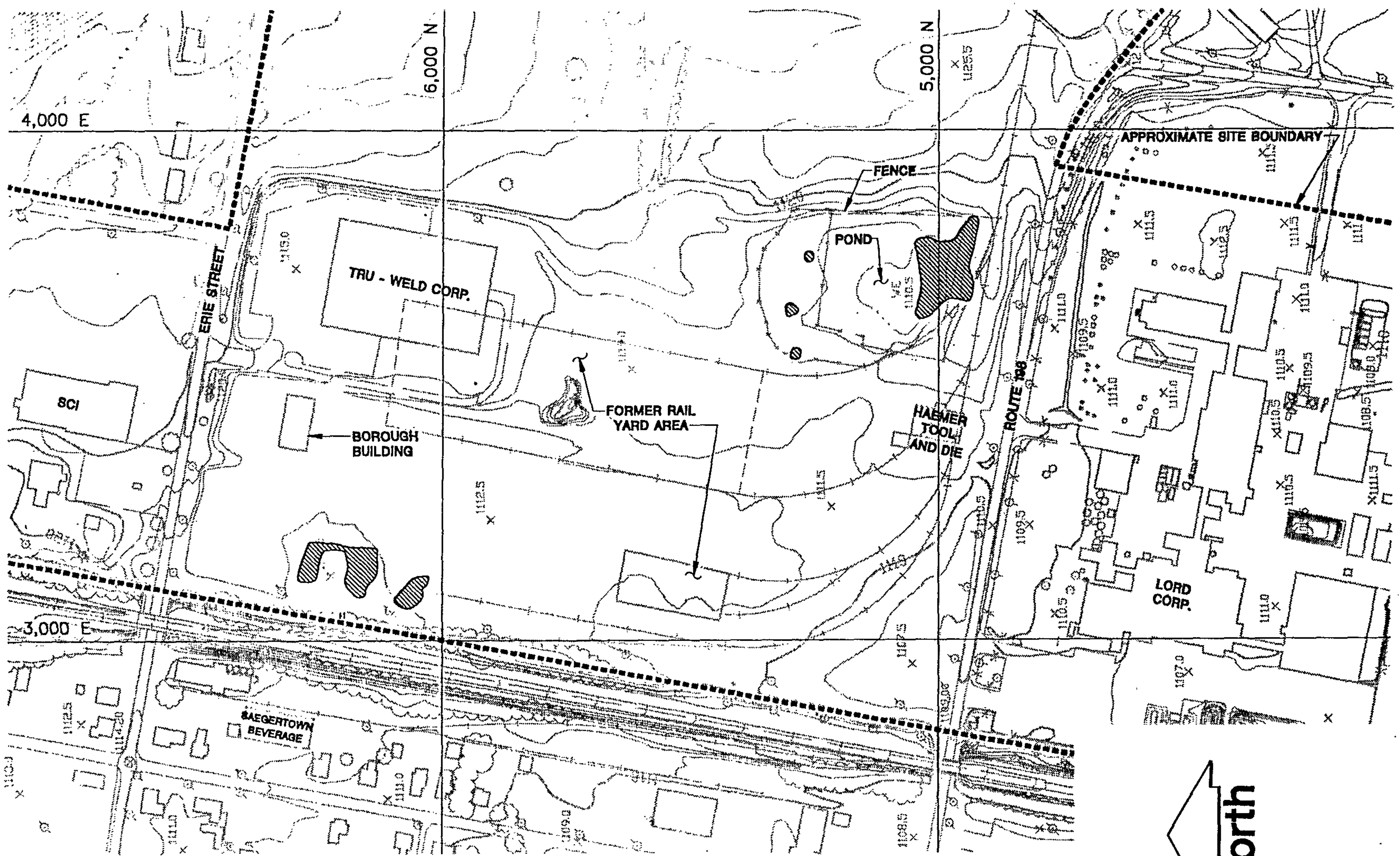
Developed By: AJS	Drawn By: DLL
Approved By: Gary E. Parker	Date: 1/10/92
Reference:	
Revisions:	

GLACIAL GEOLOGY MAP
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAEGERTOWN INDUSTRIAL AREA SITE
SAEGERTOWN, PENNSYLVANIA

Drawing Number 60882 B8

WARZYN

QUALITY CONTROL	Graphic Standards D. LINDSLEY	Technical Review	Management Review
	Lead Professional A. SCHMIDT	Project Manager G. PARKER	Other



LEGEND

- AREA CONTAINING SLUDGE
- POWER OR TELEPHONE LINEPOLE
- FENCE
- BUILDING
- TREES OR SHRUBS
- RAILROAD TRACKS

NOTES

1. BASE MAP WAS DEVELOPED BASED ON AERIAL PHOTOGRAPHY PERFORMED BY DAVID JAMES LAIRD ASSOCIATES ON APRIL 8, 1990.
2. NORTH-SOUTH GRID LINE IS ALIGNED WITH MAGNETIC NORTH.
3. VERTICAL DATUM IS USGS DATUM; CONTOUR INTERVAL IS TWO (2) FEET.
4. SEE FIGURES 6 & 7 FOR MORE DETAIL ON SLUDGE EXTENT.

AR303679

FIGURE 5

AREAS CONTAINING SLUDGE - FORMER GATX PROPERTY

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAEGERTOWN INDUSTRIAL AREA SITE
SAEGERTOWN, PENNSYLVANIA

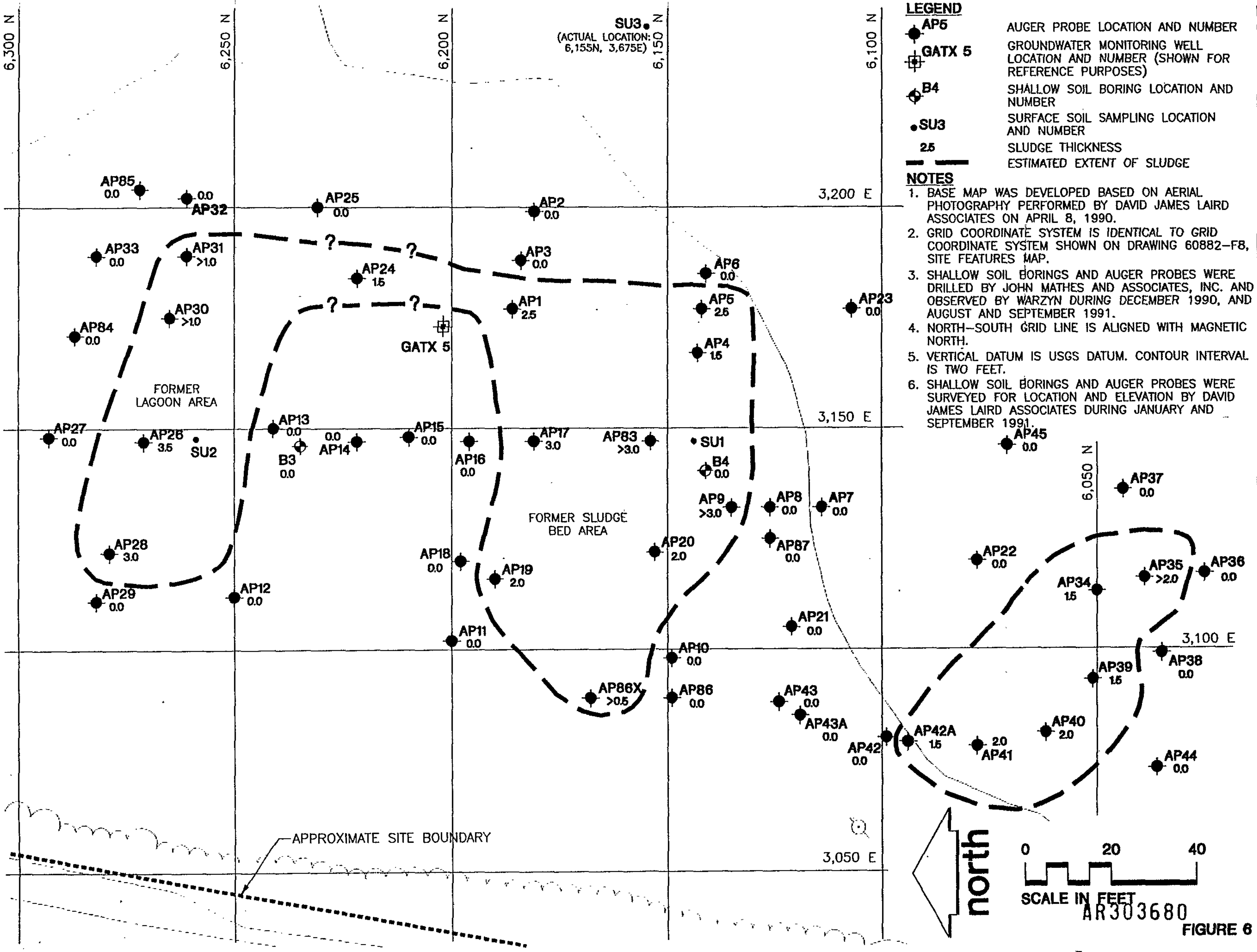
Drawing Number 60882 B5

WARZYN

Developed By: AJS | Drawn By: ELR
Approved By: Alan J Schmidt | Date: 1-10-92
Reference:
Revisions:

WARZYN INC.

QUALITY CONTROL	Graphic Standards	Technical Review	Management Review
	Lead Professional	Project Manager	Other



LEGEND

Symbol	Description
AP5	AUGER PROBE LOCATION AND NUMBER
GATX 5	GROUNDWATER MONITORING WELL LOCATION AND NUMBER (SHOWN FOR REFERENCE PURPOSES)
B4	SHALLOW SOIL BORING LOCATION AND NUMBER
SU3	SURFACE SOIL SAMPLING LOCATION AND NUMBER
2.5	SLUDGE THICKNESS
— —	ESTIMATED EXTENT OF SLUDGE

NOTES

1. BASE MAP WAS DEVELOPED BASED ON AERIAL PHOTOGRAPHY PERFORMED BY DAVID JAMES LAIRD ASSOCIATES ON APRIL 8, 1990.
2. GRID COORDINATE SYSTEM IS IDENTICAL TO GRID COORDINATE SYSTEM SHOWN ON DRAWING 60882-F8, SITE FEATURES MAP.
3. SHALLOW SOIL BORINGS AND AUGER PROBES WERE DRILLED BY JOHN MATHES AND ASSOCIATES, INC. AND OBSERVED BY WARZYN DURING DECEMBER 1990, AND AUGUST AND SEPTEMBER 1991.
4. NORTH-SOUTH GRID LINE IS ALIGNED WITH MAGNETIC NORTH.
5. VERTICAL DATUM IS USGS DATUM. CONTOUR INTERVAL IS TWO FEET.
6. SHALLOW SOIL BORINGS AND AUGER PROBES WERE SURVEYED FOR LOCATION AND ELEVATION BY DAVID JAMES LAIRD ASSOCIATES DURING JANUARY AND SEPTEMBER 1991.

FIGURE 6

AR303680

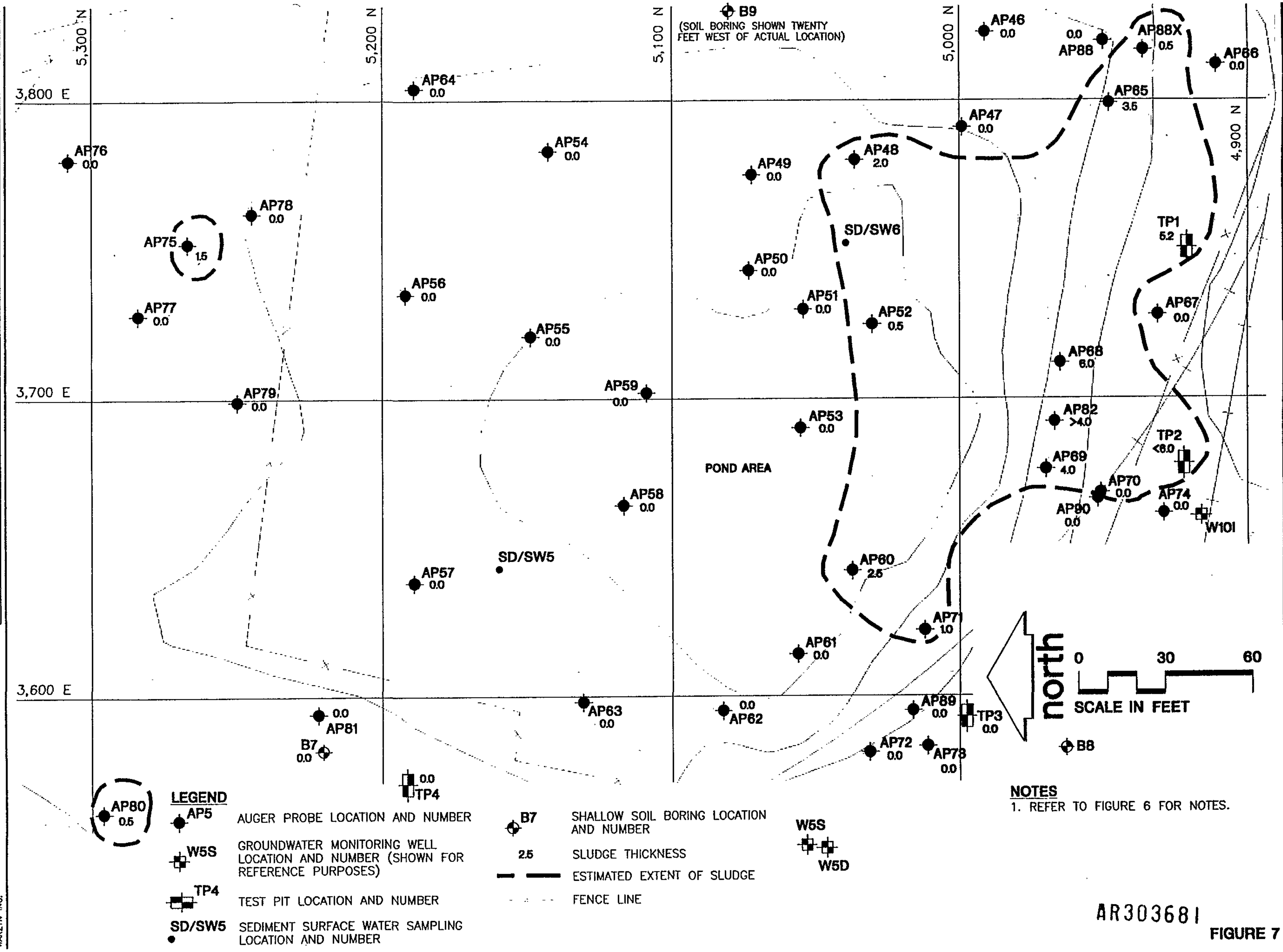
EXTENT OF SLUDGE - FORMER GATX LAGOON AND SLUDGE BED

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAEGERTOWN INDUSTRIAL AREA SITE
SAEGERTOWN, PENNSYLVANIA

Drawing Number 60882 B3

WARZYN

Developed By: AJS
Drawn By: ELR
Approved By: Alan J. Schmidt
Date: 8/7/92
Reference:
Revisions:



AR303681

FIGURE 7

WARZYN INC.

QUALITY CONTROL | Graphic Standards | Lead Professional | Technical Review | Project Manager | Management Review | Other

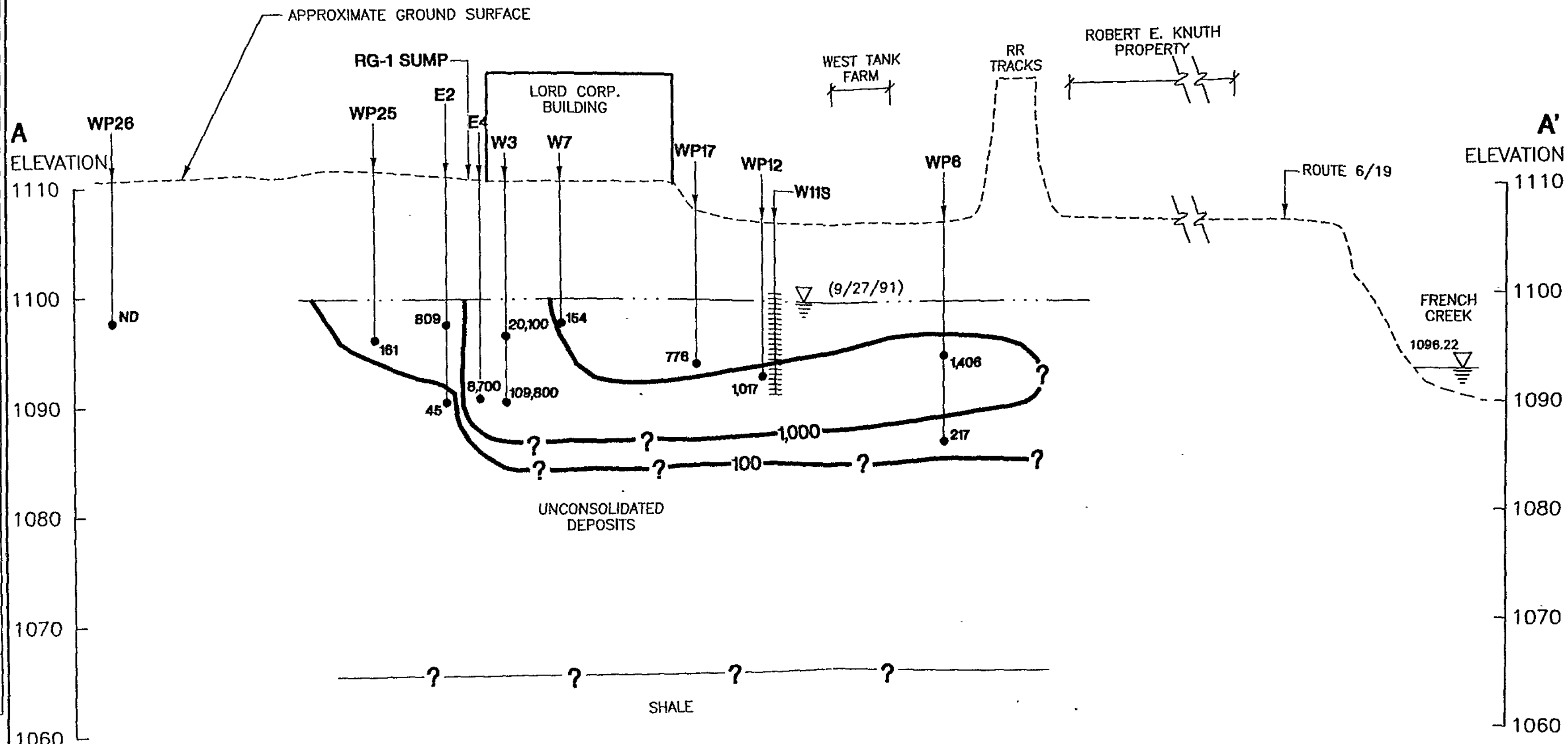
Developed By: AJS
Drawn By: ELR
Approved By:
Date: 1-10-92
Reference:
Revisions:

EXTENT OF SLUDGE - FORMER GATX POND

REMEDIAL INVESTIGATION/FEASIBILTY STUDY
SAEGERTOWN INDUSTRIAL AREA SITE
SAEGERTOWN, PENNSYLVANIA

Drawing Number 60882 B4

WARZYN



LEGEND

—100—	TOTAL ETHENE CONTOUR (ug/L)
●217	TEMPORARY WELL POINT SAMPLING DEPTH AND TOTAL ETHENE CONCENTRATION (ug/L)
▽	WATER TABLE
ND	NO ETHENES DETECTED

NOTES

1. SAMPLING WAS CONDUCTED BY WARZYN DURING THE PERIOD AUGUST 26 THROUGH AUGUST 30, 1991, AND BY REMCOR(E2, E4, W3, AND W7) DURING THE PERIOD OF OCTOBER 3 THROUGH OCTOBER 6, 1991. SAMPLES WERE ANALYZED IN THE FIELD USING A GAS CHROMATOGRAPH.
2. TOTAL ETHENES IS THE SUM OF THE CONCENTRATION OF TETRACHLOROETHENE, TRICHLOROETHENE, AND TOTAL 1,2-DICHLOROETHENE.
3. LOCATION OF PROFILE SHOWN ON DRAWING 60882-F15.
4. THE CONTAMINANT PROFILE ALONG THE WESTERN PROPERTY LINE IS ILLUSTRATED ON FIGURE 9. FIGURE 9 SHOWS THAT CONTAMINANTS WERE NOT DETECTED AT DEPTH AT WELL W7D.

CROSS SECTION SCALE

10
0
0 100 200

SCALE IN FEET
VERTICAL EXAGGERATION: TEN TIMES

AR303682

FIGURE 8

QUALITY CONTROL	Graphic Standards D. LINDSLEY; Lead Professional A. SCHMIDT; Technical Review ____; Project Manager G. PARKER; Management Review ____; Other ____

WARZYN INC.

TOTAL ETHENE CONCENTRATION PROFILE A - A'

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAEGERTOWN INDUSTRIAL AREA SITE
SAEGERTOWN, PENNSYLVANIA

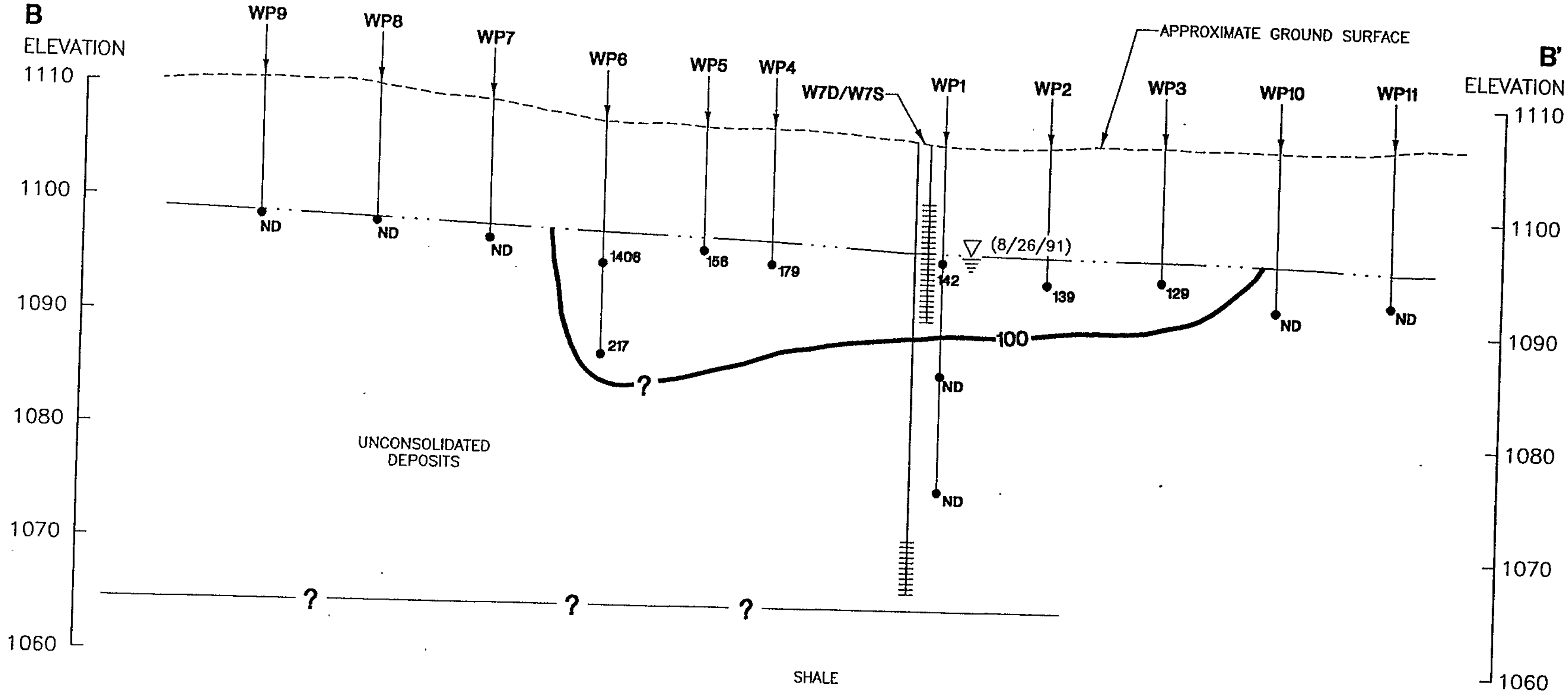
Developed By: AJS
Drawn By: ELR
Approved By: Alan Schmidt
Date: 1-10-92
Reference:
Revisions:

Drawing Number 60882 B6

WARZYN

QUALITY CONTROL	Graphic Standards D. LUNDSLEY Lead Professional A. SCHMIDT	Technical Review Project Manager G. PARKER	Management Review Other

WARZYN INC.



LEGEND

—100—	TOTAL ETHENE CONTOUR (ug/L)
● 217	TEMPORARY WELL POINT SAMPLING DEPTH AND TOTAL ETHENE CONCENTRATION (ug/L)
▽	WATER TABLE
ND	NO ETHENES DETECTED

NOTES

1. SAMPLING WAS CONDUCTED BY WARZYN DURING THE PERIOD AUGUST 26 THROUGH AUGUST 30, 1991. SAMPLES WERE ANALYZED IN THE FIELD USING A GAS CHROMATOGRAPH.
2. TOTAL ETHENES IS THE SUM OF THE CONCENTRATION OF TETRACHLOROETHENE, TRICHLOROETHENE, AND TOTAL 1,2-DICHLOROETHENE.
3. LOCATION OF PROFILE SHOWN ON DRAWING 60882-F15.

CROSS SECTION SCALE

10

0

0 100 200

SCALE IN FEET

VERTICAL EXAGGERATION: TEN TIMES

AR303683

FIGURE 9

Developed By: AJS	Drawn By: ELR
Approved By: Alan J Schmidt	Date: 1-10-92
Reference:	
Revisions:	

TOTAL ETHENE CONCENTRATION PROFILE B - B'

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAEGERTOWN INDUSTRIAL AREA SITE
SAEGERTOWN, PENNSYLVANIA

Drawing Number 60882 B7

WARZYN

DRAWINGS

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