INVESTIGATION OF THE FORMER COAL GASIFICATION SITE AT MECHANICVILLE, NEW YORK

FINAL TASK 4 REPORT
RISK ASSESSMENT

Prepared for:

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EXECUTIVE SUMMARY

The former Mechanicville coal gasification plant site is located in Mechanicville, New York, along the Anthony Kill (a small tributary of the Hudson River). The site is a quarter-mile upstream of the Hudson River, on the western side of North Central Avenue. A gas manufacturing plant was operated at the site by New York State Electric and Gas Corporation (NYSEG) and its predecessor companies from 1901 until 1955. Most of the structures utilized in the coal gas manufacturing operation were demolished at the time of closure in 1955. Since then, the site has become a NYSEG natural gas and electric service center. The site is being investigated because it was formerly used for coal gas manufacturing. Samples of soil, groundwater, surface water, stream sediments, and air were collected at and adjacent to the site and tested in a laboratory. The chemical compounds found in the samples are those routinely found at former coal gasification sites; those present at elevated concentrations include polynuclear aromatic hydrocarbons, volatile organic compounds, and cyanide.

This report, prepared by the E.C. Jordan Co. (Jordan), presents the results of the Task 4 Risk Assessment for the Mechanicville site. The study identifies and estimates the potential risks associated with the chemicals present in the soil, sediment, groundwater, and air at the site by (1) selecting "contaminants of concern" that represent potential hazards; (2) identifying potential exposure pathways and exposed populations at and near the site; and (3) assessing the public health and environmental risks associated with exposure to site-related chemicals through the use of dose/response data

(e.g., USEPA cancer potency factors and reference doses) and relevant standards and criteria (e.g., interim sediment quality criteria).

Contaminants of concern were selected following a field investigation in which data were collected to determine each contaminant's location, level, and frequency of detection. It should be noted that the sampling program was designed to indicate areas where residuals from the coal gasification processes would be expected. The carcinogenic contaminants of concern which were identified are carcinogenic polycyclic aromatic hydrocarbons (PAHs) and benzene. The noncarcinogenic contaminants of concern which were identified are toluene, ethyl benzene, styrene, trimethylbenzene, xylenes, noncarcinogenic PAHs, and cyanide.

Health risks were estimated using accepted methods (USEPA, 1986a and Atlantic Environmental Services, 1988). Carcinogenic risk estimates were determined by multiplying the estimated body dose from exposure to a carcinogen by its USEPA carcinogenic potency value. This calculation results in an estimate of an individual's incremental or excess cancer risk due to exposure to site-related contamination. It should be recognized that the USEPA cancer potency factor is the upper 95-percent confidence limit of the slope of the dose-response curve for benzo(a)pyrene. This means that, with 95-percent statistical certainty, the true potency is as stated or less. Therefore, it is highly unlikely that the true potency of benzo(a)pyrene is greater than stated, and it could be considerably lower. For these reasons, the calculated cancer risks associated with the various exposure levels are expected to represent upper limits of the true risk.

Noncarcinogenic risk estimates were determined by dividing the body dose for each noncarcinogen by the relevant standard, criterion, or guideline, resulting in a ratio called the risk ratio. Noncarcinogenic risk ratios for the individual compounds were then summed together to form a hazard index. To put these risk estimates into perspective, they were evaluated against target risk levels.

Target risk levels for carcinogenic compounds have been adopted from USEPA guidelines stating that the total incremental carcinogenic risk for an individual resulting from exposure at a hazardous waste site should be between 10^{-4} and 10^{-6}. (A risk of 10^{-4} is interpreted as an additional 1 in 10,000 chance of an individual developing cancer during a lifetime, as a result of the exposure.) For noncarcinogenic compounds, the hazard index is compared to 1. If the hazard index is less than or equal to 1, no adverse health effects are anticipated from the predicted body-dose level. If the index is greater than 1, the predicted body-dose level could potentially result in adverse health effects.

Public exposure to the contaminants detected at the Mechanicville site is currently limited by two conditions: (1) the majority of the site is paved or covered with buildings, providing limited access to the site and thus minimizing exposure potential to either volatilized contaminants or contact with contaminated soil; and (2) the groundwater at the site is not used as a drinking water source.

For the public health risk assessment, Jordan estimated the potential carcinogenic and noncarcinogenic risks from site-related exposures under baseline conditions (i.e., current conditions and future conditions, assuming no construction or remedial action). It was determined that direct contact with on-site soil (surface and subsurface) and Anthony Kill sediments by area residents (specifically, older children between ages 8 and 18), construction workers, or utility workers, would not be expected to pose a significant health risk under the assumed exposure conditions. Both carcinogenic and noncarcinogenic risks were within target risk levels. Future on-site excavation could also expose nearby residents to inhalation of airborne volatile and particulate-bound contaminants. Jordan concluded that inhalation of contaminants, volatilized or aerosolized by potential future site activities involving soil excavation, also does not pose a significant health risk to the general population.

The Mechanicville site is not located over a water supply aquifer. The nearest water supply wells are about one mile southwest (upgradient) of the site in the town of Halfmoon. Because Mechanicville site groundwater is neither currently used nor expected to be used in the foreseeable future as a source of drinking water, public health risks associated with the groundwater are negligible.

Groundwater beneath the site, however, does contain several contaminants at concentrations which exceed both USEPA and NY State drinking water standards.

As has been done in the past, the site health and safety plan should be followed during any future exploratory work on the Mechanicville site to prevent or minimize undue exposure.

It is unlikely that the site is significantly utilized by wildlife because of the industrial nature of the area and the lack of suitable habitats. Aquatic organisms in the Anthony Kill, immediately adjacent to the site, were determined to be the environmental receptors most likely to be affected by site-related contamination.

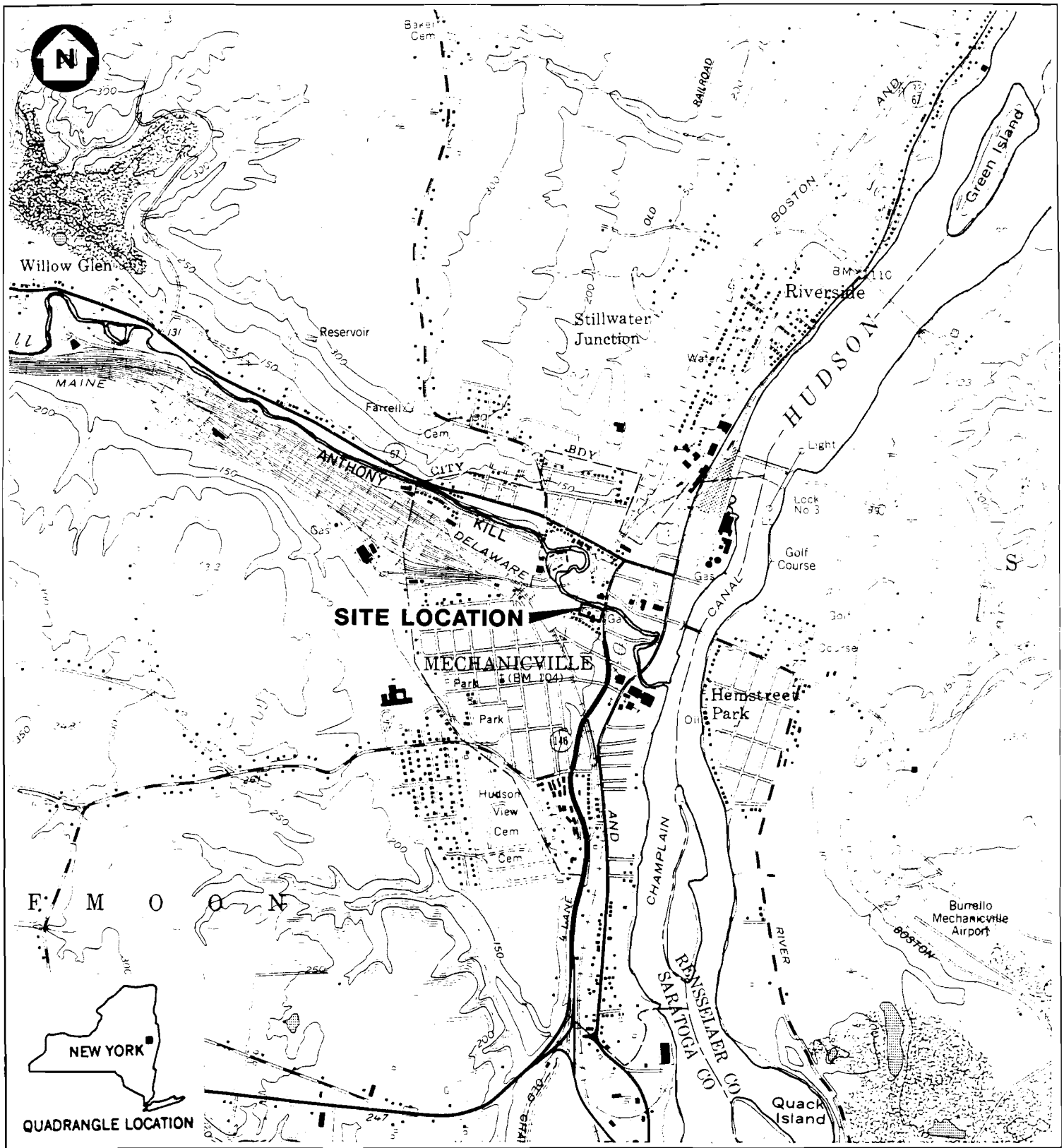
The results of the environmental risk assessment indicate that some potential for impacts does exist for aquatic organisms living in the Anthony Kill immediately adjacent to the site. However, these risks appear to be relatively minor, for several reasons. Few compounds were present at levels in excess of their environmental criteria, the extent of exceedances was minimal, and potential impacts were associated only with "worst case" conditions, with no impacts expected under typical conditions. Also, the amount of benthic habitat is limited due to the stream bed morphology and exposed bedrock, with little sediment accumulation. Finally, there is no evidence that contaminants are being transported downstream at significant levels. Levels of contaminants in the downstream surface water and sediment samples did not exceed protective criteria, even under the most conservative assumptions.

1.0 INTRODUCTION

This report presents the results of the Risk Assessment (Task 4) for the Mechanicville former manufactured gas plant (MGP) site in Saratoga County, New York. The report was prepared by E.C. Jordan Co. (Jordan) for the New York State Electric and Gas Corporation (NYSEG) under Contract No. 85S-159, Investigation of Former Coal Gasification Sites. This report was preceded by four reports summarizing a Preliminary Site Evaluation (Task 1), Quality Control/Quality Assurance and Health and Safety Plans, an Initial Field Investigation Program (Task 2), and an Expanded Problem Definition Program (Task 3). These reports were completed in August 1986, November 1986, December 1987, and September 1989, respectively.

The site is located in Mechanicville, Saratoga County, New York (Figure 1-1). Saratoga County is in the Valley and Ridge physiographic province of east central New York (Heath, et al., 1963). The Hudson River forms the north-eastern and eastern boundaries of Saratoga County; the Mohawk River, which is the largest tributary to the Hudson, forms the southeastern boundary. The Anthony Kill, a small tributary, flows into the Hudson River at Mechanicville. The Mechanicville site is adjacent to the Anthony Kill, one quarter-mile upstream from its confluence with the Hudson River. The site lies in a glacial outwash plain, at approximately 95 feet above mean sea level (MSL).

The Champlain Canal once bordered the site on the east. Completed in 1823, the canal connected the Hudson River at Waterford (south of Mechanicville) to Lake Champlain. The canal flowed through Mechanicville along what is now

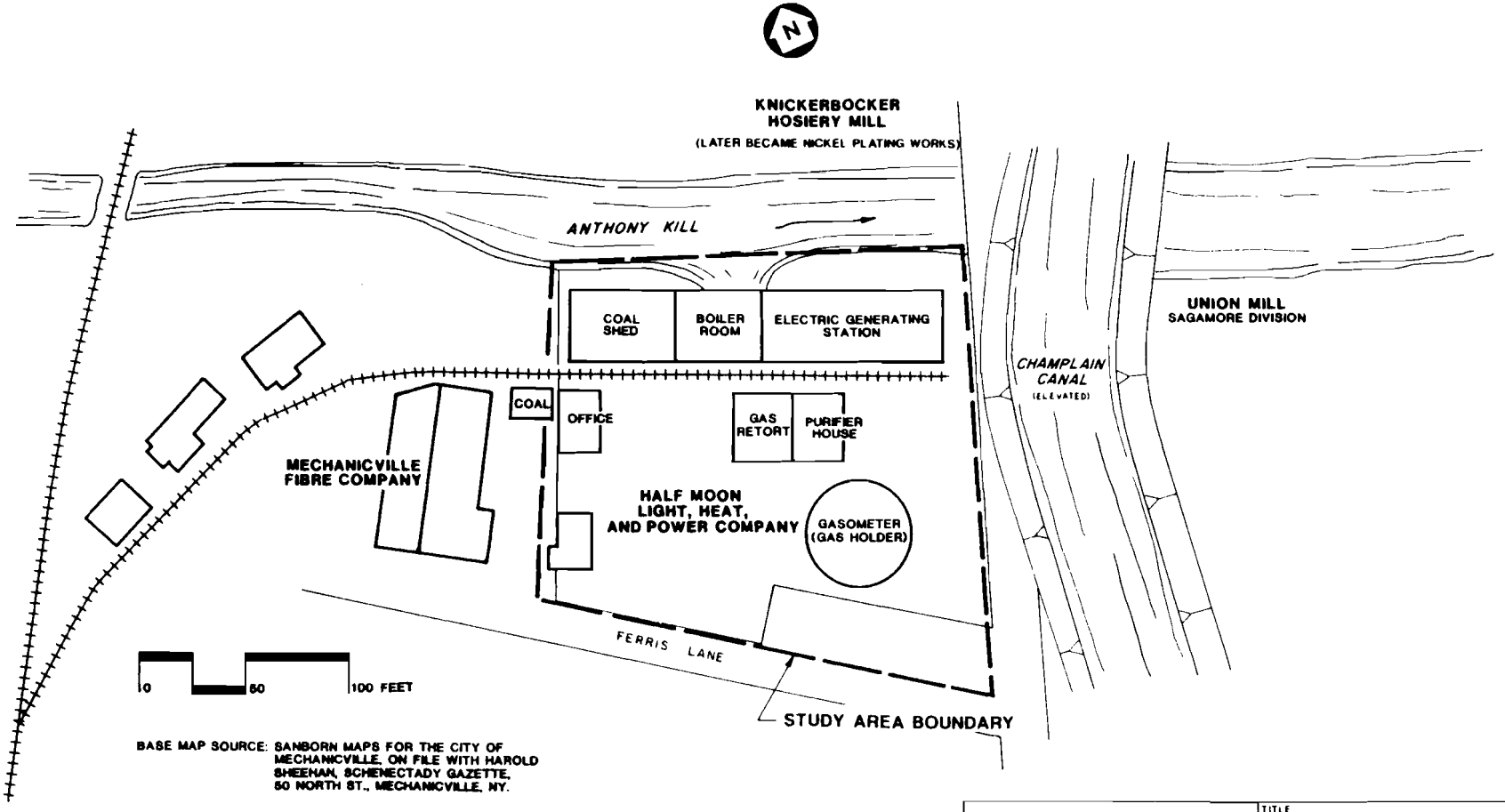


BASE MAP SOURCE: **USGS QUADRANGLE** **MECHANICVILLE (1980)**	**E.C. JORDAN CO.** CONSULTING ENGINEERS	TITLE **MECHANICVILLE SITE LOCATION MAP**
SCALE IN FEET 0 — 2000 — 4000	CLIENT **NEW YORK STATE ELECTRIC AND GAS CORP.** **BINGHAMTON, NEW YORK**	**INVESTIGATION OF FORMER COAL GASIFICATION SITES** PROJECT NO. 4945-04 **FIGURE 1-1**

Central Avenue (Figure 1-2). Like the present roadway, the canal was elevated and the water surface was approximately 10 feet above the gas plant site. The hand-dug canal was approximately 12 feet deep and 30 feet wide. The Champlain Canal, abandoned in 1916 when the Barge Canal opened, became a receptacle for garbage, debris, and junk before it was completely filled with soil by the City of Mechanicville in 1917. Later, the state dug up the canal, removed the trash and debris, and prepared the roadbed for Central Avenue (Sheehan, Records).

The site housed a coal gasification plant (Figures 1-2 and 1-3) owned by NYSEG and its predecessor companies from 1901 until 1955, at which time coal gas production ended due to the availability of natural gas. Most of the above ground structures were demolished at the time of closure and removed, including the coal storage shed, gas house, purifier and oxide houses, gas holders, oil tanks, and tar dehydrator (see Figures 1-2 and 1-3). Only the boiler room, indoor substation, and an old office building remain on-site. The filter beds and relief gas holder were left in the ground and covered with soil (E.C. Jordan Co, 1987; 1989).

After closure of the Mechanicville gas plant in 1955, NYSEG converted the site to a natural gas and electric service center (Figure 1-4). A small natural gas distribution shed was constructed over a portion of the old distribution gas holder. The former boiler room/substation building was converted to offices, a garage, and a storeroom. The old office is now used as a storage building and tool house.



E.C. JORDAN CO.
CONSULTING ENGINEERS

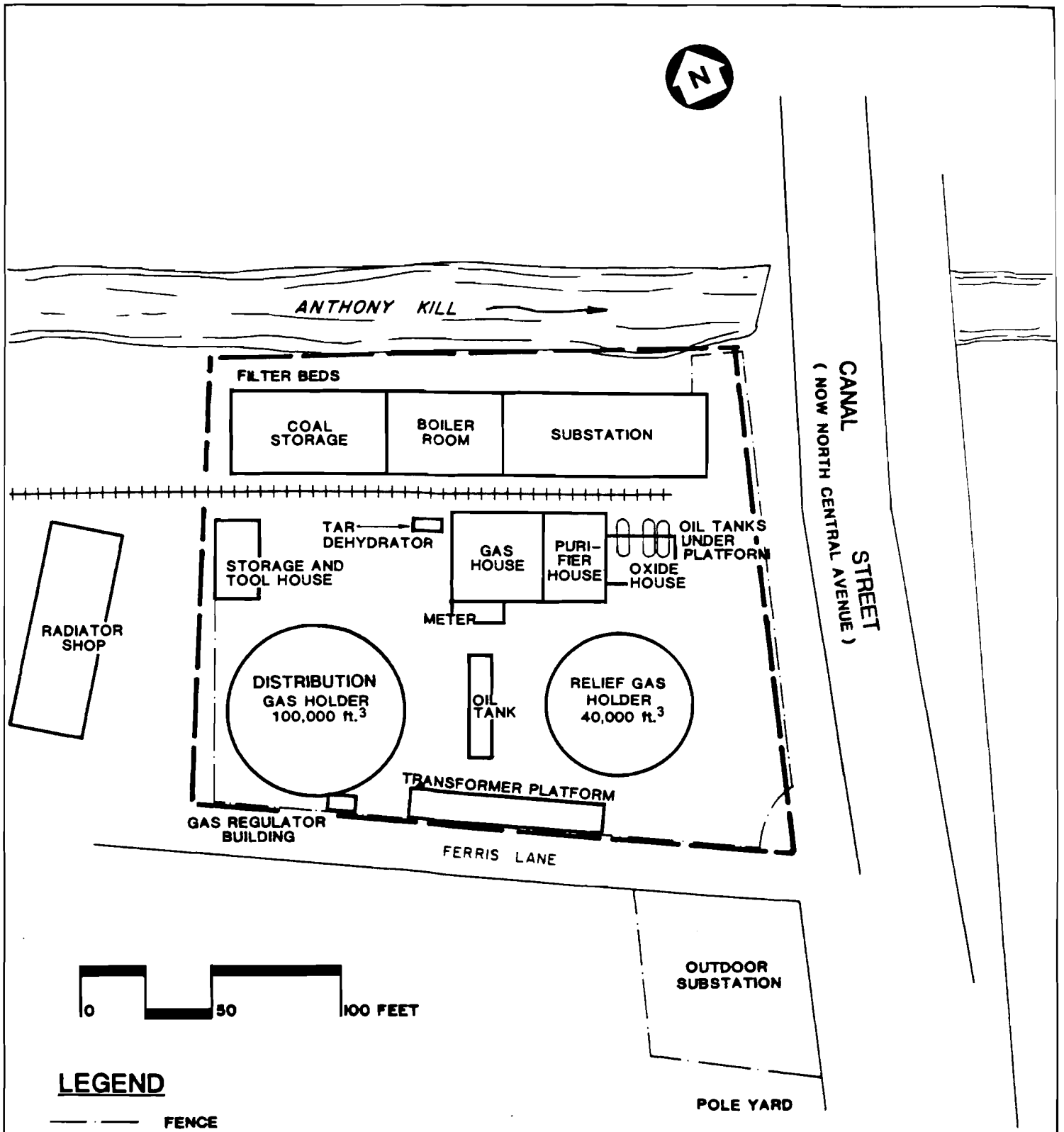
CLIENT
NEW YORK STATE
ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

TITLE
PLAN OF MECHANICVILLE
COAL GASIFICATION PLANT
CIRCA 1910

INVESTIGATION OF FORMER
COAL GASIFICATION SITES

PROJECT NO. 4945-04

FIGURE 1-2



LEGEND

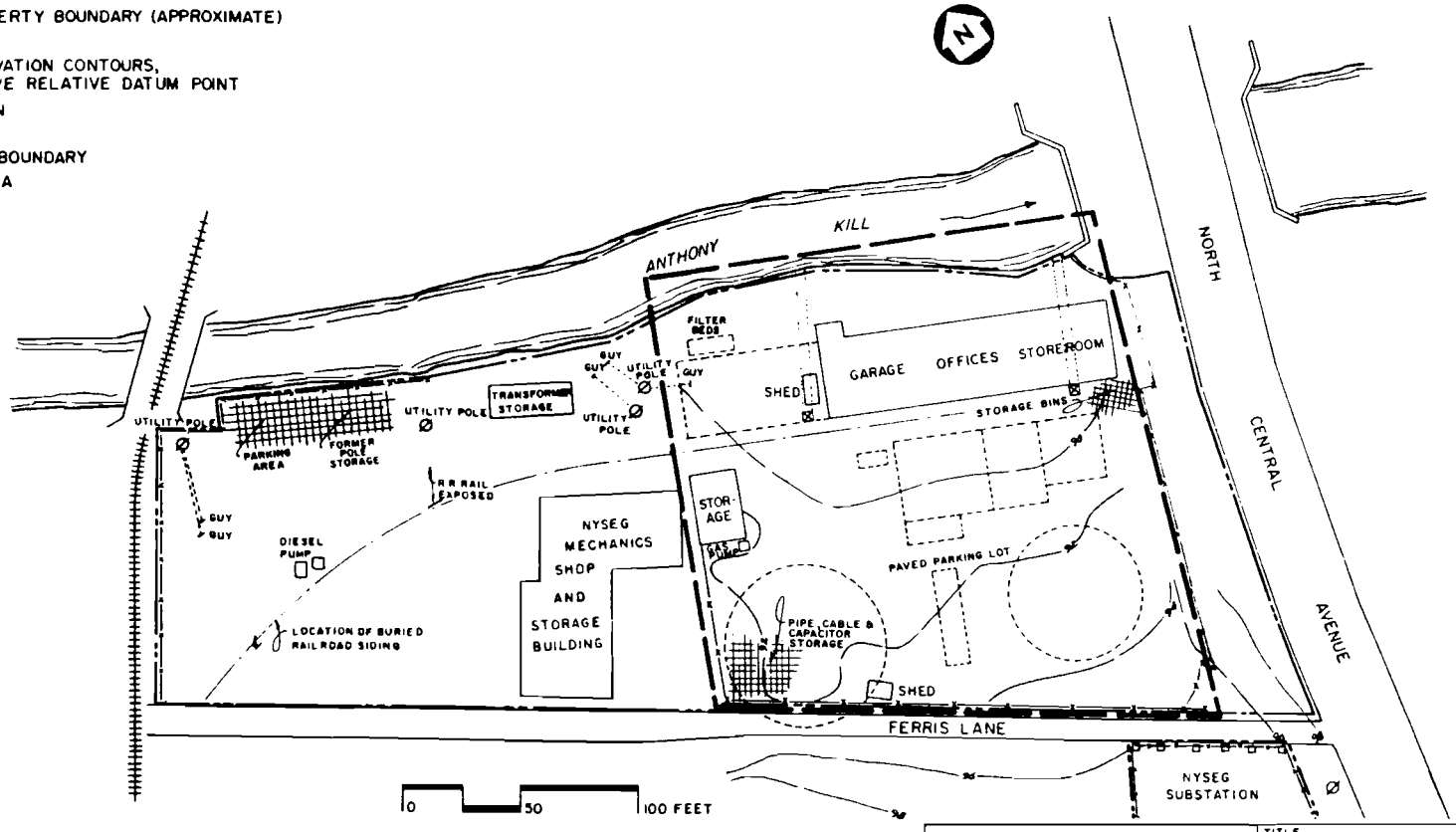
- FENCE
- RAILROAD SIDING
- STUDY AREA BOUNDARY

BASE MAP PREPARED BY BROWN, CROSBY, & CO., INC., ENGINEERING DEPARTMENT, 96 WALL ST., NEW YORK, APRIL 1951.

E.C. JORDAN CO. CONSULTING ENGINEERS	PLAN OF MECHANICVILLE COAL GASIFICATION PLANT CIRCA 1951
NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
	JOB NO. 4945-04 FIGURE 1-3

LEGEND

- APPROXIMATE LOCATION OF FORMER GAS PLANT STRUCTURES
- NYSEG PROPERTY BOUNDARY (APPROXIMATE)
- FENCE
- GROUND ELEVATION CONTOURS, IN FEET ABOVE RELATIVE DATUM POINT
- STORM DRAIN
- CULVERT
- STUDY AREA BOUNDARY
- STORAGE AREA



BASE MAP SOURCE:

TOPOGRAPHIC SURVEY PREPARED BY DAVID A FLANDERS ASSOCIATES, 6 MORNINGSIDE DRIVE, BALLSTON LAKE, NEW YORK, DATED 6/26/86 (86-72-S). REVISED 12/87

ELEVATIONS BASED ON ASSUMED DATUM OF 100.00' AT RR SPIKE IN UTILITY POLE LOCATED 25' SOUTH OF FERRIS LANE AND NORTH CENTRAL AVENUE

E.C. JORDAN CO.
CONSULTING ENGINEERS

CLIENT
NEW YORK STATE ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

TITLE
MECHANICVILLE SITE PLAN - 1987
MECHANICVILLE, NEW YORK

INVESTIGATION OF FORMER COAL GASIFICATION SITES

PROJECT NO 4945-04

FIGURE 1-4

An underground gasoline storage tank, containing unleaded gasoline, is currently located adjacent to the southeastern corner of the old office. The 2,000-gallon tank, installed around 1980, replaced an older tank that was reportedly taking in water, without any gasoline leaks reported (McBride, et al., 1986). The remaining developed portion of the site is a paved parking lot. NYSEG has extended its property boundaries over the years by reclaiming the Anthony Kill embankment. Therefore, the stream appears wider in Figure 1-3 than in Figure 1-4.

In 1922, NYSEG purchased a quarter-acre lot on the corner of Ferris Lane and North Central Street (Bevis, 1986). This property was vacant during the years the coal gas plant was operating. According to the plan shown in Figure 1-3, NYSEG built the electrical substation that currently stands on the lot in 1951. NYSEG also owns the land on the western side of the site. The portion between the railroad tracks and the Anthony Kill (see Figure 1-4) was purchased by NYSEG in 1952 (Bevis, 1986), and the parcel between the tracks and Ferris Lane was acquired in October 1987. Jordan's investigations focused on the eastern portion of the site (approximately 1 acre), where coal gas production activities occurred.

1.1 PROBLEM SUMMARY

The Mechanicville site is being investigated because of its former use as a coal gasification facility. By-products of the coal gasification process included coal ash, condensate material from the gas house, woodchips from the purifier house, coal tar and oil sludges. Ashes and clinkers were spread on

the site, as were some of the spent woodchips. Residual tar was left both in the filter beds and in the base of the relief holder.

The Initial Field Investigation (Task 2) and Expanded Problem Definition Programs (Task 3) detected the presence of chemicals related to former coal gasification activities. They included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAHs), and metals. These were found in both the soil and shallow and deep groundwater samples collected near the former plant structures, specifically the purifier and oxide houses, the relief gas holder, and the filter beds. Low concentrations of VOCs were found in background air and indoor air samples.

The subsurface coal gasification wastes are a source of chemicals to soil and groundwater, thus making groundwater a vehicle of transport. Compounds are migrating northeasterly in the groundwater at the site, discharging to the Anthony Kill, and migrating easterly toward the Hudson River. However, site-derived compounds were not found at elevated levels in surface water samples collected downstream of the site, which suggests that compounds are not entering the stream in sufficient quantities to be detected.

The scope of the Risk Assessment (Task 4) was developed based on information obtained during the Preliminary Site Evaluation (Task 1), Initial Field Investigation Program (Task 2), and Expanded Problem Definition Program (Task 3). The Task 4 program was designed to (1) identify and assess the potential risk associated with exposure to the chemicals present on-site; and (2)

evaluate the need for and develop, if necessary, the scope, budget, and schedule for a Conceptual Design (Task 5). This report summarizes Task 4 findings and provides recommendations for future activities.

1.2 SCOPE OF TASK 4

The scope of work required to complete the objectives of the Task 4 Risk Assessment is described in the Task 3 Report submitted to NYSEG in September 1989 (E.C. Jordan Co., 1989). The subtasks completed as part of the Task 4 assessment include the following:

- review and summary of Tasks 2 and 3 field investigation findings on the distribution of chemicals present on-site;
- selection of contaminants of concern identified on-site that represent potential hazards at the site;
- identification of possible pathways of exposure and potentially exposed populations at and near the site;
- identification of the potential hazards associated with exposure to the contaminants of concern including acute and chronic toxic effects of the compounds;

- identification of the dose/response data used to quantitatively assess risk (e.g., USEPA cancer potency factors and reference doses);

- comparison of the environmental concentrations of chemicals on-site to existing state and federal health-based criteria and standards;

- characterization of human health and environmental risks associated with exposure to site-related chemicals;

- establishment, if necessary, of target clean-up levels to protect against future potential exposure to contaminants of concern;

- evaluation of the need for Conceptual Remedial Design (Task 5); and

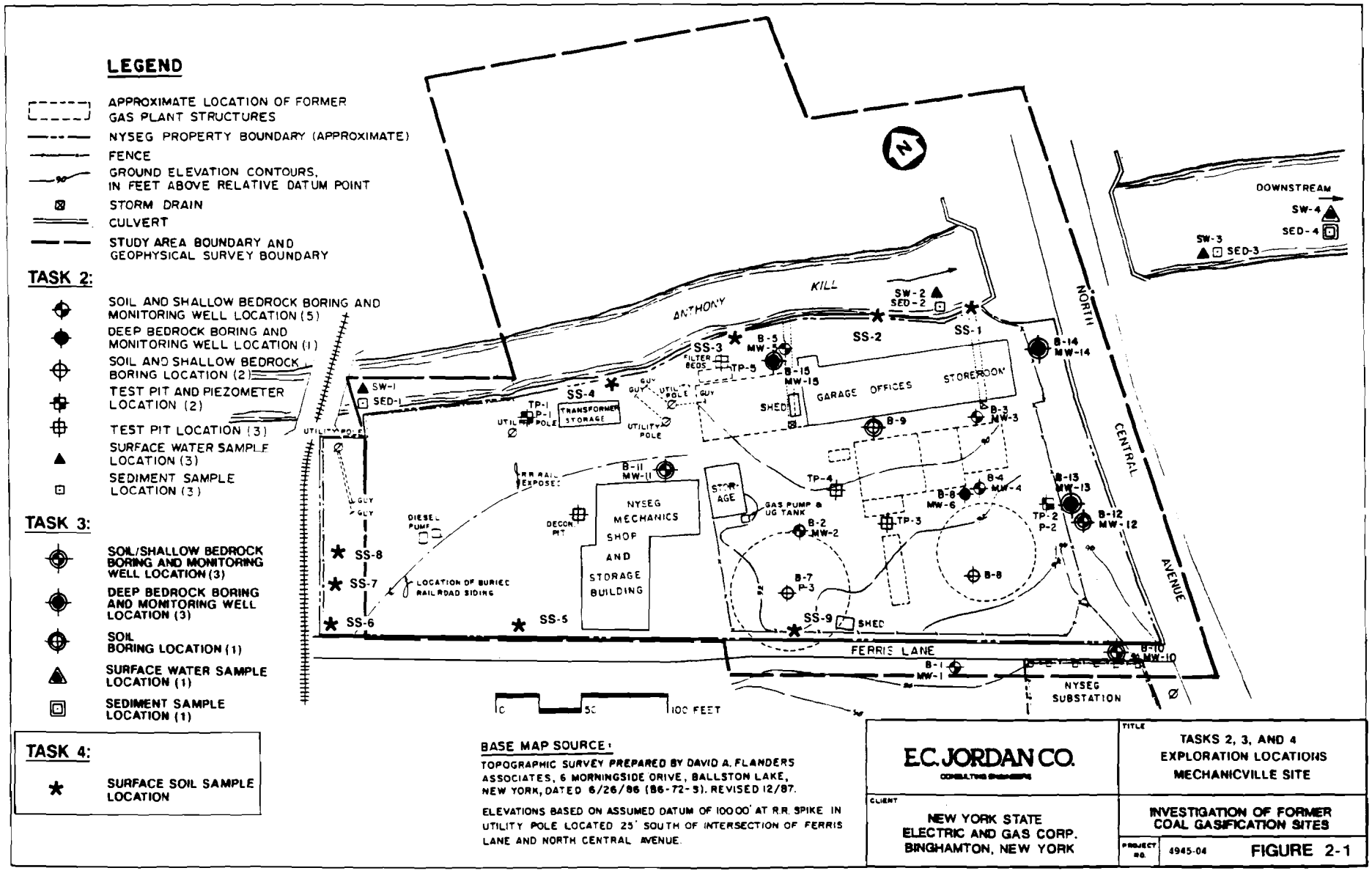
- generation of a report that summarizes the Task 4 findings.

2.0 SITE CHARACTERIZATION AND SELECTION OF CONTAMINANTS OF CONCERN

2.1 INTRODUCTION

This section presents a summary of the geologic/hydrogeologic conditions at the Mechanicville site and the distribution of chemicals at the site, as interpreted from data gathered during Tasks 2, 3, and 4. Figure 2-1 shows the locations of all Task 2, Task 3, and Task 4 explorations and Appendix A contains the analytical data collected as part of these field exploration programs. More detailed information on site conditions is contained in the Task 2 and Task 3 Reports (E.C. Jordan Co., 1987; 1989).

The site characterization summary is followed by a discussion of the screening method used to select contaminants of concern for the site. These are compounds that are judged to be important in evaluating the risks to public health posed by the site. This screening process provides the basis to limit the number of compounds evaluated, if appropriate. In accordance with the guidelines presented in the Superfund Public Health Evaluation Manual (USEPA, 1986a), compounds were selected based on inherent toxicity, concentration, distribution, and frequency of detection. This discussion considers soil (both surface and subsurface), surface water, sediment, air, and groundwater samples.



BASE MAP SOURCE:

TOPOGRAPHIC SURVEY PREPARED BY DAVID A. FLANDERS ASSOCIATES, 6 MORNINGSIDE DRIVE, BALLSTON LAKE, NEW YORK, DATED 6/26/86 (86-72-S). REVISED 12/87.

ELEVATIONS BASED ON ASSUMED DATUM OF 100.00' AT R.R. SPIKE IN UTILITY POLE LOCATED 25' SOUTH OF INTERSECTION OF FERRIS LANE AND NORTH CENTRAL AVENUE.

E.C. JORDAN CO.
CONSULTING ENGINEERS

CLIENT
NEW YORK STATE ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

TITLE
TASKS 2, 3, AND 4 EXPLORATION LOCATIONS MECHANICVILLE SITE

INVESTIGATION OF FORMER COAL GASIFICATION SITES

PROJECT NO. 4945-04

FIGURE 2-1

2.2 SUMMARY OF SITE GEOLOGY/HYDROGEOLOGY

2.2.1 Geology and Soils

The subsurface conditions at the Mechanicville site were investigated by means of test pit and soil boring explorations. The top eight feet consists of fill material. Beneath the fill, the shallow geology (8 to 25 feet) includes silty sand, gravel, and clayey silt, which overlies fractured shale bedrock. Isolated gravelly sand and silty clay till units were also observed at the site. The geologic profile of the site is described in Appendix A-1.

2.2.2 Hydrogeology

The interpretation of hydrogeologic conditions at the site is based on field and laboratory permeability data and water level observations made during Tasks 2 and 3.

Groundwater is 2 to 20 feet below ground surface and migrates through the fill material, shallow soils, and fractured bedrock. Based on permeability data and seepage gradients, the primary zone of groundwater movement exists within the fractured zones of the shallow bedrock. Groundwater flow in the fill and shallow bedrock is northeasterly toward the Anthony Kill across the western and northern portions of the site. On the eastern portion of the site, groundwater is flowing easterly along a east-west trending bedrock channel. The regional groundwater flow west of the Hudson River, where the site is located, is also easterly (E.C. Jordan Co., 1989).

Groundwater velocity was estimated in the Task 3 report, based on hydraulic conductivity, effective porosity, and groundwater gradient. Horizontal groundwater flow rates were estimated at approximately 20, 200, and 140 ft/yr in the silty shale, shallow bedrock, and deeper bedrock, respectively.

2.3 SUMMARY OF CONTAMINANT DISTRIBUTION IN SOILS

Both surface and subsurface soil samples were collected and analyzed for the Mechanicville site.

2.3.1 Subsurface Soil

Subsurface soil samples collected at the Mechanicville site for Tasks 2 and 3 were analyzed for VOCs, SVOCs, selected trace metals (i.e., iron and zinc), cyanide, total recoverable phenolics (phenols) and total organic carbon (TOC). A total of 16 locations were sampled. Five test pit samples were collected from depths of 3 to 7.5 feet below ground surface. Thirteen soil boring samples (plus one duplicate) were collected from 4 to 24 foot depths. The analytical results of the soil sampling program are presented in Appendix A-2.

Analyses of subsurface soil samples from the field investigation program showed the presence of coal tar and coal gasification-related compounds (i.e., VOCs, PAHs, and cyanide) near the former relief gas holder, purifier and oxide houses, and filter beds. The highest levels of VOCs and PAHs were detected in samples taken at or near these sites. Figure 2-2 shows the concentrations of total VOCs, total PAHs, and total cyanide in soil borings at the site, based

on both Task 2 and Task 3 sampling results. The highest levels of VOCs (3,800 and 3,410 mg/kg) were observed in samples taken at B-8 (at depths of 13.5 to 15.5 feet and 15.5 to 17.5 feet) which is located at the site of the former gas relief holder. The highest levels of PAHs were observed in samples taken from B-8 (5,440 mg/kg), TP-5 (8500 mg/kg; adjacent to the filter beds) and B-3 (9,310 mg/kg in the vicinity of the former purifier and oxide houses). Deep soil samples (greater than 15 feet deep) contained lower levels of organics than the samples collected from shallow soils.

Iron levels ranged from 18,000-35,000 mg/kg. The lower concentrations were in the deeper fine silty sand. Higher levels were seen in shallow fill samples. Zinc levels generally ranged from 32-390 mg/kg, except for one Task 2 sample (B-5/S-1) which contained 1,600 mg/kg.

Cyanide was detected in three subsurface soil samples at levels ranging from 1.0-3.2 mg/kg. These samples were collected in the vicinity of the former purifier and oxide houses. The concentration of cyanide in this area is most likely due to spillage during cleaning of the purifier house (Wilson and Stevens, 1981).

Phenolic compounds were found in four soil boring samples at depths of 4 to 11 feet. Concentrations ranged from 0.74 to 3.6 mg/kg. These samples were

LEGEND

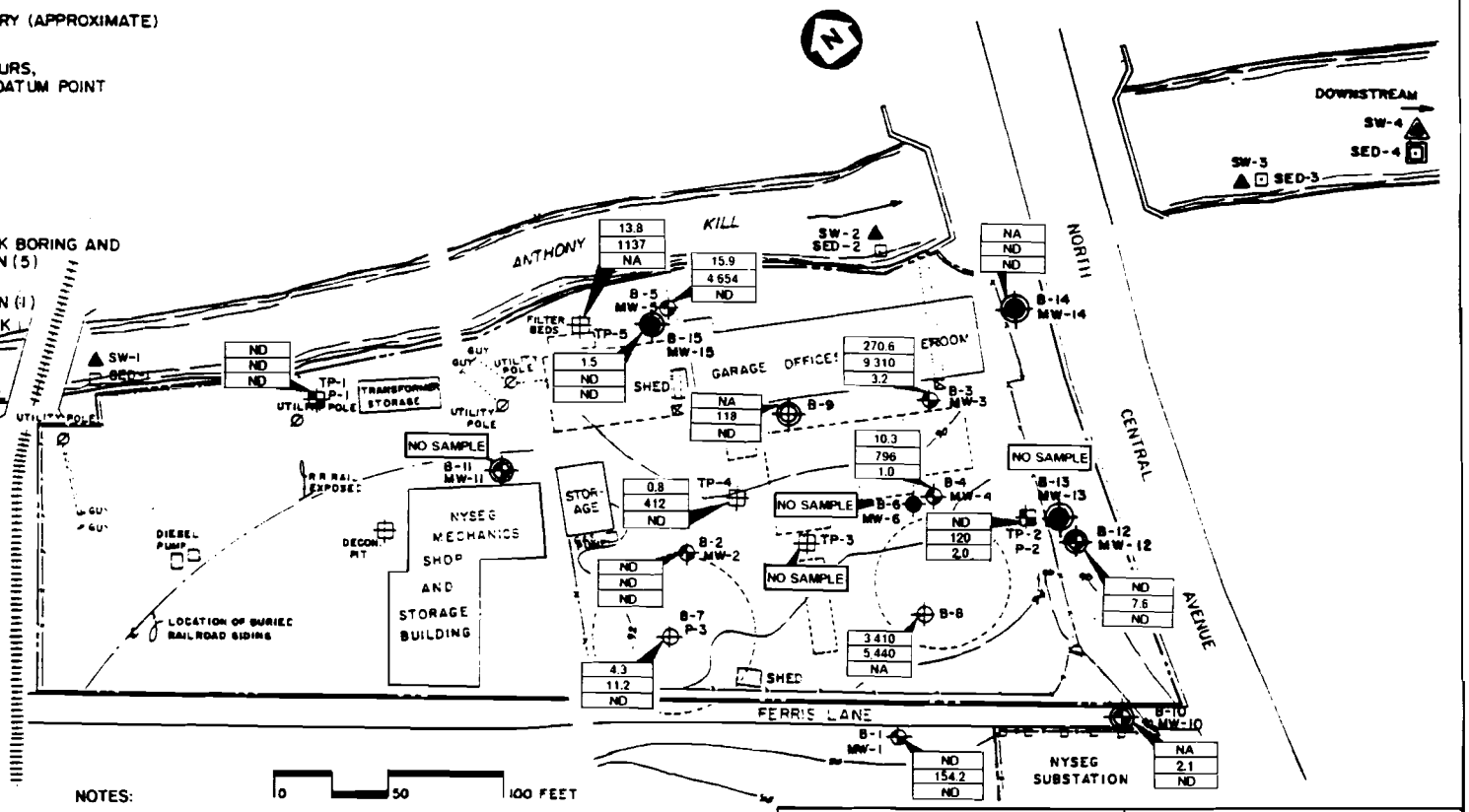
- APPROXIMATE LOCATION OF FORMER GAS PLANT STRUCTURES
- NYSEG PROPERTY BOUNDARY (APPROXIMATE)
- FENCE
- GROUND ELEVATION CONTOURS, IN FEET ABOVE RELATIVE DATUM POINT
- STORM DRAIN

TASK 2:

- SOIL AND SHALLOW BEDROCK BORING AND MONITORING WELL LOCATION (5)
- DEEP BEDROCK BORING AND MONITORING WELL LOCATION (1)
- SOIL AND SHALLOW BEDROCK BORING LOCATION (2)
- TEST PIT AND PIEZOMETER LOCATION (2)
- TEST PIT LOCATION (3)
- SURFACE WATER SAMPLE LOCATION (3)
- SEDIMENT SAMPLE LOCATION (3)

TASK 3:

- SOIL/SHALLOW BEDROCK BORING AND MONITORING WELL LOCATION (3)
- DEEP BEDROCK BORING AND MONITORING WELL LOCATION (3)
- SOIL BORING LOCATION (1)
- SURFACE WATER SAMPLE LOCATION (1)
- SEDIMENT SAMPLE LOCATION (1)



NOTES:

1. HPLC ORGANIC ANALYSIS RESULTS ARE SHOWN EXCEPT WHERE GC/MS RESULTS ARE AVAILABLE (TP-5; B-8, B-9, B-10, B-12, B-14, AND B-15).
2. WHERE DUPLICATE SAMPLES WERE ANALYZED BY THE SAME TECHNIQUE, THE HIGHER VALUE IS SHOWN.
3. SAMPLES WERE COLLECTED AT DEPTHS BETWEEN 3 AND 24 FEET BELOW GROUND SURFACE.
4. ALL SAMPLES EXCEPT TP-5 AND B-9 WERE COLLECTED BELOW THE WATER TABLE.

TOTAL VOCs TOTAL PAHs TOTAL CN	CONCENTRATIONS DETECTED IN SOIL BORINGS IN mg/kg DURING TASK 2 AND TASK 3 SAMPLING EVENTS.
NA	NOT ANALYZED
ND	NOT DETECTED

BASE MAP SOURCE:

TOPOGRAPHIC SURVEY PREPARED BY DAVID A. FLANDERS ASSOCIATES, 6 MORNINGSIDE DRIVE, BALSTON LAKE, NEW YORK, DATED 6/26/86 (86-72-S). REVISED 12/87.
ELEVATIONS BASED ON ASSUMED DATUM OF 100.00' AT R.R. SPIKE IN UTILITY POLE LOCATED 25' SOUTH OF INTERSECTION OF FERRIS LANE AND NORTH CENTRAL AVENUE.

E.C. JORDAN CO.
CONSULTING ENGINEERS

TITLE: DISTRIBUTION OF CHEMICALS IN SOILS MECHANICVILLE SITE

CLIENT: NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK

INVESTIGATION OF FORMER COAL GASIFICATION SITES

PROJECT NO. 4945-04

FIGURE 2-2

collected in the vicinity of the former filter beds and the former gas and purifier houses. Phenolics are widely distributed in the environment due to both natural (i.e., vegetative decomposition) and manmade processes. Tars and wastewaters at coal gas plants are a source of phenolics; however, the tars produced by water gas plants such as the one at Mechanicville, usually contain only negligible amounts of phenolics. The detectable levels of phenolics in soils at the gas house and filter beds may be due to other site activities.

2.3.2 Surface Soil

As part of the Task 4 work plan, nine surface soil samples plus one duplicate sample were collected at the site in August 1989. These samples were taken to characterize the extent of contamination in surface soils at the site. The nine samples and one duplicate (SS-1 through SS-9, plus SS-3A), along with one trip blank, were sent to a laboratory for analysis. Samples SS-1, SS-2, SS-3, SS-3A, SS-4, and SS-5 were analyzed for cyanide, SVOCs, VOCs, and PCBs. The remaining samples, SS-6 through SS-9, were analyzed for PCBs only. The analytical results are included in Appendix A-7.

The analytical results of the Task 4 surface soil sampling program were reviewed for quality control/quality assurance. Two issues were identified upon data review. The first relates to sample holding time. Although the soil samples were held for 50 days instead of the recommended 40 days, they were stored properly (in dark containers at 4° C) so that the analytical results are expected to be reliable. The second issue relates to the relatively high detection limits for the volatile organic compound (VOC)

analyses. This is not thought to be a serious data issue at the Mechanicville site because VOCs would not be expected to be present at significant concentrations in surface soils. Volatilization over the many years since coal gasification activity terminated would most likely result in insignificant levels in surface soils.

No PCBs were detected in any of the surface soil samples that were collected. This includes sample SS-5, which was taken next to the PCB waste-oil drums (see Figure 2-1). Additionally, no VOCs were detected in samples SS-1 through SS-5. A trace of bromomethane was detected in sample SS-3, but at a concentration below the detection limit for that sample. In addition, this compound was not detected in the duplicate sample, SS-3A.

Cyanide was detected in two surface soil samples, SS-1 and SS-3A (no cyanide was detected in replicate sample SS-3) at 1.8 and 1.9 mg/kg, respectively. Both of these samples were collected from the area behind the garage offices and storeroom building, along the upper bank of the Anthony Kill. Several PAHs were detected in Samples SS-1 through SS-4, including the duplicate sample. Concentrations of total PAHs ranged from 9.1 mg/kg to 71 mg/kg. No PAHs were detected in sample SS-5. Bis(2-ethylhexyl)phthalate (BEHP) was found in two samples plus the duplicate sample. Although this compound is a common laboratory contaminant, no BEHP was detected in the laboratory blank, therefore this compound is considered to be present in the surface soil. One other SVOC, di-n-butyl phthalate, was detected in several samples. However, this is also a common laboratory contaminant and was found in the laboratory

blank at similar concentrations. Therefore this compound was not considered to be present in surface soils at the site.

2.4 SUMMARY OF CONTAMINANT DISTRIBUTION IN GROUNDWATER

Groundwater samples were collected from 12 wells at the site during Tasks 2 and 3. Four rounds of samples were collected during Task 2 and two rounds during Task 3. All samples were analyzed for VOCs, SVOCs, dissolved iron and zinc, cyanide, phenolics, and TOC. Conductivity, pH, and temperature were measured in the field. The analytical results are presented in Tables A-3-1 and A-3-2 in Appendix A-3.

Cyanide was detected in all wells except MW-11. The highest levels of total cyanide (0.58 - 0.8 mg/L) were observed at MW-12 during Task 3. During Task 2, a maximum level of 0.42 mg/L was reported at MW-3. Well MW-12 is located downgradient from the former relief gas holder while MW-3 is downgradient from the former purifier/oxide structures.

Volatile aromatic compounds, a subset of VOCs, were detected consistently in all wells except MW-1, MW-2, and MW-11. MW-1, MW-10, and MW-11 are located upgradient of the historical coal gasification plant. MW-2 is downgradient from the former distribution gas holder, but soils data from B-2 and B-7 suggest little or no contamination in this area. Concentrations in the deep bedrock wells (MW-6, MW-13, MW-14, and MW-15) were generally greater than those detected in the shallow wells. Other VOCs, including 1,1,1-trichloroethane, 1,1-dichloroethane, and trichloroethylene were detected in

several samples but they are not believed to be site-derived (E.C. Jordan Co., 1989; GRI, 1987).

PAHs were observed in at least one sample from all wells except MW-1, MW-2, and MW-11. The average concentrations of all the samples collected at each well ranged from nondetectable (at MW-1, MW-2, and MW-11) to 750 mg/L at MW-12. The maximum levels of 1,500 and 1,564 mg/L were observed at wells MW-12 and MW-5, respectively. The distribution of PAHs in the groundwater is similar to the distribution in the soil, indicating that contaminated soil is the source of PAHs in the groundwater.

It should be noted that the groundwater sampling data indicate that the detected PAHs are particulate in nature, rather than dissolved species. Some concentrations measured greatly exceed the solubility of PAHs in water. The solubility of PAHs ranges from 0.50 μg/l for dibenzo(a,h)anthracene to 620 μg/l for indeno(1,2,3-cd)pyrene. Thus, the groundwater concentrations must not be indicative of dissolved PAH concentrations. This conclusion is consistent with the sampling protocol, because groundwater samples for organics are not filtered prior to analysis for organic contamination.

Dissolved iron was present in at least one sample from every well. Wells MW-1, MW-2, MW-10, and MW-11, considered to provide the most representative background concentrations, contained concentrations ranging from 0.04 to 1.4 mg/L. The wells with the highest concentrations of dissolved iron were MW-3, MW-4, MW-5, MW-6, and MW-12. These were the same wells that had the highest concentrations of PAHs.

Dissolved zinc was detected at least once in every well. Samples from MW-4 and MW-5 contained unusually high levels (0.52 to 1.09 mg/L). This may be related to the past site usage of zinc acetate. Samples at other wells were fairly uniform (0.01 to 0.11 mg/L). This uniformity suggests that zinc is a natural constituent of site groundwater which has not been elevated by site activities (E.C. Jordan Co., 1989).

Total recoverable phenolics were detected in all wells. The maximum concentration in shallow wells was 17 mg/L while the maximum concentration in deep wells was 0.3 mg/L.

2.5 SUMMARY OF CONTAMINANT DISTRIBUTION IN SURFACE WATER

Surface water samples were collected from four locations: SW-01 (upstream), SW-02 (adjacent), and SW-03 and SW-04 (downstream). There were four sampling episodes during Task 2 and two during Task 3. Samples were analyzed for VOCs, SVOCs, iron, zinc, phenolics, cyanide, and TOC. The analytical results of the surface water sampling program are presented in Appendix A-4.

No volatile aromatics were detected in any surface water samples. PAHs were detected once at the location adjacent to the site at a concentration of 0.105 mg/L. Other organics detected during Task 2 included methylene chloride (upstream), acetone (adjacent), and bis(2-ethylhexyl)phthalate (all locations). These compounds were found at concentrations less than 0.1 mg/L. They were also found in some sampler and trip blanks. During Task 3, bis(2-

ethylhexyl)phthalate was found upstream on both sampling occasions at concentrations less than 0.5 mg/L; it was not found adjacent or downstream of the site. These three contaminants (methylene chloride, acetone, and bis(2-ethylhexyl)phthalate), when present at low concentrations, are common laboratory contaminants. It is unlikely that they are derived from the site (GRI, 1987).

Iron was found at all four locations at levels ranging from 0.2 to 1.8 mg/L. The highest concentration was found adjacent to the site. Zinc was detected in at least one sample from three locations; only the downstream sample taken during Task 3 had no detectable zinc. Concentrations ranged from 0.01 to 0.03 mg/L. Phenolics were detected in at least one sample from all locations except the upstream and adjacent locations sampled during Task 3. Cyanide was not detected in any of the Task 3 samples. It was detected in at least one sample in each Task 2 location.

2.6 SUMMARY OF CONTAMINANT DISTRIBUTION IN SEDIMENT

Sediment samples were collected from the same locations as surface water samples. There were four sediment sampling episodes during Task 2 and two during Task 3. The samples were analyzed for VOCs, SVOCs, iron, zinc, phenolics, TOC, and cyanide. The analytical results of the sediment sampling program are presented in Appendix A-5.

Three VOCs were detected in the sediments. During Task 2, Round 3 sampling, benzene and toluene were found at a concentration of 0.07 mg/kg, adjacent to

and downstream from the site. During Task 3, ethylbenzene was detected at a level of 0.087 mg/kg adjacent to the site, along with a trace concentration of benzene. These contaminants are associated with coal tar wastes as well as petroleum products and industrial chemicals.

Analysis of Task 2 and Task 3 sediment samples indicated that PAH concentrations adjacent to the site are elevated compared to upstream and downstream sampling locations. Sampling location SD-02 contained trace levels up to 75.8 mg/kg of total PAHs during Task 2 sampling, and trace levels to 5.1 mg/kg during Task 3 sampling.

Concentrations of iron and zinc were fairly consistent in the four locations. Iron concentrations ranged from 7,100-33,100 mg/kg while zinc concentrations ranged from 25 to 100 mg/kg. Cyanide compounds were not detected in any Task 2 samples while in Task 3 a cyanide level of 1.3 mg/kg was detected adjacent to the site. Phenolics were detected in Task 2 Round 4 samples at all three locations at comparable levels (1.8-6.1 mg/kg). During Task 3, phenolic levels ranged from 0.68 to 2.3 mg/kg.

2.7 SUMMARY OF VOLATILE AROMATIC COMPOUND DISTRIBUTION IN INDOOR AIR

Indoor air samples were collected at the Mechanicville site, at four locations: in the office, the adjacent storeroom area, the separate garage building, and an additional background location at the property-line fence (see Figure 2-1). The samples were analyzed for the presence of benzene,

toluene, ethylbenzene, and xylenes. The analytical results of the air sampling program are presented in Appendix A-6.

The results of the indoor air program revealed low levels of benzene and toluene at most sampling locations. The only exception was benzene not being detected in the background sample. Ethyl benzene and xylenes were below analytical detection limits for all samples.

The highest indoor levels of toluene and benzene were found in the storeroom. A possible source of benzene in the storeroom may be a forklift which is used in this area. Although the engine was not running during the sampling period, it is possible that residual gasoline vapors had volatilized into the air. Toluene was detected in the background sample at higher levels than two of the indoor samples. It was highest in the garage. It is possible that the sample was affected by vehicle use in the area.

2.8 CONTAMINANTS OF CONCERN

Summary tables of subsurface soil, sediment, and groundwater data at the Mechanicville site were prepared for selected sampling locations. Sampling locations were chosen for statistical analysis on the basis of human exposure potential. It should be noted that the sampling program was designed to investigate areas where residuals from the coal gasification processes would be expected. The summary statistics presented in Tables 2-1 through 2-9 were used to select the contaminants of concern for the public health risk

S2soil

TABLE 2-1

SUMMARY STATISTICS OF SELECTED SUBSURFACE SOIL SAMPLING LOCATIONS
VOLATILE ORGANIC COMPOUNDS
MECHANICVILLE SITE

VOLATILE ORGANICS	ARITHMETIC MEAN (mg/kg)	MAXIMUM (mg/kg)	MINIMUM (mg/kg)	FREQUENCY OF DETECTION
BENZENE	103.6	640	0	5/10
TOLUENE	151.2	840	0	8/10
ETHYLBENZENE	82.1	440	0	8/10
STYRENE	150.0	780	0	3/10
TOTAL XYLENES	306.0	1400	0.235	8/8
TRIMETHYLBENZENE	26.7	170	0	4/8
n-PROPYLBENZENE	0.3	2.05	0	2/8
ACETONE	0.0	0	0	0/2
METHYLENE CHLORIDE	0.5	1	0	1/2
CARBON DISULFIDE	0.1	0.11	0	1/2
2-BUTANONE				0

NOTES:

Includes Task 2 soil borings B-2, B-3, B-4, B-7, and B-8
and test pits TP-2, TP-4, and TP-5, and Task 3 boring B-09.

Frequency of detection equals the number of times a compound was found
(above the detection limit) over the number of samples in which it was analyzed.

S2soil

TABLE 2-2

SUMMARY STATISTICS OF SELECTED SUBSURFACE SOIL SAMPLING LOCATIONS
SEMI-VOLATILE ORGANIC COMPOUNDS
MECHANICVILLE SITE

SEMI-VOLATILE ORGANICS	ARITHMETIC MEAN (mg/kg)	MAXIMUM (mg/kg)	MINIMUM (mg/kg)	FREQUENCY OF DETECTION
ACENAPHTHENE	128.8	600	0	10/11
ACENAPHTHYLENE	365.8	1388	0	9/11
ANTHRACENE	183.0	670	0	10/11
BENZO(b)FLUORANTHENE	35.4	200	0	7/11
BENZO(k)FLUORANTHENE	30.0	240	0	5/11
BENZO(g,h,i)PERYLENE	29.3	140	0	7/11
BENZO(a)ANTHRACENE	76.5	390	0	10/11
BENZO(a)PYRENE	45.2	200	0	10/11
CHRYSENE	76.2	390	0	10/11
DIBENZO(a,h)ANTHRACENE	1.3	13	0	3/11
FLUORANTHENE	285.2	1100	0.28	11/11
FLUORENE	514.3	2100	0.28	11/11
INDENO(1,2,3-cd)-PYRENE	6.1	65	0	2/11
NAPHTHALENE	545.5	2500	0	10/11
PHENANTHRENE	320.7	940	0.28	11/11
PYRENE	398.7	1400	0.28	11/11
BIS(2-ETHYLHEXYL)PHTHALATE	0.0	0	0	0/3
2-METHYLNAPHTHALENE	13.0	13	13	1/11
DIBENZOFURAN	-	-	-	
TOTAL CARCINOGENIC PAHS	271.0	1305	0.28	11/11
TOTAL PAHS	3040.0	9480	2.38	11/11

NOTES:

Includes Task 2 soil borings B-2, B-3, B-4, B-7, and B-8 and test pits TP-2, TP-4, and TP-5, and Task 3 boring B-09.

Frequency of detection equals the number of times a compound was found (above the detection limit) over the number of samples in which it was analyzed.

S2soil

TABLE 2-3

SUMMARY STATISTICS OF SELECTED SUBSURFACE SOIL SAMPLING LOCATIONS
INORGANIC COMPOUNDS
MECHANICVILLE SITE

INORGANICS	ARITHMETIC MEAN (mg/kg)	MAXIMUM (mg/kg)	MINIMUM (mg/kg)	FREQUENCY OF DETECTION
IRON	29333.3	35000	19000	9/9
ZINC	120.2	320	59	9/9
-CYANIDE-				
TOTAL CYANIDE	0.7	3.2	0	3/9
AMENABLE CYANIDE	0.5	3.2	0	2/8
FERRO-FERRI CYANIDE	0.3	2	0	1/8
-OTHER-				
TOTAL RECOVERABLE PHENOLICS	0.5	3.6	0	2/9
TOTAL ORGANIC CARBON	51133.3	190000	1400	9/9

NOTES:

Includes Task 2 soil borings B-2, B-3, B-4, B-7, and B-8
and test pits TP-2, TP-4, and TP-5, and Task 3 boring B-09.

Frequency of detection equals the number of times a compound was found
(above the detection limit) over the number of samples in which it was analyzed.

S2tbls

TABLE 2-4

SUMMARY STATISTICS FOR SELECTED SEDIMENT SAMPLING LOCATIONS
VOLATILE ORGANIC COMPOUNDS
MECHANICVILLE SITE

VOLATILE ORGANICS	ARITHMETIC MEAN (mg/kg)	MAXIMUM (mg/kg)	MINIMUM (mg/kg)	FREQUENCY OF DETECTION
Benzene	0.0330	0.095	0	2/5
Toluene	0.0000	0	0	0/5
Ethylbenzene	0.0174	0.087	0	1/5
Styrene	0.0000	0	0	0/5
Total Xylenes	0.0000	0	0	0/5
Acetone	2.6000	5.2	0	1/2
Methylene Chloride	0.7375	2.95	0	1/4
2-Butanone	0.0000	0	0	0/2

NOTES:

Includes Task 2 samples SED-302 and SED-402;Task 3 sample at SD-02;
two NYSEG samples collected in 11/88, and ; the NYSDEC sample of 10/88.

Frequency of detection equals the number of times a compound was found
(above the detection limit) over the number of samples in which it was analyzed.

S2tbls

TABLE 2-5

SUMMARY STATISTICS FOR SELECTED SEDIMENT SAMPLING LOCATIONS
SEMIVOLATILE ORGANIC COMPOUNDS
MECHANICVILLE SITE

SEMI-VOLATILE ORGANICS	ARITHMETIC (mg/kg)	MAXIMUM (mg/kg)	MINIMUM (mg/kg)	FREQUENCY OF DETECTION
Acenaphthene	0.5093	1.6	0	4/7
Acenaphthylene	0.8664	3	0	4/7
Anthracene	0.7593	1.63	0	5/7
Benzo(b)Fluoranthene	0.2371	0.95	0	3/7
Benzo(k)Fluoranthene	0.9729	3.1	0	4/7
Benzo(g,h,i,)Perylene	0.1307	0.4	0	3/7
Benzo(a)Pyrene	0.8386	2	0	5/7
Benzo(a)Anthracene	0.8143	2.5	0	4/7
Chrysene	0.7643	2.3	0	4/7
Dibenz(a,h)Anthracene	0.0307	0.215	0	1/7
Fluoranthene	2.8486	10	0	5/7
Fluorene	0.4364	1.59	0	4/7
Indeno(1,2,3-cd)Pyrene	0.1021	0.3	0	3/7
Naphthalene	2.0543	8.7	0	6/7
Phenanthrene	2.0871	5.49	0	6/7
Pyrene	2.4743	7.6	0	5/7
4-Methylphenol	0.0430	0.215	0	1/5
2-Methylnaphthalene	0.6750	2.66	0	5/7
Butylbenzylphthalate	0.0430	0.215	0	1/5
bis(2-Ethylhexyl)phthalate	0.8264	2.8	0	4/7
Di-n-octylphthalate	0.0330	0.165	0	1/5
Dibutyl phthalate	1.1750	2	0	3/4
Total Carcinogenic PAHs	3.7600	10.2	0	5/7
Total PAHs	16.0	38.9	0.95	7/7

NOTES:

Includes Task 2 samples SED-302 and SED-402;Task 3 sample at SD-02;
two NYSEG samples collected in 11/88, and ; the NYSDEC sample of 10/88.

Frequency of detection equals the number of times a compound was found
(above the detection limit) over the number of samples in which it was anlayzed.

S2tbls

TABLE 2-6

SUMMARY STATISTICS FOR SELECTED SEDIMENT SAMPLING LOCATIONS
INORGANIC COMPOUNDS
MECHANICVILLE SITE

INORGANICS	ARITHMETIC MEAN (mg/kg)	MAXIMUM (mg/kg)	MINIMUM (mg/kg)	FREQUENCY OF DETECTION
Iron	15193.3	27200	8400	3/3
Zinc	45.5	46	45	2/2
-CYANIDE-				
Total Cyanide (ppm)	0.4	1.3	0	1/3
-OTHER-				
Total Recoverable Phenolics	2.3	4.6	0	2/3
Total Organic Carbon	21533.3	32000	16100	3/3
Sulfate	-	-	-	-

NOTES:

Includes Task 2 samples SED-302 and SED-402;Task 3 samples at SD-02;
two NYSEG samples collected in 11/88, and; the NYSDEC sample of 10/88.

Frequency of detection equals the number of times a compound was found
(above the detection limit) over the number of samples in which it was analyzed.

S-2tabs

TABLE 2-7

SUMMARY STATISTICS FOR SELECTED DOWNGRADIENT WELLS
GROUNDWATER FROM
VOLATILE ORGANIC COMPOUNDS
MECHANICVILLE SITE

VOLATILE ORGANICS	ARITHMETIC MEAN (mg/l)	MAXIMUM (mg/l)	MINIMUM (mg/l)	FREQUENCY OF DETECTION
BENZENE	1.12774	12.000	0	27/33
TOLUENE	0.44912	6.400	0	19/33
ETHYLBENZENE	0.43933	2.000	0	20/33
STYRENE	0.10533	1.800	0	4/33
TOTAL XYLENE	0.74081	3.500	0	27/33
TRIMETHYLBENZENE	-	-	-	0
ACETONE	0.06071	0.850	0	1/14
METHYLENE CHLORIDE	1.13594	36.000	0	2/32
2-BUTANONE	0.00139	0.025	0	1/18
1,1,1-TRICHLOROETHANE	0.00183	0.021	0	2/18
VINYL ACETATE	0.00556	0.100	0	1/18
2-HEXANONE	0.00028	0.005	0	1/18
CHLOROBENZENE	0.00007	0.001	0	1/18
1,1-DICHLOROETHANE	0.00018	0.003	0	1/18
TRICHLOROETHENE	0.00294	0.053	0	1/18

NOTES:

Includes all Task 2 and 3 monitoring wells except upgradient wells MW-1, MW-10, and MW-11.

Frequency of detection equals the number of times a compound was found
(above the detection limit) over the number of samples in which it was analyzed.

S-2tabs

TABLE 2-B

SUMMARY STATISTICS FOR GROUNDWATER FROM SELECTED DOWNGRADIENT WELLS
SEMIVOLATILE ORGANIC COMPOUNDS
MECHANICVILLE SITE

SEMIVOLATILE ORGANICS	ARITHMETIC MEAN (mg/l)	MAXIMUM (mg/l)	MINIMUM (mg/l)	FREQUENCY OF DETECTION
BENZO(b)FLUORANTHENE	0.8308	25.000	0	6/33
BENZO(k)FLUORANTHENE	0.8680	25.000	0	6/33
BENZO(g,h,i)PERYLENE	0.0121	0.400	0	1/33
BENZO(a)ANTHRACENE	1.5607	25.000	0	8/32
BENZO(a)PYRENE	0.9665	25.000	0	8/33
CHRYSENE	1.2873	25.000	0	7/33
DIBENZO(a,h)ANTHRACENE	0.0000	0.000	0	0/33
FLUORANTHENE	5.1082	82.000	0	19/33
FLUORENE	6.5798	110.000	0	21/33
INDENO(1,2,3,-cd)PYRENE	0.0152	0.400	0	2/33
NAPHTHALENE	35.7671	580.000	0	27/33
PHENANTHRENE	18.4497	320.000	0	22/33
PYRENE	8.1093	130.000	0	16/33
2,4-DIMETHYLPHENOL	0.0014	0.025	0	1/18
2,4-DINITROTOLUENE	0.0207	0.310	0	2/18
2,6-DINITROTOLUENE	0.0202	0.300	0	2/18
2-CHLORONAPHTHALENE	0.0167	0.300	0	1/18
2-METHYLNAPHTHALENE	25.7826	540.000	0	17/33
2-METHYLPHENOL	0.0297	0.300	0	4/18
2-NITROANILINE	0.1722	1.550	0	2/18
3-NITROANILINE	0.0861	1.550	0	1/18
4,6-DINITRO-2-METHYLPHENOL	0.0000	0.000	0	0/18
4-METHYLPHENOL	0.0202	0.200	0	3/18
4-NITROANILINE	0.0861	1.550	0	1/18
4-NITROPHENOL	0.0000	0.000	0	0/18
BENZOIC ACID	0.0875	1.550	0	2/18
BENZYL ALCOHOL	0.0003	0.005	0	1/18
BUTYLBENZYLPHTHALATE	0.0069	0.125	0	1/18
DIBENZOFURAN	1.7089	25.000	0	8/18
HEXACHLOROETHANE	0.0000	0.000	0	0/18
N-NITROSODIPHENYLAMIME	0.0167	0.300	0	1/18
NITROBENZENE	0.0003	0.005	0	1/18
PHENOL	0.0622	0.580	0	6/18
BIS(2-ETHYLHEXYL)PHTHALATE	0.0648	1.710	0	8/33
TOTAL CARCINOGENIC PAHS	5.4800	125.000	0	11/33
TOTAL PAHS	109.0000	1668.000	0	29/33

NOTES:

Includes all Task 2 and 3 monitoring wells except upgradient wells MW-1, MW-10, and MW-11.

Frequency of detection equals the number of times a compound was found
(above the detection limit) over the number of samples in which it was analyzed.

S-2tabs

TABLE 2-9

SUMMARY STATISTICS FOR SELECTED DOWNGRADIENT WELLS
GROUNDWATER FROM
INORGANIC COMPOUNDS
MECHANICVILLE SITE

INORGANICS	ARITHMETIC MEAN (mg/l)	MAXIMUM (mg/l)	MINIMUM (mg/l)	FREQUENCY OF DETECTION
IRON	5.930	25.000	0	31/32
ZINC	0.102	1.090	0	26/32
-CYANIDE-				
TOTAL CYANIDE	0.111	0.800	0	24/32
AMENABLE CYANIDE	0.012	0.100	0	2/12
FERRO-FERRI CYANIDE	0.083	0.420	0	13/14
UNDISTILLED CYANIDE	0.006	0.070	0	3/17
TOTAL RECOVERABLE PHENOLICS	0.793	17.000	0	22/23
TOTAL ORGANIC CARBON	1679.662	50000.000	2.500	30/30
SULFATE	42.000	84.000	14.500	5/5
TOTAL NEW YORK STATE REGULATED ORGANICS (7)	120.670	2060.600	0	32/33

NOTES:

Includes all Task 2 and 3 monitoring wells except upgradient wells MW-1, MW-10, and MW-11.

Frequency of detection equals the number of times a compound was found (above the detection limit) over the number of samples in which it was analyzed.

assessment and to represent the exposure point concentrations for the estimation of contaminant body dose levels. (Appendix A contains the analytical data for individual sampling locations which were used to calculate the summary statistics.)

The summary statistics shown in these tables include the frequency of detection, the minimum, maximum, and arithmetic mean of concentrations. In computing the mean, "non-detects" were assigned the value of zero. This assignment tends to lower the mean not that significantly, unless a detection limit is high.

Sampling locations used to represent the potential for human exposure to subsurface soils (see Tables 2-1 through 2-3) include Task 2 soil borings B-2, B-3, B-4, B-7, and B-8 and test pits TP-2, TP-4, and TP-5, and Task 3 boring B-9. As seen in Figure 2-1, these sampling locations correspond to the site parking lot (the area in front of the garage and offices) and the filter bed area. These areas were judged to represent locations on the site of possible future subsurface exploration and excavation.

Tables 2-4 through 2-6 contain summary statistics for selected sediment sampling locations. To model potential human exposure to sediments in the Anthony Kill, data for sampling locations adjacent to the site were selected. These include Task 2 and 3 data for sampling location SD-02, two NYSEG samples collected in 11/88, and one New York Department of Environmental Conservation (NYSDEC) sample collected in 10/88.

Summary statistics which reflect the levels of site-related contaminants in the on-site groundwater are presented in Tables 2-7 through 2-9. These data include all Task 2 and 3 monitoring well locations except upgradient wells MW-1, MW-10 and MW-11.

No contaminants of concern were chosen for surface water or groundwater. This is because there was no indication of site-related surface water contamination, based on the Task 2 and 3 surface water sampling results. Also, groundwater is not a current source of drinking water nor does it represent a potential source for the future. Therefore Jordan's evaluation of the risks associated with groundwater consumption is limited to a comparison of the concentrations found to groundwater or drinking water standards.

Chemicals were selected as contaminants of concern in subsurface soil, sediment, and indoor air based upon their concentrations, frequency of detection, and toxicologic properties. All chemicals detected in surface soil samples SS-1 through SS-4 were chosen as contaminants of concern for this medium. Table 2-10 lists the contaminants of concern selected for this risk assessment. All of the contaminants of concern in Table 2-10 are associated with coal gasification activities (GRI, 1987).

Both carcinogenic and noncarcinogenic PAHs were detected at a high frequency and magnitude. Of the sixteen PAHs detected at the site, seven have been classified as potential human carcinogens and were selected as contaminants of concern. These include benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, and

TABLE 2-10

CONTAMINANTS OF CONCERN
MECHANICVILLE SITE

CARCINOGENS	MEDIUM IN WHICH DETECTED
Carcinogenic PAHs[1]	Soil, Sediment
Benzene	Soil, Sediment, Indoor Air
NONCARCINOGENS	
Toluene	Soil, Indoor Air
Xylene	Soil
Ethyl Benzene	Soil, Sediment
Styrene	Soil
Noncarcinogenic PAHs[2]	Soil, Sediment
Cyanide	Soil, Sediment
Trimethylbenzene	Soil

NOTES:

1 Include benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

2 Include acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene, and 2-methylnaphthalene (sediment only).

indeno(1,2,3-cd)pyrene. In addition, several PAHs were chosen as contaminants of concern to represent the noncarcinogenic hazards of PAHs. These include naphthalene, pyrene, acenaphthene, acenaphthylene, phenanthrene, fluoranthene, fluorene, anthracene, 2-methylnaphthalene, and benzo(g,h,i)perylene.

Although iron and zinc were found in all samples, they were not selected because they are of such low toxicity. In addition, levels in soil were similar to background levels at the site, while levels in sediment were within an average background range reported by Moore and Ramamoorthy (1984).

Other compounds such as acetone, butylbenzyl phthalate, di-n-octyl phthalate, carbon disulfide, 4-methylphenol and propyl benzene were not chosen because of their low frequency of detection. In addition, some of these compounds are common laboratory contaminants and therefore may not actually be present on the site.

3.0 HAZARD IDENTIFICATION

In this section, the toxicological properties of the contaminants of concern, all of which are associated with coal gasification activities, are briefly reviewed. A detailed discussion of the health effects of all contaminants is presented in Appendix B.

3.1 POLYNUCLEAR AROMATIC HYDROCARBONS

Most PAHs in the environment are formed during the combustion of organic compounds. Major sources of PAHs include incomplete combustion of fuels for heat and manufacturing; burning of coals, gasoline, and diesel exhaust; and burning of municipal and agricultural wastes. Cigarette smoke also contains PAHs. To a limited extent, these compounds also occur naturally (i.e., plants and bacteria synthesize PAHs during growth, and naturally caused brush and forest fires produce PAHs).

PAHs represent a class of several hundred compounds consisting of annelated (benzene) rings. PAHs are ubiquitous in the environment and most are formed during the combustion of organic compounds. Sixteen PAHs were detected at this site. Seven of these compounds have been classified as potential human carcinogens (Carcinogen Assessment Group [CAG] B2 classification): benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene (USEPA, 1984). Several other PAHs are genotoxic but have not been shown to be carcinogenic (i.e., anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene,

phenanthrene, and pyrene). Numerous epidemiological studies of worker populations have shown a clear association between PAH-containing materials (e.g., soots, tars, and oils) and increased cancer risk (IARC, 1983).

Several noncarcinogenic PAHs were also detected at the site. One of them, naphthalene, was selected as a surrogate to represent noncarcinogenic PAH hazard potential. Except for naphthalene, little toxicological information exists on the other compounds. The toxicity of naphthalene is summarized in Section 3.3.

PAHs are highly lipid-soluble and are absorbed via the gastrointestinal (GI) tract, skin, and lungs (USEPA, 1984). Many PAHs produce tumors in mouse skin when applied topically in solvents or as coal tar products. Therefore, dermal contact is a potentially important exposure route for these compounds. The degree of skin absorption of PAHs from contaminated soils, however, is not known (USEPA, 1984).

The USEPA cancer potency factors for oral and inhalation exposures of benzo(a)pyrene are 11.5 and 6.11 $(mg/kg/day)^{-1}$, respectively. These values are used to assess the carcinogenic risks associated with the mixture of carcinogenic PAHs found in the soil. (Potency factors are not available for the other carcinogenic PAHs). Using the factor for benzo(a)pyrene to represent the potency of the seven identified carcinogenic compounds is widely practiced for risk assessment of PAHs. Although benzo(a)pyrene is one of the most potent carcinogenic PAHs, many other carcinogenic PAHs are known

to be present in coal tar wastes that were not analytes in the methods used to test site soils.

It should be recognized that the USEPA cancer potency factor is the upper 95-percent confidence limit of the slope of the dose-response curve for benzo(a)pyrene (using the linearized multistage extrapolation model). This means that, with 95-percent statistical certainty, the true potency is as stated or less. Therefore, it is highly unlikely that the true potency of benzo(a)pyrene is greater than stated, and it could be considerably lower. For these reasons, the calculated cancer risks associated with the various exposure levels are expected to represent upper limits of the true risk.

It should be noted that these potency values were under reevaluation by USEPA at the time of this writing. New values were not available for use in this risk assessment.

In addition to the USEPA-derived potency factors, ICF-Clement Associates have developed new potency factors for benzo(a)pyrene using a different dose-response model than the USEPA. While the USEPA used the linearized multi-stage model, ICF-Clement used a newly-developed two-stage biologically-based model, which is a special case of the Moolgavkar and Knudson risk model (Atlantic Environmental Services, Inc., 1988). These new oral and inhalation potency estimates for benzo(a)pyrene are 3.22 and 0.453 $(mg/kg/day)^{-1}$, respectively and they can be used with the USEPA estimates to provide a range of possible cancer risks associated with PAHs.

ICF-Clement Associates has also developed relative potency factors for other PAH compounds, based on their comparative potencies to that of benzo(a)pyrene. These comparative potencies are illustrated below:

PAH	Relative Potency
Benzo(a)pyrene	1.000
Benzo(a)anthracene	0.145
Benzo(b)fluoranthene	0.140
Benzo(k)fluoranthene	0.066
Benzo(g,h,i)perylene	0.022

PAH	Relative Potency
Chrysene	0.0044
Dibenzo(a,h)anthracene	1.1100
Indeno(1,2,3-c,d)pyrene	0.2320

Source: Atlantic Environmental Services, 1988

The merits and limitations of using the various cancer potency factors are discussed in detail in Appendix B-1.

3.2 BENZENE

Benzene, a highly flammable volatile aromatic hydrocarbon, is used both as a gasoline additive and a chemical intermediate in the production of many compounds (e.g., styrene and phenol).

Benzene is recognized human carcinogen (IARC, 1982). Several epidemiological studies provided sufficient evidence of a causal relationship between benzene exposure and leukemia in humans. Benzene is a known inducer of aplastic anemia in humans, with a latency period of up to 10 years. It reduces the

number of white blood cells and other blood components, which may progress to a reduction in all blood cell types. Similar adverse effects on the blood-cell-producing system occur in animals exposed to benzene. In both humans and animals, benzene exposure is associated with chromosomal damage, although it has not been shown to be mutagenic. Embryolethality has also been observed in experimental animals.

Exposure to high concentrations of benzene in the air causes central nervous system (CNS) depression and cardiovascular effects. Benzene has been reported to cause subjective symptoms (e.g., headaches and nausea) with chronic exposure to as little as 100 parts per million (ppm).

3.3 NAPHTHALENE

Naphthalene is a member of the class of compounds known as PAHs, which were described in Section 3.1. In this risk assessment, naphthalene is used to represent the toxicity of noncarcinogenic PAHs.

Naphthalene is absorbed most readily by the inhalation route in humans. Acute short-term exposure to naphthalene may lead to severe anemia. In severe exposure, ingestion causes gastroenteric distress, tremors, and convulsions. Corneal ulceration and cataracts have been observed in humans after repeat exposure to naphthalene vapor. Naphthalene vapors may also cause headache, nausea, and profuse perspiration. With dermal contact, naphthalene is a mild primary irritant. Naphthalene is not known to be a mutagen or carcinogen (Clayton and Clayton, 1981).

3.4 TOLUENE

Toluene is an important raw material for organic syntheses. It is used in the production of benzene, benzyl chloride, benzoic acid, phenol, cresols, vinyl toluene, TNT and toluene diisocyanate. It is also used as a solvent for paints, rubber and resins and as a component of motor and aviation fuels.

Acute and chronic exposures to 200 ppm or greater concentrations of toluene vapor cause eye irritation, headache, nausea, and other CNS effects in humans. In humans, acute exposures to very high concentrations can cause narcosis; however, exposures to quantities sufficient to produce unconsciousness fail to produce organ damage. There is no conclusive evidence that toluene is carcinogenic or mutagenic in animals or humans (USEPA, 1980a). The National Toxicology Program (NTP) is currently conducting an inhalation carcinogenicity bioassay in rats and mice.

Researchers have reported that toluene is embryotoxic and one study reported a high incidence of cleft palate in mice. There are no accounts of teratogenic effects in humans after exposure to toluene (USEPA, 1987).

3.5 ETHYL BENZENE

The major use of ethyl benzene is as an intermediate in the production of styrene. It is also used in the manufacture of cellulose acetate and synthetic rubber. Significant quantities are consumed in connection with xylene, which may contain as much as 20% ethyl benzene as a solvent or

diluent. These xylene/ethyl benzene mixtures are used as diluents in the paint industry, in agricultural sprays for insecticides and in gasoline blends.

To date, ethyl benzene has not been evaluated by USEPA for human carcinogenicity potential. The target organs for health impacts from acute exposures are the eyes, upper respiratory system, skin, and CNS. No data on teratogenicity or mutagenicity of ethyl benzene were located by USEPA (1980b). Human toxicity of ethyl benzene is characterized by its irritancy to the skin and, less markedly, to the mucous membranes (ACGIH, 1986).

3.6 XYLENE(S)

Xylene is a VOC used as a solvent for prints, inks, and adhesives. Xylenes are components of detergents and other household and industrial products.

Xylene has not been found to be carcinogenic when administered orally to rats or mice. Xylene was not found to be mutagenic in a battery of short-term assays. Xylene is not teratogenic but has caused fetotoxicity in rats and mice. Acute exposure to high levels of xylene affects the CNS and irritates the mucous membranes. Short-term xylene exposure can cause eye, nose, and throat irritation at 200 ppm. There is some evidence that chronic exposures to less than 50 ppm can cause headaches and other CNS effects.

3.7 CYANIDE

Both cyanide gases and salts are used in industrial processes. HCN is manufactured at 14 sites in the U.S. and is used as an intermediate in the production of nylon and other compounds. Minor uses of HCN include insecticides and rodenticides for fumigating enclosed spaces (e.g., grain storage areas). Cyanide salts are used mainly in the electroplating and metal-finishing industries. Minor applications of the salts include the manufacture of dyes and pigments, as well as use as insecticides and rodenticides.

Cyanide is a compound that may exist as a salt (e.g., potassium or sodium cyanide) or as a gas (e.g., hydrogen cyanide [HCN]). Cyanides as a class are absorbed readily by the lungs, GI tract, and skin of animals and humans (USEPA, 1985). The fastest route of uptake for cyanide is the inhalation of gaseous HCN. Once cyanide is absorbed, it is readily distributed throughout the body. The liver can readily detoxify cyanide compounds. Therefore, cyanides absorbed from the GI tract first pass through the liver, where they are converted to less toxic compounds (usually thiocyanide), before systemic distribution. When inhalation is the route of exposure, systemic distribution occurs before the cyanide-containing blood passes through the liver. Therefore, the effective dose to target organs is higher for inhalation exposure than oral exposure for the same administered body dose.

Acute exposure to high levels of cyanides produces adverse effects on the central nervous, respiratory, and cardiovascular systems (ATSDR, 1988). Coma

and/or death can be eventual outcomes. Lower-level exposures produce rapid deep breathing, convulsions, and loss of consciousness (ATSDR, 1988). Skin irritation can result from contact with dust containing cyanide (ATSDR, 1988). Chronic exposures (months to years) to low levels of cyanides affect the CNS and the thyroid gland. No evidence exists to indicate that cyanide is carcinogenic (ATSDR, 1988).

3.8 STYRENE

Styrene is a volatile aromatic compound produced primarily from the dehydrogenation of ethyl benzene. Styrene is used to produce polystyrene, which is a thermoplastic with excellent electrical properties and thermal stability.

Styrene is classified by USEPA as a possible human carcinogen (Group C) because there is limited evidence of carcinogenicity from animal studies but no human data. There is, however, no USEPA cancer potency factor for styrene.

The target organs for toxic effects are the CNS, the respiratory system, and the eyes and skin. There is some epidemiologic evidence suggesting reproductive effects.

3.9 TRIMETHYLBENZENE

Trimethylbenzenes are alkylated benzenes. This group of compounds, which include xylenes, toluene, and ethylbenzene is a by-product of petroleum

distillation and found in coke oven effluents. Trimethylbenzene is primarily used in industry as solvents, paint thinners, and motor fuel components. One of the three trimethylbenzene isomers has been identified as an insect attractant.

Little experimental work has been carried out on trimethylbenzene. It seems to have very similar properties to other alkylated benzenes, such as xylene and toluene. Like these compounds, trimethylbenzene is relatively non-toxic except with acute exposures to very high concentrations.

Trimethylbenzene, like other alkylated benzenes, is primarily a CNS depressant with such symptoms as irritability, nervousness, headache, nausea, and even narcosis. It is absorbed through the skin, gastrointestinal tract, and lungs; however, unlike other compounds of its class, it is not systemically toxic through dermal absorption. There have been reports of hypochromic anemia in peripheral blood and deviation from normal coagulation in workers exposed for many years to trimethylbenzene at air concentrations between 10 and 60 ppm.

4.0 DOSE/RESPONSE ASSESSMENT

4.1 INTRODUCTION

In risk assessments, the likely range of incremental risk associated with given levels and conditions of human exposure to a carcinogenic or noncarcinogenic substance is estimated. For carcinogens, the purpose of the dose/response assessment is to define the relationship between the dose of a substance and the likelihood of a carcinogenic effect. Noncarcinogens are thought to have a threshold level for health effects; therefore, USEPA has derived some guidelines based on acceptable exposure levels. The outcome of the dose/response assessment, when coupled with information or assumptions concerning the magnitude of human exposure, can provide a numerical estimate of risk.

Information derived from the hazard identification process is used to guide the dose/response assessment. This guidance is necessary for determining the appropriateness and limitations of the available data sets that might be used for dose/response extrapolation. Such guidance is important, since numerical risk estimates are not affected by the likelihood that an agent is in reality a human carcinogen. That is, a numerical risk estimate can often be derived for a substance even if the weight-of-evidence in support of human carcinogenicity is extremely weak. Therefore, current USEPA guidelines state that agents classified in Groups A (human carcinogens) and B (probable human carcinogens) according to the weight-of-evidence stratification are suitable for quantitative risk estimation. Agents categorized in Group C (possible human carcinogens) must be judged on a case-by-case basis, and agents in

Groups D (not classified) and E (no evidence of human carcinogenicity) do not have risk estimates derived.

Regardless of the weight-of-evidence, there are major uncertainties in derived risk estimates, which are due to experimental and epidemiologic variability, as well as problems in extrapolating both from animals to humans and from high to low doses. Three major issues impact the validity of dose-response assessments used to derive risk estimates: (1) the selection of a study (i.e., data set) upon which to base the calculations; (2) the mathematical model used to extrapolate from experimental observations at high doses to predicted occurrences at very low doses; and (3) the conversion to an equivalent human dose corresponding to the animal dose used. USEPA provides guidance in these three areas.

Study selection involves the identification of a data set that provides sufficient, well-documented dose/response information to enable a valid extrapolation. Ideally, human data are preferable to animal data, although adequate human data sets are relatively uncommon. Therefore, it is often necessary to seek dose/response information from a species which biologically resembles humans (e.g., with respect to metabolism, physiology, and pharmacokinetics), and where the route of administration is similar to the expected mode of human exposure (e.g., inhalation and ingestion). Cancer incidence data should allow for determination of statistically significant elevations in the occurrence of tumors at specific target organ sites.

The low levels of cancer risk that are generally considered acceptable in community settings (typically $1x10^{-5}$ to $1x10^{-6}$) cannot be measured directly,

either by animal experiments or epidemiologic studies. Therefore, different extrapolation models have been developed to estimate cancer risk associated with extremely low doses, based on the observed responses that occur at high doses. Current theories on the carcinogenic process led to the belief that carcinogenesis is associated with a low-dose linearity and linear nonthreshold dose-response relationship. The mathematical formulation typically chosen to describe the dose-risk relationship at low doses is the linearized multi-stage model. Although this is generally regarded as the base of many of the current mathematical extrapolation models, USEPA cautions that no solid scientific basis exists for any extrapolation model and that the risk estimates made with such models are intended to be plausible upper limits (i.e., the true risk is not likely to be higher than the estimate, but it could be as low as zero).

The determination of human equivalent doses by conversion of doses administered to experimental animals requires the assumption that humans and animals are equally sensitive to the toxic effects of a substance, if the same dose per unit body surface area is absorbed by each species. Further assumptions for dose conversions involve standardized scaling factors to account for differences between humans and experimental animals with respect to lifespan, body size, breathing rates, and other physiologic parameters. In addition, evaluation of risks associated with one route of administration (e.g., inhalation) when tests in animals involve a different route (e.g., ingestion) requires additional assumptions with corresponding additional uncertainties. These uncertainties should be acknowledged and explained as thoroughly as possible.

4.2 USE OF MATHEMATICAL MODELS IN DERIVATION OF A CANCER POTENCY FACTOR

The USEPA cancer potency factors (CPFs) are derived by use of the linearized multi-staged procedure. USEPA recognizes that this method produces very conservative risk estimates and that other mathematical models exist. Several dose/response models are available for low-dose extrapolation. These include the probit, the multi-hit, the logit, and the multistage models. These models are generally statistical in character and are not derived from biological arguments, except for the multistage model, which has been used to support the somatic mutation hypothesis of carcinogenesis. In the Guidelines for Carcinogen Risk Assessment (51FR33997), USEPA states:

> No single mathematical procedure is recognized as the most appropriate for low-dose extrapolation in carcinogenesis. When relevant biological evidence on mechanism of action exists (e.g., pharmacokinetics or target organ dose), the models or procedures employed should be consistent with the evidence. When data and information are limited, however, and when much uncertainty exists regarding the mechanism of carcinogenic action, models or procedures that incorporate low-dose linearity are preferred when compatible with the limited information.

USEPA policy is to use the linearized multistage model unless there is adequate scientific justification for using another model. The multistage model is used for the extrapolation because it is the most general model, with other models approximating some form of the multistage model according to the values of the parameters. The goodness of fit of experimental data is not, however, an appropriate means for justifying the use of one model over another.

USEPA emphasizes in the guidelines that the linearized multistage model leads to a plausible upper limit to the risk that is consistent with some proposed mechanisms of carcinogenesis. Such an estimate, however, does not necessarily give a realistic prediction of the risk. The true value of the risk is unknown and may be as low as zero. An established procedure does not yet exist for making "most likely" or "best" estimates of risk within the range of uncertainty defined by the upper- and lower-limit estimates. The point estimate generated from the model is not used because a question remains as to the shape of the dose/response curve beyond the experimental exposure level. Therefore, the upper-bound estimate of the carcinogenic potency is derived when animal bioassay data are used. This upper-bound estimate can be taken as a plausible estimate if the true dose/response curve is actually linear at low doses. The other reason why the upper-bound estimate is used instead of the point estimate is that, in some cases, the point estimate is extremely unstable, depending on where the lowest experimental dose is, while the upper-bound estimate is much more stable.

For several reasons, estimates such as the unit risk, when based on animal studies, provide only an approximate indication of the absolute risk in populations exposed to known carcinogen concentrations. There may be important differences between animals and humans in target site susceptibility, immunological responses, hormone function, dietary factors, and disease. Unit risk estimates can be useful, however, in making rough comparisons of the relative potency of a given agent, as compared to other carcinogens.

Derivation of the unit risk estimate requires calculation of the slope of the dose-risk relationship, which is obtained by application of the extrapolation model. The dose-risk slope value, q_1, is taken as an upper bound of the potency of the chemical in inducing cancer at low doses; it is referred to as the cancer potency factor (CPF). Therefore, at a given dose d, q_1 x d is a 95-percent upper confidence limit on the extra lifetime risk (probability) of cancer occurring.

The USEPA integrated risk information system (IRIS) is a database that USEPA has established that contains all evaluated data on many toxic substances found at hazardous waste sites. This database was employed by Jordan to identify the cancer potency factors and reference doses (RfDs) applicable to this risk assessment. A reference dose is the dose-response value used to assess noncarcinogenic effects. It is defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Where no information was found in IRIS, other government documents were used (e.g., Superfund Public Health Evaluation Manual update 1987 and Health Effects Assessment documents). Tables 4-1 through 4-3 present the dose/response data used in this risk assessment for the contaminants of concern at the Mechanicville site, including CPF or RfD values, source of these values, the study type used to determine these values, and toxicokinetic factors (TKFs).

As stated in Section 3.1, ICF-Clement Associates has developed new oral and inhalation potency factors for benzo(a)pyrene based on a different extrapolation model than that used by the USEPA. ICF-Clement's model is a

mechdr

TABLE 4-1

ORAL DOSE RESPONSE DATA
MECHANICVILLE SITE

COMPOUND	DOSE-RESPONSE VALUE	UNIT	SOURCE	DATE	STUDY TYPE *	TOXICOKINETIC FACTORS Most Probable/Realistic Worst: SOIL (oral)	SOIL (dermal)
CARCINOGENS							
PAHs (1)	11.5	(mg/kg/day)-1	SPHEM (6)	Oct 87	diet	0.50 / 1.00	0.01 / 0.10
PAHs (2)	3.22	(mg/kg/day)-1	AES (9)	1988	diet	0.50 / 1.00	0.01 / 0.10
Benzene	0.02	(mg/kg/day)-1	IRIS (7)	Aug 89	inhalation	0.10 / 0.50	0.05 / 0.25
NONCARCINOGENS							
Toluene (3)	0.3	mg/kg/day	IRIS	Aug 89	inhalation	0.05 / 0.25	0.025 /0.125
Xylenes	2.0	mg/kg/day	IRIS	Aug 89	gavage	0.10 / 0.50	0.050 /0.250
Ethylbenzene (4)	0.1	mg/kg/day	IRIS	Aug 89	gavage	0.10 / 0.50	0.050 /0.250
Cyanide	0.02	mg/kg/day	IRIS	Aug 89	diet	0.5 / 1.00	1.000 / 2.50
Styrene	0.2	mg/kg/day	IRIS	Aug 89	gavage	0.1 / 0.5	0.050 / 0.25
Noncarcinogenic PAHs (5)	0.4	mg/kg/day	SPHEM	Sept 88	diet	0.5 / 1.00	0.010 / 0.10
Trimethylbenzene (5)	2.0	mg/kg/day	IRIS	Aug 89	gavage	0.10 / 0.50	0.050 / 0.25

(1) USEPA dose/response value for benzo(a)pyrene
(2) ICF-Clement dose/response value for benzo(a)pyrene
(3) Toluene study based on 50% absorption
(4) Ethylbenzene administered in olive oil
(5) Dose/response value for naphthalene
(6) Dose/response value for xylenes
(7) Superfund Public Health Evaluation Manual
(8) USEPA Integrated Risk Information System
(9) Atlantic Environmental Services (AES), 1988

TABLE 4-2

INHALATION DOSE RESPONSE DATA
MECHANICVILLE SITE

COMPOUND	DOSE-RESPONSE VALUE	UNIT	SOURCE	DATE	STUDY TYPE *	TOXICOKINETIC FACTORS: INHALATION TKF Volatile	TOXICOKINETIC FACTORS: INHALATION TKF Particulate
CARCINOGENS							
PAHs (1)	6.1	(mg/kg/day)-1	SPHEM(6)	Oct 87	inhalation	N/A (8)	1.00
PAHs (2)	0.453	(mg/kg/day)-1	AES (9)	1988	inhalation	N/A (8)	1.00
Benzene	0.029	(mg/kg/day)-1	IRIS(7)	Aug 89	inhalation	1.00	N/A
NONCARCINOGENS							
Toluene	1.0	mg/kg/day	IRIS	Sept 88	inhalation	1.00	N/A
Xylenes	0.4	mg/kg/day	AIC	Sept 88	inhalation	1.00	N/A
Ethylbenzene (3)	0.1	mg/kg/day	IRIS	Aug 89	gavage	1.00	N/A
Cyanide (3)	0.02	mg/kg/day	IRIS	Nov 88	diet	N/A	7.50
Styrene (3)	0.2	mg/kg/day	IRIS	Sept 88	gavage	1.00	N/A
Noncarcinogenic PAHs (4)	0.4	mg/kg/day	SPHEM	April 89	diet	N/A	0.75
Trimethylbenzene (5)	0.4	mg/kg/day	AIC	Sept 88	inhalation	1.00	N/A

(1) USEPA dose/response value for benzo(a)pyrene
(2) ICF-Clement dose/response value for benzo(a)pyrene
(3) Inhalation dose/response value is not available for this compound; therefore, the oral dose/response value was used
(4) Dose/response value for naphthalene
(5) Dose/response value for xylene
(6) Superfund Public Health Evaluation Manual
(7) USEPA Integrated Risk Information System
(8) Not applicable
(9) Atlantic Environmental Services (AES), 1988

TABLE 4-3

TOXICOKINETIC FACTORS (TKFs)
MECHANICVILLE SITE

STUDY TYPE	DERMAL/SOIL	ORAL/SOIL
Gavage	0.05/0.25[1]	0.1/0.5
Drinking Water	0.05/0.25	0.1/0.5
Diet	.01/0.10	0.5/1.0
Inhalation	0.05/0.25[2]	0.1/0.5[2]

Notes:
[1] Most probable case/realistic worst case.

[2] Multiplied by the absorption-factor from inhalation study, if any.

two-stage biologically-based model which produces oral and inhalation potency factors 72 and 93 percent lower than the USEPA factors. ICF-Clement's estimates can be used to provide a range of possible cancer risks associated with PAHs.

4.3 TOXICOKINETIC FACTOR (TKF)

To estimate the risk to human health posed by the presence of chemicals in soil and sediment at the Mechanicville site, Jordan first estimated the exposure dose of each constituent. The exposure dose is similar to the administered dose of a laboratory experiment. The experimentally-based cancer potency factors and reference doses used in quantitative risk assessment are based on administered doses in most cases.

The toxicokinetic factor (TKF) is defined as the ratio of the estimated absorption factor for the site-specific medium and route of exposure to the known or estimated absorption factor for the laboratory study from which the cancer potency factor or the reference dose was derived. Use of this factor allows Jordan to make appropriate adjustments if the efficiency of absorption is known or expected to differ because of physiological effects and/or matrix or vehicle effects.

TKFs can be less than one or greater than one, depending on the particular circumstances at hand. If it is thought that absorption from the site-specific exposure is the same as absorption in the laboratory study, then the TKF is 1.0.

In the absence of detailed toxicological information on every compound of interest, it has been common practice for risk assessors to use a default value of 1.0. This approach is not always adequately protective of public health, because there are many cases in which it is expected that absorption from the site-related exposure would be higher than that in the laboratory study. In this assessment, the absorption by inhalation of cyanide adsorbed to soil particles would be expected to be higher than in the diet study upon which its dose/response value is based.

For carcinogenic PAHs and cyanide, specific TKFs were derived based on a review of relevant toxicological data. These TKFs are described in the dose/response profile for each compound (see Appendix B-1). For the other contaminants of concern, Jordan has estimated compound-specific TKFs based on a conservative, internally consistent algorithm as shown in Table 4-3. The procedure requires that the route of exposure and the vehicle be known for all studies from which cancer potency factors or reference doses were derived by USEPA. This information is discussed in the dose/response profile for each contaminant of concern. The algorithm requires the use of numerous assumptions regarding systemic absorption of the constituents. These assumptions are reasonable and are presented in the following paragraphs.

TKFs were derived for three situations: (1) dermal uptake from soil; (2) ingestion of soil; and (3) inhalation of volatilized compounds or particulates. The dose/response values listed in Tables 4-1 and 4-2 were derived from several types of studies. Most oral values were derived from studies in which animals were administered the test compound orally either by gavage, in drinking water, or in diet. However, some oral dose/response

values (i.e., for benzene and toluene) were based on inhalation studies. Most inhalation dose/response values were based on inhalation studies.

The TKF values for situations 1 and 2 are listed in Tables 4-1 and Table 4-3. The assumptions employed in deriving them are discussed below:

- Absorption from gavage studies (in which feeding is by stomach tube) is similar to absorption from drinking water studies.

- Absorption of compounds from drinking water in humans is similar to absorption in laboratory animals from drinking water or gavage.

- Absorption of volatile compounds via inhalation in animals is similar to absorption from drinking water. That is, in both cases absorption is assumed to be very high.

The above assumptions are conservative and reasonable. Their application results in a series of TKFs that can be applied to specific contaminants of concern depending on the nature of the study from which the dose/response values were derived. In some cases, the TKFs are one or greater than one. For instance, the gastrointestinal (GI) absorption of a constituent such as PAHs from soil may be as great as it is from diet. Since the cancer potency factor is based on a dietary study, a TKF of 0.5-1.0 is used to account for the difference in absorption expected for the estimated exposure at the Mechanicville site. In other cases, the TKFs are less than one. For instance, dermal absorption of a compound such as xylene from soil is expected

to be less than absorption when the compound is administered by gavage. Thus, the TKF for this compound for dermal uptake from soil is 0.05-0.25.

In the derivation of TKFs, for most of the contaminants of concern, Jordan assumes the following:

- Absorption of vapors at the site is the same as absorption of vapors in a laboratory study.

- Absorption of vapors at the site is the same as absorption from gavage in a laboratory study.

- Absorption of inhaled particles at the site is the same as absorption of vapors in a laboratory study; however, 75 percent of the inhaled particles is assumed to remain in the lungs and be available for absorption.

Therefore, the TKFs for most of these compounds are 1.0 for volatilized compounds and 0.75 for particulates (see Table 4-2).

The exceptions are PAHs and amenable cyanide. The cancer inhalation potency factor for PAHs is based on an inhalation study where hamsters were exposed to benzo(a)pyrene in a sodium chloride aerosol. It is assumed that absorption from soil particulates is the same as absorption from the sodium chloride aerosol; therefore, the TKF is 1.0. Jordan assumed that 75 percent of PAH particulates are retained in the lungs compared to volatilized PAHs; Thus, the TKF for volatilized PAHs is 1.33. The inhalation TKF for amenable cyanide

(particulates) is 7.5 based on route-specific metabolic differences. Its derivation is explained in the dose/response section for cyanide in Appendix B.

Table 4-2 contains the inhalation TKFs used in the risk scenarios.

5.0 EXPOSURE ASSESSMENT

The purpose of this exposure assessment is to identify and characterize potential exposures at the Mechanicville site. The exposure assessment consists of three steps. First, the exposure pathway analysis identifies potential pathways by which individuals may be exposed to site-related contamination. Second, the exposed population analysis identifies populations around the site who might be exposed. Finally, the methods to calculate incurred body doses resulting from these exposures are presented, along with some of the assumptions and parameters that are used in these calculations.

5.1 INTRODUCTION

The Mechanicville site is currently used as an electric and gas service center. However, NYSEG has other plans for the site in the future. These plans include moving the service center to another location outside the City of Mechanicville. NYSEG does not intend to sell the site, but it expects to lease the site (O'Meara and Martin, 1989). There are currently two potential bidders to lease the property: the city (to use the site as a storage lot), and a private car dealership (to use it as a car lot). Leasing of the site may require regrading the site and removing existing underground and aboveground structures at the site.

Because of the contamination found at the site (as described in Section 2 of this report), it is possible that individuals may be exposed to site-related

contamination. Under current conditions, the potential for exposure of nearby residents and site trespassers is limited because the site is not easily accessible. The property is bordered on three sides by a fence, and on the fourth side by a steep embankment along the Anthony Kill Stream.

5.2 EXPOSURE PATHWAY ANALYSIS

There are several pathways by which individuals on or near the site may be exposed to site-related contamination. These pathways involve exposure to soil, groundwater, surface water, air, and sediment. Table 5-1 presents the exposure pathways evaluated in this risk assessment.

5.2.1 Soil Exposure Pathway

Contamination was found in surface and subsurface soil, thus individuals who might contact these soils could be exposed to site-related contamination. Surface soil along the Anthony Kill bank was found to contain semivolatile organic compounds. Subsurface soils near the former gas plant structure locations were found to contain VOCs, SVOCs, and some inorganic compounds.

Because the area along the Anthony Kill is not fenced, the potential exists for trespassers to gain access to the site and contact soil contaminants. However, a steep embankment limits access to the site, making the potential for this exposure very low. Furthermore, most of the site is covered by asphalt or buildings. It is assumed that trespassers could only be exposed to

TABLE 5-1

EXPOSURE PATHWAYS
MECHANICVILLE SITE

MEDIUM	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	STATUS
Subsurface Soils	On-Site	-Dermal absorption -Incidental ingestion	Utility Workers	Future
Surface soils	On-Site (Stream bank area)	-Dermal absorption -Incidental ingestion	Trespassers	Current
Air Emissions	On-Site,	-Inhalation	Site Residents	Current
			Construction Workers	Future
	Off-Site, dispersion		Children	Future
Sediments	Off-Site (adjacent to site)	-Dermal absorption -Incidental ingestion	Recreational river users	Current
			Construction Workers	

surface soil behind the office building near the Anthony Kill, an area that is densely vegetated. If trespassers were to gain access to other areas of the site, it is unlikely that they would dig below the surface to contact contaminated soil. Since the exposure of trespassers to contaminated subsurface soil is unlikely, only surface soil exposure will be assessed under this exposure scenario.

Subsurface soil could be uncovered during excavation activities in the future. Such activities might include the servicing of underground sewer, water, or other utility lines. Workers could contact contaminated soil and uncovered stockpiled materials. Therefore, exposure of workers (i.e., utility workers) to excavated soil will be evaluated in this report.

5.2.2 Groundwater Exposure Pathway

Contamination was found in groundwater. However, there appear to be no exposures to this medium, for two reasons. First, as shown in the Tasks 2 and 3 Reports, most of the groundwater under the site appears to discharge directly into the Anthony Kill, except for groundwater in the southern and eastern portions of the site which moves easterly towards the Hudson River. Second, there are no known current users of the groundwater near or downgradient of the Mechanicville site. The City of Mechanicville obtains its drinking water from a surface water reservoir approximately 3 miles northeast of the site, at an elevation approximately 160 feet higher than the site. The closest domestic wells are nearly a mile southwest (upgradient) of the site in the Town of Halfmoon, and no active industrial wells were identified in the

Mechanicville area. Two abandoned industrial wells are located northeast and south of the site. Neither appear to be downgradient from the site. Although some groundwater moves east of the site before discharging into the river, there are no known receptors and thus groundwater is not considered a potential current or future exposure pathway.

5.2.3 Surface Water Exposure Pathway

Surface water of the Anthony Kill represents another potential pathway for exposure to site-related contaminants. Surface water runoff from the site flows into two drainage catch basins that empty via underground culverts into the Anthony Kill. Another potential source of site-related contamination to Anthony Kill surface water is on-site shallow groundwater which discharges to the stream.

The New York State Department of Environmental Conservation (NYSDEC) has classified the section of stream from the Mechanicville city line to the Hudson River as Class D (usable for secondary non-contact recreation such as boating). Use of this section of the Anthony Kill for secondary recreation has been confirmed by the City of Mechanicville (Erano, 1989). Every spring there is a canoe race down the Anthony Kill, going through Mechanicville, to the Hudson River.

Because of the proximity of residential neighborhoods to the site, and because the stream is used for recreational purposes, it is likely that people contact the surface water in the Anthony Kill. Surface water data collected from the

Anthony Kill do not indicate that site-related contaminants are present at detectable levels. Therefore, exposure by this pathway will not be assessed further.

5.2.4 Sediment Exposure Pathway

Site-related contaminants were found in the sediments of the Anthony Kill, primarily in the samples collected adjacent to the site (SED-2). Individuals who might contact these sediments could be exposed to site-related contamination. In addition to the contaminants found in the sediments, there has been an unconfirmed report of coal tar from the site seeping into the Anthony Kill (E.C. Jordan, 1989).

Public contact with contaminated sediments is possible because the stream is used for recreational purposes. Also, each year residents of Mechanicville clear away debris that collects in the stream for an annual canoe race to the Hudson River (Erano, 1989). Sediment exposure could occur if canoeists get out of their boats and contact the contaminated sediments. On occasion, town workers enter the stream near the site to clear debris or to work on the North Central Avenue Bridge. During such activities, workers could be exposed to contaminated sediments. Therefore, potential exposures of both the general public and construction workers to contaminants in the sediments of the Anthony Kill will be assessed.

5.2.5 Inhalation Exposure Pathway

The possibility of current site users inhaling VOCs was investigated by monitoring indoor air on the site. The indoor air sampling program was described in Section 2.7 and the results of the indoor air evaluation are discussed in Section 7.3.

Residents living near the site could be exposed to site-related contaminants by the inhalation of fugitive dust. Coal tar contaminants could be released to the air during the excavation of contaminated soil from such activities as underground utility repair. If the excavated soil were to remain stockpiled on the site, the soil pile could act as a source of fugitive dust. Contaminants can become airborne by vaporizing or by aerosolizing as particulate-bound contaminants from wind erosion of excavated soil. These contaminants could potentially be inhaled by residents downwind of the Mechanicville site during the period such activities occur. Therefore, exposure of residents to site-related compounds via the inhalation pathway will be evaluated.

Utility workers may also be exposed to these volatile compounds and particulate emissions. Worker exposure will be evaluated by comparing modeled ambient concentrations to worker health standards, to assess compliance with health and safety regulations.

5.2.6 Additional Potential Routes of Exposure

If the site were to be used in the future for other purposes, existing above- and below-ground structures would most likely be removed. The site could be regraded, which might lead to potential dermal and inhalation exposures. As stated earlier, future plans for the site include possible leasing for a car dealership, in which event the existing underground fuel tank would probably be removed (O'Meara and Martin, 1989). This removal could result in subsurface soil exposure of workers. However, the length of time required for the underground tank removal is expected to be minimal relative to the time predicted for soil excavation during utility repairs. Various dust control measures can eliminate this exposure pathway. NYSEG recognizes that, should this activity occur, protective measures would need to be taken. Inhalation exposures associated with the removal of the underground tank or the regrading of the site will not be assessed further in this report.

5.3 EXPOSED POPULATION ANALYSIS

In this section, the general characteristics of the human population who represent potential receptors to site-related contamination will be discussed. The discussion includes identification of particularly sensitive subpopulations within the vicinity of the Mechanicville site, and land uses which would be associated with these populations.

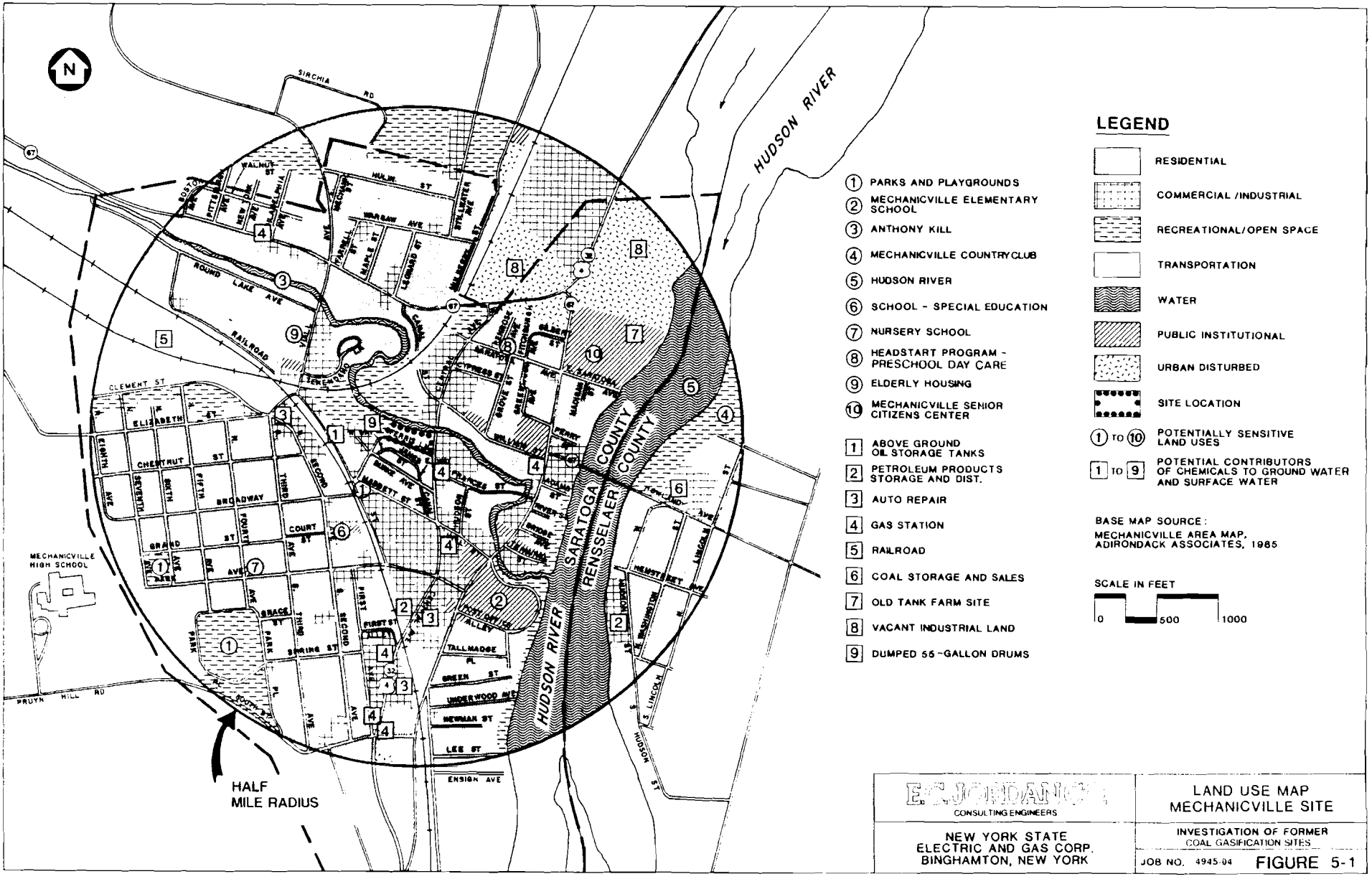
There are several subpopulations that are particularly sensitive to chemical exposures: the very young, the very old, and the infirm. The young are

particularly sensitive to chemical insult. This is because an equivalent dose of a harmful chemical will have a greater effect on a child than on an adult due to the child's smaller body weight (a dose is expressed as milligrams of contaminant per kilogram of body weight). A child's immature immune system is also more susceptible to insult than an adult's. The old and the infirm are sensitive because they typically suffer from other medical problems which decrease the body's ability to fight chemical insult. Also, the elderly and the infirm may take medication for their health problems which may exacerbate the effects of harmful chemicals on the body.

According to the 1980 US Census, the population of Mechanicville was 5,500. Of these 5,500, 733 people were under the age of 10, 621 were ages 10 to 18, and 943 were over 65. Approximately half of the people of Mechanicville can be considered to be potentially sensitive individuals.

Potentially sensitive subpopulations are often associated with certain land uses. These include daycare centers, schools, recreational areas, nursing homes, hospitals, waterways used for drinking water, and agricultural land used for food production.

Figure 5-1 shows land use within a one-half mile radius of the Mechanicville site. The area surrounding the site is primarily residential. Potentially sensitive land uses within a one-half mile radius from the Mechanicville site include a nursery school, an elementary school, a special education school, a day care center, an elderly housing project, several parks and playgrounds, and a large area of recreational/open space.



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CONSULTING ENGINEERS

NEW YORK STATE
ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

LAND USE MAP
MECHANICVILLE SITE

INVESTIGATION OF FORMER
COAL GASIFICATION SITES

JOB NO. 4945-04 FIGURE 5-1

5.4 CALCULATION OF BODY DOSE LEVELS

To estimate incurred body dose levels, two hypothetical exposure scenarios were developed. These reflect realistic worst case and most probable case exposure conditions. These scenarios differ by varying exposure parameters (e.g., duration of exposure, frequency of contact) and by varying environmental concentrations, using either the maximum concentration detected (realistic worst case) or the average concentration (most probable case). This approach provides a range of potentially incurred body dose levels that would presumably bracket actual exposures for a hypothetical individual. The hypothetical populations for these exposure scenarios are categorized as the general population, children (ages 1 to 6), older children (ages 8 to 18), and utility or construction workers.

Incurred body dose levels were calculated for dermal, oral, and inhalation exposures by multiplying the concentration of each contaminant by appropriate exposure parameters or factors. These factors include the following: frequency and duration of exposure, ventilation rate or sediment/soil contact rate, and the appropriate TKF. The equations used to calculate incurred body dose levels for carcinogenic and noncarcinogenic compounds are presented in Table 5-2.

Incurred body doses were estimated for both current and future potential exposures. Current exposures include the potential exposure of older children (ages 8 to 18) and workers to site-related contamination in sediments of the Anthony Kill (adjacent to the site) and older children (ages 8 to 18) to

TABLE 5-2

EQUATIONS USED TO ESTIMATE BODY DOSES

MECHANICVILLE SITE

CARCINOGENS

1. Inhalation:

$$\text{Average Daily Dose Over Lifetime (mg/kg/day)} = \text{Concentration in Medium (ug/m}^3\text{)} \times \text{Amount of Air Inhaled (m}^3\text{) per Event} \times \frac{1}{\text{Body Wt. (kg)}}$$

$$\times \frac{\text{Events/yr}}{365 \text{ days/yr}} \times \frac{\text{Yrs. Exposure}}{70 \text{ years}} \times \text{TKF}^{1} \times \frac{1 \text{ mg}}{1{,}000 \text{ ug}}$$

2. Direct Contact and Incidental Ingestion, Soil or Sediment

$$\text{Average Daily Dose Over Lifetime (mg/kg/day)} = \text{Concentration in Medium (ug/g)} \times [(\text{Soil Contacted (g) per Event} \times \text{Dermal TKF}) + (\text{Soil Ingested (g) per Event} \times \text{Oral TKF})] \times \frac{1}{\text{Body Wt. (kg)}}$$

$$\times \frac{\text{Events/yr}}{365 \text{ days/yr}} \times \frac{\text{Yrs. Exposure}}{70 \text{ years}} \times \frac{1 \text{ mg}}{1{,}000 \text{ ug}}$$

TABLE 5-2 (continued)

EQUATIONS USED TO ESTIMATE BODY DOSES
MECHANICVILLE SITE

NONCARCINOGENS

1. Inhalation:

$$\text{Average Daily Dose Over Period of Exposure (mg/kg/day)} = \text{Concentration in Medium } (\mu g/m^3) \times \text{Amount of Air Inhaled } (m^3) \text{ per Event} \times \frac{1}{\text{Body Wt. (kg)}} \times \frac{\text{Events/yr}}{365 \text{ days/yr}} \times \text{TKF} \times \frac{1 \text{ mg}}{1{,}000 \text{ ug}}$$

2. Direct Contact and Incidental Ingestion, Soil or Sediment:

$$\text{Average Daily Dose Level Over Period of Exposure (mg/kg/day)} = \text{Concentration in Medium } (\mu g/g) \times [(\text{Soil Contacted } (g) \text{ per Event} \times \text{Dermal TKF}) + (\text{Soil Ingested } (g) \text{ per Event} \times \text{Oral TKF})] \times \frac{1}{\text{Body Wt. (kg)}} \times \frac{\text{Events/yr}}{365 \text{ days/yr}} \times \frac{1 \text{ mg}}{1{,}000 \text{ ug}}$$

Note: TKF = Toxicokinetic Factor

surface soil. These exposures could occur by direct contact with and incidental ingestion of sediments and soil. (Incidental ingestion can occur when sediment or soil present on a person's hands is transferred to food or cigarettes, and is then ingested.) Future exposures include potential exposures to contaminated subsurface soil on the site during excavation activities. Workers on the site could be exposed by direct contact with and incidental ingestion of subsurface soil, and inhalation of volatilized organic compounds and airborne particulate contaminants. Future exposures may also include the general population, residents downwind of the site who may be exposed to VOCs and airborne particulate contaminants during excavation activities.

5.4.1 Exposure Parameters for Current Potential Exposures

As discussed above, incurred body doses were calculated for current potential exposures to site-related contaminants in sediments from the Anthony Kill. These doses were estimated for two populations: older children (ages 8 to 18) and construction workers.

Sediment Exposure Scenarios

Parameters used for body dose calculations of older children exposed to sediments are presented in Table 5-3. For this scenario, "children" refers to age 8 up to age 18 (children under 8 years of age would not be as likely to canoe the Anthony Kill). Older children were chosen to represent the general population because they are more sensitive to chemical insult than adults (as

TABLE 5-3

DERMAL AND ORAL EXPOSURE TO CONTAMINATED SEDIMENTS
DURING RECREATIONAL ACTIVITIES (1)
MECHANICVILLE SITE

	MOST PROBABLE CASE	WORST CASE
Average Body Weight (2)	45 kg	45 kg
Surface Area Exposed (3)	4970 cm^2	6097 cm^2
Soil Contacted (unit deposition) (4)	0.5 mg/cm^2	1.5 mg/cm^2
Incidental Ingestion (5)	50 mg/event	100 mg/event
Frequency of Exposure	1 events/yr	2 events/yr
Total Exposure Duration	5 yrs	10 yrs

Notes:

(1) Older children, ages 8 through 18

(2) Average body weight, males and females, Anderson et al., 1985

(3) Hands, forearms, feet, and lower legs, USEPA, 1989

(4) Shaum, 1984

(5) Lagoy, 1987

described in the previous section) and because it is more probable for older children to get out of their canoes and contact the sediments than adults.

The average body weight of the 8 to 18 age group is 45 kg (Anderson et al., 1985). The surface area exposed is assumed to be the hands, forearms, feet, and lower legs, and it is based on the 50th percentile (most probable) and 95th percentile (realistic worst). A frequency of one exposure per year was chosen to represent the most probable case because the canoe race occurs only once per year. Two exposures per year were assumed for the realistic worst case scenario. Even though older children could be exposed to Anthony Kill sediments more than once a year, it is unlikely that they would be adjacent to the site during each exposure. In addition, because it is most likely that only older children (i.e., ages 13-18) would be allowed to canoe down the stream, five years was chosen as a most probable exposure duration, while 10 years was chosen as the realistic worst case. Ten years represents the maximum possible exposure duration for the ages of 8 to 18.

Table 5-4 presents the parameters used for calculating incurred body doses of construction workers exposed to sediments in the Anthony Kill. It is assumed that construction workers could be exposed to contaminated sediments while performing such activities as repairing the Central Avenue Bridge. Only hands and forearms were assumed to be exposed because workers would most likely wear long pants, boots, and shirts which would limit the exposed surface area. The 50th percentile was used to calculate the most probable case surface area, while the 95th percentile was used to calculate the realistic worst case surface area. It was assumed that some sediment could remain on the hands

TABLE 5-4

DERMAL AND ORAL EXPOSURE TO CONTAMINATED SEDIMENTS
DURING CONSTRUCTION WORK IN THE ANTHONY KILL (1)
MECHANICVILLE SITE

	MOST PROBABLE CASE	REALISTIC WORST CASE
Average Body Weight	70 kg	70 kg
Surface Area Exposed (2)	2300 cm^2	2830cm^2
Sediment Contacted (unit deposition) (3)	0.5 mg/cm^2	1.5 mg/cm^2
Sediment Ingestion (4)	50 mg/event	100 mg/event
Frequency of Exposure	5 events/yr	10 events/yr
Total Exposure Duration	3 yrs	10 yrs

Notes

(1) Construction Workers

(2) Hands and forearms, Anderson et al., 1985

(3) Shaum, 1984

(4) Lagoy, 1987

after working and be incidentally ingested, and that the frequency of these exposures would be five or 10 days per year. The duration of exposure was assumed to be three years for the most probable case and ten years for the realistic worst case. Although construction-type work could occur for several years, it is unlikely that a particular worker would return to the same place for more than 10 years.

Soil Exposure Scenario

Table 5-5 presents the parameters used for calculating incurred body doses of trespassers to surface soil. Many of these parameters are the same as for sediment exposures. The potentially exposed population was assumed to be the same, older children between the ages 8-18 with an average body weight of 45 kg. Surface area, soil contacted, amount incidentally ingested, and the total exposure duration were also assumed to be the same. The frequency of exposure, however, differs in that exposure to surface soil is assumed to occur 5 days per year for a most probable case, and 10 days per year for a realistic worst case. Few exposures are assumed because access to the site is gained only by climbing a steep, highly vegetated slope.

5.4.2 Exposure Parameters for Future Potential Exposure

Incurred body doses were estimated for future potential exposures to both subsurface soil and air emissions. Subsurface soil exposure body doses were calculated for utility workers, while incurred body doses from inhalation of contaminants were estimated for the general population.

TABLE 5-5

DERMAL AND ORAL EXPOSURE TO CONTAMINATED SURFACE SOIL
DURING RECREATIONAL ACTIVITIES (1)
MECHANICVILLE SITE

	MOST PROBABLE CASE	REALISTIC WORST CASE
Average Body Weight (2)	45 kg	45 kg
Surface Area Exposed (3)	4970 cm^2	6097 cm^2
Soil Contacted (unit deposition) (4)	0.5 mg/cm^2	1.5 mg/cm^2
Incidental Ingestion (5)	50 mg/event	100 mg/event
Frequency of Exposure	5 events/yr	10 events/yr
Total Exposure Duration	5 yrs	10 yrs

Notes:

(1) Older children, ages 8 through 18

(2) Average body weight, males and females, Anderson et al., 1985

(3) Hands, forearms, feet, and lower legs, USEPA, 1989

(4) Shaum, 1984

(5) Lagoy, 1987

Subsurface Soil Exposure Scenario

Table 5-6 presents the exposure parameters used to estimate incurred body doses to utility workers via direct contact with and incidental ingestion of contaminated soil. Utility workers' hands and forearms only were assumed to be exposed to subsurface soil. It was also assumed that the frequency of utility repair activities in which the worker might be exposed to soil was relatively low (one or two days per year), although the pile of excavated soil could sit around for several days. The duration of exposure was assumed to be over a 2 or 4 year period, meaning that a worker could return to the site in subsequent years.

Inhalation Exposure Scenario

Exposure to VOCs on the site was evaluated by sampling indoor air. The indoor air sampling program is described in Section 2.7 and the results are evaluated in Section 7.3.2.

Table 5-7 presents the exposure parameters used to estimate incurred body doses due to inhalation of airborne particulates and volatile contaminants during utility repair activities. Although the general population downwind of the site could be exposed to particulate dust and volatiles, exposure doses were estimated for children only, ages 1 to 6, because they represent the most sensitive population. To estimate a child's incurred body dose due to inhalation exposure, Jordan assumed that the child could be exposed 24 hours a day at two different locations and during three different activities. These

TABLE 5-6

DERMAL AND ORAL EXPOSURE TO CONTAMINATED SOILS DURING UTILITY WORK (1) MECHANICVILLE SITE

	MOST PROBABLE CASE	REALISTIC WORST CASE
Average Body Weight	70 kg	70 kg
Surface Area Exposed (2)	2300 cm^2	2830 cm^2
Soil Contacted (unit deposition) (3)	0.5 mg/cm^2	1.5 mg/cm^2
Incidental Soil Ingestion (4)	50 mg/event	100 mg/event
Frequency of Exposure	1 day/yr	2 days/yr
Total Exposure Duration	2 yrs	4 yrs

Notes:

(1) Utility Workers

(2) Hands and forearms, Anderson et al., 1985

(3) Shaum, 1984

(4) Lagoy, 1987

TABLE 5-7
FUTURE INHALATION EXPOSURES (1)
DURING UTILITY WORK AND EXCAVATION
MECHANICVILLE SITE

	MOST PROBABLE CASE	REALISTIC WORST CASE
Average Body Weight	21 kg	21 kg
Duration of Utility Repair Activity	20 days	25 days
I. Child at Preschool		
Distance from Activity	750 ft	750 ft
Duration of Exposure	8 hrs	8 hrs
Inhalation Rate (light activity) (2)	0.8 m^3/hr	0.8 m^3/hr
II. Child at Home		
Distance from Activity	100 ft	100 ft
Duration of Exposure	6 hrs	6 hrs
Inhalation Rate (moderate activity) (2)	2.0 m^3/hr	2.0 m^3/hr
III. Child Asleep		
Distance from Activity	100 ft	100 ft
Duration of Exposure	10 hrs	10 hrs
Inhalation Rate (2)	0.4 m^3/hr	0.4 m^3/hr

Notes:

(1) Child 1 - 6 years of age, inhalation of volatile compounds and particulates

(2) USEPA, 1987

include attending pre-school and playing and sleeping at home. It is assumed that both of these locations are downwind of the site. The child was assumed to attend the nearest identified school, which was at an estimated distance of 750 feet from the site. The child was also assumed to live at the nearest identified residence, which is approximately 100 feet from the site.

Inhalation rates for the three activities are different: light activity during school, moderate activity during play, and a resting rate while asleep. Although actual utility repair might only take one or two days, the soil pile that was assumed to be stockpiled on the site could potentially remain on the site for several days after the repair work. Thus chemicals in the soil could volatilize, and particulates could be blown downwind, increasing the time that a child could be exposed to site-related contaminants. The soil pile was assumed to sit for 20 days (most probable case) or 25 days (realistic worst case), corresponding to exposure durations of 20 or 25 days.

As mentioned earlier, incurred body doses will not be estimated for workers onsite. Instead, the estimated concentrations of contaminants in air will be compared to Occupational Safety and Health Administration (OSHA) standards, specifically Permissible Exposure Levels (PELs).

Finally, although potentially contaminated subsurface soil may remain in a pile for several days at the site, incurred body doses for children due to direct contact with these soils will not be estimated. This is because, as stated earlier, access to the site is restricted.

6.0 AIR QUALITY MODELING OF FUGITIVE AIR EMISSIONS

Future inhalation exposures at the Mechanicville site are possible during activities such as underground utility repair. This section presents the air modeling approach used to predict particle and VOC emissions and the resulting downwind air concentrations.

6.1 INTRODUCTION

Currently, the Mechanicville site is not a source of fugitive air emissions because the site is covered with buildings and asphalt paving. However, if construction activities occurred (e.g., excavation of a trench to repair utility lines), contaminated shallow soils (at an average depth of 7 feet) could be dispersed into the air. In addition, VOCs could become airborne due to volatilization. As discussed in Section 5.0, two future potential scenarios involving excavation of soil have been identified in this risk assessment: removal of coal tar-related structures and utility repair. Since Jordan predicted the duration of volatile emissions to be 10 times longer for utility repair compared with tank removal, only utility repair activities are modeled.

Jordan used a two-step modeling process to estimate atmospheric concentrations of air contaminants potentially emitted from the Mechanicville site. In the first step, Jordan estimated contaminant emission rates. In the second step, Jordan estimated downwind ambient concentrations using air dispersion modeling.

The modeling process is summarized in the following paragraphs and is discussed in detail in Appendix D.

To predict emission rates for nonvolatile contaminants (i.e., PAHs and amenable cyanide), Jordan used USEPA-developed particle emission rates due to wind erosion and assumed the contaminant fraction of the particles to be equal to the soil fraction (Cowherd, 1985). For VOCs (assumed to be a source of exposure only during utility repair work when subsurface soil is exposed for more than a couple of days), Jordan estimated volatilization emission rates based on the total mass of each contaminant which could be volatilized. Jordan found that emission rates for volatilized contaminants, under assumed conditions, greatly exceeded the contaminant emission rates for particles.

6.2 ESTIMATE OF EMISSIONS

Jordan predicted emission rates of contaminants from the Mechanicville site for both particles (dust) and VOCs using the modeling methods described in this section.

6.2.1 Fugitive Dust Emissions

To predict total inhalable fugitive dust emissions, Jordan applied equations based on field research of surface mines and storage piles for various materials (Cowherd, 1985). These equations can be used to estimate contaminant emissions assuming contaminant concentration in the airborne dust equals the measured chemical concentrations in the surface soil.

Airborne inhalable particulate matter, defined as particles with an aerodynamic diameter equal to or smaller than 10 micrometers (um), are denoted by the symbol PM_{10}. Inhalable particulates can be retained by the body upon inhalation and contribute to inhalation exposure.

Estimates of contaminant emission rates were based upon PM_{10} emission factors for wind erosion, the duration of construction activities, the mass fraction of contaminant in the soil, and the exposed surface area of the contaminated soil (see Appendix D).

6.2.2 Volatilization Rates from Soil

The volatilization of contaminants through the soil is a complex process involving the mass transfer of volatiles from the soil particles into the air pores in the soil, mass transfer through the soil pore spaces, and mass transfer from the soil surface into the ambient air. To estimate the volatilization rates of organic chemicals from the contaminated soil, Jordan used a simplified but conservative approach.

Based on the mean soil concentration measured at the Mechanicville site, the mass (grams) of the contaminant in the soil for two soil volume cases was estimated. Contaminant emission rates due to volatilization from the surface soils were calculated (see Table D-2 in Appendix D) for the following two cases:

Most probable: 10 percent of VOC mass emitted over 20-day period

Worst case: 100 percent of VOC mass emitted over 30-day period

For the two cases, the emission rates due to volatilization from the exposed soil are assumed to remain constant over the specified period.

6.3 AIR QUALITY DISPERSION MODELS

After estimating contaminant emission rates for the different scenarios, Jordan used air dispersion models to estimate ambient air concentrations at selected distances to the receptor from the Mechanicville site. For modeling purposes, Jordan considered the soil piles from the hypothetical future site construction to be area sources with dimensions equaling the exposed soil surface area. Contaminant emissions were assumed to be mixed uniformly over a height equal to the height of the soil pile.

The ambient air concentrations were predicted as hourly values of contaminant concentrations. In order to relate these predictions to longer averaging times, conservative scaling factors recommended by USEPA (1977) were used to estimate longer-duration exposure concentrations. The 1-hour average concentration predictions were multiplied by 0.40 to obtain 24-hour average off-site concentrations, and by 0.70 to obtain 8-hour average on-site concentrations (see Appendix D).

6.4 AIR QUALITY MODELING RESULTS

The estimated ambient air concentrations due to fugitive dust emissions from soil erosion for the utility repair scenario are presented in Tables D-3 and D-4 in Appendix D. The ambient 1-hour average concentration was calculated based on an assumed D atmospheric stability class, and windspeeds of 4.0 m/s and 21.4 m/sec. These windspeeds are based on local climatological data to represent the most-probable and maximum hourly windspeeds, respectively.

Based on the emission rates for volatilization from surface soil, Table D-5 provides the chemical-specific 1-hour average VOC concentrations for the two contaminated soil volume cases (i.e., two utility repair scenarios). The ambient 1-hour average concentrations were calculated based on an assumed D atmospheric stability class and wind speed values of 2.0 and 4.0 m/sec. These assumed wind speeds are low, to be extremely conservative. It is unlikely that there would be 2.0 m/sec winds at a D stability class for extended periods.

7.0 COMPARISON OF RESULTS TO REGULATORY STANDARDS AND GUIDELINES

In this section analytical results are compared to relevant or applicable standards and guidelines which were identified from the following sources: (1) New York State standards and guidance values; (2) National Drinking Water Regulations; (3) USEPA Health Advisories; and (4) New York State Air Guide No. 1. Relevant and applicable standards and guidelines are listed in Table 7-1 and Table 7-2.

Regulatory standards and guidelines are not available for the chemicals detected in on-site soils. For groundwater and air, New York State standards and guidance values are used in this assessment for several reasons. Firstly, New York State has established standards and guidelines for many of the chemicals detected at the Mechanicville site, including all those chemicals regulated at the federal level. Secondly, where both federal and state criteria exist for a given chemical, the New York State standard is generally more stringent. New York State standards are enforced by regulation, while guidance values are not enforceable by law.

7.1 GROUNDWATER

The Mechanicville site is not located over a water supply aquifer. The nearest known water supply wells are about one mile southwest (upgradient) of the site in the Town of Halfmoon. Because Mechanicville groundwater is not currently used as a public potable water supply, drinking water standards are

TABLE 7-1

CRITERIA FOR CHEMICALS FOUND IN GROUNDWATER AND SURFACE WATER
MECHANICVILLE SITE

	NEW YORK STATE AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES (1)				NATIONAL DRINKING WATER REGULATIONS		EPA HEALTH ADVISORIES(4)	EPA AMBIENT WATER QUALITY CRITERIA (5)					NEW YORK STATE DRINKING WATER REGULATIONS
	CLASS D ----SURFACE WATER----		CLASS GA -----GROUNDWATER-----					----AQUATIC LIFE(6)----		----------HUMAN HEALTH (9)----------			
	STANDARDS	GUIDANCE VALUES	STANDARDS	GUIDANCE VALUES	MAXIMUM CONTAMINANT LEVELS(2)	MAXIMUM CONTAMINANT LEVEL GOAL(3)	LIFETIME ADULT EXPOSURE	ACUTE (7)	CHRONIC (8)	DRINKING WATER ONLY (10)	FISH CONSUMPTION ONLY	DRINKING WATER AND FISH CONSUMPTION	MAXIMUM CONTAMINANT LEVELS(18)
VOLATILE ORGANICS (mg/L)													
-VOLATILE AROMATICS-													
BENZENE	----	0.006	ND(11)	----	0.005(12)	0	----	5.3	----	0.00067	----	0.00066	0.005
TOLUENE	----	----	----	0.05	2.0(12)	2(12)	2	17.5	----	15	424	14.3	0.005
ETHYLBENZENE	----	----	----	0.05	0.7(12)	0.68(12)	0.7	32	----	2.40	3.28	1.4	0.005
STYRENE	----	----	0.931	----	0.005(12)	0(12)	0	----	----	----	----	----	0.005
TOTAL XYLENE	----	----	----	0.05	10(12)	10(12)	10	----	----	----	----	----	0.005
m - XYLENE	----	----	----	----	----	----	----	----	----	----	----	----	0.005
o - XYLENE	----	----	----	----	----	----	----	----	----	----	----	----	0.005
p - XYLENE	----	----	----	----	----	----	----	----	----	----	----	----	0.005
TRIMETHYLBENZENE	----	----	----	0.05	----	----	----	----	----	----	----	----	0.005
-OTHER-													
ACETONE	----	----	----	----	----	----	----	----	----	----	----	----	0.05
METHYLENE CHLORIDE	----	----	----	0.05	----	----	----	12	----	----	----	----	0.005
SEMIVOLATILE ORGANICS (mg/l)													
-PAH-													
ACENAPHTHENE	----	----	----	0.02	----	----	----	1.7	0.52	0.02(13)	----	0.05	0.05
ACENAPHTHYLENE	----	----	----	----	----	----	----	----	----	----	----	----	0.05
ANTHRACENE	----	----	----	0.05	----	----	----	----	----	----	----	----	0.05
BENZO(b)FLUORANTHENE	----	----	----	0.000002	----	----	----	----	----	0.0000031	----	0.0000028	0.05
BENZO(k)FLUORANTHENE	----	----	----	0.000002	----	----	----	----	----	0.0000031	----	0.0000028	0.05
BENZO(g,h,i)PERYLENE	----	----	----	----	----	----	----	----	----	----	----	----	0.05
BENZO(a)ANTHRACENE	----	----	----	0.000002	----	----	----	----	----	0.0000031	----	0.0000028	0.05
BENZO(a)PYRENE	----	0.0000012	ND	----	----	----	----	----	----	0.0000031	----	0.0000028	0.05
CHRYSENE	----	----	----	0.000002	----	----	----	----	----	0.0000031	----	0.0000028	0.05
DIBENZO(a,h)ANTHRACENE	----	----	----	----	----	----	----	----	----	----	----	----	0.05
FLUORANTHENE	----	----	----	0.05	----	----	----	3.98	----	0.19	0.054	0.042	0.05
FLUORENE	----	----	----	0.05	----	----	----	----	----	----	----	----	0.05
INDENO(1,2,3,-cd)PYRENE	----	----	----	0.000002	----	----	----	----	----	0.0000031	----	0.0000028	0.05
NAPHTHALENE	----	----	----	0.01	----	----	----	2.3	0.62	----	----	----	0.05
PHENANTHRENE	----	----	----	0.05	----	----	----	----	----	----	----	----	0.05
PYRENE	----	----	----	0.05	----	----	----	----	----	----	----	----	0.05
TOTAL CARCINOGENIC PAH	----	----	----	----	----	----	----	----	----	0.0000031	----	0.0000028	0.05
-OTHER-													
BIS(2-ETHYLHEXYL)PHTHALATE	----	----	4.2	----	----	----	----	0.94	0.003	21	50	15	0.05
TOTAL NEW YORK STATE REGULATED ORGANICS (14)	----	----	0.1	----	----	----	----	----	----	----	----	----	----

TABLE 7-1 (Continued)

CRITERIA FOR CHEMICALS FOUND IN GROUNDWATER AND SURFACE WATER
MECHANICVILLE SITE

	NEW YORK STATE AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES (1)				NATIONAL DRINKING WATER REGULATIONS		EPA HEALTH ADVISORIES(4)	EPA AMBIENT WATER QUALITY CRITERIA (5)					NEW YORK STATE DRINKING WATER REGULATIONS
	CLASS D ----SURFACE WATER---		CLASS GA -----GROUNDWATER-----					----AQUATIC LIFE(6)----		----------HUMAN HEALTH (9)----------			
	STANDARDS	GUIDANCE VALUES	STANDARDS	GUIDANCE VALUES	MAXIMUM CONTAMINANT LEVELS(2)	MAXIMUM CONTAMINANT LEVEL GOAL(3)	LIFETIME ADULT EXPOSURE	ACUTE (7)	CHRONIC (8)	DRINKING WATER ONLY (10)	FISH CONSUMPTION ONLY	DRINKING WATER AND FISH CONSUMPTION	MAXIMUM CONTAMINANT LEVELS(18)
-METALS-						**Other Chemicals (mg/L)**							
IRON	0.3	----	0.3	----	----	0.3(15)	----	----	----	----	----	----	0.3(15)
ZINC	(16)	----	5	----	----	5(15)	----	----	----	5(13)	----	5(13)	5.0(15)
-CYANIDE-													
TOTAL CYANIDE	----	----	0.2	----	----	----	0.2	----	----	----	----	----	----
FERRO-FERRI CYANIDE	----	----	----	----	----	----	----	----	----	----	----	----	----
FREE CYANIDE	0.022	----	----	----	----	----	----	0.0035	0.052	0.2	----	0.2	----
-OTHER-													
TOTAL RECOVERABLE PHENOLICS (17)	----	----	0.001	----	----	----	----	----	----	3.5	----	3.5	----
TOTAL ORGANIC CARBON	----	----	----	----	----	----	----	----	----	----	----	----	----
SULFATE	----	----	250.0	----	----	----	----	----	----	----	----	----	250(15)

NOTES:
(1) NYSDEC TECHNICAL AND OPERATIONAL GUIDANCE SERIES 85-W-38 AS REVISED APRIL 1, 1987. CLASS D SURFACE WATER ARE SUITABLE FOR SECONDARY CONTACT RECREATION; CLASS GA DENOTES FRESH GROUNDWATER WHICH IS A SOURCE OF POTABLE WATER SUPPLY.
(2) MCLs (MAXIMUM CONTAMINANT LEVELS) ARE ENFORCEABLE STANDARDS FOR PUBLIC WATER SUPPLY SYSTEMS PROMULGATED UNDER THE SAFE DRINKING WATER ACT (40 CFR PART 141).
(3) MCLGs (MAXIMUM CONTAMINANT LEVEL GOALS) ARE PROPOSED NON-ENFORCEABLE HEALTH GOALS AND HAVE BEEN SET AT A LEVEL OF NO KNOWN OR ANTICIPATED HEALTH AFFECTS.
(4) EPA HEALTH ADVISORIES (FORMERLY SNARLs) ARE NON-ENFORCEABLE CRITERIA ESTABLISHED BY THE OFFICE OF DRINKING WATER. THEY ARE SET AT LEVELS WHERE ADVERSE HEALTH EFFECTS ARE NOT EXPECTED.
(5) WATER QUALITY CRITERIA WERE FORMULATED TO PROTECT AQUATIC LIFE AND HUMAN HEALTH FROM POLLUTANTS IN SURFACE WATERS. (40 CFR SUMMARY, FRI, NOV. 28, 1980, P.79318-79379). WATER QUALITY CRITERIA HAVE NO REGULATORY IMPACT, BUT ARE USEFUL IN ESTABLISHING WATER QUALITY-BASED EFFLUENT LIMITATIONS, WATER QUALITY STANDARDS, AND TOXIC POLLUTANT EFFLUENT STANDARDS.
(6) GUIDANCE CRITERIA FOR THE PROTECTION OF FRESHWATER AQUATIC LIFE. CONCENTRATIONS SPECIFIED SHOULD PROTECT MOST (BUT NOT NECESSARILY ALL) AQUATIC FRESHWATER LIF AND ITS USES.
(7) THE ACUTE TOXICITY LEVEL IS THE MAXIMUM TO WHICH ORGANISMS CAN BE EXPOSED WITHOUT SIGNIFICANT RISK OF ADVERSE IMPACT.
(8) CHRONIC TOXICITY LEVEL IS THE 24-HOUR AVERAGE VALUE THAT ORGANISMS CAN BE EXPOSED TO WITHOUT SIGNIFICANT RISK OF ADVERSE IMPACT.
(9) HUMAN HEALTH GUIDELINES WERE DERIVED BASED ON "GUIDELINES AND METHODOLOGY USED IN THE PREPARATION OF HEALTH EFFECT ASSESSMENT CHAPTERS OF THE CONSENT WATER CRITERIA DOCUMENTS" DEVELOPED BY EPA's OFFICE OF RESEARCH AND DEVELOPMENT.
(10) THESE ADJUSTED CRITERIA, FOR DRINKING WATER INGESTION ONLY, WERE DERIVED FROM PUBLISHED EPA AWOC FOR COMBINED FISH AND DRINKING WATER INGESTION AND FOR FISH INGESTION ALONE. THESE ADJUSTED VALUES ARE NOT OFFICIAL EPA AWQC, BUT MAY BE APPROPRIATE FOR SUPERFUND SITES WITH CONTAMINATED GROUNDWATER. (USEPA SUPERFUND PUBLIC HEALTH EVALUATION MANUAL, OCTOBER 1986, PAGES 61-64.)
(11) ND = DETECTABLE BY USEPA METHODS 602 OR 624 (BENZENE) OR METHODS 610 OR 625 (BENZO(a)PYRENE).
(12) PROPOSED
(13) TO PROTECT AGAINST TASTE AND ODOR EFFECTS; NOT HEALTH BASED.
(14) NEW YORK STATE WAS A MAXIMUM WATER QUALITY VALUE OF 0.1 MG/L OF DESIGNATED ORGANIC CHEMICALS FOR SURFACE WATER AND GROUNDWATER DISCHARGES REQUIRING PERMITS. THE DESIGNATED ORGANICS INCLUDE ALL OF THE ORGANIC CHEMICALS LISTED EXCEPT ACENAPHTHYLENE, BENZO(g,h,l)PERYLENE DIBENZO(a,h)ANTHRACENE, AND STYRENE.
(15) SECONDARY MAXIMUM CONTAMINANT LEVELS WHICH APPLY TO PUBLIC WATER SYSTEMS. THESE REGULATIONS CONTROL CONTAMINANTS IN DRINKING WATER THAT PRIMARILY AFFECT THE AESTHETIC QUALITIES RELATING TO THE PUBLIC ACCEPTANCE OF DRINKING WATER (40 CFR PART 143).
(16) ZINC STANDARD FOR CLASS D WATERS IS DETERMINED BY THE FORMULA EXP(0.83[LW(PPH HARDNESS)] + 1.95) AND APPLIES TO THE ACID SOLUBLE FORM.
(17) AS MEASURE BY APHA METHOD 510.8 WHICH IS EQUIVALENT TO EPA METHOD 420.1 (SEE APHA, 1985; USEPA, 1983).
(18) N.Y. DEPT. OF HEALTH REGULATIONS, SUBPART 5-1 OF PART 5 OF TITLE 10, EFFECTIVE 1/19/90.

TABLE 7-2

POTENTIALLY APPLICABLE STANDARDS AND GUIDELINES
FOR AIRBORNE CHEMICALS MODELED FROM TASK 2 AND TASK 3 SOIL SAMPLES
MECHANICVILLE SITE

CONTAMINANT	NEW YORK STATE AALs (ug/m3)
-VOLATILE AROMATICS-	
Benzene	100 (1)
Toluene	7,500 (1)
Ethyl Benzene	1,450 (1)
Styrene	716 (1)
Xylene	1,450 (1)
-OTHER-	
Methylene Chloride	1,167 (1)
-PAH-	
Acenaphthene	-- (2)
Acenaphthylene	--
Anthracene	--
Benzo(b)Fluoranthene	--
Benzo(k)Fluoranthene	--
Benzo(g,h,i)Perylene	--
Benzo(a)Anthracene	--
Benzo(a)Pyrene	--
Chrysene	--
Dibenzo(a,h)Anthracene	--
Fluoranthene	--
Fluorene	--
Ideneo(1,2,3-cd)Pyrene	--
Naphthalene	167
Phenanthrene	--
Pyrene	--
-OTHER-	
Bis(2-Ethylhexyl)Phthalate	--

TABLE 7-2 (continued)

POTENTIALLY APPLICABLE STANDARDS AND GUIDELINES
FOR AIRBORNE CHEMICALS MODELED FROM TASK 2 AND TASK 3 SOIL SAMPLES
MECHANICVILLE SITE

CONTAMINANT	NEW YORK STATE AALs (ug/m^3)
-METALS-	
Iron	0.167 (3)
Zinc	--
-CYANIDE-	
Total Cyanide	16.7 (1)(4)
Ferro-Ferri Cyanide	--
Amenable Cyanide	--
-OTHER-	
Total Recoverable Phenolics	--
Total Organic Carbon	--
Total New York State Regulated Organics	--

NOTES:

(1) Interim Ambient Air Level (AAL), Derived from American Conference of Governmental and Industrial Hygienists Time-weighted Average Threshold Limit Value (ACGIH TWA-TLV).

(2) Not available

(3) Proposed AAL - Personal Communication with Stanley Byer, NYSDEC, 12/14/88.

(4) As cyanide.

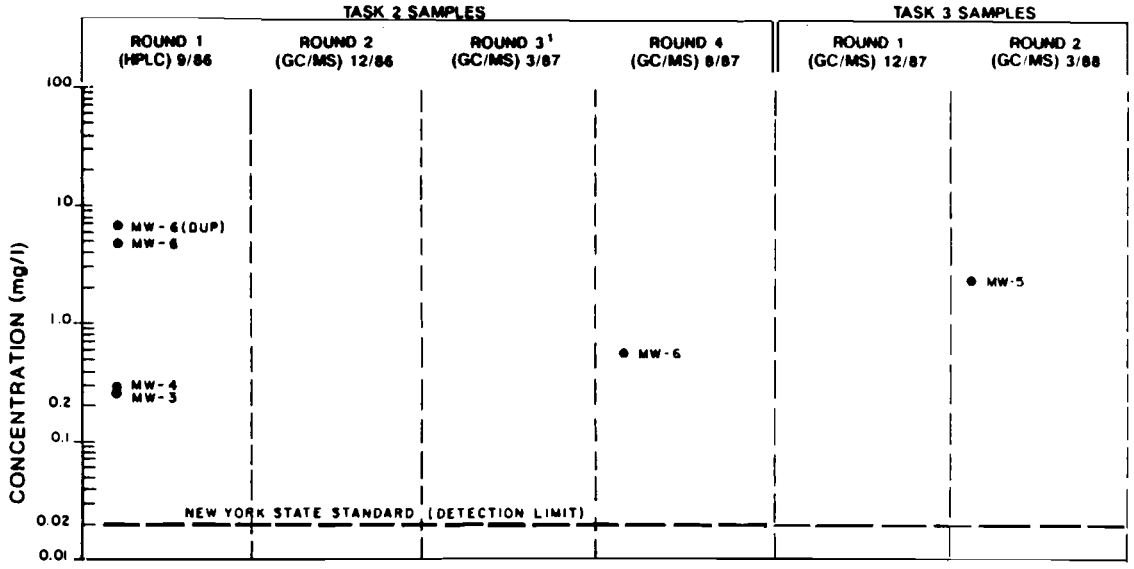
PAH = Polynuclear Aromatic Hydrocarbon.

not presently applicable. They are included for hypothetical comparison purposes only and are listed in Table 7-1.

The New York State standards and guidelines are for groundwater used as a source of potable water. The federal Maximum Contaminant Levels (MCLs) are enforceable standards for water supply systems promulgated under the authority of the federal Safe Drinking Water Act (SDWA). Maximum Contaminant Level Goals (MCLGs) are nonenforceable health goals established under the same act to prevent any adverse health effects or risks, without considering the cost or feasibility of attainment. USEPA Health Advisories are nonenforceable guidelines established by the Office of Drinking Water. They are set at levels where adverse health effects are not expected. Carcinogenic risks are not considered in setting USEPA Health Advisories. However, these advisories consider the length of exposure to the chemical in drinking water. The values shown in Table 7-1 are for lifetime adult exposure. Assumptions were made about the weight of the exposed individuals and the amount of water ingested in developing these values.

As shown in Table 7-1, groundwater (Class GA) standards have been promulgated by New York State for 10 of the chemicals detected in groundwater beneath the Mechanicville site: benzene, styrene, benzo(a)pyrene, bis(2-ethylhexyl) phthalate, total regulated organics, iron, zinc, cyanide, phenolic compounds, and sulfate. Concentrations in excess of the New York State standard were measured for each of these chemicals except bis(2-ethylhexyl) phthalate, sulfate and zinc. The exceedances are graphically depicted in Figures 7-1 through 7-5.

BENZO (a) PYRENE IN GROUNDWATER



SAMPLES IN WHICH BENZO (a) PYRENE WAS NOT DETECTED

ROUND 1 (HPLC) 9/86	ROUND 2 (GC/MS) 12/86	ROUND 3[1] (GC/MS) 3/87	ROUND 4 (GC/MS) 8/87	ROUND 1 (GC/MS) 12/87	ROUND 2 (GC/MS) 3/88
MW-1[2]	MW-1	MW-1	MW-1	MW-1	MW-1
MW-1(GC/MS)[2]	MW-2	MW-2	MW-2	MW-2	MW-2
MW-2	MW-2 (DUP)	MW-3	MW-3	MW-3[2]	MW-2(DUP)
MW-3(GC/MS)[2]	MW-3	MW-4	MW-4	MW-4	MW-3[2]
MW-5	MW-4	MW-6	MW-5	MW-5	MW-4
	MW-5	MW-6(DUP)	MW-5(DUP)	MW-6[2]	MW-6
	MW-6			MW-10	MW-10
				MW-11	MW-11
				MW-11(DUP)	MW-12[2]
				MW-12	MW-13[2]
				MW-13	MW-13(DUP)[2]
				MW-14	MW-14
				MW-15	MW-15
				MW-15(DUP)	

[1] MW-5 WAS NOT SAMPLED IN ROUND 3.
[2] TRACE CONCENTRATIONS DETECTED BELOW QUANTIFIABLE REPORTING LIMIT

E.C. JORDAN CO.
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CLIENT
NEW YORK STATE ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

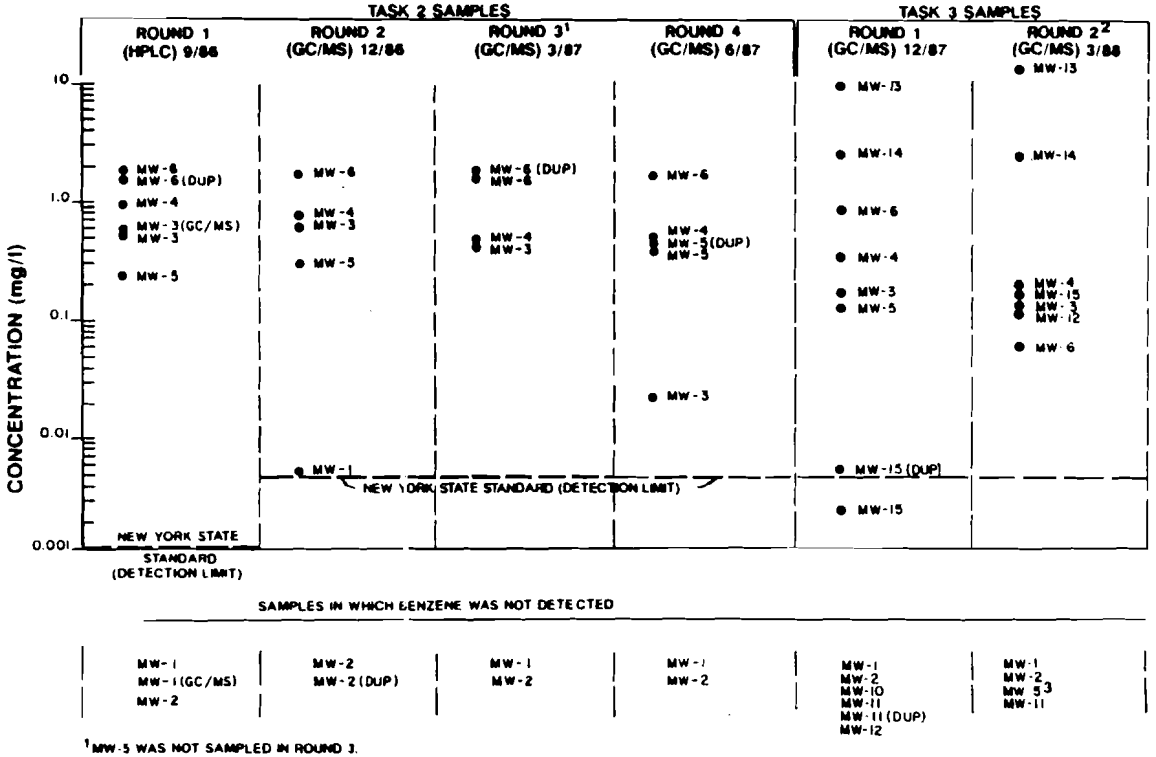
TITLE
BENZO (a) PYRENE IN GROUNDWATER
MECHANICVILLE SITE

INVESTIGATION OF FORMER COAL GASIFICATION SITES

PROJECT NO 4945-04

FIGURE 7-1

BENZENE IN GROUNDWATER



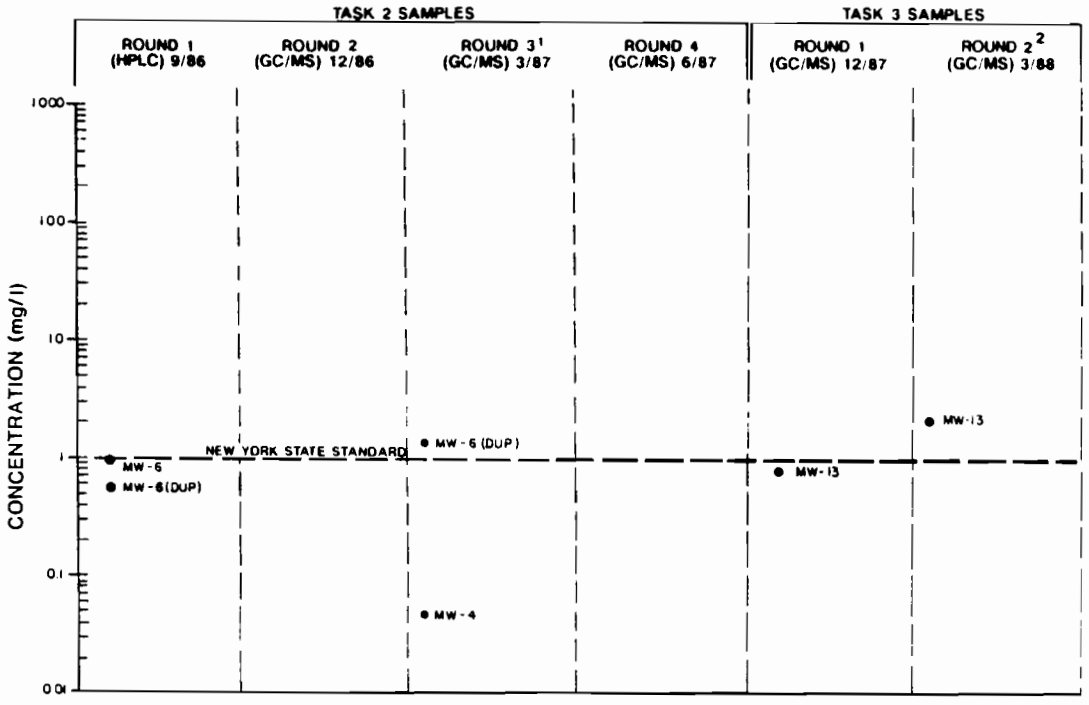
[1] MW-5 WAS NOT SAMPLED IN ROUND 3.

[2] BENZENE ANALYSIS WAS NOT PERFORMED ON ROUND 2 SAMPLES, MW-2(DUP), MW-10, AND MW-13(DUP).

[3] TRACE CONCENTRATIONS DETECTED BELOW QUANTIFIABLE REPORTING LIMIT.

E.C. JORDAN CO. CONSULTING ENGINEERS	TITLE: BENZENE IN GROUNDWATER MECHANICVILLE SITE
CLIENT: NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
PROJECT NO. 4945-04	FIGURE 7-2

STYRENE IN GROUNDWATER



SAMPLES IN WHICH STYRENE WAS NOT DETECTED

ROUND 1 (HPLC) 9/86	ROUND 2 (GC/MS) 12/86	ROUND 3[1] (GC/MS) 3/87	ROUND 4 (GC/MS) 6/87	ROUND 1 (GC/MS) 12/87	ROUND 2[2] (GC/MS) 3/88
MW-1	MW-1	MW-1	MW-1	MW-1	MW-1
MW-1(GC/MS)	MW-2	MW-2	MW-2	MW-2	MW-2
MW-2	MW-2(DUP)	MW-3	MW-3	MW-2(DUP)	MW-3
MW-3	MW-3	MW-6	MW-4	MW-3	MW-4
MW-3(GC/MS)	MW-4		MW-5	MW-4	MW-5
MW-4	MW-5		MW-5(DUP)	MW-5	MW-6
MW-5	MW-6		MW-6	MW-6	MW-11
				MW-10	MW-12
				MW-11	MW-14 MW-15
				MW-11(DUP)	
				MW-12	
				MW-14	
				MW-15	
				MW-15(DUP)	

[1] MW-5 WAS NOT SAMPLED ON ROUND 3.

[2] STYRENE ANALYSIS WAS NOT PERFORMED ON ROUND 2 SAMPLES MW-2(DUP), MW-10, AND MW-13(DUP).

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TITLE
STYRENE IN GROUNDWATER
MECHANICVILLE SITE

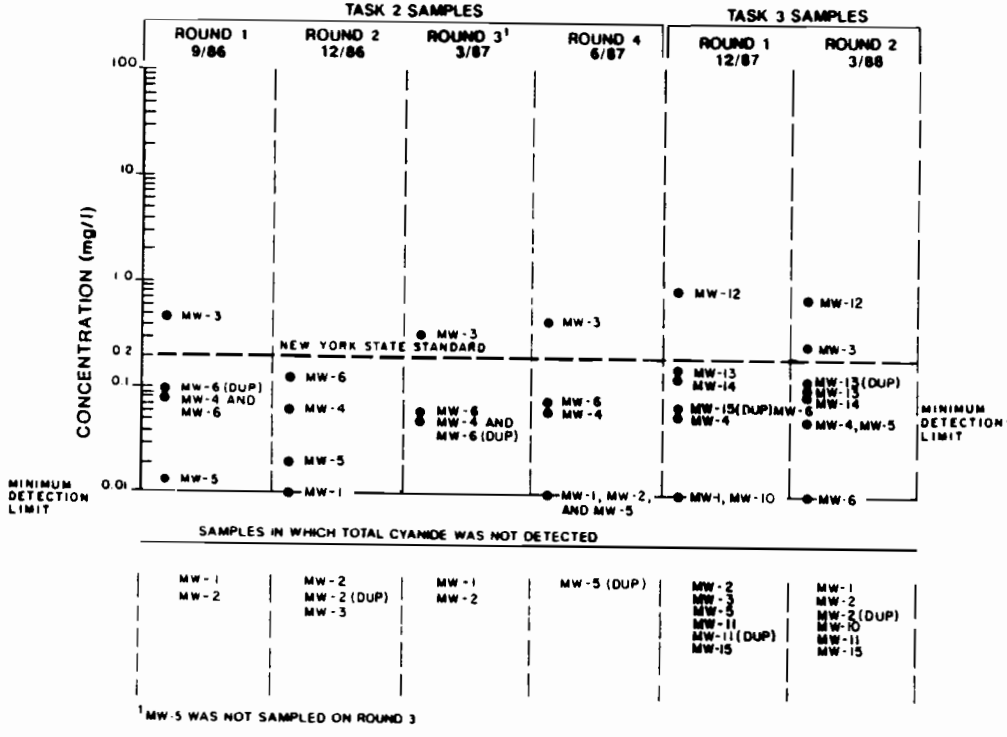
CLIENT
NEW YORK STATE ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

INVESTIGATION OF FORMER COAL GASIFICATION SITES

PROJECT NO 4945-04

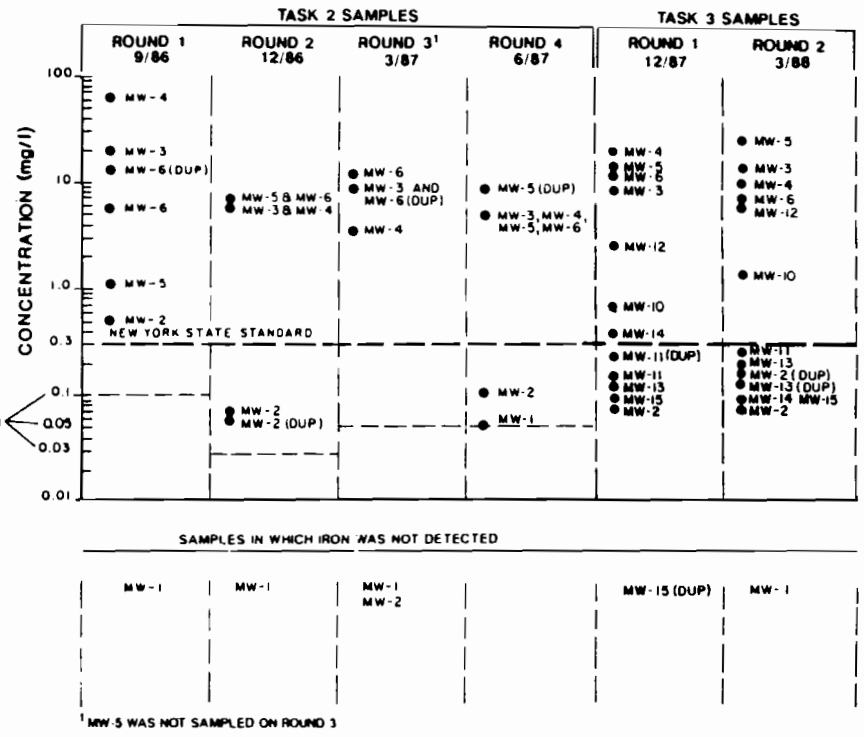
FIGURE 7-3

TOTAL CYANIDE IN GROUNDWATER



[1] MW-5 WAS NOT SAMPLED ON ROUND 3

IRON IN GROUNDWATER



[1] MW-5 WAS NOT SAMPLED ON ROUND 3

E.C. JORDAN CO.
CONSULTING ENGINEERS

TITLE: TOTAL CYANIDE AND IRON IN GROUNDWATER
MECHANICVILLE SITE

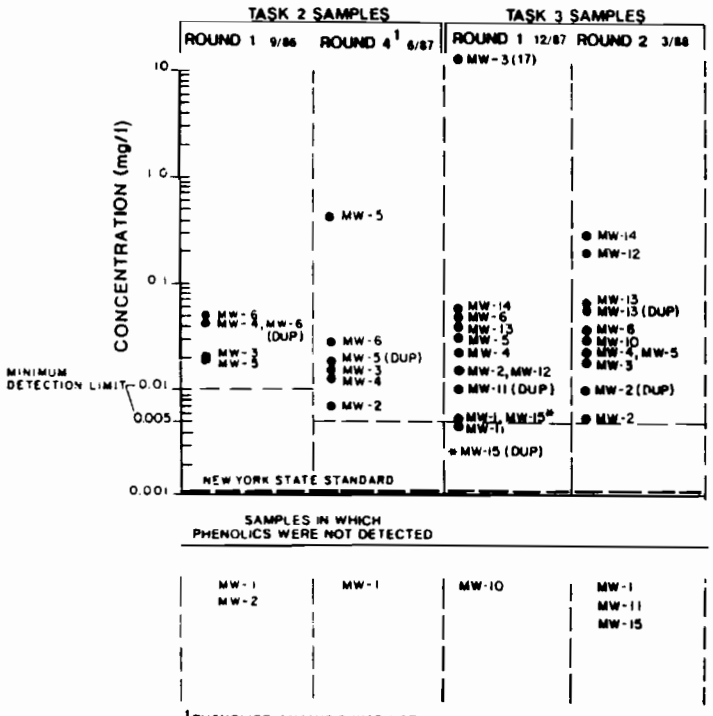
CLIENT: NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK

INVESTIGATION OF FORMER COAL GASIFICATION SITES

PROJECT NO. 4945-04

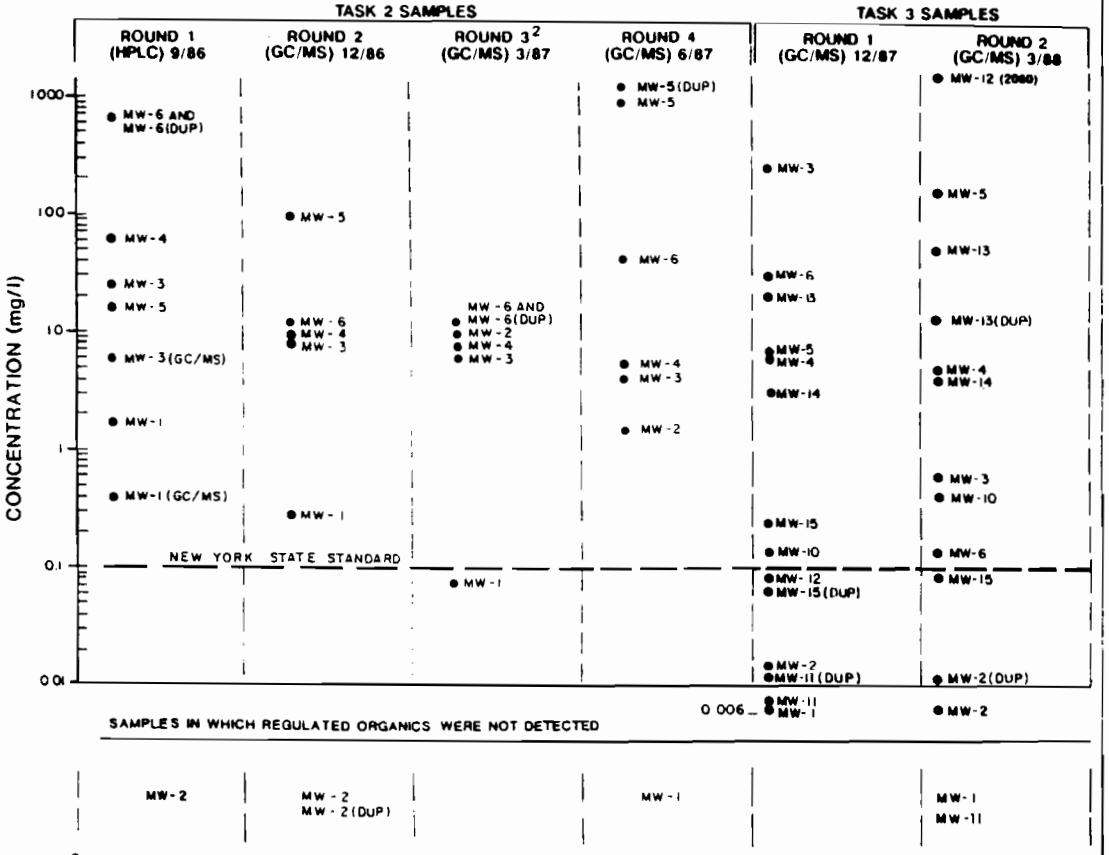
FIGURE 7-4

PHENOLICS IN GROUNDWATER



[1] PHENOLICS ANALYSIS WAS NOT PERFORMED ON SAMPLES FROM ROUNDS 2 AND 3.

TOTAL NEW YORK STATE REGULATED ORGANICS IN GROUNDWATER[1]



[2] MW-5 WAS NOT SAMPLED ON ROUND 3

[1] THE N.Y. STATE CLASS GA STANDARD FOR ORGANICS INCLUDES PHENOLIC COMPOUNDS, VOLATILE ORGANICS, AND SEMI-VOLATILE ORGANICS, EXCEPT FOR ACETONE, STYRENE, ACENAPHTHYLENE, BENZO(G,H,I)PENYLENE, DIBENZO(A,H)ANTHRACENE, AND BIS(2-ETHYLHEXYL)PHTHALATE.

E.C. JORDAN CO. CONSULTING ENGINEERS	TITLE: PHENOLICS AND TOTAL N.Y. STATE REGULATED ORGANICS IN GROUNDWATER MECHANICVILLE SITE
CLIENT: NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
PROJECT NO 4945-04	FIGURE 7-5

During Task 2, the standard for benzo(a)pyrene (nondetectable levels) was exceeded at MW-3, MW-4 and MW-6 in at least one sampling round. Except for one exceedance, all of these occurred during Round 1 when HPLC analysis was used. One Task 3 sample from MW-5 exceeded the standard and trace levels were detected in samples from MW-3, MW-6, MW-12 and MW-13.

The benzene standard for groundwater (nondetectable levels) was exceeded at MW-1, MW-3, MW-4, MW-5 and MW-6 in Task 2. During Task 3, the standard was exceeded at MW-3, MW-4, MW-5, MW-6, MW-12, MW-13, MW-14 and MW-15.

The styrene standard (0.931 mg/L) was exceeded only in the MW-6 Round 3 sample taken during Task 2. During Task 3, all four samples from MW-13 exceeded the standard. Styrene was not detected in any other wells during Task 3.

During Task 2, the New York State standard for regulated organics (0.1 mg/L) was exceeded at MW-1, MW-2, MW-3, MW-4, MW-5 and MW-6. During Task 3, the standard was exceeded at all wells except MW-2 and MW-11.

Total cyanide concentrations above the 0.2 mg/L standard were found at MW-3 during Task 2. During Task 3, the standard was exceeded in MW-3 and MW-12.

The iron standard of 0.3 mg/L was exceeded at MW-2, MW-3, MW-4, MW-5 and MW-6 during Task 2. During Task 3, concentrations above the standard were detected in all wells except MW-1, MW-2, MW-13 and MW-15.

Phenolic compounds exceeded the 0.001 mg/L standard at MW-2, MW-3, MW-4, MW-5, and MW-6 during Task 2. In Task 3, the standard was exceeded in all wells except MW-11.

The New York State Department of Health has also promulgated Maximum Contaminant Levels (MCLs) for most of the compounds of interest at Mechanicville. Table 7-3 identifies groundwater samples containing chemicals in excess of these drinking water standards.

New York State has guidance values for 16 chemicals detected at Mechanicville, all of which were exceeded at one or more monitoring wells. Groundwater samples that contained chemicals in excess of the New York State guidance values are listed in Table 7-4.

7.2 SURFACE WATER

Table 7-1 also contains relevant federal and state criteria for surface water. The New York State criteria are for Class D waters which is the classification of the Anthony Kill near the Mechanicville site. USEPA Ambient Water Quality Criteria (AWQC) for aquatic life and human health are also listed.

Iron was the only chemical identified in the Anthony Kill surface water samples that exceeded the New York State Class D standards. The iron standard of 0.3 mg/L was exceeded at all sampling locations (upstream, adjacent to the site, downstream) during both Task 2 and Task 3 sampling. The chronic AWQC for bis(2-ethylhexyl)phthalate was exceeded during Task 2 sampling at all

TABLE 7-3

GROUNDWATER SAMPLES CONTAINING CHEMICALS
IN EXCESS OF NEW YORK STATE DEPARTMENT OF HEALTH
MAXIMUM CONTAMINANT LEVELS
MECHANICVILLE SITE

CHEMICAL	MCL (mg/L)[1]	WELL NUMBER
Volatile Aromatics		
Benzene	0.005	MW-1, MW-3, MW-4, MW-5, MW-6 MW-12, MW-13, MW-14, MW-15
Toluene	0.005	MW-3, MW-4, MW-5, MW-6, MW-13, MW-14
Ethylbenzene	0.005	MW-3, MW-4, MW-5, MW-6, MW-12, MW-13, MW-14
Styrene	0.005	MW-4, MW-6, MW-13
Total Xylenes	0.005	MW-1, MW-3, MW-4, MW-5, MW-6, MW-10, MW-12, MW-13, MW-14, MW-15
Trimethylbenzene	0.005	MW-4, MW-5, MW-6
PAHs		
Acenaphthene	0.02	MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-10, MW-12, MW-14
Acenaphthylene	0.05	MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-13
Anthracene	0.05	MW-3, MW-4, MW-5, MW-6, MW-12
Benzo(b)fluoranthene	0.05	MW-6
Benzo(k)fluoranthene	0.05	MW-5, MW-6
Benzo(a)anthracene	0.05	MW-3, MW-5
Benzo(a)pyrene	0.05	MW-3, MW-4, MW-6
Chrysene	0.05	MW-3, MW-4, MW-5, MW-6
Fluoranthene	0.05	MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-12, MW-13

TABLE 7-3 (continued)

GROUNDWATER SAMPLES CONTAINING CHEMICALS
IN EXCESS OF NEW YORK STATE DEPARTMENT OF HEALTH
MAXIMUM CONTAMINANT LEVELS
MECHANICVILLE SITE

CHEMICAL	MCL (mg/L)[1]	WELL NUMBER
	.01	
Naphthalene	0.05	MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-12, MW-13, MW-14
Phenanthrene	0.05	MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-12, MW-13
Pyrene	0.05	MW-3, MW-4, MW-5, MW-6, MW-12, MW-13
Other Chemicals		
Iron	0.3*	MW-2, MW-3, MW-4, MW-5, MW-6, MW-10, MW-12
Zinc	5.0*	MW-4, MW-5

Notes:

(1) NY Dept. of Health Regulations, Title 1C, Part 5, Subpart 5-1; effective 1/19/90
(2) POL - Principal Organic Contaminant
UOL - Unspecified Organic Contaminant
* - Secondary MCL

TABLE 7-4

GROUNDWATER SAMPLES CONTAINING CHEMICALS
IN EXCESS OF NEW YORK STATE GUIDANCE VALUES
MECHANICVILLE SITE

CHEMICAL	GUIDANCE VALUE (mg/l)[1]	WELL NUMBER
Volatile Aromatics		
Toluene	0.05	MW-3 MW-4 MW-5 MW-6 MW-13 MW-14
Ethylbenzene	0.05	MW-3 MW-4 MW-5 MW-6 MW-12 MW-13 MW-14
Total Xylene	0.05	MW-3 MW-4 MW-5 MW-6 MW-12 MW-13 MW-14
Trimethylbenzene	0.05	MW-4 MW-6
Methylene Chloride	0.05	MW-13 MW-6
PAHs		
Acenaphthene	0.02	MW-1 MW-2 MW-3 MW-5 MW-6 MW-10 MW-12 MW-14 MW-15

TABLE 7-4 (Continued)

GROUNDWATER SAMPLES CONTAINING CHEMICALS
IN EXCESS OF NEW YORK STATE GUIDANCE VALUES
MECHANICVILLE SITE

CHEMICAL	GUIDANCE VALUE (mg/l)[1]	WELL NUMBER
Anthracene	0.05	MW-3 MW-4 MW-5 MW-6 MW-12
Benzo(k)Fluoranthene	0.000002	MW-5 MW-6
Benzo(a)Anthracene	0.000002	MW-3 MW-5
Benzo(b)Fluoranthene	0.000002	MW-6
Benzo(a)Fluoranthene	0.000002	MW-3 MW-5
Fluoranthene	0.05	MW-1 MW-2 MW-3 MW-4 MW-5 MW-6 MW-12 MW-13
Fluorene	0.05	MW-1 MW-3 MW-4 MW-5 MW-6 MW-12

TABLE 7-4 (Continued)

GROUNDWATER SAMPLES CONTAINING CHEMICALS
IN EXCESS OF NEW YORK STATE GUIDANCE VALUES
MECHANICVILLE SITE

CHEMICAL	GUIDANCE VALUE (mg/l)[1]	WELL NUMBER
Naphthalene	0.01	MW-1
		MW-2
		MW-3
		MW-4
		MW-5
		MW-6
		MW-12
		MW-13
		MW-14
		MW-15
Phenanthrene	0.05	MW-1
		MW-2
		MW-3
		MW-4
		MW-5
		MW-6
		MW-12
		MW-13
Pyrene	0.05	MW-3
		MW-4
		MW-5
		MW-6
		MW-12
		MW-13
Chrysene	0.000002	MW-1
		MW-3
		MW-4
		MW-5
		MW-6

[1]NYSDEC, Division of Water; Technical and Operational Guidance Series 86-W38; April 1987.

locations and, during Task 3, only at the upstream sampling location. Bis(2-ethylhexyl)phthalate was detected in a range attributable to laboratory contamination; therefore, it is unlikely to be a site-derived chemical.

7.3 AIR

Modeled ambient air concentrations of site-derived chemicals can be compared to New York State Acceptable Ambient Levels (AALs). Measured indoor air concentrations of selected analytes (benzene, toluene, ethylbenzene, and xylene) can be compared to worker standards for indoor exposure.

7.3.1 Ambient Air

New York State has promulgated guidelines for various toxic air contaminants (NYSDEC, 1985-1986). There are no federal air regulations applicable to the atmospheric release of the contaminants of concern at the Mechanicville site. The New York State Air Guide No. 1 establishes Acceptable Ambient Levels (AALs) and contaminant-specific levels for a variety of air contaminants. Interim AALs are based on the threshold limit value-time weighted average (TLV-TWA) concentration, adopted as guidance criteria by the American Conference of Governmental and Industrial Hygienists (ACGIH) (NYSDEC, 1985-1986). Contaminant-specific levels will be developed to replace interim AALs as more detailed data and information concerning these chemicals become available. Contaminant-specific AALs are based on an in-depth evaluation of the chemical in question; they are derived using a No-Observed-Effect-Level (NOEL) and applying safety factors.

The ACGIH criteria are for 5-day, 8-hour workplace exposures and assume no exposure during non-working hours. The New York State Interim AALs are equal to the ACGIH values divided by 300. This adjustment takes into account 24-hour exposure to the chemicals. AALs are annual average ambient concentrations that should not be exceeded for any off-site receptor. Table 7-2 shows AALs for contaminants of concern at the Mechanicville site. PAHs are considered "high" toxicity air contaminants. There are no chemical-specific AALs for this compound class.

A comparison of the modeled 24-hour ambient concentrations at the nearest off-site receptor (100 feet downwind) are compared to AALs in Table 7-5. For those compounds for which AALs exist, the modeled concentrations were several orders of magnitude lower than the respective AALs.

7.3.2 Indoor Air

Table 7-6 compares the results of the indoor air sampling program to various air standards and guidelines developed to protect workers exposed during an 8-hour work day. PELs set by OSHA and guidelines established by ACGIH and the National Institute of Occupational Safety and Health (NIOSH) are identified. All samples with detectable levels of benzene and toluene were well below OSHA, NIOSH, and ACGIH standards or guidelines. Neither ethylbenzene nor xylene were detectable.

TABLE 7-5

COMPARISON OF MODELED AMBIENT CONCENTRATIONS
AT 100 FT. DOWNWIND
OF SITE TO NEW YORK STATE
ACCEPTABLE AMBIENT LEVELS (ug/m^3)
MECHANICVILLE SITE

CONTAMINANT	NY AAL (ug/m^3)	MODELED 24-HOUR AVERAGE CONCENTRATION	
		MOST PROBABLE	REALISTIC WORST
CARCINOGENS			
Benzene	100	0.3	12.8
Methylene chloride	1167	0.001	0.06
NONCARCINOGENS			
Cyanide	16.7	0.00002	0.0009
Ethylbenzene	1450	0.2	10.1
Styrene	716	0.4	18.4
Toluene	7500	0.4	18.6
Xylenes	1450	0.9	37.7

TABLE 7-6

COMPARISON OF INDOOR AIR SAMPLING RESULTS
TO WORKER STANDARDS AND GUIDELINES
MECHANICVILLE SITE

	Worker Standards and Guidelines						Air Analytical Results - ppm							
							Office		Garage		Storeroom		Background	
		OSHA		NIOSH	ACGIH		OF-01	OF-02	GA-01	GA-02	ST-01	ST-02	BA-01	BA-02
Substance	TWA	CC	Peak	TWA	TLV	STEL	12/88	12/88	12/88	12/88	12/88	12/88	12/88	12/88
Benzene	10	25	50	1	10	25	0.03	0.031	0.016	0.015	0.043	0.043	ND	ND
Toluene	200	300	500	100	100	150	0.009	0.009	0.048	0.048	0.012	0.012	0.037	0.028

ND = Not detected. The minimum detection limits are: benzene - 0.013 ppm; ethylbenzene and xylenes - 0.01 ppm.

TWA = Time Weighted Average (8-hr)

CC = Ceiling Concentration

Peak = Maximum Duration 10 minutes in 8 hours

TLV = Threshold Limit Value

STEL = Short-Term (15 minute) Exposure Limit

7.4 SOIL AND SEDIMENT

Regulatory standards and criteria are not available for chemicals detected in the soil or sediment, at either the federal or state level.

8.0 PUBLIC HEALTH RISK CHARACTERIZATION

This section characterizes the risks to those populations who could potentially be exposed to contamination found at the Mechanicville site. The type and extent of risks depend on the nature, duration, and frequency of exposure to the contaminants, as well as the characteristics of the populations exposed. This exposure-related information, discussed in Section 5, combined with the dose/response data presented in Section 4, are the basis for this risk characterization.

Carcinogenic and noncarcinogenic risk estimates were calculated for each of the hypothetical exposure scenarios discussed in Section 5. Two types of hypothetical exposure scenarios were developed to reflect realistic worst and most probable case exposure conditions. These scenarios differ by varying exposure parameter and by ranging environmental concentrations, using the maximum concentration detected (realistic worst) or the average concentration (most probable case). Briefly, these scenarios include older children (ages 8 to 18) being exposed to on-site surface soil and sediment in the Anthony Kill, construction workers exposed to sediment, utility workers exposed to on-site subsurface soil, and children exposed to off-site volatile compounds and particulate dusts emanating from excavated soil.

Carcinogenic risk estimates were determined by multiplying the body-dose level for each carcinogen by its USEPA carcinogenic potency value and, for PAHs, by the ICF-Clement potency value as well. This calculation results in an estimate of an individual's incremental or excess cancer risk due to exposure to site-related contamination. Noncarcinogenic risk estimates were determined

by dividing the body-dose level for each noncarcinogen by the relevant standard, criterion, or guideline, resulting in a ratio called the risk ratio. Noncarcinogenic risk ratios for the individual compounds were then summed together to form a hazard index. To put these risk estimates into perspective, they were evaluated against target risk levels.

Target risk levels for carcinogenic compounds have been adopted from USEPA guidelines stating that the total incremental carcinogenic risk for an individual resulting from exposure at a hazardous waste site should be between 10^{-4} and 10^{-6}. (A risk of 10^{-4} is interpreted as an 1 in 10,000 chance of an individual developing cancer during a lifetime, as a result of the exposure.) Based on these guidelines, the risk characterization in this report refers to the carcinogenic risk estimates as being "below the target range" when risks are less than 10^{-6}, "within the target range" when risks are between 10^{-4} and 10^{-6}, and "above the target range" when risks are above 10^{-4}. Historically, regulatory agencies have considered risks between 10^{-5} and 10^{-6} to be acceptable.

For noncarcinogenic compounds, the hazard index is compared to 1. If the hazard index is less than or equal to 1, no adverse health effects are anticipated from the predicted body-dose level. If the index is greater than 1, the predicted body-dose level could potentially result in adverse health effects. This determination is necessarily imprecise, because the derivation of the relevant standard or guideline involves the use of multiple safety factors. In addition, the risk ratios for individual compounds should properly be summed only if the target organ or mechanisms of action are identical for the compounds. Therefore, the potential for adverse health

effects of a mixture having a hazard index greater than one must be evaluated on a case-by-case basis.

8.1 RISKS DUE TO SOIL EXPOSURES

Both carcinogenic and noncarcinogenic risks were estimated for exposure to contaminated soil at the Mechanicville site. The two populations who could potentially be exposed are older children, ages 8-18, and utility workers. Risks were estimated for older children exposed to surface soil, and utility workers exposed to subsurface soil.

8.1.1 Potential Risks to Teenagers and Older Children

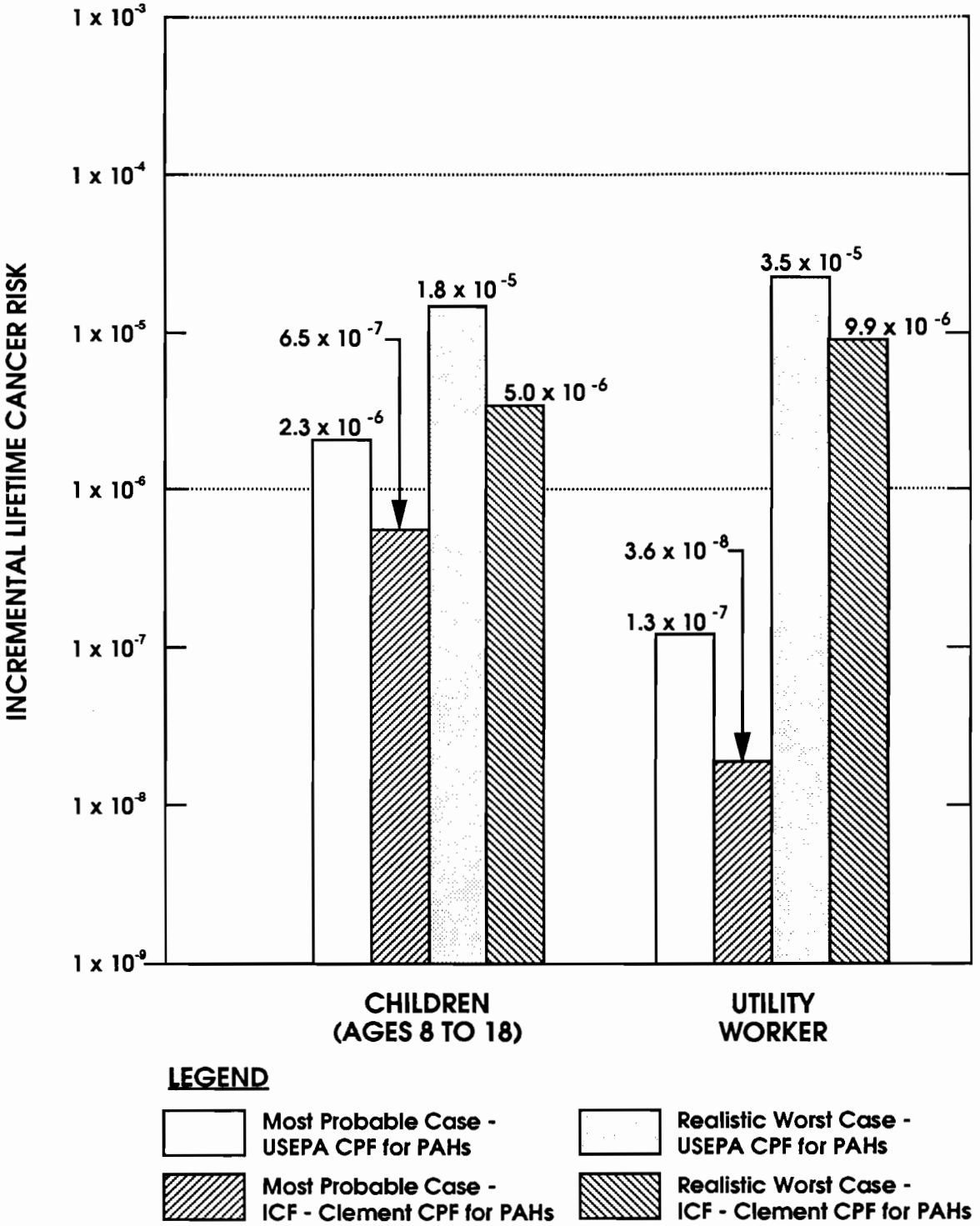
Risk estimates were calculated for teenagers and older children potentially exposed to contaminated surface soil at the Mechanicville site. This population (ages 8 to 18) was selected because it represents the one with the highest exposure potential; older children play unsupervised, are mobile, and could trespass onto the site and be exposed to surface soil. The risk estimates are presented in Table 8-1 and Figures 8-1 and 8-2. The incremental carcinogenic risk estimated for the most probable case scenario is 2.3×10^{-6} and for the realistic worst case, 1.8×10^{-5}. The excess risk is essentially due to exposure to the carcinogenic PAHs. Both estimates are within the USEPA target range. Using the carcinogenic potency factor developed by Clement Associates (1987), carcinogenic risks of 6.5×10^{-7} and 5.0×10^{-6} were estimated for the most probable and realistic worst cases, respectively. These estimates are below and within the USEPA target range.

TABLE 8-1

RISK ESTIMATES FOR EXPOSURE OF OLDER CHILDREN
TO SURFACE SOIL
MECHANICVILLE SITE

Compound	Most Probable Case	Realistic Worst Case
	Incremental Lifetime Carcinogenic Risk Estimates	
Carcinogenic PAHs	2.3×10^{-6}(1) 6.5×10^{-7}(2)	1.8×10^{-5}(1) 5.0×10^{-6}(2)
Total:	2.3×10^{-6}(1) 6.5×10^{-7}(2)	1.8×10^{-5}(1) 5.0×10^{-6}(2)
	Noncarcinogenic Hazard Ratios	
Cyanide (amenable)	9.7×10^{-5}	1.3×10^{-3}
Noncarcinogenic PAHs	8.5×10^{-6}	2.7×10^{-5}
Total:	1.1×10^{-4}	1.3×10^{-3}

(1) Using USEPA Potency Factor
(2) Using ICF-Clement (1987) Potency Factor



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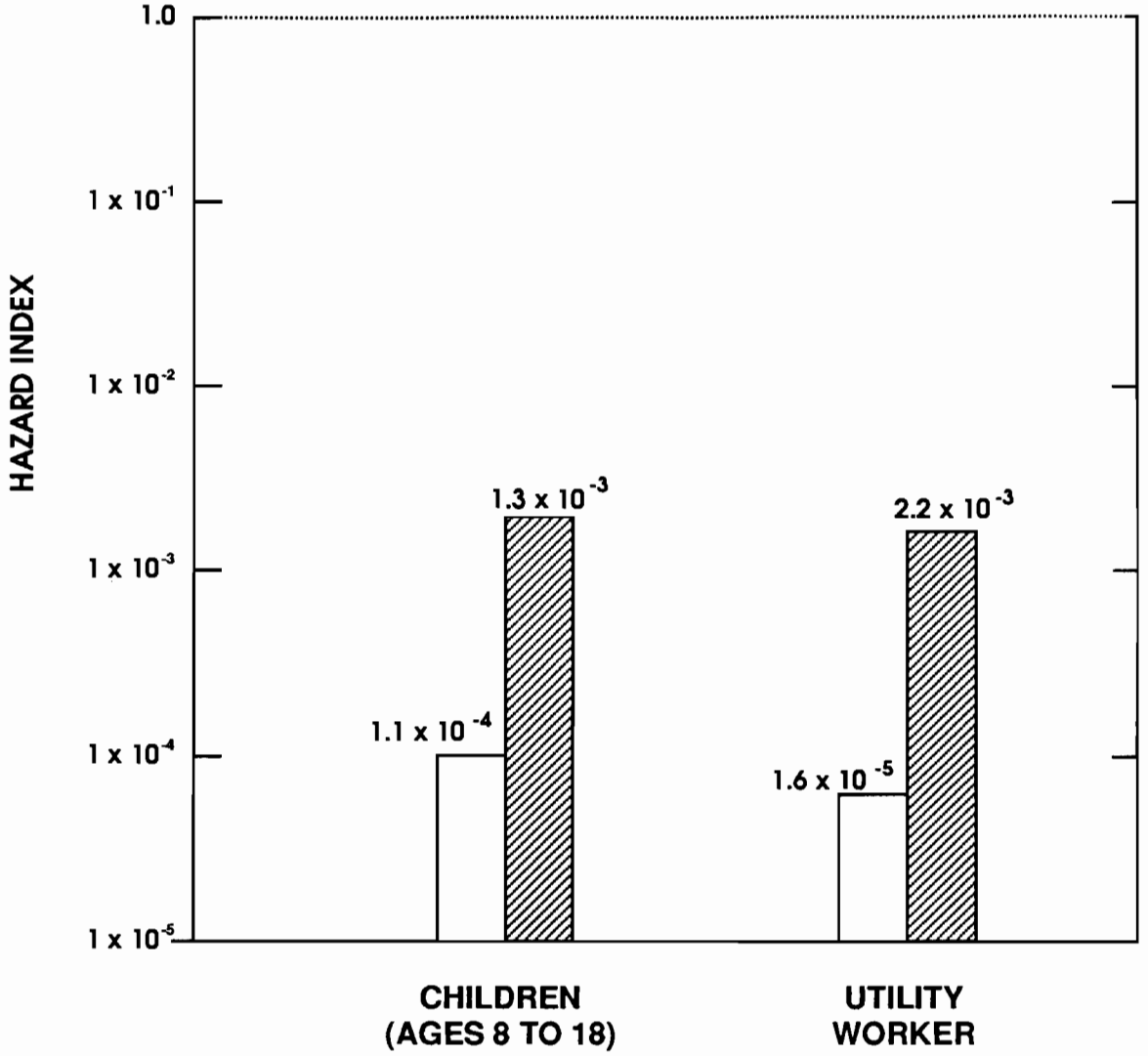
MECHANICVILLE CARCINOGENIC RISKS - DERMAL CONTACT/ INGESTION OF SOIL

NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK

INVESTIGATION OF FORMER COAL GASIFICATION SITES

JOB NO. 4945-04

FIGURE 8-1



E.C.JORDAN CONSULTING ENGINEERS	MECHANICVILLE NONCARCINOGENIC HAZARD INDEX - DERMAL CONTACT/ INGESTION OF SOIL
NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
	JOB NO. 4945-04 FIGURE 8-2

Noncarcinogenic risks are 0.00011 for the most probable case scenario, and 0.0013 for the realistic worst case scenario. Both of these are well below 1. Therefore no significant adverse health effects would be expected due to the exposure of older children to contaminated soil under the assumed conditions of exposure.

8.1.2 Potential Risks to Utility Workers

Risk estimates were also calculated for utility workers who could be exposed to contaminated subsurface soil during future utility repair work. They are presented in Table 8-2 and Figures 8-1 and 8-2. Using the USEPA cancer potency factor, total incremental carcinogenic risks for the most probable case scenario were estimated at 1.3×10^{-7}. Although there were two carcinogenic compounds detected in the subsurface soil, over 99 percent of the risk is attributed to the presence of carcinogenic PAHs. Risk for the realistic worst case was estimated at 3.5×10^{-5}. This is also attributable to the presence of carcinogenic PAHs. Both of these risk estimates are within the USEPA's target range. Using the PAH potency factor developed by Clement Associates (1987), carcinogenic risks were estimated at 3.6×10^{-8} and 9.9×10^{-6} for the most probable and realistic worst cases, respectively. These are below and within the USEPA target range.

The noncarcinogenic hazard indices were significantly less than one for both scenarios, with an index of 0.000016 for the most probable case and 0.0022 for the realistic worst case. Because the hazard index for both scenarios was well below one, no adverse health effects would be expected in utility workers

TABLE 8-2

RISK ESTIMATES FOR EXPOSURE OF UTILITY WORKERS
TO SUBSURFACE SOIL
MECHANICVILLE SITE

Compound	Most Probable Case	Realistic Worst Case
	Incremental Lifetime Carcinogenic Risk Estimates	
Benzene	2.1×10^{-10}	9.2×10^{-8}
Carcinogenic PAHs	1.3×10^{-7}(1) 3.5×10^{-8}(2)	3.5×10^{-5}(1) 9.8×10^{-6}(2)
Total:	1.3×10^{-7}(1) 3.6×10^{-8}(2)	3.5×10^{-5}(1) 9.9×10^{-6}(2)
	Noncarcinogenic Hazard Ratios	
Cyanide (amenable)	1.2×10^{-6}	1.3×10^{-4}
Ethyl Benzene	2.0×10^{-6}	3.8×10^{-4}
Noncarcinogenic PAHs	9.9×10^{-6}	1.1×10^{-3}
Styrene	1.8×10^{-6}	3.4×10^{-4}
Toluene	6.2×10^{-7}	1.2×10^{-4}
Trimethylbenzene	3.3×10^{-8}	7.4×10^{-6}
Xylene (total)	3.7×10^{-7}	6.1×10^{-5}
Total:	1.6×10^{-5}	2.2×10^{-3}

(1) Using USEPA Potency Factor
(2) Using ICF-Clement (1987) Potency Factor

exposed to subsurface soil at the Mechanicville site under the assumed exposure conditions.

8.2 RISKS DUE TO SEDIMENT EXPOSURES

Both carcinogenic and noncarcinogenic risks were estimated for exposure to sediment in the Anthony Kill. The two populations who could potentially be exposed are older children and construction workers.

8.2.1 Potential Risks to Older Children

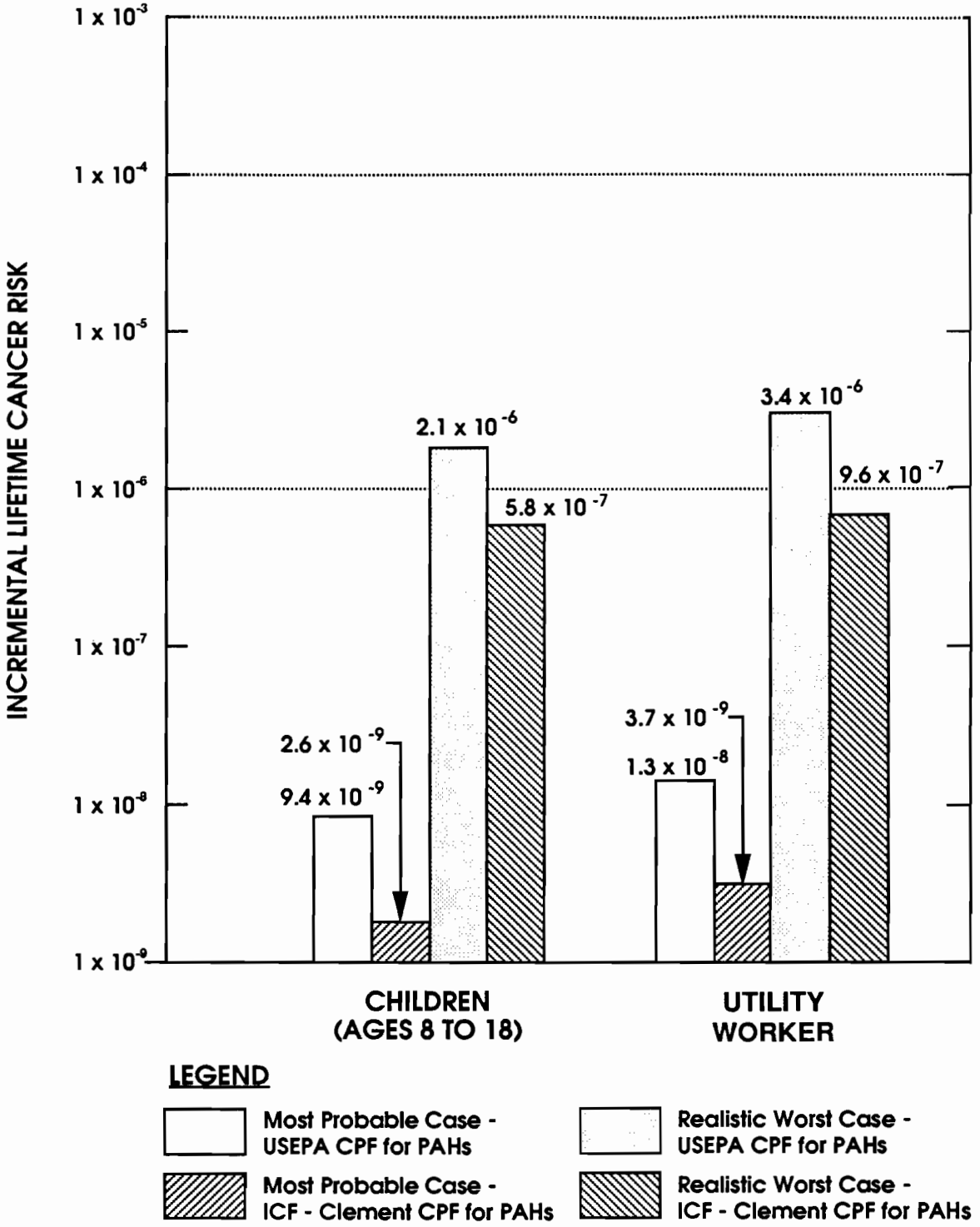
Risk estimates were calculated for older children potentially exposed to site-related contamination in the sediments of the Anthony Kill which are adjacent to the site. They are presented in Table 8-3 and Figures 8-3 and 8-4. Using the USEPA potency factor for PAHs, total incremental carcinogenic risks were below the USEPA target range for the most probable case scenario (9.4×10^{-9}), and within the target range for the realistic worst case scenario (2.1×10^{-6}). Carcinogenic PAHs contributed to over 99 percent of the total incremental risk in both cases. Using the PAH potency factor developed by Clement Associates (1987), the carcinogenic risks were estimated at 2.6×10^{-9} and 5.8×10^{-7} for the most probable and realistic worst cases, respectively. Both estimates are below the USEPA target range. The hazard index was estimated at 0.000003 for the most probable case and 0.0002 for the realistic worst case. These hazard indices are significantly below one. Therefore no adverse health effects would be expected from the exposure of older children to contaminated sediments.

TABLE 8-3

RISK ESTIMATES FOR EXPOSURE OF CHILDREN
TO SEDIMENT
MECHANICVILLE SITE

Compound	Most Probable Case	Realistic Worst Case
	Incremental Lifetime Carcinogenic Risk Estimates	
Benzene	5.4×10^{-13}	1.1×10^{-10}
Carcinogenic PAHs	9.4×10^{-9}(1) 2.6×10^{-9}(2)	2.1×10^{-6}(1) 5.8×10^{-7}(2)
Total:	9.4×10^{-9}(1) 2.6×10^{-9}(2)	2.1×10^{-6}(1) 5.8×10^{-7}(2)
	Noncarcinogenic Hazard Ratios	
Cyanide (total)	3.3×10^{-6}	1.8×10^{-4}
Ethyl Benzene	1.4×10^{-9}	2.5×10^{-7}
Noncarcinogenic PAHs	9.7×10^{-8}	1.3×10^{-5}
Total:	3.4×10^{-6}	2.0×10^{-4}

(1) Using USEPA Potency Factor
(2) Using ICF-Clement (1987) Potency Factor



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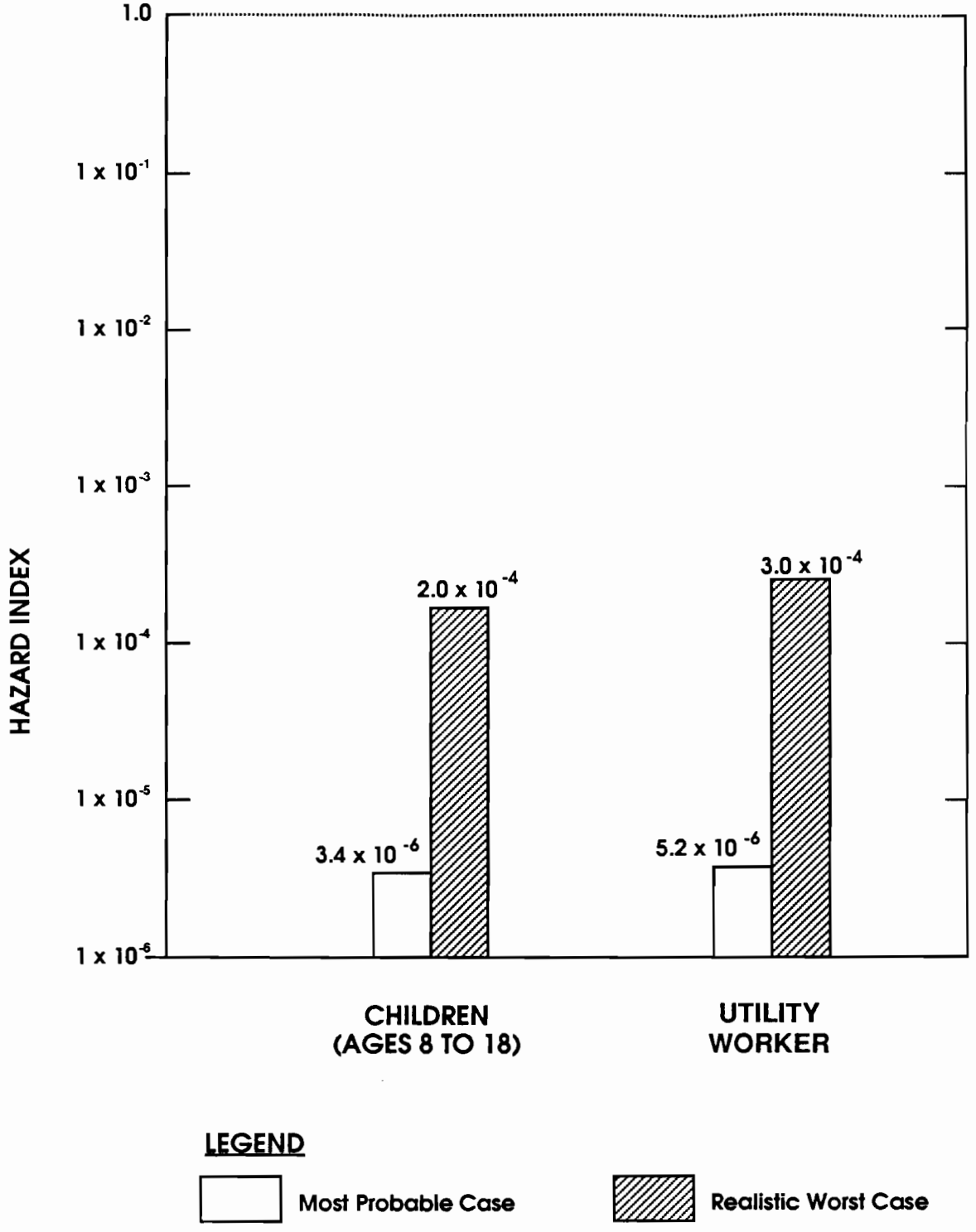
MECHANICVILLE
CARCINOGENIC RISKS -
DERMAL CONTACT/
INGESTION OF SEDIMENT

NEW YORK STATE
ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

INVESTIGATION OF FORMER
COAL GASIFICATION SITES

JOB NO. 4945-04

FIGURE 8-3



E.C.JORDAN CONSULTING ENGINEERS	MECHANICVILLE NONCARCINOGENIC HAZARD INDEX - DERMAL CONTACT/ INGESTION OF SEDIMENT
NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
JOB NO. 4945-04	FIGURE 8-4

8.2.2 Potential Risks to Workers

Risks were estimated for construction workers potentially exposed to contaminated sediments of the Anthony Kill. They are presented in Table 8-4 and Figures 8-3 and 8-4. Using the USEPA potency factor, incremental carcinogenic risk estimates were below the USEPA target range for the most probable case (1.3×10^{-8}) and within the target range for the realistic worst case (3.4×10^{-6}). Carcinogenic PAHs contributed to more than 99 percent of the total risk in both cases. Using the PAH potency factor developed by Clement Associates (1987), carcinogenic risks were estimated at 3.7×10^{-9} and 9.6×10^{-7} for the most probable and realistic worst cases, respectively. Both estimates are below the USEPA target range.

Hazard indices were below one for both the most probable and realistic worst case, with indices of 0.0000052 and 0.0003, respectively. Because both indices are significantly below one, no adverse health effects would be expected due to contaminated sediments during assumed construction-type activities.

8.3 RISKS DUE TO INHALATION OF VOLATILE ORGANIC COMPOUNDS AND PARTICULATES

Both carcinogenic and noncarcinogenic risk estimates were calculated for exposure to VOCs and particulate dust originating from a hypothetical soil pile excavated and stockpiled on-site during utility repair work. The population assumed to be exposed were young children living

TABLE 8-4

RISK ESTIMATES FOR EXPOSURE OF WORKERS
TO SEDIMENT
MECHANICVILLE SITE

Compound	Most Probable Case	Realistic Worst Case
	Incremental Lifetime Carcinogenic Risk Estimates	
Benzene	5.0×10^{-13}	1.7×10^{-10}
Carcinogenic PAHs	1.3×10^{-8}(1) 3.7×10^{-9}(2)	3.4×10^{-6}(1) 9.6×10^{-7}(2)
Total:	1.3×10^{-8}(1) 3.7×10^{-9}(2)	3.4×10^{-6}(1) 9.6×10^{-7}(2)
	Noncarcinogenic Hazard Ratios	
Cyanide (total)	5.0×10^{-6}	2.7×10^{-4}
Ethyl Benzene	2.1×10^{-9}	3.8×10^{-7}
Noncarcinogenic PAHs	2.3×10^{-7}	2.2×10^{-5}
Total:	5.2×10^{-6}	3.0×10^{-4}

(1) Using USEPA Potency Factor
(2) Using ICF-Clement (1987) Potency Factor

downwind of the site. This population was used because it represents the most sensitive group.

8.3.1 Potential Risks to Young Children

Risk estimates were calculated for young children, ages 1 to 6, assumed to inhale VOCs and particulates originating on-site and are presented in Table 8-5 and Figures 8-5 and 8-6. Using the USEPA potency factor for PAHs, the total incremental carcinogenic risk was estimated at 2.2×10^{-7} for the most probable case and 1.3×10^{-5} for the realistic worst case. Both estimates are within the USEPA target range. The major contributor to these estimates is carcinogenic PAHs, at 85 and 86 percent of the total risk for the most probable and realistic worst cases, respectively. Using the PAH potency factor developed by Clement Associates (1987), carcinogenic risks were estimated at 4.9×10^{-8} and 2.6×10^{-6} for the most probable and realistic worst cases, respectively. Both estimates are below or within the USEPA target range.

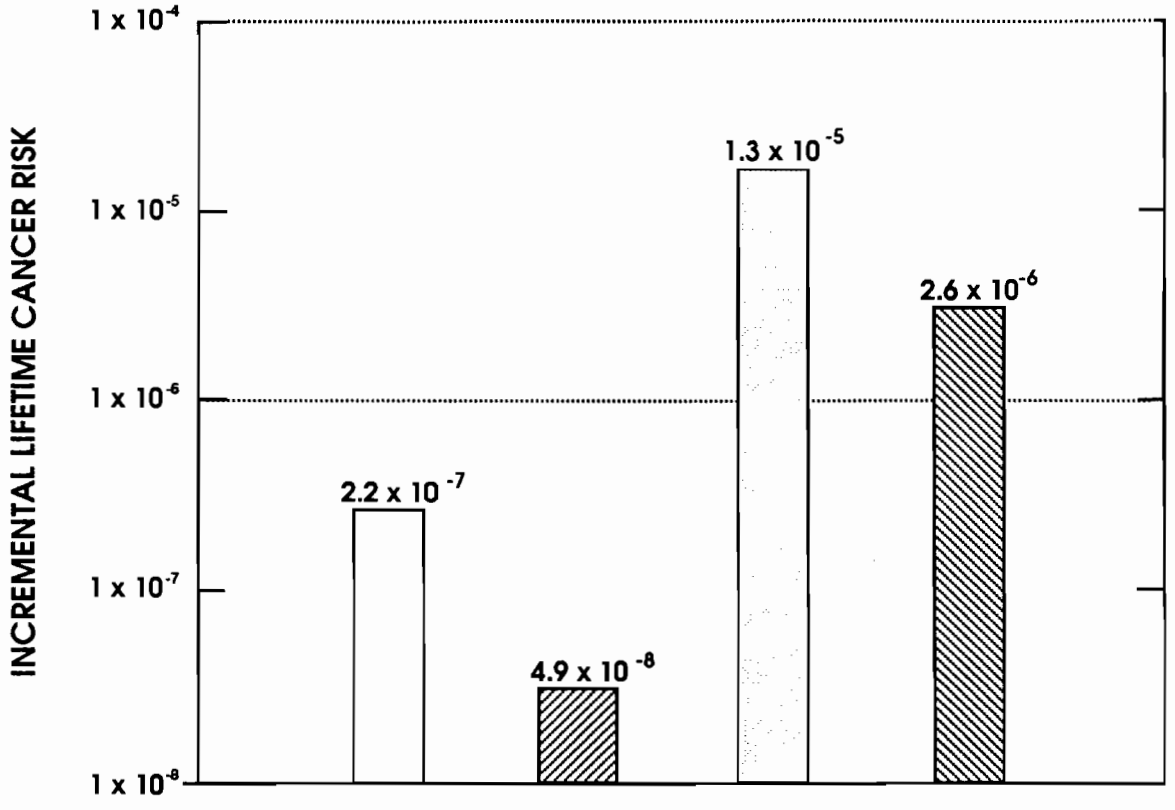
The hazard index was estimated at 0.00035 for the most probable case and 0.018 for the realistic worst case. Both indices are well below one. Therefore no adverse health effects would be expected due to the inhalation of VOCs or fugitive dust particulates originating at the Mechanicville site under the assumed conditions of exposure.

TABLE 8-5

RISK ESTIMATES FOR EXPOSURE OF YOUNG CHILDREN
TO SOIL CONTAMINATION VIA INHALATION
MECHANICVILLE SITE

Compound	Most Probable Case	Realistic Worst Case
	Incremental Lifetime Carcinogenic Risk Estimates	
Benzene	3.5×10^{-8}	1.8×10^{-6}
Carcinogenic PAHs	1.9×10^{-7}(1) 1.4×10^{-8}(2)	1.1×10^{-5}(1) 8.3×10^{-7}(2)
Total:	2.2×10^{-7}(1) 4.9×10^{-8}(2)	1.3×10^{-5}(1) 2.6×10^{-6}(2)
	Noncarcinogenic Hazard Ratios	
Cyanide (amenable)	3.5×10^{-7}	2.0×10^{-5}
Ethyl Benzene	1.1×10^{-4}	5.7×10^{-3}
Noncarcinogenic PAHs	7.0×10^{-6}	4.1×10^{-4}
Styrene	1.0×10^{-4}	5.2×10^{-3}
Toluene	2.0×10^{-5}	1.1×10^{-3}
Trimethylbenzene	9.0×10^{-6}	4.6×10^{-4}
Xylene (total)	1.0×10^{-4}	5.3×10^{-3}
Total:	3.5×10^{-4}	1.8×10^{-2}

(1) Using USEPA Potency Factor
(2) Using ICF-Clement (1987) Potency Factor



LEGEND

- Most Probable Case - USEPA CPF for PAHs
- Realistic Worst Case - USEPA CPF for PAHs
- Most Probable Case - ICF - Clement CPF for PAHs
- Realistic Worst Case - ICF - Clement CPF for PAHs

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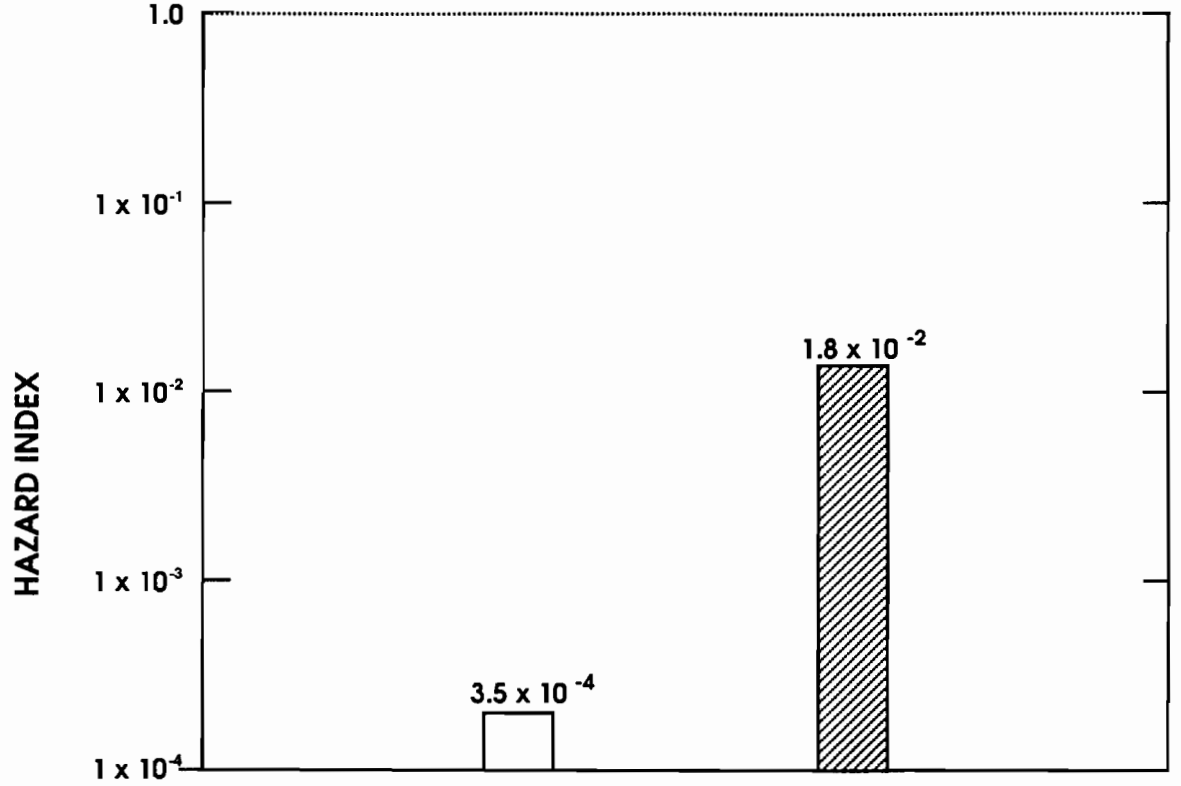
NEW YORK STATE
ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

MECHANICVILLE
CARCINOGENIC RISKS -
FUTURE INHALATION EXPOSURE
OF CHILDREN DURING
SOIL EXCAVATION

INVESTIGATION OF FORMER
COAL GASIFICATION SITES

JOB NO. 4945-04

FIGURE 8-5



LEGEND

Most Probable Case

Realistic Worst Case

E.C.JORDAN CONSULTING ENGINEERS	MECHANICVILLE NONCARCINOGENIC HAZARD INDEX - FUTURE INHALATION EXPOSURE OF CHILDREN DURING SOIL EXCAVATION
NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
	JOB NO. 4945-04 FIGURE 8-6

8.4 UNCERTAINTY/LIMITATIONS IN RISK ASSESSMENT

Regardless of the type of risk estimate developed, it should be emphasized that all estimates of risk are based on numerous assumptions which introduce many uncertainties into the risk characterization process. Assumptions such as frequency and duration of exposure are subjective decisions based on knowledge of site conditions. Absorption rates are often unknown for specific chemicals, and the pharmacokinetics of a contaminant may differ between the specific site and the laboratory study from which the dose/response criterion was derived. In addition, the use of established standards or guidelines, such as the dose/response value, introduces additional uncertainties into the risk estimates due to the following factors:

- potential adverse human health effects are extrapolated from effects seen in animal studies,
- effects observed at low doses are often extrapolated from effects seen at high doses,
- atmospheric concentrations of contaminants volatilizing from soil are often estimated using models,
- dose/response effects are often estimated using models.

By using a range of realistic exposure assumptions, it is Jordan's opinion that the uncertainty inherent in the risk characterization process has been

minimized to the best extent possible. Both lower and upper bounds for risk have been provided for each exposure scenario. These estimates are designed to ensure human health protection. These should be used to determine the location and relative magnitude of risk at the site, and the relative magnitude of risk among media.

8.5 SUMMARY

Table 8-6 presents a summary of estimated risks due to exposure to contamination in soil and sediment at the Mechanicville site. All incremental carcinogenic risks were either within or below the USEPA target range of 10^{-4} to 10^{-6}. Carcinogenic PAHs appear to be the major contributor to these risks. In addition, all hazard indices of noncarcinogenic risks were well below one, indicating that no adverse noncarcinogenic health effects would be expected due to exposure. Based on the results/conditions of this quantitative risk assessment, Jordan concludes that, under the assumed exposure conditions, contaminants found at this site do not pose a significant health risk to workers on the site or to residents around the site. As has been done in the past, the site health and safety plan should be followed during any future exploratory work on the Mechanicville site to prevent or minimize undue exposure.

TABLE 8-6

SUMMARY OF RISK ESTIMATES BY MEDIUM
MECHANICVILLE SITE

Medium	Most Probable Case	Realistic Worst Case
	Incremental Lifetime Carcinogenic Risk Estimates	
Surface Soil, Children	2.3×10^{-6}(1) 6.5×10^{-7}(2)	1.8×10^{-5}(1) 5.0×10^{-6}(2)
Subsurface Soil, Worker	1.3×10^{-7}(1) 3.6×10^{-8}(2)	3.5×10^{-5}(1) 9.9×10^{-6}(2)
Sediment, Children	9.4×10^{-9}(1) 2.6×10^{-9}(2)	2.1×10^{-6}(1) 5.8×10^{-7}(2)
Sediment, Workers	1.3×10^{-8}(1) 3.7×10^{-9}(2)	3.4×10^{-6}(1) 9.6×10^{-7}(2)
Inhalation, Children	2.2×10^{-7}(1) 4.9×10^{-8}(2)	1.3×10^{-5}(1) 2.6×10^{-6}(2)
	Noncarcinogenic Hazard Ratios	
Surface Soil, Children	1.1×10^{-4}	1.3×10^{-3}
Subsurface Soil, Worker	1.6×10^{-5}	2.2×10^{-3}
Sediment, Children	3.4×10^{-6}	2.0×10^{-4}
Sediment, Workers	5.2×10^{-6}	3.0×10^{-4}
Inhalation, Children	3.5×10^{-4}	1.8×10^{-2}

(1) Using USEPA Potency Factor
(2) Using ICF-Clement (1987) Potency Factor

9.0 ENVIRONMENTAL RISK ASSESSMENT

The primary objectives of the environmental assessment for the Mechanicville site are to characterize the environmental receptors associated with the site; evaluate present and future impacts; and if appropriate, provide sufficient information to support remedial alternatives and develop mitigative measures to address any adverse effects. The risk assessment focused primarily on the Anthony Kill, as this stream is directly adjacent to the site. Potentially affected media investigated include soil, surface water, groundwater, and sediment.

9.1 ENVIRONMENTAL RECEPTORS

Environmental receptors potentially affected by site-related chemicals include aquatic organisms in the Anthony Kill, and terrestrial wildlife which utilize the area. Due to the industrialized nature of the area, and the lack of suitable habitats, it is unlikely that the site is significantly utilized by wildlife. Although the surficial soil is contaminated with PAHs, the exposed soil consists primarily of packed gravel unsuitable for soil invertebrates. Consequently, a movement of contaminants through the terrestrial food web is considered unlikely. In addition, the relative importance of this exposure pathway is minimized by the small size of the site and the low wildlife-carrying capacity of the surrounding commercial area.

Aquatic habitats adjacent to the site are potentially at risk because these areas can function as contaminant sinks and groundwater discharge areas. As

overland runoff and groundwater discharge to the Anthony Kill, potential contaminants transported in these flows can accumulate in sediment or be directly discharged to surface water. Accumulated contaminants in sediment may resist breakdown and contribute to water quality degradation over time. There is also the potential for impact to downstream areas. Potential aquatic receptor taxa include fish, macroinvertebrates, plankton, and amphibians. Limited data exist on the species present in adjacent aquatic areas.

The NYSDEC has assigned two stream classifications to the Anthony Kill. The section upstream from the Mechanicville city line is classified as C(t). Class C waters are suitable for fishing and all other uses except as a source of water supply for drinking, culinary, or food processing purposes or primary contact recreation. The "t" denotes that this segment of the stream is a trout stream. In Mechanicville, the stream is classified as D. Class D waters are designated for secondary contact recreation, but no higher classification uses because of intermittent flow or water conditions that do not support the propagation of game fish.

According to the records of the New York State Wildlife Resources Center, no endangered, threatened, or species of special concern occur in proximity of the site.

9.2 ENVIRONMENTAL RISK ASSESSMENT

This section presents an assessment of risk to environmental receptors from contaminated surface water, groundwater, and sediments.

9.2.1 Surface Water

As part of the Task 2 field investigation, four rounds of surface water samples were collected at three locations along the Anthony Kill during 1986 and 1987. Location SW-1 is situated upstream of the site, location SW-2 is situated adjacent to the site, and location SW-3 is situated downstream. Samples were collected in September and December of 1986, and March and June of 1987. In the Task 3 field investigation, two additional surface water sampling rounds were performed, again at three locations along the Anthony Kill. However, during this field investigation, a new sample location (SW-4) further downstream was chosen to replace SW-3, based on a more complete understanding of the extent of groundwater discharge to the stream. A statistical summary of compounds detected during the surface water sampling is presented in Table 9-1. Mean values presented in Table 9-1, as well as the tables which follow, were calculated using zeros for sample data reported as ND. The range of concentrations at which these compounds were detected are presented in Table 9-2, along with relevant water quality standards.

Only bis(2-ethylhexyl)phthalate, 2-methylnaphthalene and two inorganics (cyanide and iron) were detected at levels exceeding the AWQC or the New York Class D Standards. However, the levels of bis(2-ethylhexyl)phthalate and the two inorganic compounds were not elevated, compared with the upstream location. In addition, 2-methylnaphthalene was only detected once (in a location adjacent to the site) during the surface water sampling program, and was not detected in a duplicate sample taken concurrently. Three other PAH compounds, acenaphthene, acenaphthylene and pyrene, were also detected at

MC_TAB_1.WK1

TABLE 9-1

SUMMARY OF CHEMICALS DETECTED IN SURFACE WATER
MECHANICVILLE SITE

CHEMICAL	UPSTREAM			ADJACENT			DOWNSTREAM		
	MEAN	MAX	DETECTION FREQUENCY	MEAN	MAX	DETECTION FREQUENCY	MEAN	MAX	DETECTION FREQUENCY
ACETONE	ND	-	0/3	3.3E-03	1.0E-02	1/3	ND	-	0/3
METHYLENE CHLORIDE	1.1E-03	5.4E-03	1/5	ND	-	0/4	ND	-	0/4
ACENAPHTHENE	ND	-	0/5	4.2E-03	2.1E-02	1/5	ND	-	0/5
ACENAPHTHYLENE	ND	-	0/5	4.4E-03	2.2E-02	1/5	ND	-	0/5
PYRENE	ND	-	0/5	2.0E-03	1.0E-02	1/5	ND	-	0/5
BIS(2-ETHYLHEXYL)PHTHALATE	8.8E-02	3.9E-01	3/5	1.2E-03	6.0E-03	1/5	1.1E-02	3.0E-02	2/5
2-METHYLNAPHTHALENE	ND	-	0/3	1.1E-02	3.5E-02	1/3	ND	-	0/5
CYANIDE (total)	2.0E-03	1.0E-02	1/5	2.0E-03	1.0E-02	2/5	2.0E-03	1.0E-02	1/5
IRON	4.2E-01	1.0E+00	5/5	8.9E-01	1.8E+00	5/5	4.4E-01	7.8E-01	5/5
ZINC	8.0E-03	3.0E-02	2/5	7.8E-03	2.0E-02	3/5	2.0E-03	1.0E-02	1/5

NOTES:
a Only chemicals found above detection limits presented.
b All compounds expressed in mg/l unless otherwise noted.
c ND = Not detected.

MP_TAB-2.WK1

TABLE 9-2

COMPARISON OF CHEMICALS FOUND IN SURFACE WATER SAMPLES WITH STANDARDS AND CRITERIA FOR THE PROTECTION OF AQUATIC LIFE
MECHANICVILLE SITE

COMPOUND	RANGE OF CONCENTRATIONS	CHRONIC AWQC		NEW YORK STATE CLASS D STANDARDS	NEW YORK STATE CLASS C STANDARDS
ACETONE	ND - 0.01	9.7	f	---	---
METHYLENE CHLORIDE	ND - 0.0054	11	g	---	---
ACENAPHTHENE	ND - 0.021	0.52		---	---
ACENAPHTHYLENE	ND - 0.022	0.037	f	---	---
PYRENE	ND - 0.01	0.013		---	---
BIS(2-ETHYLHEXYL)PHTHALATE	ND - 0.39	0.012	f	---	0.0006
2-METHYLNAPHTHALENE	ND - 0.035	0.027	f	---	---
CYANIDE	ND - 0.01	0.0052		0.022	0.0052
IRON	0.037 - 1.8	1.0		0.3	0.3
ZINC	ND - 0.02	0.11		0.23	0.03

NOTES:
a Only those compounds found above detection limits presented.
b All compounds expressed in mg/l unless otherwise noted.
c Ambient Water Quality Criteria (USEPA, 1986) for freshwater species, assuming hardness of 100mg/l.
d NYSDEC (1986). Creek is currently graded Class D in the vicinity of the site. Assuming hardness of 100mg/l.
e Not detected (see Task 2 Report Appendix for minimum detection limits [Jordan, 1987]).
f Based on a 10-fold safety factor of an estimated EC50 value for Daphnia magna, using a QSAR equation from Hermens et al., 1984
g Criterion for total halomethanes.

levels below their respective AWQC in the surface water sample which contained 2-methylnaphthalene. These compounds were not detected in the associated duplicate sample. The presence of PAHs in surface water appears to be infrequent. Levels are low when detected adjacent to the site and are not detected in downstream surface water samples. Therefore, the impact of PAH releases on stream water quality is expected to be minimal.

9.2.2 Groundwater

Although no environmental receptors are exposed directly to groundwater at the site, the majority of groundwater beneath the site discharges to the Anthony Kill (Jordan, 1987; Jordan, 1989), and stream quality could potentially be affected. Therefore an assessment of the potential impact of groundwater constituents discharging in the Anthony Kill was conducted.

Data used in this evaluation included analytical results from groundwater samples collected from the 12 site wells during December 1987 and March 1988, as part of the Task 3 Investigation, and the six Task 2 wells sampled on four previous occasions (September and December of 1986, and March and June of 1987). A summary of these analytical data is presented in Table 9-3, and maximum levels of each chemical were used in conjunction with a dilution factor, described below, to estimate potential groundwater impacts on the Anthony Kill.

In order to conservatively assess potential impacts of groundwater discharge to the Anthony Kill, an estimate of stream water quality under low flow

MP_TAB-3.WK1

TABLE 9-3

COMPARISON OF CHEMICALS FOUND IN GROUNDWATER SAMPLES WITH STANDARDS
AND CRITERIA FOR THE PROTECTION OF AQUATIC LIFE
ASSUMING DILUTION WITH RECEIVING WATER DURING LOW FLOW CONDITIONS

COMPOUND	RANGE OF CONCENTRATIONS IN GROUNDWATER	REPORTED MAXIMUM SOLUBILITY	ESTIMATED CONCENTRATION IN ANTHONY KILL ASSUMING DILUTION	CHRONIC AWQC	NEW YORK STATE CLASS D STANDARDS
BENZENE	ND - 12.0		2.00E-03	0.053 i	---
TOLUENE	ND - 6.4		1.00E-03	0.175 i	---
ETHYLBENZENE	ND - 2.0		4.00E-04	0.32 i	---
TOTAL XYLENES	ND - 3.5		7.00E-04	0.053 h	---
ACENAPHTHENE	ND - 210.0	3.42	6.38E-04	0.52	---
ACENAPHTHYLENE	ND - 173.74	3.93	7.33E-04	0.037 h	---
ANTHRACENE	ND - 203.07	1.29	2.41E-04	0.012 h	---
BENZO(b)FLUORANTHENE	ND - 25.0	0.14	2.61E-05	0.001 h	---
BENZO(k)FLUORANTHENE	ND - 25.0	0.00055	1.03E-07	0.001 h	---
BENZO(a)ANTHRACENE	ND - 25.0	0.044	8.20E-06	0.003	---
BENZO(a)PYRENE	ND - 25.0	0.0038	7.09E-07	0.0012	---
CHRYSENE	ND - 25.0	0.006	1.12E-06	0.002 h	---
FLUORANTHENE	ND - 82.0	0.26	4.85E-05	0.013 j	---
FLUORENE	ND - 110.0	1.98	3.69E-04	0.012 h	---
NAPHTHALENE	ND - 580.0	34.4	6.41E-03	0.62	---
PHENANTHRENE	ND - 320.0	1.29	2.41E-04	0.036	---
PYRENE	ND - 130.0	0.14	2.61E-05	0.013	---
2-METHYLNAPHTHALENE	ND - 540.0	28	5.22E-03	0.027 h	---
PHENOL	ND - 0.58		1.00E-04	2.56	0.005
BIS(2-ETHYLHEXYL)PHTHALATE	ND - 1.71	0.4	7.46E-05	0.012 h	---
IRON	ND - 25.0		5.00E-03	1.0	0.3
TOTAL CYANIDE	ND - 0.8		2.00E-04	0.0052	0.22
ZINC	ND - 1.09		2.00E-04	0.11	0.23

NOTES:
a See text for criteria for selecting compounds.
b All compounds expressed in mg/l unless otherwise noted.
c Including all wells sampled in 1986 and 1987.
d Dilution factor of 5363 used; from ratio of annual low-flow estimate in Anthony Kill (17 cfs) to groundwater flow (0.003 cfs) in shallow bedrock. See text for assumptions.
e Ambient Water Quality Criteria (USEPA, 1986) for freshwater species, assuming hardness of 100mg/l.
f NYSDEC (1986). Creek is currently graded Class D in the vicinity of the site. Assuming hardness of 100mg/l.
g Not detected (see task 2 Report Appendix for minimum detection limits [Jordan, 1987]).
h Based on a 10-fold safety factor applied to the estimated EC50 value for Daphnia magna using a QSAR equation from Hermens et al., 1984.
i Estimated from acute AWQC using a ratio of 100:1.
j EPA, 1988.
k See Appendix __ for references to PAH solubility data.

conditions was made. The estimated stream concentrations were conservatively computed using the reported average low flow over a seven-day period with a ten year recurrence interval (i.e., 7Q10) and the estimated groundwater discharge rate to the stream. The reported 7Q10 for the Anthony Kill is 17 cubic feet per second (cfs). The estimated groundwater discharge rate was computed using a 500 foot length of the stream and a stream bank depth of one foot. The stream bottom is composed primarily of competent bedrock, and given the relative permeability of the soil, it is reasonable to assume that the majority of the groundwater discharge occurs through the stream bank soils. Using the estimated hydraulic conductivity for the on-site soils (200 feet per year or 6.3×10^{-6} feet per second) and a stream bank area of 500 square feet, the groundwater discharge rate is 0.003 cfs. Therefore, under low flow conditions during which dilution effect would be minimized, the estimated stream dilution factor is 5363.

Estimated low flow stream concentrations were computed for all chemicals detected in groundwater at the site. For chemicals which were detected at levels below their reported solubilities the maximum observed groundwater concentration was divided by the estimated dilution factor to calculate the low flow stream concentrations. For those chemicals which were detected at levels which exceeded the respective reported solubilities, the maximum solubility reported in the literature was divided by the estimated low flow dilution factor to calculate the low flow stream concentrations.

The estimated low flow stream concentrations and the ambient water quality criteria (AWQC) are listed in Table 9-3 along with groundwater concentration

ranges and maximum reported solubility values. A list of reported solubility values from which the maximum solubility values were derived is presented as Appendix E. The estimated low flow concentrations are below the respective water quality criteria for all listed chemicals. This correlates with available stream water quality data where only 2-methylnaphthalene was detected at a level (0.035 mg/L) slightly exceeding the ambient water quality criterion (0.027 mg/L). The sample was collected adjacent to the site where the dilution is incomplete. Downstream samples showed no exceedance of the AWQC as predicted by the dilution estimates.

9.2.3 Sediments

Task 2 sediment samples were collected during four sampling episodes at three locations in the Anthony Kill concurrently with surface water collections (see Section 9.2.1 for location descriptions and sampling dates). Task 3 samples were collected during two episodes (December 1987 and March 1988) from the same locations along the Anthony Kill as surface water samples. Additional sediment samples were taken by NYSEG personnel on November 1988 from a location adjacent to the site, and two samples were collected by NYSDEC personnel under the Route 146 bridge. These analytical results were divided into three groups (upstream, adjacent and downstream) and statistically summarized (Table 9-4). A number of VOCs, PAHs and metals were detected in these samples. Sediment concentrations of two VOCs, 18 SVOCs and one inorganic compound were higher adjacent to the site than at the upstream reference location (Task 2 and Task 3 reports; Jordan, 1987; Jordan, 1989)

MC_TAB-4.WK1

TABLE 9-4
SUMMARY OF CHEMICALS DETECTED IN ANTHONY KILL SEDIMENT
MECHANICVILLE SITE

CHEMICAL	UPSTREAM			ADJACENT			DOWNSTREAM		
	MEAN	MAX	DETECTION FREQUENCY	MEAN	MAX	DETECTION FREQUENCY	MEAN	MAX	DETECTION FREQUENCY
ACETONE	2.6E+00	5.3E+00	1/2	2.6E+00	5.2E+00	1/2	2.0E+00	4.0E+00	1/2
BENZENE	ND	-	0/4	1.8E-02	7.0E-02	1/4	ND	-	0/4
ETHYLBENZENE	ND	-	0/4	2.2E-02	8.7E-02	1/4	ND	-	0/4
METHYLENE CHLORIDE	6.0E-01	2.4E+00	1/4	7.4E-01	3.0E+00	1/4	5.7E-01	2.3E+00	1/4
TOLUENE	ND	-	0/4	ND	-	0/4	1.8E-02	7.0E-02	1/4
ACENAPHTHENE	ND	-	0/4	5.9E-01	1.6E+00	4/6	ND	-	0/4
ACENAPHTHYLENE	ND	-	0/4	1.0E+00	3.0E+00	4/6	ND	-	0/4
ANTHRACENE	ND	-	0/4	7.5E-01	1.6E+00	5/7	1.2E-01	4.7E-01	1/4
BENZO(b)FLUORANTHENE	ND	-	0/4	2.8E-01	4.8E-01	3/5	1.2E-01	4.7E-01	1/4
BENZO(k)FLUORANTHENE	ND	-	0/4	1.1E+00	3.1E+00	5/7	1.2E-01	4.7E-01	1/4
BENZO(g,h,i)PERYLENE	ND	-	0/4	1.4E-01	4.0E-01	3/6	1.2E-01	4.7E-01	1/4
BENZO(a)ANTHRACENE	4.1E-02	1.7E-01	1/4	9.5E-01	2.5E+00	4/6	1.2E-01	4.7E-01	1/4
BENZO(a)PYRENE	ND	-	0/4	8.4E-01	2.0E+00	5/7	1.2E-01	4.7E-01	1/4
CHRYSENE	4.1E-02	1.7E-01	1/4	8.9E-01	2.3E+00	4/6	1.2E-01	4.7E-01	1/4
DIBENZO(a,h)ANTHRACENE	ND	-	0/4	2.8E-02	1.7E-01	1/6	ND	-	0/4
FLUORANTHENE	4.1E-02	1.7E-01	1/4	2.7E+00	1.0E+01	5/7	1.6E-01	4.7E-01	2/4
FLUORENE	ND	-	0/4	1.0E-01	4.0E-01	3/5	ND	-	0/4
INDENO(1,2,3-cd)PYRENE	ND	-	0/4	1.1E-01	3.0E-01	3/6	1.2E-01	4.7E-01	1/4
NAPHTHALENE	ND	-	0/4	2.1E+00	8.7E+00	6/7	4.1E-02	1.7E-01	1/4
PHENANTHRENE	4.1E-02	1.7E-01	1/4	2.1E+00	5.5E+00	6/7	1.6E-01	4.7E-01	2/4
PYRENE	4.1E-02	1.7E-01	1/4	2.5E+00	7.6E+00	5/7	1.6E-01	4.7E-01	2/4
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-01	5.5E-01	1/4	9.6E-01	2.8E+00	4/6	1.1E-01	4.5E-01	1/4
2-METHYLNAPHTHALENE	ND	-	0/4	6.7E-01	2.7E+00	5/7	ND	-	0/4
DI-N-BUTYL PHTHALATE	2.1E+00	2.1E+00	1/1	2.0E+00	2.0E+00	1/1	3.2E+00	3.2E+00	1/1
DI-N-OCTYL PHTHALATE	1.3E+01	1.3E+01	1/1	5.0E-01	5.0E-01	1/1	5.8E-01	9.0E-01	1/1
CYANIDE (total)	ND	-	0/3	4.3E-01	1.3E+00	1/3	ND	-	0/3
IRON	1.1E+04	1.6E+04	3/3	1.5E+04	2.7E+04	3/3	1.8E+04	3.3E+04	3/3
ZINC	3.2E+01	3.4E+01	2/2	4.6E+01	4.6E+01	2/2	5.1E+01	7.6E+01	2/2

NOTES:
a Only those compounds found above detection limits are presented.
b All compounds expressed in mg/kg unless otherwise noted.
c ND = Not detected.

There are no final standards or criteria for the protection of aquatic life for chemical levels in sediment. However, interim sediment criteria values have been established (USEPA 1988). These interim criteria are based on the Equilibrium Partitioning Approach (USEPA 1988), which estimates the interstitial water concentration of the contaminant given the total organic carbon (TOC) sediment concentration and the partitioning coefficient between the two media. From this relationship chronic AWQC are used to establish the "no-effect" concentration in the interstitial water. Thus, toxicity to benthic organisms is correlated to the interstitial, or pore water concentration, and not directly to the total concentration of the contaminant in the sediment.

Interim sediment criteria have been developed for only six of the chemicals (all PAHs) found during the sediment sampling program conducted for the Mechanicville site. These criteria, presented in Table 9-5, can be directly compared to the TOC-normalized PAH concentrations detected in Anthony Kill sediment. Chemical concentrations must be normalized because the extent to which PAHs and other hydrophobic organic compounds are bound to sediment, and hence unavailable to biota, is directly related to the amount of organic carbon (USEPA, 1988). The normalized average sediment concentrations measured upstream, adjacent to, and downstream of the site, along with available Interim Sediment Quality Criteria (SQC) and associated confidence intervals, are listed in Table 9-5. The confidence interval represents the range within which (with 95% certainty) the actual sediment criterion should fall, and is based on the uncertainty associated with the derivation the protective criteria. The lower value of the interval represents the sediment

MC_TAB_5.WK1

TABLE 9-5

COMPARISON OF SEDIMENT CHEMICAL CONCENTRATIONS WITH INTERIM
SEDIMENT QUALITY CRITERIA (SQC) FOR THE PROTECTION OF AQUATIC LIFE
MECHANICVILLE SITE

		UPSTREAM			ADJACENT			DOWNSTREAM		
COMPOUND	SQC (mg/kg C)	AVERAGE CONCENTRATION (mg/kg)	TOC (kg C/kg)	NORMALIZED CONCENTRATION (mg/kg C)	AVERAGE CONCENTRATION (mg/kg)	TOC (kg C/kg)	NORMALIZED CONCENTRATION (mg/kg C)	AVERAGE CONCENTRATION (mg/kg)	TOC (kg C/kg)	NORMALIZED CONCENTRATION (mg/kg C)
ACENAPHTHENE	732 (180-3,030)	—	0.0086	—	0.59	0.0215	27.4	—	0.0129	—
BENZO(a)ANTHRACENE	1317 (217-7,999)	0.041	0.0086	4.8	0.95	0.0215	44.2	0.12	0.0129	9.3
BENZO(a)PYRENE	1063 (225-5018)	—	0.0086	—	0.84	0.0215	39.1	0.12	0.0129	9.3
FLUORANTHENE	1883 (423-8,375)	0.041	0.0086	4.8	2.7	0.0215	125.6	0.16	0.0129	12.4
PHENANTHRENE	139 (32.6-605)	0.041	0.0086	4.8	2.1	0.0215	97.7	0.16	0.0129	12.4
PYRENE	1311 (265-6465)	0.041	0.0086	4.8	2.5	0.0215	116.3	0.16	0.0129	12.4

NOTES:
a Interim Sediment Quality Criterion, expressed as mg per kg of sediment carbon. Figures in brackets are the lower and upper 95% confidence interval values.
b Total organic carbon.
c Chemical concentration expressed in terms of kilograms of carbon.

concentration which, with 97.5% certainty, will be protective of aquatic biota. Similarly, the upper value represents a concentration at which deleterious effects are to be expected, with a similar degree of certainty, in at least some aquatic species.

To evaluate the potential impacts associated with chemical levels in sediment, chemical concentrations were compared with the available SQC and associated confidence intervals. The potential for deleterious effects exists when the average concentration at which a chemical is detected falls within the confidence interval of the particular SQC. Chemicals detected at average concentrations in the sediment below the lower value of the confidence interval are likely having no deleterious effects upon aquatic receptor organisms; similarly, chemicals detected at average concentrations above the upper value are likely having an impact on at least some species.

For the sediment quality criteria presented, the average concentration of phenanthrene in sediments adjacent to the site exceeds the lower SQC confidence interval value, but falls below the SQC itself. This indicates that there is a possibility that phenanthrene is impacting some components of the aquatic community in the Anthony Kill. Due to the fact that typical concentrations do fall below the actual SQC itself, however, this possibility is considered of minor concern. Mean concentrations of the other PAH concentrations, for which SQC are available, fell below the lower value of the respective confidence intervals and are predicted to represent no risk of adverse impacts to aquatic receptors. The potential effect on aquatic life of other sediment chemical concentrations cannot be evaluated due to the lack of

applicable standards or criteria. However, the chemicals evaluated are considered to be representative of other similar compounds.

Two site-specific factors further reduce the potential for negative impacts that elevated PAH levels in the sediments have on stream biota in the Anthony Kill. First, because the stream is fairly fast-moving (17 cfs under low flow conditions) and the substrate is rocky, with exposed bedrock in places, it is not likely that the benthic community is well developed in the vicinity of the Mechanicville site. Consequently, the abundance and diversity of aquatic receptors is expected to be quite limited. In addition, the significant reduction in PAH levels in sediment in the downstream locations indicates that there is, at present, little migration of contaminants down the Anthony Kill. These results suggest that while elevated PAH levels are present in sediments of the Anthony Kill adjacent to the site, the levels are likely having little or no impact on freshwater life. Moreover, any potential impacts would be limited to a small area adjacent to the site.

This evaluation suggests that any potential adverse effects, due to the presence of PAHs in sediments, are quite minimal.

9.3 Conclusions

An environmental risk assessment was conducted for the NYSEG Mechanicville site located in Mechanicville, New York. Potential impacts on environmental receptors from contaminated soils, surface water, groundwater, and stream sediment were evaluated.

There is no indication that any threatened, endangered or species of special concern occur in the general vicinity of the site. Aquatic organisms (including benthic species) are the environmental receptors most likely to be affected by site-related contamination.

An evaluation of the risks posed by contaminants detected in the surface water, groundwater and sediment suggests that some potential for impacts does exist for organisms existing in the Anthony Kill in a limited area adjacent to the site. However these risks appear to be relatively minor, for several reasons. Few compounds were determined to exceed their media-specific protective criteria, and the extent of these exceedances were minimal. Moreover, potential impacts were associated only with "worst case" conditions (e.g. stream low-flow conditions), with no impacts expected under more typical assumptions. Finally, there is no evidence that contaminants are being transported downstream at significant levels. Levels of contaminants detected in the downstream surface water and sediment samples never exceeded relevant protective criteria, even under the most conservative assumptions.

10.0 SUMMARY AND CONCLUSIONS

The significant findings and conclusions of the Task 4 Risk Assessment are as follows:

- The contaminants of concern identified in the soil and sediment at the Mechanicville site include carcinogenic PAHs and benzene and several noncarcinogens (toluene, trimethylbenznene, ethyl benzene, styrene, PAHs, trimethylbenzene, xylenes, and cyanide).

- Under current site conditions, the potential for public exposure to the contaminants of concern is low, for two reasons: (1) most of the site is paved or covered with buildings and access to the site is limited, restricting the possibility of contact with contaminated soil or volatilized contaminants; and (2) the groundwater at the site is not used as a drinking water source.

- For the public health risk assessment, Jordan identified probable exposure pathways by which people could come in contact with site-derived chemicals under current and future conditions, assuming no remedial action at the site. These included the following: direct contact with and incidental ingestion of surface soil, subsurface soil, and Anthony Kill sediment, and inhalation of volatile compounds and soil particulates.

- Potential carcinogenic and noncarcinogenic risks to human health

were estimated under these assumed exposure pathways. Estimated incremental lifetime carcinogenic risks were within the USEPA target risk range for both the most probable and realistic worst exposure scenarios, for all of the exposure pathways identified. (USEPA guidelines state that the total incremental carcinogenic risk for an individual resulting from exposure at a hazardous waste site should be between 10^{-4} and 10^{-6}; a risk of 10^{-4} is interpreted as an additional 1 in 10,000 chance of an individual developing cancer during a lifetime, as a result of the exposure.) The noncarcinogenic hazard indices were all well below the cutoff of 1.0, indicating that no significant adverse noncarcinogenic effects would be expected. Therefore, Jordan concludes that, under the assumed conditions of exposure, no significant adverse health effects would be anticipated.

- Because Mechanicville site groundwater is not currently used or expected to be used in the foreseeable future as a source of drinking water, public health risks associated with the groundwater are negligible. Groundwater beneath the site, however, does contain several contaminants at levels above both USEPA and NY drinking water standards.

- As has been done in the past, the site health and safety plan should be followed during any future exploratory work on the Mechanicville site to prevent or minimize undue exposure.

- It is unlikely that the site is significantly utilized by wildlife because of the industrial nature of the area and the lack of suitable habitats. Aquatic organisms in the Anthony Kill, immediately adjacent to the site, were determined to be the environmental receptors most likely to be affected by site-related contamination.

- The results of the environmental risk assessment indicate that some potential for impacts does exist for aquatic organisms living in the Anthony Kill immediately adjacent to the site. However, these risks appear to be relatively minor, for several reasons. Few compounds were present at levels in excess of their environmental criteria, the extent of exceedances was minimal, and potential impacts were associated only with "worst case" conditions, with no impacts expected under typical conditions. Also, the amount of benthic habitat is limited due to the stream bed morphology and exposed bedrock, with little sediment accumulation. Finally, there is no evidence that contaminants are being transported downstream at significant levels. Levels of contaminants in the downstream surface water and sediment samples did not exceed protective criteria, even under the most conservative assumptions.

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). "Toxicological Profile for Di(2-ethylhexyl) phthalate"; Atlanta, Georgia; 1987.

Agency for Toxic Substances and Disease Registry (ATSDR). "Toxicological Profile for Cyanide"; Atlanta, Georgia; 1988.

American Conference of Governmental Industrial Hygienists (ACGIH). Documentation of the Threshold Limit Values. 5th Edition; Cincinnati, Ohio; 695 pp.; 1986.

Anderson, E., Browne, N., Duletsky, S., et al. "Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments." Revised final draft report. Office of Health and Environmental Assessment, U.S. Environmental Protection Agency. Washington, D.C., 1985.

Atlantic Environmental Services, Inc. "Management of Manufactured Gas Plant Sites: Volume III Risk Assessment Appendices"; prepared for Gas Research Institute; Chicago, Illinois; Atlantic Project No. 1019-01-60; January 1988.

Bevis, Lucille, 1986. Supervisor of Real Estate for NYSEG; Park Plaza, Mechanicville, New York 12118 (518-664-7371); interview on May 6, 1986.

Clayton, G.C. and F.E. Clayton (editors). Patty's Industrial Hygiene and Toxicology, Volume IIA and IIB; John Wiley and Sons; New York; 1981.

Clement Associates, 1987. "Comparative Potency Approach for Estimation of the Total Cancer Risk Associated with Exposure to Mixtures of Polycyclic Aromatic Hydrocarbons in the Environment"; Washington, D.C.

E.C. Jordan Co., 1986. "Investigation of the Former Coal Gasification Site at Mechanicville, New York -Task 1 Report"; prepared for New York State Electric and Gas Corporation; Binghamton, New York; August 1986.

E.C. Jordan Co., 1987. "Investigation of the Former Coal Gasification Site at Mechanicville, New York - Task 2 Report"; prepared for the New York State Electric and Gas Corporation; Binghamton, New York; December 1987.

E.C. Jordan Co., 1989. "Investigation of the Former Coal Gasification Site at Mechanicville, New York - Task 3 Report"; prepared for the New York State Electric and Gas Corporation; Binghamton, New York; September 1989.

Erano, J. Chairman of the Annual Anthony Kill Canoe Race through Mechanicville. Personal Communication in August 1989.

Gas Research Institute (GRI), 1987. "Management of Manufactured Gas Plant Sites: Volume I Wastes and Chemicals of Interest"; prepared by Remediation Technologies, Inc., Atlantic Environmental Services, Inc., and Keystone Environmental Resources, Inc.; October 1987.

Heath, R.C., F.K. Mack, and J.A. Tannenbaum, 1963. "Groundwater Studies in Saratoga County, New York"; U.S. Geological Survey; Bulletin GW-49; Albany, New York; pp. 1-42.

Hermans, J., H. Canton, P. Janssen and R. DeJong. 1984. "Quantitative Structure - Activity Relationships and Toxicity Studies of Mixtures of Chemicals with Anaesthetic Potency: Acute, Lethal and Sublethal Toxicity to Daphnia magna"; Aquatic Toxicology; 5:143-154.

ICF-Clement Associates. "Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites"; 1985.

International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Vol. 29 Some Industrial Chemicals and Dyestuffs; World Health Organization; Lyon, France; 1982.

International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans; Vol. 32; Polynuclear Aromatic Compounds, Part 1. Chemical, Environmental and Experimental Data; World Health Organization, Lyon, France; 1983.

LaGoy, P.K. "Estimated Soil Ingestion Rates for Use in Risk Assessment." Risk Analysis. 7(3):355-359, 1987.

McBride, John, Mike Gilbert, and John McNeil, 1986. Employees of NYSEG; Park Plaza, Mechanicville, New York 12118 (518 664-7371, ext. 34); interview on May 5, 1986.

Moore, J.W. and S. Ramamoorthy. Heavy Metals in Natural Waters. New York: Springer-Verlag. 1984; p. 190.

NYSDEC. Ambient Water Quality Standards and Guidance Values; Technical and Operation Guidance Series (85-W-38); Division of Water; Albany, New York; 1985a.

NYSDEC. Air Guide - 1: Application of 6 NYCRR PART 212 - Toxic Air Contaminants; Albany, New York; 1985b.

NYSDEC. New York State Surface Water Quality Regulations; Bureau of Water Quality Management, Division of Water; Albany, New York; 1986.

New York State Department of Environmental Conservation (NYSDEC). New York State Air Guide; Guideline for the Control of Toxic Air Contaminants; Division of Air Resources; 1985-86 Edition; NYSDEC; Albany, New York; 1985-86.

New York State Department of Environmental Conservation Water Quality Regulations, Surface Water, and Groundwater Classifications and Standards; Title 6; Chapter X, Parts 700-705; revised March 31, 1986.

New York State Department of Environmental Conservation, 1989. Personal Communication, Re: Significant Habitat Program and the Natural Heritage Program.

O'Meara, T. and Martin, B. Personal Communication in September 1989.

Schaum, J. Risk analysis of TCDD-contaminated soil. Office of Health and Environmental Assessment. U.S. Environmental Protection Agency. Washington, D.C. EPA-600/8-84-031, 1984.

Sheehan, Harold. Records on file; Schenectady Gazette, 50 North Main Street, Mechanicville, New York (518-664-3347).

Tucker, C.A. New York Department of Environmental Conservation, Division of Water, Albany, NY. Telephone conversation of August 1, 1989.

U.S. Environmental Protection Agency (USEPA). "Guideline for Air Quality Maintenance Planning and Analysis (Volume 10-Revised): Procedures for Evaluating Air Quality Impact of New Stationary Sources"; prepared for USEPA Office of Air Quality Planning and Standards; Research Triangle Park, North Carolina; USEPA-450/4-77-001; 1977.

U.S. Environmental Protection Agency (USEPA). "Ambient Water Quality Criteria for Toluene": Office of Water Regulations and Standards; Criteria and Standards Division; Washington, D.C.; USEPA 440/4-79-029; October 1980a.

U.S. Environmental Protection Agency (USEPA). "Ambient Water Quality Criteria for Ethyl Benzene"; USEPA 440/5-80-048; Washington, D.C.; 1980b. (As cited in Atlantic Environmental Services, Inc., January 1988.)

U.S. Environmental Protection Agency (USEPA). Water Quality Standards Handbook, Office of Water Regulations and Standards, Washington, D.C. December 1983.

U.S. Environmental Protection Agency (USEPA). "Health Effects Assessments for Polycyclic Aromatic Hydrocarbons (PAHs)"; Final Draft; September 1984.

U.S. Environmental Protection Agency (USEPA). "Health Advisory for Cyanide"; Office of Drinking Water; Washington, D.C.; 1985.

U.S. Environmental Protection Agency (USEPA). "Quality Criteria for Water." Office of Water Regulations and Standards; Washington, D.C.; 440/5-86-001; 1986.

U.S. Environmental Protection Agency (USEPA). Superfund Public Health Evaluation Manual; Office of Emergency and Remedial Response; Washington, DC; USEPA 540/1-86-060; 1986a.

U.S. Environmental Protection Agency (USEPA). "Health Advisory for Toluene." Office of Drinking Water; Washington, D.C.; 1987.

U.S. Environmental Protection Agency (USEPA), 1988. "Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Compounds;" SCD #17; USEPA, Office of Water, May 1988.

U.S. Environmental Protection Agency (USEPA). Exposure Factors Handbook; Exposure Assessment Group, Office of Health and Environmental Assessment, Washington, D.C., May 1989.

Wilson, D.C. and C. Stevens, 1981. "Problems Arising from the Redevelopment of Gas Works and Similar Sites"; Environmental and Medical Sciences Division of AERE Harwell; Oxfordshire, England; November 1981.

GLOSSARY OF ACRONYMS

AAL	Acceptable Ambient Level
ACGIH	American Conference of Governmental Industrial Hygienists
AIC	Acceptable Intake - chronic
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
BEHP	bis(2-ethylhexyl)phthalate
CC	ceiling concentration
CAG	Carcinogen Assessment Group
CNS	central nervous system
CPF	cancer potency factor
DOT	Department of Transportation
GC	gas chromatography
GI	gastrointestinal
HCN	hydrogen cyanide
HPLC	high-performance liquid chromatography
IARC	International Agency for Research on Cancer
IRIS	Integrated Risk Information System
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MDL	Minimum Detection Limit
mg/kg	milligrams per kilogram
MSL	mean sea level
ND	nondetect
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NTP	National Toxicology Program
NYSDEC	New York State Department of Environmental Conservation
NYSEG	New York State Electric and Gas Corporation
OSHA	Occupational Safety and Health Administration
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PEL	permissible exposure level
PM_{10}	inhalable particulate matter
ppm	part per million
QA/QC	quality assurance/quality control

GLOSSARY OF ACRONYMS (cont.)

RfD	reference dose
SDWA	Safe Drinking Water Act
SPHEM	Superfund Public Health Evaluation Manual
SQC	sediment quality criteria
STEL	short-term (15-minute) exposure limit
SVOCs	semivolatile organic compounds
TCL	target clean-up level
TKF	toxicokinetic factor
TLV	Threshold Limit Values
TOC	total organic carbon
TSP	total suspended particulates
TWA	time-weighted average
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOCs	volatile organic compound

APPENDIX A

SITE CHARACTERIZATION DATA
MECHANICVILLE SITE

APPENDIX A-1

GEOLOGIC PROFILES
MECHANICVILLE SITE

SUBSURFACE GEOLOGIC CONDITIONS

Subsurface geologic conditions investigated at the site are described in the following subsections. An interpretation of site stratigraphy is illustrated through geologic profiles located on a plan view of the site (Figure A-1).

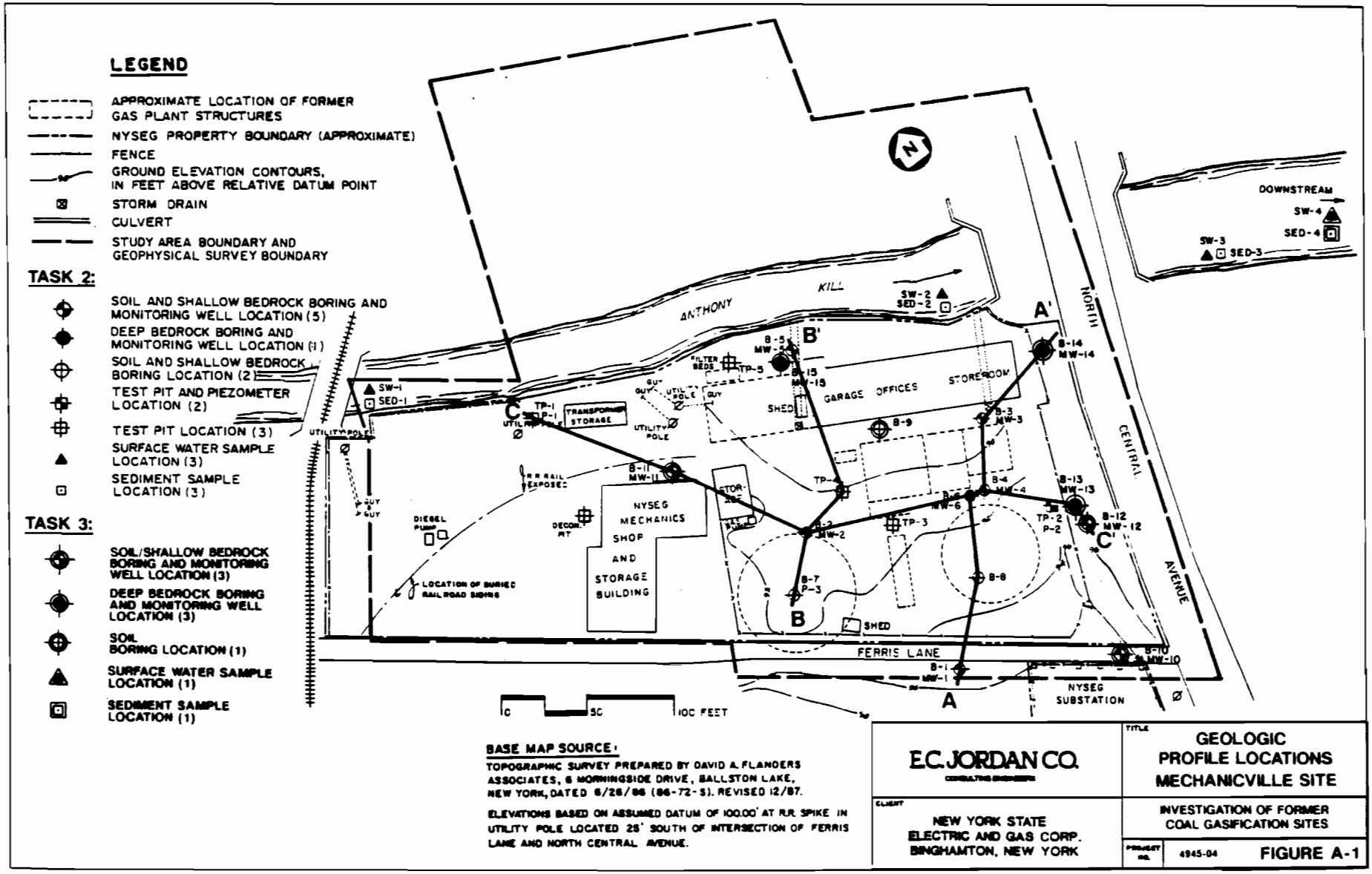
Fill. The uppermost fill consists primarily of brown to black silty sand and gravel with organic matter, ash, brick fragments, glass, and woodchips. Within the fill, there is considerable heterogeneity, including zones of clayey silt and fractured shale. The fill averages 8 to 25 feet thick across the site, but thins at the Anthony Kill (see Figures A-2 and A-3). The off-site lateral extent of the fill is unknown, but is expected to occur east of the site along North Central Avenue where the old Champlain Canal was filled.

Gravelly Sand. A brown, dense, gravelly sand was encountered in only one boring (B-1) at a depth of 8 feet below ground surface (see Figure A-2). The gravelly sand unit is 1.5 to 4 feet thick. At B-1, the gravelly sand overlies weathered bedrock. The gravelly sand may be fill or, if the area has not been disturbed, a glaciofluvial deposit.

Silty Shale. In the southeastern portion of the site, and between the present-day office building and the Anthony Kill, a silty shale unit overlies the bedrock. This unit consists of black to gray platy shale fragments with silt. The silty shale is loose, saturated, and lacks a consistent structure. These properties indicate that this area may have been disturbed by excavation, backfilling, and grading during construction of the gas plant. The silty shale in these areas is interpreted to be fill material. The silty shale unit varies in thickness across the site from 1 to 9 feet. It is thickest in the area of the former relief gas holder, near B-4, B-6, and B-8 (see Figure A-2). The off-site lateral extent of the silty shale layer is unknown.

Till. A thin, discontinuous tan to light gray silty clay till with fine gravel was encountered at the top of the bedrock surface in one boring (B-4). The pocket of till is less than one foot thick and is located along the northern edge of a small bedrock trough. The till contained some natural organic matter, suggesting that this remnant till was the original postglacial topsoil at the site. Because the till appears to be laterally discontinuous, it is not anticipated to significantly influence groundwater flow at the site.

Shale Bedrock. The bedrock at the Mechanicville site is a thinly bedded gray shale with calcite inclusions. The upper one to two feet of the bedrock is severely weathered and contains silt and dry platy shale fragments. Bedrock crops out at several locations along the southern bank of the Anthony Kill. Based on measurements taken from these outcrops, the bedrock strikes nearly east-west, and bedding dips approximately 30 degrees to the south. Bedrock core was obtained in eight borings beneath the highly weathered zone. As observed in the core, the upper portion of the bedrock contains fractures spaced between two inches to a foot apart. The primary fractures are parallel to bedding and secondary fractures exist at angles up to 90 degrees to the primary fracture. Some weathering has occurred along the fracture faces. In the deeper borings, more competent bedrock was encountered (i.e., deeper bedrock contained fewer fractures than shallow bedrock). Some of the deeper bedrock fractures contained coal tar or had a distinct coal tar odor. Groundwater movement in the bedrock occurs primarily through the fractures in response to the hydraulic gradient.



BASE MAP SOURCE:

TOPOGRAPHIC SURVEY PREPARED BY DAVID A. FLANDERS ASSOCIATES, 6 MORNINGSIDE DRIVE, BALLSTON LAKE, NEW YORK, DATED 6/26/86 (86-72-S). REVISED 12/87.

ELEVATIONS BASED ON ASSUMED DATUM OF 100.00' AT R.R. SPIKE IN UTILITY POLE LOCATED 25' SOUTH OF INTERSECTION OF FERRIS LANE AND NORTH CENTRAL AVENUE.

E.C. JORDAN CO.
CONSULTING ENGINEERS

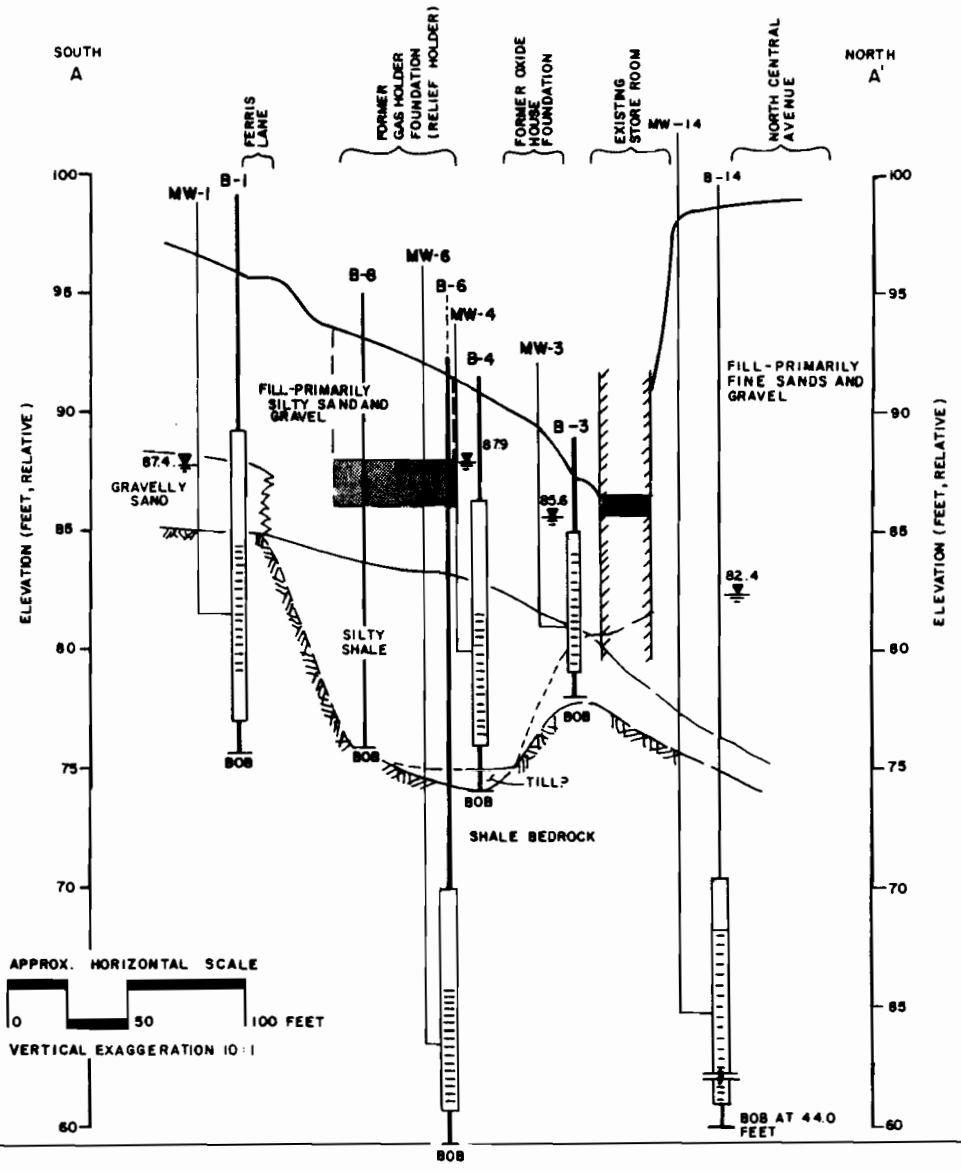
CLIENT
NEW YORK STATE ELECTRIC AND GAS CORP.
BINGHAMTON, NEW YORK

TITLE
GEOLOGIC PROFILE LOCATIONS
MECHANICVILLE SITE

INVESTIGATION OF FORMER COAL GASIFICATION SITES

PROJECT NO. 4945-04

FIGURE A-1



GEOLOGIC DESCRIPTIONS

FILL: PRIMARILY SILTY SAND AND GRAVEL WITH ORGANIC MATTER, ASH, BRICK FRAGMENTS, GLASS, AND WOOD CHIPS WITH ZONES OF HIGHER CLAYEY SILT AND FRACTURED SHALE CONTENT.

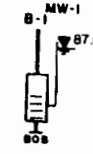
GRAVELLY SAND: DISCONTINUOUS BROWN TO DARK GRAY SAND AND GRAVEL.

SILTY SHALE: BLACK TO GRAY PLATY SHALE FRAGMENTS WITH INTERSTITIAL SILT. LOOSE AND SATURATED. POSSIBLY FILL.

TILL: DISCONTINUOUS TAN TO LIGHT GRAY SILTY CLAY TILL WITH FINE GRAVEL.

SHALE BEDROCK: LAMINATED, BROKEN, DARK GRAY SHALE WITH CALCITE VEINS AND INCLUSIONS. BEDDING DIPS 30-40° FROM HORIZONTAL; FRACTURES ARE 0-90° FROM BEDDING PLANES. UPPER 1 TO 2 FEET SEVERELY WEATHERED.

LEGEND



BORING AND MONITORING WELL LOCATION

OBSERVED WATER LEVEL (FEET, RELATIVE) ON MARCH 29, 1988

EFFECTIVE SCREEN LENGTH (ACTUAL SCREEN SHOWN AS ▤)

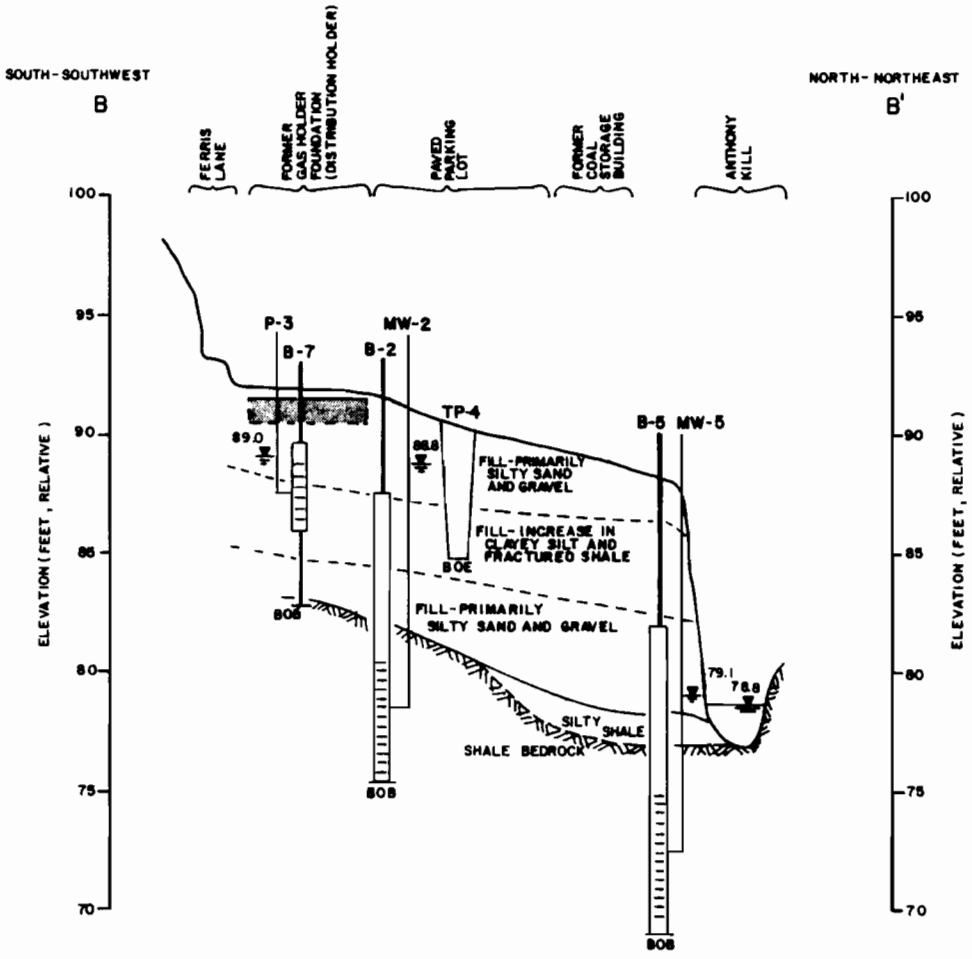
BOTTOM OF BORING

79.3 OBSERVED SURFACE WATER LEVEL (FEET, RELATIVE) ON MARCH 29, 1988

NOTES

1. SEE FIGURE 3-1 FOR LOCATION AND ORIENTATION OF PROFILE.
2. PROFILE IS BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS MAY VARY FROM THOSE SHOWN.
3. ELEVATIONS BASED ON ASSUMED DATUM OF 100.00' AT R.R. SPIKE IN UTILITY POLE LOCATED 25' SOUTH OF INTERSECTION OF FERRIS LANE AND NORTH CENTRAL AVENUE.
4. FOUNDATION STRUCTURE LOCATIONS SHOWN ARE APPROXIMATE.

E.C. JORDAN CO. CONSULTING ENGINEERS	INTERPRETIVE GEOLOGIC PROFILE A-A' MECHANICVILLE SITE
NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
	4945-04 FIGURE A-2



APPROX. HORIZONTAL SCALE

0 50 100 FEET

VERTICAL EXAGGERATION 10:1

GEOLOGIC DESCRIPTIONS

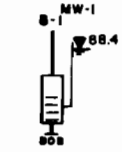
FILL: PRIMARILY SILTY SAND AND GRAVEL WITH ORGANIC MATTER, ASH, BRICK FRAGMENTS, GLASS, AND WOOD CHIPS WITH ZONES OF HIGHER CLAYEY SILT AND FRACTURED SHALE CONTENT.

GRAVELLY SAND: DISCONTINUOUS BROWN TO DARK GRAY SAND AND GRAVEL.

SILTY SHALE: BLACK TO GRAY PLATY SHALE FRAGMENTS WITH INTERSTITIAL SILT. LOOSE AND SATURATED. POSSIBLY FILL.

SHALE BEDROCK: LAMINATED, BROKEN, DARK GRAY SHALE WITH CALCITE VEINS AND INCLUSIONS. BEDDING DIPS 30-60° FROM HORIZONTAL; FRACTURES ARE 0-90° FROM BEDDING PLANES. UPPER 1 TO 2 FEET SEVERELY WEATHERED.

LEGEND



BORING AND MONITORING WELL LOCATION

OBSERVED WATER LEVEL (FEET, RELATIVE) ON MARCH 29, 1988

EFFECTIVE SCREEN LENGTH (ACTUAL SCREEN SHOWN AS ⊟)

BOTTOM OF BORING



TEST PIT AND PIEZOMETER LOCATION

OBSERVED WATER LEVEL (FEET, RELATIVE) ON MARCH 29, 1988

PIEZOMETER SCREEN

BOTTOM OF EXPLORATION

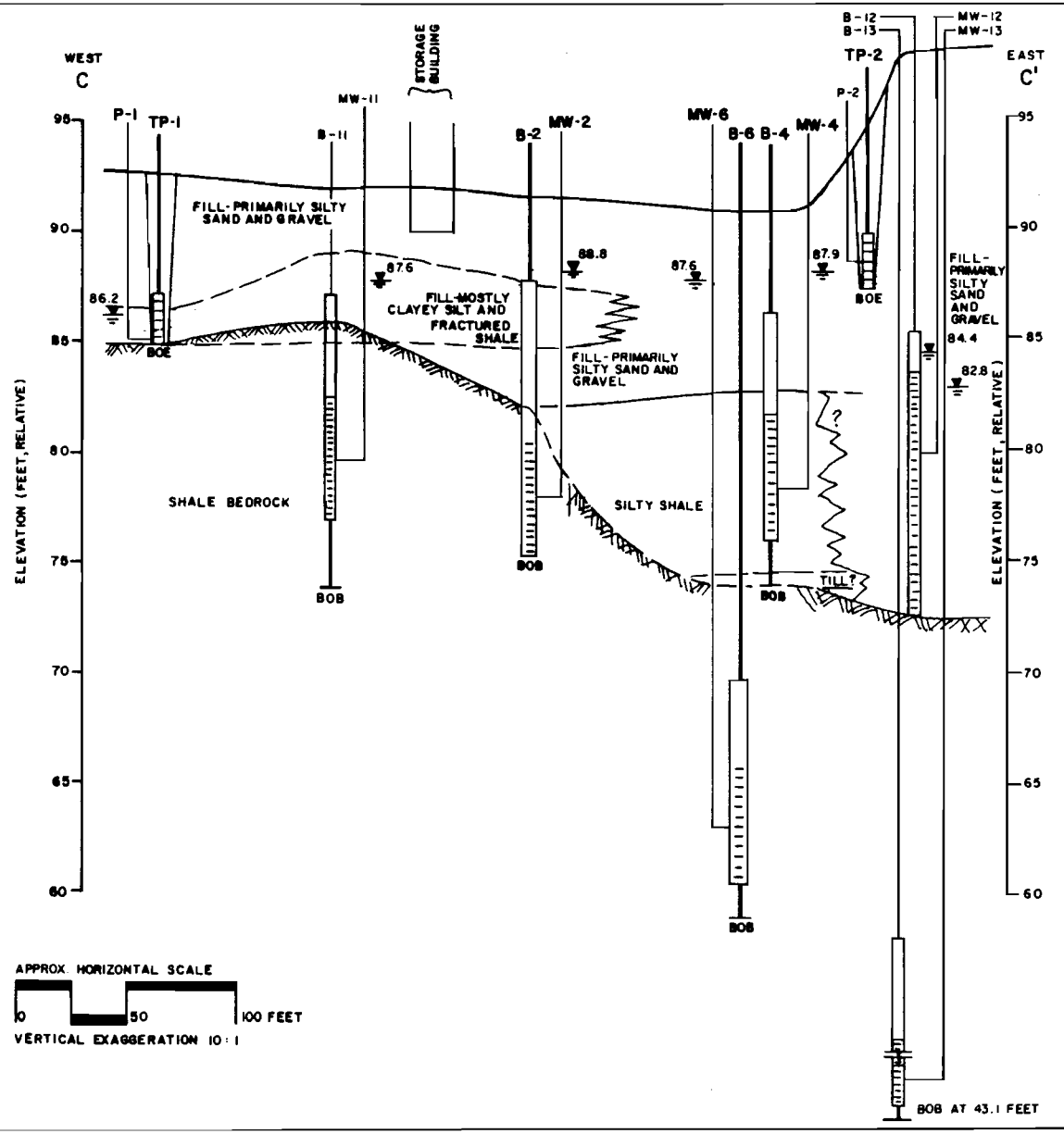
79.3

OBSERVED SURFACE WATER LEVEL (FEET, RELATIVE) ON MARCH 29, 1988

NOTES

1. SEE FIGURE 3-1 FOR LOCATION AND ORIENTATION OF PROFILE.
2. PROFILE IS BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS MAY VARY FROM THOSE SHOWN.
3. ELEVATIONS BASED ON ASSUMED DATUM OF 100.00' AT R.R. SPIKE IN UTILITY POLE LOCATED 25' SOUTH OF INTERSECTION OF FERRIS LANE AND NORTH CENTRAL AVENUE.
4. FOUNDATION STRUCTURE LOCATIONS SHOWN ARE APPROXIMATE.

E.C. JORDAN CO. CONSULTING ENGINEERS	INTERPRETIVE GEOLOGIC PROFILE B-B' MECHANICVILLE SITE
NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
	4945-04 FIGURE A-3



GEOLOGIC DESCRIPTIONS

FILL: PRIMARILY SILTY SAND AND GRAVEL WITH ORGANIC MATTER, ASH, BRICK FRAGMENTS, GLASS, AND WOOD CHIPS WITH ZONES OF HIGHER CLAYEY SILT AND FRACTURED SHALE CONTENT.

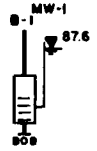
GRAVELLY SAND: DISCONTINUOUS BROWN TO DARK GRAY SAND AND GRAVEL.

SILTY SHALE: BLACK TO GRAY PLATY SHALE FRAGMENTS WITH INTERSTITIAL SILT. LOOSE AND SATURATED. POSSIBLY FILL.

TILL: DISCONTINUOUS TAN TO LIGHT GRAY SILTY CLAY TILL WITH FINE GRAVEL.

SHALE BEDROCK: LAMINATED, BROKEN, DARK GRAY SHALE WITH CALCITE VEINS AND INCLUSIONS. BEDDING DIPS 30-40° FROM HORIZONTAL; FRACTURES ARE 0-90° FROM BEDDING PLANES. UPPER 1 TO 2 FEET SEVERELY WEATHERED.

LEGEND



BORING AND MONITORING WELL LOCATION

OBSERVED WATER LEVEL (FEET, RELATIVE) ON MARCH 29, 1988

EFFECTIVE SCREEN LENGTH (ACTUAL SCREEN SHOWN AS ▭)

BOTTOM OF BORING



TEST PIT AND PIEZOMETER LOCATION

OBSERVED WATER LEVEL (FEET, RELATIVE) ON MARCH 29, 1988

PIEZOMETER SCREEN

BOTTOM OF EXPLORATION

NOTES

1. SEE FIGURE 3-1 FOR LOCATION AND ORIENTATION OF PROFILE.
2. PROFILE IS BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS MAY VARY FROM THOSE SHOWN.
3. ELEVATIONS BASED ON ASSUMED DATUM OF 100.00' AT R.R. SPIKE IN UTILITY POLE LOCATED 25' SOUTH OF INTERSECTION OF FERRIS LANE AND NORTH CENTRAL AVENUE.
4. FOUNDATION STRUCTURE LOCATIONS SHOWN ARE APPROXIMATE.

E.C. JORDAN CO. CONSULTING ENGINEERS	INTERPRETIVE GEOLOGIC PROFILE C–C' MECHANICVILLE SITE
NEW YORK STATE ELECTRIC AND GAS CORP. BINGHAMTON, NEW YORK	INVESTIGATION OF FORMER COAL GASIFICATION SITES
4945-04	FIGURE A-4

APPENDIX A-2

TASKS 2 AND 3 SOIL ANALYTICAL DATA
MECHANICVILLE SITE

4945TA21

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TABLE A-2-1
CHEMICALS FOUND IN TASK 2 TEST PIT SAMPLES
MECHANICVILLE SITE

SAMPLE IDENTIFIER	TP-1/S-1	TP-2/S-1	TP-4/S-1	TP-5/S-1	TP-5/S-1	TP-5/S-1
ORGANICS ANALYSIS (1)	HPLC	HPLC	HPLC	HPLC	HPLC DUP	GC/MS
DATE OF SAMPLE COLLECTION	7/21/86	7/21/86	7/21/86	7/21/86	7/21/86	7/21/86
SAMPLE DEPTH (FT)	6.5-7.0	7.0-7.5	3.0-4.0	3.0-4.0	3.0-4.0	4.0-6.0
ZONE SAMPLED	FILL	FILL	FILL	FILL	FILL	FILL
VOLATILE ORGANICS (MG/KG)						
-VOLATILE AROMATICS-						
BENZENE	ND (2)	ND	0.220	ND	ND	ND
TOLUENE	ND	ND	0.160	1.000	0.750	0.640
ETHYLBENZENE	ND	ND	0.150	6.600	6.100	2.200
STYRENE	ND	ND	ND	ND	ND	ND
TOTAL XYLENES	-- (3)	--	--	--	--	11.000
m-XYLENE	ND	ND	0.091	4.100	3.100	--
o-XYLENE	ND	ND	0.082	3.900	3.000	--
p-XYLENE	ND	ND	0.062	2.100	1.600	--
TRIMETHYLBENZENE	ND	ND	ND	4.600	5.100	--
n-PROPYLBENZENE	ND	ND	0.083	2.100	2.000	--
-OTHER-						
ACETONE	--	--	--	--	--	ND
METHYLENE CHLORIDE	--	--	--	--	--	1.000
CARBON DISULFIDE	--	--	--	--	--	0.110
TOTAL VOLATILE AROMATICS	ND	ND	0.848	24.400	21.650	13.840
SEMIVOLATILE ORGANICS (MG/KG)						
-PAH-						
ACENAPHTHENE	ND	(4)	ND	290.000	(4)	140.000
ACENAPHTHYLENE	ND	ND	(5)	(5)	(5)	33.000
ANTHRACENE	ND	ND	25.000	470.000	220.000	67.000
BENZO(b)FLUORANTHENE	ND	ND	23.000	ND	ND	13.000
BENZO(k)FLUORANTHENE	ND	ND	ND	ND	ND	21.000
BENZO(g,h,i)PERYLENE	ND	ND	18.000	ND	ND	13.000
BENZO(a)ANTHRACENE	ND	ND	(6)	(6)	ND	35.000
BENZO(a)PYRENE	ND	(4)	13.000	(4)	ND	36.000
CHRYSENE	ND	ND	59.000	110.000	ND	32.000
DIBENZO(a,h)ANTHRACENE	ND	ND	13.000	ND	ND	(4)
FLUORANTHENE	ND	45.000	84.000	880.000	220.000	78.000
FLUORENE	ND	18.000	31.000	620.000	2600.000	89.000
INDENO(1,2,3-cd)-PYRENE	ND	ND	ND	ND	ND	ND
NAPHTHALENE	ND	ND	19.000	350.000	5200.000	120.000
PHENANTHRENE	ND	12.000	31.000	810.000	260.000	210.000
PYRENE	ND	45.000	96.000	1100.000	ND	250.000
-OTHER-						
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	--	ND
TOTAL PAH	ND	120.000	412.000	4630.000	8500.000	1137.000

11/21/89

TABLE A-2-1 (CONT.)
CHEMICALS FOUND IN TASK 2 TEST PIT SAMPLES
MECHANICVILLE SITE

SAMPLE IDENTIFIER	TP-1/S-1	TP-2/S-1	TP-4/S-1	TP-5/S-1	TP-5/S-1	TP-5/S-1
ORGANICS ANALYSIS (1)	HPLC	HPLC	HPLC	HPLC	HPLC DUP	GC/MS
DATE OF SAMPLE COLLECTION	7/21/86	7/21/86	7/21/86	7/21/86	7/21/86	7/21/86
SAMPLE DEPTH (FT)	6.5-7.0	7.0-7.5	3.0-4.0	3.0-4.0	3.0-4.0	4.0-6.0
ZONE SAMPLED	FILL	FILL	FILL	FILL	FILL	FILL
OTHER CHEMICALS (MG/KG)						
-METALS-						
IRON	27000	35000	27000	31000	35000	--
ZINC	260	120	87	79	220	--
-CYANIDE-						
TOTAL CYANIDE	ND	2.0	ND	ND	ND	--
AMENABLE CYANIDE	ND	ND	ND	ND	ND	--
FERRO-FERRI CYANIDE	ND	2.0	ND	ND	ND	--
-OTHER-						
TOTAL RECOVERABLE PHENOLICS	ND	ND	ND	ND	ND	--
TOTAL ORGANIC CARBON	8300	1400	10000	30000	26000	--

NOTES:
(1) INDICATES SAMPLE WAS ANALYZED BY GC/MS (EPA METHODS 8240 AND 8270) OR BY HPLC (EPA METHODS 8020 AND 8310).
(2) ND = NOT DETECTED.
(3) -- = NOT ANALYZED OR NOT APPLICABLE.
(4) TRACE CONCENTRATIONS DETECTED BELOW THE QUANTIFIABLE REPORTING LIMIT.
(5) ACENAPHTHYLENE AND NAPHTHALENE, COELUTED.
(6) BENZO(a)ANTHRACENE AND CHRYSENE, COELUTED.

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TABLE A-2-2
CHEMICALS FOUND IN TASK 2 SOIL BORING SAMPLES
MECHANICVILLE SITE

SAMPLE IDENTIFIER	B-1/S-1	B-2/S-1	B-3/S-1	B-4/S-1	B-5/S-1	B-7/S-1	B-8/S-1	B-8/S-1
ORGANICS ANALYSIS (1)	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	GC/MS
DATE OF SAMPLE COLLECTION	7/23/86	8/1/86	8/5/86	7/29/86	8/4/86	7/31/86	8/6/86	8/6/86
SAMPLE DEPTH (FT)	8.0-10.0	8.0-9.5	4.0-6.0	6.0-8.0	10.0-11.0	7.0-9.0	13.5-15.5	15.5-17.5
ZONE SAMPLED	GRAVELLY SAND	FILL	FILL AND SILTY SHALE	FILL AND SILTY SHALE	SILTY SHALE	FILL	SILTY SHALE	SILTY SHALE
VOLATILE ORGANICS (MG/KG)								
-VOLATILE AROMATICS-								
BENZENE	ND (2)	ND	13.000	ND	0.880	2.400	640.000	380.000
TOLUENE	ND	ND	8.600	0.310	1.600	1.300	840.000	660.000
ETHYLBENZENE	ND	ND	120.000	2.300	6.300	0.170	440.000	250.000
STYRENE	ND	ND	ND	ND	ND	0.180	780.000	720.000
TOTAL XYLENES	-- (3)	--	--	--	--	--	--	1400.000
m-XYLENE	ND	ND	25.000	0.640	1.500	0.180	400.000	--
o-XYLENE	ND	ND	44.000	2.400	ND	ND	320.000	--
p-XYLENE	ND	ND	25.000	0.870	1.500	0.075	210.000	--
TRIMETHYLBENZENE	ND	ND	35.000	3.800	4.200	ND	170.000	--
n-PROPYLBENZENE	ND	ND	ND	ND	ND	ND	ND	--
-OTHER-								
ACETONE	--	--	--	--	--	--	--	ND
METHYLENE CHLORIDE	--	--	--	--	--	--	--	ND
CARBON DISULFIDE	--	--	--	--	--	--	--	ND
TOTAL VOLATILE AROMATICS	ND	ND	270.600	10.320	15.980	4.305	3800.000	3410.000
SEMIVOLATILE ORGANICS (MG/KG)								
-PAH-								
ACENAPHTHENE	9.000	(4)	380.000	42.000	250.000	(4)	600.000	(4)
ACENAPHTHYLENE	ND	(5)	(5)	(5)	(5)	(5)	(5)	670.000
ANTHRACENE	8.000	(4)	670.000	80.000	450.000	(4)	550.000	270.000
BENZO(b)FLUORANTHENE	5.700	ND	(4)	ND	120.000	(4)	200.000	(4)
BENZO(k)FLUORANTHENE	(4)	ND	240.000	ND	ND	0.980	ND	(4)
BENZO(g,h,i)PERYLENE	(4)	ND	(4)	ND	ND	1.400	140.000	(4)
BENZO(a)ANTHRACENE	(6)	(6)	(6)	(6)	ND	(6)	(6)	(4)
BENZO(a)PYRENE	6.200	ND	200.000	(4)	94.000	1.100	140.000	(4)
CHRYSENE	17.000	(4)	780.000	100.000	ND	0.800	480.000	(4)
DIBENZO(a,h)ANTHRACENE	6.300	ND	ND	ND	ND	1.300	ND	ND
FLUORANTHENE	44.000	(4)	1100.000	130.000	750.000	0.890	850.000	290.000
FLUORENE	34.000	(4)	1300.000	120.000	620.000	1.100	2100.000	380.000
INDENO(1,2,3-cd)-PYRENE	ND	ND	ND	ND	ND	ND	ND	(4)
NAPHTHALENE	ND	(4)	2300.000	44.000	760.000	1.900	1500.000	2500.000
PHENANTHRENE	13.000	(4)	940.000	110.000	630.000	0.870	760.000	870.000
PYRENE	11.000	(4)	1400.000	170.000	980.000	0.870	1400.000	460.000
-OTHER-								
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	--	--	--	ND
TOTAL PAH	154.200	(4)	9310.000	796.000	4654.000	11.210	8720.000	5440.000

11/21/89

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TABLE A-2-2 (CONT.)
CHEMICALS FOUND IN TASK 2 SOIL BORING SAMPLES
MECHANICVILLE SITE

SAMPLE IDENTIFIER	B-1/S-1	B-2/S-1	B-3/S-1	B-4/S-1	B-5/S-1	B-7/S-1	B-8/S-1	B-8/S-1
ORGANICS ANALYSIS (1)	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	GC/MS
DATE OF SAMPLE COLLECTION	7/23/86	8/1/86	8/5/86	7/29/86	8/4/86	7/31/86	8/6/86	8/6/86
SAMPLE DEPTH (FT)	8.0-10.0	8.0-9.5	4.0-6.0	6.0-8.0	10.0-11.0	7.0-9.0	13.5-15.5	15.5-17.5
ZONE SAMPLED	GRAVELLY SAND	FILL	FILL AND SILTY SHALE	FILL AND SILTY SHALE	SILTY SHALE	FILL	SILTY SHALE	SILTY SHALE
OTHER CHEMICALS (MG/KG)								
-METALS-								
IRON	34000	30000	31000	35000	27000	26000	19000	--
ZINC	190	75	130	80	1600	320	61	--
-CYANIDE-								
TOTAL CYANIDE	ND	ND	3.2	1.0	ND	ND	ND	--
AMENABLE CYANIDE	ND	ND	3.2	1.0	ND	ND	ND	--
FERRO-FERRI CYANIDE	ND	ND	ND	ND	ND	ND	ND	--
-OTHER-								
TOTAL RECOVERABLE PHENOLICS	ND	ND	3.6	ND	2.6	ND	ND	--
TOTAL ORGANIC CARBON	110000	6800	100000	23000	110000	76000	190000	--

NOTES:
(1) INDICATES SAMPLE WAS ANALYZED BY GC/MS (EPA METHODS 8240 AND 8270) OR BY HPLC (EPA METHODS 8020 AND 8310).
(2) ND = NOT DETECTED (SEE APPENDIX B-2 FOR MINIMUM DETECTION LIMITS).
(3) -- = NOT ANALYZED
(4) TRACE CONCENTRATIONS DETECTED BELOW THE QUANTIFIABLE REPORTING LIMIT.
(5) ACENAPHTHYLENE AND NAPHTHALENE, COELUTED.
(6) BENZO(a)ANTHRACENE AND CHRYSENE, COELUTED.

11/21/89

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TABLE A-2-3
TASK 3 SOIL BORING ANALYTICAL RESULTS
MECHANICVILLE SITE

SAMPLE IDENTIFIER	B-09(S-1)	B-10(S-2)	B-10(S-2) DUP-503	B-12(S-2)	B-14(S-2)	B-15(S-1)
DATE OF SAMPLE COLLECTION:	11/17/87	11/17/87	11/17/87	11/19/87	11/17/87	11/19/87
DEPTH (FT.):	4-5.5	16-18	16-18	22-24	18-20	4-8
ZONE SAMPLED:	SILTY SAND	SILTY SAND	SILTY SAND	SILTY FINE SAND	SILTY FINE SAND	FILL
VOLATILE ORGANICS (MG/KG) (1)						
-VOLATILE AROMATICS-						
BENZENE	-- (2)	--	--	ND	--	ND
TOLUENE	--	--	--	ND	--	ND
ETHYLBENZENE	--	--	--	ND	--	0.570
STYRENE	--	--	--	ND	--	ND
TOTAL XYLENES	--	--	--	ND	--	0.880
-OTHER-						
METHYLENE CHLORIDE	--	--	--	ND	--	ND
2-BUTANONE	--	--	--	ND	--	ND
TOTAL VOLATILE AROMATICS	--	--	--	ND	--	1.4
TOTAL VOLATILE ORGANICS	--	--	--	ND	--	1.4
SEMIVOLATILE ORGANICS (MG/KG) (1)						
-PAH-						
ACENAPHTHENE	T (3)	T	0.53	2.35	ND	ND
ACENAPHTHYLENE	ND (4)	T	T	ND	ND	ND
ANTHRACENE	T	T	T	0.8	ND	ND
BENZO(b)FLUORANTHENE	T	T	ND	ND	ND	ND
BENZO(k)FLUORANTHENE	(5)	(5)	ND	ND	ND	ND
BENZO(g,h,i)PERYLENE	T	ND	ND	ND	ND	ND
BENZO(a)ANTHRACENE	T	T	T	ND	ND	ND
BENZO(a)PYRENE	T	T	T	ND	ND	ND
CHRYSENE	T	T	T	ND	ND	ND
FLUORANTHENE	T	T	T	1.01	ND	ND
FLUORENE	T	T	T	1.25	ND	ND
INDENO(1,2,3-cd)-PYRENE	T	ND	ND	ND	ND	ND
NAPHTHALENE	60	T	0.45	ND	ND	ND
PHENANTHRENE	58	0.88	1.1	0.8	ND	ND
PYRENE	T	0.6	T	1.39	ND	ND

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TABLE A-2-3 (CONT.)
TASK 3 SOIL BORING ANALYTICAL RESULTS
MECHANICVILLE SITE

SAMPLE IDENTIFIER	B-09(S-1)	B-10(S-2)	B-10(S-2) DUP-503	B-12(S02)	B-14(S-2)	B-15(S-1)
DATE OF SAMPLE COLLECTION:	11/17/87	11/17/87	11/17/87	11/19/87	11/17/87	11/19/87
DEPTH (FT.):	4-5.5	16-18	16-18	22-24	18-20	4-8
ZONE SAMPLED:	SILTY SAND	SILTY SAND	SILTY SAND	SILTY FINE SAND	SILTY FINE SAND	FILL
-OTHER-						
2-Methylnaphthalene	T	T	T	ND	ND	ND
Dibenzofuran	ND	T	T	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	ND	R(6)	T	R
TOTAL PAH	120	1.5	2.1	7.6	ND	ND
TOTAL SEMI-VOLATILE ORGANIC	120	1.5	2.1	7.6	T	ND
OTHER CHEMICALS (MG/KS (MG/KG)						
-METALS-						
IRON	28000	24000	22000	18000	21000	23000
ZINC	59	42	44	32	49	390
-CYANIDE-						
TOTAL CYANIDE	ND	ND	ND	ND	ND	ND
UNDISTILLED CYANIDE (7)	ND	ND	ND	ND	ND	ND
-OTHER-						
TOTAL RECOVERABLE PHENOLICS	ND	ND	ND	ND	ND	2.6
TOTAL ORGANIC CARBON	33000	22000	24000	22000	32000	42000

NOTES:
(1) VOCs and SVOCs analyzed by GC/MS (USEPA Method 8240 and 8270).
(2) -- = Not analyzed (Laboratory Error).
(3) T = Trace concentrations detected below the quantifiable reporting limit.
(4) ND = Not Detected.
(5) Benzo(b)Fluoranthene and Benzo(k)Fluoranthene coeluted.
(6) Data rejected because analysis of blank indicated sampling or lab-derived contamination.
(7) Undistilled CN = Free and dissociable CN-; method used detected most, but not necessarily all, of amenable CN- present.

APPENDIX A-3

GROUNDWATER ANALYTICAL DATA
MECHANICVILLE SITE

TABLE A-3-1
CHEMICALS FOUND IN TASK 2 GROUNDWATER SAMPLES
MECHANICVILLE SITE

WELL IDENTIFIER	MW-1					MW-2					MW-3				
SAMPLE IDENTIFIER	MW-101	MW-101	MW-201	MW-301	MW-401	MW-102	MW-202	MW-202 DUP	MW-302	MW-402	MW-103	MW-103	MW-203	MW-303	MW-403
ORGANICS ANALYSIS (1)	HPLC	GC/MS	GC/MS	GC/MS	GC/MS	HPLC	GC/MS	GC/MS	GC/MS	GC/MS	HPLC	GC/MS	GC/MS	GC/MS	GC/MS
DATE OF SAMPLE COLLECTION	9/9/86	9/9/86	12/2/86	3/10/87	6/2/87	9/9/86	12/2/86	12/2/86	3/10/87	6/2/87	9/9/86	9/9/86	12/2/86	3/10/87	6/2/87
VOLATILE ORGANICS (MG/L)															
-VOLATILE AROMATICS-															
BENZENE	ND (2)	ND	0.0055	ND	ND	ND	ND	ND	ND	ND	0.530	0.560	0.608	0.429	0.230
TOLUENE	ND	ND	(4)	ND	ND	ND	ND	ND	ND	ND	0.100	0.120	(4)	0.0576	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.640	0.910	0.719	ND	ND
STYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL XYLENE	-- (3)	ND	0.010	ND	ND	--	ND	ND	ND	ND	--	0.770	0.640	0.0329	0.379
m - XYLENE	ND	--	--	--	--	ND	--	--	--	--	0.110	--	--	--	--
o - XYLENE	ND	--	--	--	--	ND	--	--	--	--	0.300	--	--	--	--
p - XYLENE	ND	--	--	--	--	ND	--	--	--	--	0.140	--	--	--	--
TRIMETHYLBENZENE	ND	--	--	--	--	ND	--	--	--	--	ND	--	--	--	--
-OTHER-															
ACETONE	--	0.220	3.780	0.059	ND	--	ND	ND	0.0536	ND	--	ND	ND	ND	ND
METHYLENE CHLORIDE	--	ND	ND	ND	ND	--	ND	ND	0.0086	ND	--	ND	ND	ND	ND
TOTAL VOLATILE AROMATICS	ND	ND	0.0155	ND	ND	ND	ND	ND	ND	ND	1.820	2.360	1.967	0.5195	0.609
SEMIVOLATILE ORGANICS (MG/L)															
-PAH-															
ACENAPHTHENE	0.110	0.022	0.012	ND	ND	ND	ND	ND	1.030	0.902	ND	0.420	ND	0.537	0.524
ACENAPHTHYLENE	0.250	0.048	0.018	ND	ND	ND	ND	ND	ND	0.084	2.500	(4)	ND	ND	ND
ANTHRACENE	(4)	(4)	0.031	ND	ND	ND	ND	ND	ND	ND	0.300	(4)	ND	0.226	0.140
BENZO(b)FLUORANTHENE	ND	(4,5)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(k)FLUORANTHENE	ND	(5)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(g,h,i)PERYLENE	ND	(4)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(a)ANTHRACENE	(6)	(4)	ND	ND	ND	ND	ND	ND	ND	ND	(6)	(4)	ND	0.102	ND
BENZO(a)PYRENE	(4)	(4)	ND	ND	ND	ND	ND	ND	ND	ND	0.280	(4)	ND	ND	ND
CHRYSENE	0.024	(4)	ND	ND	ND	ND	ND	ND	ND	ND	0.880	(4)	ND	ND	ND
DIBENZO(a,h)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	0.061	0.024	ND	ND	ND	ND	ND	ND	0.930	ND	2.700	(4)	0.680	0.223	0.174
FLUORENE	0.240	0.026	0.010	ND	ND	ND	ND	ND	ND	ND	4.700	(4)	0.660	0.197	0.198
INDENO(1,2,3,-cd)PYRENE	ND	(4)	ND	ND	ND	ND	ND	ND	ND	ND	ND	(4)	ND	ND	ND
NAPHTHALENE	1.200	0.260	0.136	ND	ND	ND	ND	ND	6.034	0.445	13.000	2.600	4.130	2.480	1.914
PHENANTHRENE	0.051	0.039	0.028	ND	ND	ND	ND	ND	1.700	ND	1.300	0.440	ND	0.624	0.140
PYRENE	0.044	0.025	0.017	(4)	ND	ND	ND	ND	ND	ND	0.660	0.200	0.690	0.431	0.264
-OTHER-															
BIS(2-ETHYLHEXYL)PHTHALATE	--	0.073	0.016	(4)	0.040	--	0.016	0.018	1.710	ND	--	0.250	ND	ND	ND
2-METHYLNAPHTHALENE	--	ND	ND	ND	ND	--	ND	ND	ND	0.144	--	ND	ND	ND	0.856
TOTAL PAH	1.980	0.444	0.252	(4)	ND	ND	ND	ND	9.694	1.431	26.320	3.660	6.160	4.820	3.354

TABLE A-3-1 (CONT.)
CHEMICALS FOUND IN TASK 2 GROUNDWATER SAMPLES
MECHANICVILLE SITE

WELL IDENTIFIER	MW-1					MW-2					MW-3				
SAMPLE IDENTIFIER	MW-101	MW-101	MW-201	MW-301	MW-401	MW-102	MW-202	MW-202	MW-302	MW-402	MW-103	MW-103	MW-203	MW-303	MW-403
ORGANICS ANALYSIS (1)	HPLC	GC/MS	GC/MS	GC/MS	GC/MS	HPLC	GC/MS	GC/MS DUP	GC/MS	GC/MS	HPLC	GC/MS	GC/MS	GC/MS	GC/MS
DATE OF SAMPLE COLLECTION	9/9/86	9/9/86	12/2/86	3/10/87	6/2/87	9/9/86	12/2/86	12/2/86	3/10/87	6/2/87	9/9/86	9/9/86	12/2/86	3/10/87	6/2/87
OTHER CHEMICALS (MG/L)															
-METALS-															
IRON	ND	--	ND	ND	0.05	0.50	0.07	0.06	ND	0.10	20.00	--	6.60	9.70	4.90
ZINC	ND	--	0.007	ND	ND	ND	0.072	0.005	ND	0.09	0.11	--	0.008	0.03	0.02
-CYANIDE-															
TOTAL CYANIDE (12)	ND	--	0.01	ND	0.01	ND	ND	ND	ND	0.01	0.46	--	ND	0.320	0.42
AMENABLE CYANIDE	ND	--	--	ND	ND	ND	ND	--	ND	ND	ND	--	--	ND	ND
FERRO-FERRI CYANIDE	ND	--	0.03	ND	0.01	ND	ND	0.02	ND	0.01	0.46	--	0.05	0.320	0.42
-OTHER-															
TOTAL RECOVERABLE PHENOLICS	ND	--	--	--	ND	ND	--	--	--	0.008	0.020	--	--	--	0.015
TOTAL ORGANIC CARBON	4.1	--	14	3.2	4.2	4.6	9	6	3.7	4.1	11	--	24	15.3	11
SULFATE	--	--	74.6	--	--	--	65.2	60.6	--	--	--	--	17.7	--	--
TOTAL NEW YORK STATE REGULATED ORGANICS (7)	1.730	0.396	0.250	0.000	ND	ND	ND	ND	9.694	1.355	25.660	6.020	8.127	5.340	3.978
FIELD MEASUREMENTS															
pH (8)	5.3	5.3	6.7	7.5	6.6	6.0	6.4	6.4	7.6	6.8	(11)	(11)	(11)	(11)	(11)
CONDUCTIVITY (9)	1830	1830	370	2040	1315	1680	786	786	1890	1225	(11)	(11)	(11)	(11)	(11)
TEMPERATURE (10)	11.2	11.2	8.4	5.9	10.0	17.8	13.3	13.3	3.2	12.6	(11)	(11)	(11)	(11)	(11)

NOTES:
(1) INDICATES WHETHER SAMPLE VALUES WERE OBTAINED BY GC/MS OR HPLC METHODS.
(2) ND = NOT DETECTED.
(3) -- = NOT ANALYZED
(4) TRACE CONCENTRATIONS DETECTED BELOW QUANTIFIABLE REPORTING LIMIT.
(5) BENZO(b)FLOURANTHENE AND BENZO(k)FLOURANTHENE, COELUTED.
(6) BENZO(a)ANTHRACENE AND CHRYSENE, COELUTED.
(7) THE N.Y. STATE CLASS GA GROUNDWATER STANDARD FOR ORGANICS INCLUDES PHENOLIC COMPOUNDS, VOLATILE ORGANICS, AND SEMIVOLATILE ORGANICS EXCEPT FOR ACETONE, STYRENE, ACENAPHTHALENE, BENZO(g,h,i)PERYLENE, DIBENZO(a,h)ANTHRACENE, AND BIS(2-ETHYLHEXYL)PHTHALATE.
(8) pH READINGS IN STANDARD UNITS
(9) CONDUCTIVITY IN MICROMHOS/CM
(10) TEMPERATURE IN DEGREES CELSIUS
(11) INDICATES SAMPLE TOO CONTAMINATED TO SUBMERGE PROBES.
(12) TOTAL CYANIDE CONCENTRATION MAY BE LOWER THAN CYANIDE COMPONENTS DUE TO LOW DETECTION LEVELS AND ACCURACY OF ANALYTICAL METHODS.

TABLE A-3-1 (CONT.)
CHEMICALS FOUND IN TASK 2 GROUNDWATER SAMPLES
MECHANICVILLE SITE

WELL IDENTIFIER	MW-4				MW-5-(12)				MW-6					
SAMPLE IDENTIFIER	MW-104	MW-204	MW-304	MW-404	MW-105	MW-205	MW-405	MW-405 DUP	MW-106	MW-106 DUP	MW-206	MW-306	MW-306 DUP	MW-406
ORGANICS ANALYSIS (1)	HPLC	GC/MS	GC/MS	GC/MS	HPLC	GC/MS	GC/MS	GC/MS	HPLC	HPLC	GC/MS	GC/MS	GC/MS	GC/MS
DATE OF SAMPLE COLLECTION	9/9/86	12/2/86	3/10/87	6/2/87	9/9/86	12/2/86	6/2/87	6/2/87	9/9/86	9/9/86	12/2/86	3/10/87	3/10/87	6/2/87
VOLATILE ORGANICS (MG/L)														
-VOLATILE AROMATICS-														
BENZENE	0.950	0.673	0.482	0.494	0.240	0.298	0.412	0.440	1.900	1.600	1.690	1.520	1.630	1.613
TOLUENE	0.760	0.487	0.335	0.409	0.200	0.295	0.400	0.362	1.600	1.200	0.815	0.353	0.353	0.616
ETHYLBENZENE	2.300	0.803	1.140	0.378	0.071	0.270	0.541	0.464	1.700	1.300	0.855	0.943	1.500	1.956
STYRENE	ND	ND	0.051	ND	ND	ND	ND	ND	0.920	0.610	ND	ND	1.370	ND
TOTAL XYLENE	--	1.230	1.440	1.347	--	ND	0.273	0.227	--	--	1.220	1.270	ND	1.452
m - XYLENE	0.850	--	--	--	0.065	--	--	--	1.200	1.000	--	--	--	--
o - XYLENE	0.810	--	--	--	0.120	--	--	--	0.940	0.770	--	--	--	--
p - XYLENE	0.430	--	--	--	0.058	--	--	--	0.570	0.450	--	--	--	--
TRIMETHYLBENZENE	0.088	--	--	--	0.046	--	--	--	0.120	0.100	--	--	--	--
-OTHER-														
ACETONE	--	ND	ND	ND	--	ND	ND	ND	--	--	0.850	ND	ND	ND
METHYLENE CHLORIDE	--	ND	ND	ND	--	ND	ND	ND	--	--	0.350	ND	ND	ND
TOTAL VOLATILE AROMATICS	6.188	3.193	3.448	2.628	0.800	0.863	1.626	1.493	8.950	7.030	4.580	4.086	4.853	5.637
SEMIVOLATILE ORGANICS (MG/L)														
-PAH-														
ACENAPHTHENE	0.980	0.240	0.187	0.218	0.260	17.300	150.280	195.500	37.000	48.000	ND	0.890	1.200	3.580
ACENAPHTHYLENE	8.300	ND	0.041	0.218	2.400	ND	150.280	197.200	26.000	59.000	ND	ND	ND	3.300
ANTHRACENE	0.510	ND	ND	ND	ND	7.600	178.330	227.800	11.000	16.000	ND	ND	ND	5.290
BENZO(b)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	4.000	6.600	ND	ND	ND	0.540
BENZO(k)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	7.200	4.100	ND	ND	ND	0.580
BENZO(g,h,i)PERYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(a)ANTHRACENE	(6)	ND	ND	ND	ND	ND	18.360	23.970	(6)	(6)	ND	ND	ND	ND
BENZO(a)PYRENE	0.290	ND	ND	ND	ND	ND	ND	ND	4.800	6.500	ND	ND	ND	0.560
CHRYSENE	1.400	ND	ND	ND	ND	ND	ND	26.350	25.000	17.000	ND	ND	ND	0.680
DIBENZO(a,h)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	4.200	ND	0.014	ND	0.150	6.300	43.860	59.500	93.000	74.000	ND	ND	1.310	2.510
FLUORENE	13.000	ND	0.026	0.100	3.900	7.600	62.220	80.920	120.000	140.000	ND	ND	ND	1.980
INDENO(1,2,3,-cd)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	33.000	6.120	3.970	2.392	11.000	39.400	331.500	413.100	280.000	300.000	6.980	5.040	5.910	18.760
PHENANTHRENE	2.000	ND	ND	ND	ND	6.700	178.330	227.800	36.000	45.000	ND	1.340	1.530	5.290
PYRENE	1.000	ND	0.027	ND	(4)	8.100	93.450	112.370	36.000	30.000	ND	0.843	ND	ND
-OTHER-														
BIS(2-ETHYLHEXYL)PHTHALATE	--	ND	0.013	ND	--	ND	ND	ND	--	--	ND	ND	ND	ND
2-METHYLNAPHTHALENE	--	ND	ND	0.580	--	ND	197.200	247.690	--	--	ND	ND	ND	7.170
TOTAL PAH	64.680	6.360	4.265	2.928	17.710	93.000	1206.610	1564.510	680.000	746.200	6.980	8.113	9.950	43.070

TABLE A-3-1 (CONT.)
CHEMICALS FOUND IN TASK 2 GROUNDWATER SAMPLES
MECHANICVILLE SITE

WELL IDENTIFIER	MW-4				MW-5-(12)				MW-6					
SAMPLE IDENTIFIER	MW-104	MW-204	MW-304	MW-404	MW-105	MW-205	MW-405	MW-405 DUP	MW-106	MW-106 DUP	MW-206	MW-306	MW-306 DUP	MW-406
ORGANICS ANALYSIS (1)	HPLC	GC/MS	GC/MS	GC/MS	HPLC	GC/MS	GC/MS	GC/MS	HPLC	HPLC	GC/MS	GC/MS	GC/MS	GC/MS
DATE OF SAMPLE COLLECTION	9/9/86	12/2/86	3/10/87	6/2/87	9/9/86	12/2/86	6/2/87	6/2/87	9/9/86	9/9/86	12/2/86	3/10/87	3/10/87	6/2/87
OTHER CHEMICALS (MG/L)														
-METALS-														
IRON	61.00	6.50	3.86	5.10	1.10	7.50	5.10	9.40	5.50	14.00	7.60	10.10	9.70	4.80
ZINC	0.29	0.02	0.02	0.01	ND	0.021	0.16	0.33	ND	ND	ND	0.01	0.01	0.03
-CYANIDE-														
TOTAL CYANIDE (13)	0.072	0.06	0.050	0.06	0.013	0.02	0.01	ND	0.075	0.081	0.12	0.060	0.050	0.07
AMENABLE CYANIDE	ND	0.04	ND	ND	0.013	--	ND	ND	0.026	0.024	0.10	ND	ND	ND
FERRO-FERRI CYANIDE	0.072	0.02	0.050	0.06	ND	0.06	0.01	0.01	0.049	0.057	0.02	0.060	0.050	0.07
-OTHER-														
TOTAL RECOVERABLE PHENOLICS	0.043	--	--	0.014	0.019	--	0.43	0.017	0.050	0.043	--	--	--	0.031
TOTAL ORGANIC CARBON	12	20	5.2	9.4	7.4	30	16	12	16	16	28	12.5	13.7	14
SULFATE	--	30.9	--	--	--	84.0	--	--	--	--	14.5	--	--	--
TOTAL NEW YORK STATE REGULATED ORGANICS (7)	62.611	9.553	7.621	5.352	16.129	93.863	1058.386	1368.820	662.080	693.663	11.910	12.199	13.433	45.438
FIELD MEASUREMENTS														
pH (8)	(11)	(11)	(11)	(11)	5.8	6.4	(11)	(11)	5.7	5.7	6.9	7.7	7.7	6.7
CONDUCTIVITY (9)	(11)	(11)	(11)	(11)	1640	680	(11)	(11)	1930	1930	1138	2300	2300	1385
TEMPERATURE (10)	(11)	(11)	(11)	(11)	12.7	12.0	(11)	(11)	16.0	16.0	14.3	6.0	6.0	13.1

NOTES:
(1) INDICATES WHETHER SAMPLE VALUES WERE OBTAINED BY GC/MS OR HPLC METHODS.
(2) ND = NOT DETECTED.
(3) -- = NOT ANALYZED
(4) TRACE CONCENTRATIONS DETECTED BELOW QUANTIFIABLE REPORTING LIMIT.
(5) BENZO(b)FLOURANTHENE AND BENZO(k)FLOURANTHENE, COELUTED.
(6) BENZO(a)ANTHRACENE AND CHRYSENE, COELUTED.
(7) THE N.Y. STATE CLASS GA GROUNDWATER STANDARD FOR ORGANICS INCLUDES PHENOLIC COMPOUNDS, VOLATILE ORGANICS, AND SEMIVOLATILE ORGANICS EXCEPT FOR ACETONE, STYRENE, ACENAPHTHALENE, BENZO(g,h,i)PERYLENE, DIBENZO(a,h)ANTHRACENE, AND BIS(2-ETHYLHEXYL)PHTHALATE.
(8) pH READINGS IN STANDARD UNITS
(9) CONDUCTIVITY IN MICROMHOS/CM
(10) TEMPERATURE IN DEGREES CELSIUS
(11) INDICATES SAMPLE TOO CONTAMINATED TO SUBMERGE PROBES.
(12) MW-5 ROUND 3 SAMPLING WAS NOT CONDUCTED DUE TO WEATHER OBSTRUCTIONS.
(13) TOTAL CYANIDE CONCENTRATION MAY BE LOWER THAN CYANIDE COMPONENTS DUE TO LOW DETECTION LEVELS AND ACCURACY OF ANALYTICAL METHODS.

TABLE A-3-2
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-01		MW-02		
SCREENED ZONE	SOIL/SHALLOW BEDROCK		SOIL/SHALLOW BEDROCK		
SAMPLE IDENTIFIER	MW-01	MW-01	MW-02	MW-02	MW-02 DUP
DATE OF SAMPLE COLLECTION	12/22/87	3/29/88	12/22/87	3/29/88	3/29/88
- VOLATILE AROMATICS -	** Volatile Organics (mg/l) (1) **				
Benzene	ND (2)	ND	ND	ND	-- (4)
Toluene	ND	ND	ND	ND	--
Ethylbenzene	ND	ND	ND	ND	--
Styrene	ND	ND	ND	ND	--
Total Xylenes	ND	ND	ND	ND	--
- OTHER -					
Methylene Chloride	ND	ND	ND	ND	--
2-Butanone	ND	ND	ND	ND	--
1,1,1-Trichloroethane	ND	ND	ND	ND	--
Vinyl Acetate	ND	ND	ND	ND	--
2-Hexanone	ND	ND	ND	ND	--
Chlorobenzene	ND	T	ND	T	--
1,1-Dichloroethane	ND	ND	ND	ND	--
Trichloroethene	ND	ND	ND	ND	--
Total Volatile Aromatics	ND	ND	ND	ND	--
Total Volatile Organics	ND	T	ND	T	--
	** Semi-Volatile Organics (mg/l) (1) **				
- PAH -					
Acenaphthene	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND
Benzo(k)fluoranthene (9)	ND	ND	ND	ND	NO
Benzo(g,h,i)Perylene	ND	ND	ND	ND	ND
Benzo(a)Pyrene	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND
Indeno (1,2,3-cd)Pyrene	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-01		MW-02		
SCREENED ZONE	SOIL/SHALLOW BEDROCK		SOIL/SHALLOW BEDROCK		
SAMPLE IDENTIFIER	MW-01	MW-01	MW-02	MW-02	MW-02 DUP
DATE OF SAMPLE COLLECTION	12/22/87	3/29/88	12/22/87	3/29/88	3/29/88
- OTHER -					
2,4 - Dimethylphenol	ND	ND	ND	ND	ND
2,4 - Dinitrotoluene	ND	ND	ND	ND	ND
2,6 - Dinitrotoluene	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND
4,6 - Dinitrol-2-Methylphenol	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	ND	ND
Benzyl Alcohol	ND	ND	ND	ND	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	T (3)	ND	ND	ND	ND
Total PAH	ND	ND	ND	ND	ND
Total Semi-Volatile Organics	T	ND	T	ND	ND
			** Other Chemicals (mg/l) **		
- DISSOLVED METALS -					
Iron	0.07	ND	0.04	0.12	0.23
Zinc	ND	0.02	ND	0.02	0.1
- CYANIDE -					
Total Cyanide (13)	0.01	ND	ND	ND	ND
Undistilled Cyanide (10)	ND	ND	ND	ND	ND
- OTHER -					
Total Recoverable Phenolics	0.006	ND	0.016	0.006	0.011
Total Organic Carbon	3.4	2.8	2.9	2.2	2.8
Total New York State Regulated Organics (5)	0.006	ND	0.0160	0.006	0.011
pH (6)	7.5	6.5	7.7	6.6	6.7

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-01		MW-02		
SCREENED ZONE	SOIL/SHALLOW BEDROCK		SOIL/SHALLOW BEDROCK		
SAMPLE IDENTIFIER	MW-01	MW-01	MW-02	MW-02	MW-02 DUP
DATE OF SAMPLE COLLECTION	12/22/87	3/29/88	12/22/87	3/29/88	3/29/88
- OTHER -					
Conductivity (7)	1125	1389	1153	1159	1302
Temperature (8)	11.1	10.2	11.9	7.0	7.0

NOTES:

(1) Sample values were obtained by GC/MS (USEPA Methods 624 and 625).
(2) ND = Not Detected.
(3) T = Trace (Concentrations detected below quantifiable reporting limits).
(4) -- = Not analyzed (Laboratory reported vial was received broken).
(5) The N.Y. State Class 6A Groundwater Standard for Organics includes phenolic compounds, volatile organics and semivolatile organics; except for Acetone, Styrene, Acenaphthalene, Benzo(g,h,i)Perylene, Dibenzo(a,h)Anthracene and bis(2-Ethylhexyl)phthalate.
(6) pH readings in standard units.
(7) Conductivity readings in micromhos/cm.
(8) Temperature in degrees Celsius.
(9) Benzo(b)fluoranthene and Benzo(k)Fluoranthene coelute.
(10) Undistilled CN - Free and dissociable CN-; method used and detected most, but not necessarily all, of the amenable CN- present.
(11) Sample too contaminated to submerge probes.
(12) Free Product in well.
(13) Total cyanide concentration may be less than distilled cyanide concentration due to analytical methods used and low detection levels.
(14) NR = Not Reported.

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TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-03		MW-04		MW-05	
SCREENED ZONE	SOIL		SOIL		SOIL/SHALLOW BEEDROCK	
SAMPLE IDENTIFIER	MW-03	MW-03	MW-04	MW-04	MW-05	MW-05
DATE OF SAMPLE COLLECTION	12/22/87	3/30/88	12/22/87	3/30/88	12/22/87	3/30/88
- VOLATILE AROMATICS -	** Volatile Organics (mg/l) (1) **					
Benzene	0.17	0.15	0.26	0.2	0.15	T
Toluene	0.021	ND	0.23	ND	0.094	ND
Ethylbenzene	0.11	ND	0.058	0.17	ND	0.054
Styrene	ND (2)	ND	ND	ND	ND	ND
Total Xylenes	0.40	0.42	2.2	1.3	0.19	0.16
- OTHER -						
Methylene Chloride	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND
Vinyl Acetate	ND	ND	ND	T	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND
Total Volatile Aromatics	0.70	0.57	2.8	1.67	0.43	0.214
Total Volatile Organics	0.70	0.57	2.8	1.67	0.43	0.214
	** Semi-Volatile Organics (mg/l) (1) **					
- PAH -						
Acenaphthene	30	ND	T	T	0.51	22
Acenaphthylene	T (3)	ND	T	T	T	2.7
Anthracene	9.7	ND	ND	T	T	ND
Benzo(b)fluoranthene	T	ND	ND	ND	ND	ND
Benzo(k)fluoranthene (9)	ND	ND	ND	ND	ND	1.3
Benzo(g,h,i)Perylene	ND	ND	ND	ND	ND	ND
Benzo(a)Anthracene	T	ND	ND	ND	ND	2.6
Benzo(a)Pyrene	T	T	ND	ND	ND	2.4
Chrysene	T	ND	ND	ND	ND	ND
Fluoranthene	12	T	ND	T	T	9.4
Fluorene	13	ND	T	T	T	10
Indeno (1,2,3-cd)Pyrene	ND	ND	ND	ND	ND	ND
Naphthalene	64	ND	1.9	1.4	3.6	30
Phenanthrene	38	ND	T	T	0.32	26
Pyrene	21	ND	ND	ND	T	1.4

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-03		MW-04		MW-05	
SCREENED ZONE	SOIL		SOIL		SOIL/SHALLOW BEEDROCK	
SAMPLE IDENTIFIER	MW-03	MW-03	MW-04	MW-04	MW-05	MW-05
DATE OF SAMPLE COLLECTION	12/22/87	3/30/88	12/22/87	3/30/88	12/22/87	3/30/88
- OTHER -						
2,4 - Dimethylphenol	ND	ND	ND	ND	ND	ND
2,4 - Dinitrotoluene	ND	T	ND	ND	ND	ND
2,6 - Dinitrotoluene	ND	ND	ND	ND	ND	T
2-Chloronaphthalene	ND	ND	ND	ND	ND	T
2-Methylnaphthalene	34	ND	0.65	0.78	1.1	35
2-Methylphenol	ND	ND	ND	ND	ND	ND
2-Nitroaniline	ND	T	ND	ND	ND	T
3-Nitroaniline	ND	ND	ND	ND	ND	T
4,6 - Dinitrol-2-Methylphenol	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	T
4-Nitoaniline	ND	T	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	ND	ND	T
Benzyl Alcohol	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	ND	ND	ND	T	ND	ND
Dibenzofuran	T	T	ND	ND	T	2
Hexachloroethane	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND	ND	T
Nitrobenzene	ND	ND	ND	ND	ND	ND
Phenol	ND	ND	T	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND	T	ND
Total PAH	190	ND	1.9	1.4	4.4	110
Total Semi-Volatile Organics	220	ND	2.6	2.18	5.5	142.2
** Other Chemicals (mg/l) **						
- DISSOLVED METALS -						
Iron	8.8	14.4	20	9.25	13	25
Zinc	0.11	0.2	0.52	0.05	0.54	1.09
- CYANIDE -						
Total Cyanide (13)	ND	0.27	0.05	0.05	ND	0.05
Undistilled Cyanide (10)	--	ND	ND	ND	ND	ND
- OTHER -						
Total Recoverable Phenolics	17	0.025	0.021	0.027	0.028	0.026
Total Organic Carbon	50,000 (12)	42	8.4	9.9	8,000 (12)	21
Total New York State Regulated Organics (5)	237.7	0.595	5.421	3.877	5.598	142.34
pH (6)	(11)	(11)	(11)	(11)	(11)	(11)

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TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-03		MW-04		MW-05	
SCREENED ZONE	SOIL		SOIL		SOIL/SHALLOW BEEDROCK	
SAMPLE IDENTIFIER	MW-03	MW-03	MW-04	MW-04	MW-05	MW-05
DATE OF SAMPLE COLLECTION	12/22/87	3/30/88	12/22/87	3/30/88	12/22/87	3/30/88
- OTHER -						
Conductivity (7)	(11)	(11)	(11)	(11)	(11)	(11)
Temperature (8)	(11)	(11)	(11)	(11)	(11)	(11)

NOTES:

(1) Sample values were obtained by GC/MS (USEPA Methods 624 and 625).
(2) ND = Not detected.
(3) T = Trace (Concentrations detected below quantifiable reporting limits).
(4) -- = Not analyzed (Laboratory reported vial was received broken).
(5) The N.Y. State Class 6A Groundwater Standard for Organics includes phenolic compounds, volatile organics and semivolatile organics; except for Acetone, Styrene, Acenaphthalene, Benzo(g,h,i)Perylene, Dibenzo(a,h)Anthracene and bis(2-Ethylhexyl)phthalate.
(6) pH readings in standard units.
(7) Conductivity readings in micromhos/cm.
(8) Temperature in degrees Celsius.
(9) Benzo(b)fluoranthene and Benzo(k)Fluoranthene coelute.
(10) Undistilled CN - Free and dissociable CN-; method used and detected most, but not necessarily all, of the amenable CN- present.
(11) Sample too contaminated to submerge probes.
(12) Free Product in well.
(13) Total cyanide concentration may be less than distilled cyanide concentration due to analytical methods used and low detection levels.
(14) NR = Not Reported.

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TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	--------- MW-06 ---------		--------- MW-10 ---------	
SCREENED ZONE	--------- BEDROCK ---------		--------- SOIL ---------	
SAMPLE IDENTIFIER	MW-06	MW-06	MW-10	MW-10
DATE OF SAMPLE COLLECTION	12/22/87	3/30/88	12/22/87	3/29/88
- VOLATILE AROMATICS -		** Volatile Organics (mg/l) (1) **		
Benzene	0.88	0.06	ND (2)	-- (4)
Toluene	0.13	ND	ND	--
Ethylbenzene	0.14	ND	ND	--
Styrene	ND	ND	ND	--
Total Xylenes	2.4	0.04	0.012	--
- OTHER -				
Methylene Chloride	ND	ND	ND	--
2-Butanone	ND	ND	ND	--
1,1,1-Trichloroethane	ND	ND	ND	--
Vinyl Acetate	ND	ND	ND	--
2-Hexanone	ND	ND	ND	--
Chlorobenzene	ND	ND	ND	--
1,1-Dichloroethane	ND	ND	ND	--
Trichloroethene	ND	ND	ND	--
Total Volatile Aromatics	3.6	0.1	0.012	--
Total Volatile Organics	3.6	0.1	0.012	--
		** Semi-Volatile Organics (mg/l) (1) **		
- PAH -				
Acenaphthene	2.2	T	0.10	T
Acenaphthylene	T	T	T (3)	ND
Anthracene	0.89	T	T	ND
Benzo(b)fluoranthene	T	T	ND	T
Benzo(k)fluoranthene (9)	T	ND	ND	ND
Benzo(g,h,i)Perylene	T	ND	ND	ND
Benzo(a)Anthracene	T	T	ND	T
Benzo(a)Pyrene	T	ND	ND	ND
Chrysene	T	ND	ND	T
Fluoranthene	1.0	T	T	ND
Fluorene	1.1	ND	0.028	T
Indeno (1,2,3-cd)Pyrene	T	ND	ND	ND
Naphthalene	12	ND	ND	ND
Phenanthrene	3.5	T	T	ND
Pyrene	1.6	T	T	ND

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-06	MW-06	MW-10	MW-10
SCREENED ZONE	BEDROCK		SOIL	
SAMPLE IDENTIFIER	MW-06	MW-06	MW-10	MW-10
DATE OF SAMPLE COLLECTION	12/22/87	3/30/88	12/22/87	3/29/88
- OTHER -				
2,4 - Dimethylphenol	ND	ND	ND	ND
2,4 - Dinitrotoluene	ND	ND	ND	ND
2,6 - Dinitrotoluene	ND	ND	ND	T
2-Chloronaphthalene	ND	ND	ND	ND
2-Methylnaphthalene	4.6	ND	T	ND
2-Methylphenol	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
4,6 - Dinitrol-2-Methylphenol	ND	ND	ND	T
4-Methylphenol	ND	ND	ND	ND
4-Nitoaniline	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	T
Benzoic Acid	ND	ND	ND	ND
Benzyl Alcohol	ND	ND	ND	ND
Butylbenzylphthalate	ND	ND	ND	ND
Dibenzofuran	T	ND	T	ND
Hexachloroethane	ND	ND	ND	T
N-Nitrosodiphenylamine	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Phenol	ND	T	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	ND	0.41
Total PAH	22	ND	0.13	ND
Total Semi-Volatile Organics	27	ND	0.13	0.41
			** Other Chemicals (mg/l) **	
- DISSOLVED METALS -				
Iron	11	5.95	0.64	1.41
Zinc	0.048	0.02	ND	0.02
- CYANIDE -				
Total Cyanide (13)	0.06	0.01	0.01	ND
Undistilled Cyanide (10)	0.07	ND	ND	ND
- OTHER -				
Total Recoverable Phenolics	0.056	0.037	ND	0.029
Total Organic Carbon	10,000 (12)	31	61	11
Total New York State Regulated Organics (5)	30.656	0.137	0.142	0.439
pH (6)	7.7	(11)	7.5	6.6

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-06		MW-10	
SCREENED ZONE	BEDROCK		SOIL	
SAMPLE IDENTIFIER	MW-06	MW-06	MW-10	MW-10
DATE OF SAMPLE COLLECTION	12/22/87	3/30/88	12/22/87	3/29/88
- OTHER -				
Conductivity (7)	1154	(11)	1262	1576
Temperature (8)	12.0	(11)	12.4	9.6

NOTES:

(1) Sample values were obtained by GC/MS (USEPA Methods 624 and 625).
(2) ND = Not Detected.
(3) T = Trace (Concentrations detected below quantifiable reporting limits).
(4) -- = Not analyzed (Laboratory reported vial was received broken).
(5) The N.Y. State Class 6A Groundwater Standard for Organics includes phenolic compounds, volatile organics and semivolatile organics; except for Acetone, Styrene, Acenaphthalene, Benzo(g,h,i)Perylene, Dibenzo(a,h)Anthracene and bis(2-Ethylhexyl)phthalate.
(6) pH readings in standard units.
(7) Conductivity readings in micromhos/cm.
(8) Temperature in degrees Celsius.
(9) Benzo(b)fluoranthene and Benzo(k)Fluoranthene coelute.
(10) Undistilled CN - Free and dissociable CN-; method used and detected most, but not necessa all, of the amenable CN- present.
(11) Sample too contaminated to submerge probes.
(12) Free Product in well.
(13) Total cyanide concentration may be less than distilled cyanide concentration due to analytical methods used and low detection levels.
(14) NR = Not Reported.

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-11			MW-12	
SCREENED ZONE	SOIL/SHALLOW BEDROCK			SOIL	
SAMPLE IDENTIFIER	MW-11	MW-11 DUP	MW-11	MW-12	MW-12
DATE OF SAMPLE COLLECTION	12/22/87	12/22/87	3/29/88	12/22/87	3/29/88
- VOLATILE AROMATICS -	** Volatile Organics (mg/l) (1) **				
Benzene	ND	ND	ND	ND	0.12
Toluene	ND	ND	ND	ND	T
Ethylbenzene	ND	ND	ND	ND	1.1
Styrene	ND	ND	ND	ND	ND
Total Xylenes	ND	ND	ND	0.075	1.2
- OTHER -					
Methylene Chloride	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	T
1,1,1-Trichloroethane	0.0026	0.0044	ND	ND	ND
Vinyl Acetate	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND
Total Volatile Aromatics	ND	ND	ND	0.075	2.4
Total Volatile Organics	0.0026	0.0044	ND	0.075	2.4
	** Semi-Volatile Organics (mg/l) (1) **				
- PAH -					
Acenaphthene	ND	ND	ND	ND	210
Acenaphthylene	ND	ND	ND	ND	T
Anthracene	ND	ND	ND	ND	86
Benzo(b)fluoranthene	ND	ND	ND	ND	T
Benzo(k)fluoranthene (9)	ND	ND	ND	ND	T
Benzo(g,h,i)Perylene	ND	ND	ND	ND	ND
Benzo(a)Anthracene	ND	ND	ND	ND	T
Benzo(a)Pyrene	ND	ND	ND	ND	T
Chrysene	ND	ND	ND	ND	T
Fluoranthene	ND	ND	ND	ND	82
Fluorene	ND	ND	ND	ND	110
Indeno (1,2,3-cd)Pyrene	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	580
Phenanthrene	ND	ND	ND	ND	320
Pyrene	ND	ND	ND	ND	130

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-11			MW-12	
SCREENED ZONE	SOIL/SHALLOW BEDROCK			SOIL	
SAMPLE IDENTIFIER	MW-11	MW-11 DUP	MW-11	MW-12	MW-12
DATE OF SAMPLE COLLECTION	12/22/87	12/22/87	3/29/88	12/22/87	3/29/88
- OTHER -					
2,4 - Dimethylphenol	ND	ND	ND	ND	ND
2,4 - Dinitrotoluene	ND	ND	ND	ND	ND
2,6 - Dinitrotoluene	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	540
2-Methylphenol	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	T	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND
4,6 - Dinitrol-2-Methylphenol	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND
4-Nitoaniline	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	ND	ND
Benzyl Alcohol	ND	ND	ND	ND	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	T
Hexachloroethane	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	T	ND	T	ND
Total PAH	ND	ND	ND	ND	1500
Total Semi-Volatile Organics	ND	T	ND	ND	2100
			** Other Chemicals (mg/l) **		
- DISSOLVED METALS -					
Iron	0.15	0.26	0.28	2.7	4.45
Zinc	ND	ND	0.01	ND	0.02
- CYANIDE -					
Total Cyanide (13)	ND	ND	ND	0.8	0.58
Undistilled Cyanide (10)	ND	ND	ND	0.02	ND
- OTHER -					
Total Recoverable Phenolics	0.005	0.01	ND	0.016	0.2
Total Organic Carbon	5.4	8.9	4.9	18	13
Total New York State Regulated Organics (5)	0.0076	0.0144	ND	0.091	2060.6
pH (6)	7.6	7.6	6.9	7.4	(11)

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-11			MW-12	
SCREENED ZONE	SOIL/SHALLOW BEDROCK			SOIL	
SAMPLE IDENTIFIER	MW-11	MW-11 DUP	MW-11	MW-12	MW-12
DATE OF SAMPLE COLLECTION	12/22/87	12/22/87	3/29/88	12/22/87	3/29/88
- OTHER -					
Conductivity (7)	785	1098	939	1470	(11)
Temperature (8)	11.7	11.1	9.1	11.3	(11)

NOTES:

(1) Sample values were obtained by GC/MS (USEPA Methods 624 and 625).
(2) ND = Not Detected.
(3) T = Trace (Concentrations detected below quantifiable reporting limits).
(4) -- = Not analyzed (Laboratory reported vial was received broken).
(5) The N.Y. State Class 6A Groundwater Standard for Organics includes phenolic compounds, volatile organics and semivolatile organics; except for Acetone, Styrene, Acenaphthalene, Benzo(g,h,i)Perylene, Dibenzo(a,h)Anthracene and bis(2-Ethylhexyl)phthalate.
(6) pH readings in standard units.
(7) Conductivity readings in micromhos/cm.
(8) Temperature in degrees Celsius.
(9) Benzo(b)fluoranthene and Benzo(k)Fluoranthene coelute.
(10) Undistilled CN - Free and dissociable CN-; method used and detected most, but not necessarily all, of the amenable CN- present.
(11) Sample too contaminated to submerge probes.
(12) Free Product in well.
(13) Total cyanide concentration may be less than distilled cyanide concentration due to analytical methods used and low detection levels.
(14) NR = Not Reported.

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TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	----------	MW-13 ----------		--------- MW-14 ---------	
SCREENED ZONE	----------	BEDROCK ----------		--------- BEDROCK ---------	
SAMPLE IDENTIFIER	MW-13	MW-13	MW-13 DUP	MW-14	MW-14
DATE OF SAMPLE COLLECTION	12/22/87	3/29/88	3/29/88	12/22/87	3/29/88
- VOLATILE AROMATICS -		** Volatile Organics (mg/l) (1) **			
Benzene	9.6	12	-- (4)	2.3	2.2
Toluene	3.6	6.4	--	0.34	ND
Ethylbenzene	2.0	2	--	0.061	T
Styrene	0.94	1.8	--	ND	ND
Total Xylenes	2.2	3.5	--	0.79	0.16
- OTHER -					
Methylene Chloride	ND	36	--	ND	ND
2-Butanone	ND	ND	--	ND	ND
1,1,1-Trichloroethane	ND	ND	--	ND	ND
Vinyl Acetate	ND	ND	--	ND	ND
2-Hexanone	ND	ND	--	ND	ND
Chlorobenzene	ND	ND	--	ND	ND
1,1-Dichloroethane	ND	ND	--	ND	ND
Trichloroethene	0.053	ND	--	ND	ND
Total Volatile Aromatics	18	26	--	3.5	2.4
Total Volatile Organics	18	62	--	3.5	2.4
		** Semi-Volatile Organics (mg/l) (1) **			
- PAH -					
Acenaphthene	T	T	T	0.069	0.076
Acenaphthylene	T	0.94	0.72	T	T
Anthracene	ND	T	T	T	ND
Benzo(b)fluoranthene	ND	T	T	ND	ND
Benzo(k)fluoranthene (9)	ND	T	ND	ND	ND
Benzo(g,h,i)Perylene	ND	ND	ND	ND	ND
Benzo(a)Anthracene	ND	T	T	ND	ND
Benzo(a)Pyrene	ND	T	T	ND	ND
Chrysene	ND	T	T	ND	ND
Fluoranthene	ND	0.3	T	ND	ND
Fluorene	T	ND	ND	T	T
Indeno (1,2,3-cd)Pyrene	ND	ND	ND	ND	ND
Naphthalene	4.6	8.1	7.8	T	1.8
Phenanthrene	T	1.3	0.92	T	T
Pyrene	ND	0.45	0.33	ND	ND

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-13			MW-14	
SCREENED ZONE	BEDROCK			BEDROCK	
SAMPLE IDENTIFIER	MW-13	MW-13	MW-13 DUP	MW-14	MW-14
DATE OF SAMPLE COLLECTION	12/22/87	3/29/88	3/29/88	12/22/87	3/29/88
- OTHER -					
2,4 - Dimethylphenol	ND	ND	ND	ND	T
2,4 - Dinitrotoluene	ND	T	ND	ND	ND
2,6 - Dinitrotoluene	ND	T	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND
2-Methylnaphthalene	0.78	2.7	2.1	0.080	0.22
2-Methylphenol	T	ND	ND	T	T
2-Nitroaniline	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND
4,6 - Dinitrol-2-Methylphenol	ND	ND	ND	ND	ND
4-Methylphenol	T	ND	ND	0.029	ND
4-Nitoaniline	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	ND	T
Benzyl Alcohol	ND	ND	ND	ND	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND
Dibenzofuran	ND	T	T	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND
Phenol	0.58	ND	ND	0.36	T
bis(2-Ethylhexyl)phthalate	ND	ND	ND	T	ND
Total PAH	4.6	11	9.8	0.069	1.9
Total Semi-Volatile Organics	6.0	14	12	0.54	2.1
			** Other Chemicals (mg/l) **		
- DISSOLVED METALS -					
Iron	0.14	0.26	0.18	0.4	0.16
Zinc	ND	0.01	0.02	ND	0.03
- CYANIDE -					
Total Cyanide (13)	0.15	0.1	0.13	0.12	0.09
Undistilled Cyanide (10)	ND	ND	ND	0.02	ND
- OTHER -					
Total Recoverable Phenolics	0.053	0.064	0.058	0.063	0.3
Total Organic Carbon	9	7.6	8.5	9.2	8.6
Total New York State Regulated Organics (5)	23.113	42.814	11.928	4.103	4.756
pH (6)	7.7	6.7	6.4	7.6	6.6

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-13	MW-13	MW-13	MW-14	MW-14
SCREENED ZONE	BEDROCK	BEDROCK		BEDROCK	BEDROCK
SAMPLE IDENTIFIER	MW-13	MW-13	MW-13 DUP	MW-14	MW-14
DATE OF SAMPLE COLLECTION	12/22/87	3/29/88	3/29/88	12/22/87	3/29/88
- OTHER -					
Conductivity (7)	1133	1332	1589	1157	1450
Temperature (8)	12.1	11.6	10.9	12.1	10.1

NOTES:

(1) Sample values were obtained by GC/MS (USEPA Methods 624 and 625).
(2) ND = Not Detected.
(3) T = Trace (Concentrations detected below quantifiable reporting limits).
(4) -- = Not analyzed (Laboratory reported vial was received broken).
(5) The N.Y. State Class 6A Groundwater Standard for Organics includes phenolic compounds, volatile organics and semivolatile organics; except for Acetone, Styrene, Acenaphthalene, Benzo(g,h,i)Perylene, Dibenzo(a,h)Anthracene and bis(2-Ethylhexyl)phthalate.
(6) pH readings in standard units.
(7) Conductivity readings in micromhos/cm.
(8) Temperature in degrees Celsius.
(9) Benzo(b)fluoranthene and Benzo(k)Fluoranthene coelute.
(10) Undistilled CN - Free and dissociable CN-; method used and detected most, but not necessarily all, of the amenable CN- present.
(11) Sample too contaminated to submerge probes.
(12) Free Product in well.
(13) Total cyanide concentration may be less than distilled cyanide concentration due to analytical methods used and low detection levels.
(14) NR = Not Reported.

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-15		
SCREENED ZONE	BEDROCK		
SAMPLE IDENTIFIER	MW-15	MW-15 DUP	MW-15
DATE OF SAMPLE COLLECTION	12/22/87	12/22/87	3/29/88
- VOLATILE AROMATICS -		** Volatile Organics (mg/l) (1) **	
Benzene	0.0026	0.0058	0.018
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Styrene	ND	ND	ND
Total Xylenes	0.0027	0.0031	0.013
- OTHER -			
Methylene Chloride	ND	ND	ND
2-Butanone	ND	ND	ND
1,1,1-Trichloroethane	0.017	0.025	0.012
Vinyl Acetate	ND	ND	ND
2-Hexanone	ND	ND	T
Chlorobenzene	ND	ND	ND
1,1-Dichloroethane	0.0033	0.0031	ND
Trichloroethene	ND	ND	ND
Total Volatile Aromatics	0.0053	0.0089	0.031
Total Volatile Organics	0.026	0.037	0.043
		** Semi-Volatile Organics (mg/l) (1) **	
- PAH -			
Acenaphthene	0.040	0.026	0.031
Acenaphthylene	0.045	0.027	T
Anthracene	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND
Benzo(k)fluoranthene (9)	ND	ND	ND
Benzo(g,h,i)Perylene	ND	ND	ND
Benzo(a)Anthracene	ND	ND	ND
Benzo(a)Pyrene	ND	ND	ND
Chrysene	ND	ND	ND
Fluoranthene	ND	ND	ND
Fluorene	T	T	0.011
Indeno (1,2,3-cd)Pyrene	ND	ND	ND
Naphthalene	0.091	T	T
Phenanthrene	T	T	T
Pyrene	ND	ND	T

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-15		
SCREENED ZONE	BEDROCK		
SAMPLE IDENTIFIER	MW-15	MW-15	MW-15 DUP
DATE OF SAMPLE COLLECTION	12/22/87	12/22/87	3/29/88
- OTHER -			
2,4 - Dimethylphenol	ND	ND	ND
2,4 - Dinitrotoluene	ND	ND	ND
2,6 - Dinitrotoluene	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND
2-Methylnaphthalene	0.030	T	ND
2-Methylphenol	ND	ND	ND
2-Nitroaniline	ND	ND	ND
3-Nitroaniline	ND	ND	ND
4,6 - Dinitrol-2-Methylphenol	ND	ND	ND
4-Methylphenol	ND	ND	ND
4-Nitoaniline	ND	ND	ND
4-Nitrophenol	ND	ND	ND
Benzoic Acid	ND	ND	ND
Benzyl Alcohol	ND	ND	T
Butylbenzylphthalate	ND	ND	ND
Dibenzofuran	ND	ND	T
Hexachloroethane	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND
Nitrobenzene	ND	ND	T
Phenol	ND	ND	T
bis(2-Ethylhexyl)phthalate	ND	ND	ND
Total PAH	0.18	0.053	0.042
Total Semi-Volatile Organics	0.21	0.053	0.042
		** Other Chemicals (mg/l) **	
- DISSOLVED METALS -			
Iron	0.13	ND	0.16
Zinc	ND	0.014	0.01
- CYANIDE -			
Total Cyanide (13)	ND	0.06	ND
Undistilled Cyanide (10)	ND	ND	ND
- OTHER -			
Total Recoverable Phenolics	0.006	0.006	ND
Total Organic Carbon	2.9	3.2	3.9
Total New York State Regulated Organics (5)	0.242	0.069	0.085
pH (6)	7.9	7.9	7.2

TABLE A-3-2 (CONT.)
TASK 3 GROUNDWATER ANALYTICAL RESULTS
MECHANICVILLE SITE

WELL IDENTIFIER	MW-15			
SCREENED ZONE	BEDROCK			
SAMPLE IDENTIFIER	MW-15	MW-15	MW-15 DUP	
DATE OF SAMPLE COLLECTION	12/22/87	12/22/87	3/29/88	
- OTHER -				
Conductivity (7)	949	1125	1589	1029
Temperature (8)	12.1	11.4	10.9	13.4

NOTES:

(1) Sample values were obtained by GC/MS (USEPA Methods 624 and 625).
(2) ND = Not Detected.
(3) T = Trace (Concentrations detected below quantifiable reporting limits).
(4) -- = Not analyzed (Laboratory reported vial was received broken).
(5) The N.Y. State Class 6A Groundwater Standard for Organics includes phenolic compounds, volatile organics and semivolatile organics; except for Acetone, Styrene, Acenaphthalene, Benzo(g,h,i)Perylene, Dibenzo(a,h)Anthracene and bis(2-Ethylhexyl)phthalate.
(6) pH readings in standard units.
(7) Conductivity readings in micromhos/cm.
(8) Temperature in degrees Celsius.
(9) Benzo(b)fluoranthene and Benzo(k)Fluoranthene coelute.
(10) Undistilled CN - Free and dissociable CN-; method used and detected most, but not necessarily all, of the amenable CN- present.
(11) Sample too contaminated to submerge probes.
(12) Free Product in well.
(13) Total cyanide concentration may be less than distilled cyanide concentration due to analytical methods used and low detection levels.
(14) NR = Not Reported.

APPENDIX A-4

SURFACE WATER ANALYTICAL DATA
MECHANICVILLE SITE

TABLE A-4-1
CHEMICALS FOUND IN TASK 2 SURFACE WATER SAMPLES
MECHANICVILLE SITE

SITE IDENTIFIER	SW-1					SW-2						SW-3				
SAMPLE IDENTIFIER	SW-101	SW-201	SW-301	SW-301 DUP	SW-401	SW-102	SW-202	SW-202 DUP	SW-302	SW-402	SW-402 DUP	SW-103	SW-103 DUP	SW-203	SW-303	SW-403
ORGANICS ANALYSIS (1)	HPLC	GC/MS	GC/MS	GC/MS	GC/MS	HPLC	GC/MS	GC/MS	GC/MS	GC/MS	GC/MS	HPLC	HPLC	GC/MS	GC/MS	GC/MS
DATE OF SAMPLE COLLECTION	9/9/86	12/2/86	3/10/87	3/10/87	6/2/87	9/9/86	12/2/86	12/2/86	3/10/87	6/2/87	6/2/87	9/9/86	9/9/86	12/2/86	3/10/87	6/2/87
VOLATILE ORGANICS (MG/L)																
-VOLATILE AROMATICS-																
BENZENE	ND (2)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
STYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL XYLENE	-- (3)	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	--	--	ND	ND	ND
m - XYLENE	ND	--	--	--	--	ND	--	--	--	--	--	ND	ND	--	--	--
o - XYLENE	ND	--	--	--	--	ND	--	--	--	--	--	ND	ND	--	--	--
p - XYLENE	ND	--	--	--	--	ND	--	--	--	--	--	ND	ND	--	--	--
TRIMETHYLBENZENE	ND	--	--	--	--	ND	--	--	--	--	--	ND	ND	--	--	--
-OTHER-																
ACETONE	--	ND	ND	ND	ND	--	ND	0.010	ND	ND	ND	--	--	ND	ND	ND
METHYLENE CHLORIDE	--	--	0.0054	ND	ND	--	--	--	ND	ND	ND	--	--	--	ND	ND
TOTAL VOLATILE AROMATICS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SEMIVOLATILE ORGANICS (MG/L)																
-PAH-																
ACENAPHTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.042	ND	ND	ND	ND	ND	ND
ACENAPHTHYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.043	ND	ND	ND	ND	ND	ND
ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(b)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(k)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(g,h,i)PERYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(a)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(a)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHRYSENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZO(a.h)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FLUORENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INDENO(1,2,3,-cd)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PHENANTHRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.020	ND	ND	ND	ND	ND	ND
-OTHER-																
BIS(2-ETHYLHEXYL)PHTHALATE	--	ND	ND	ND	0.016	--	ND	ND	ND	ND	0.012	--	--	0.025	ND	0.030
2-METHYLNAPHTHALENE	--	ND	ND	ND	ND	--	ND	ND	ND	0.069	ND	--	--	ND	ND	ND
TOTAL PAH	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.105	ND	ND	ND	ND	ND	ND

TABLE A-4-1 (CONT.)
CHEMICALS FOUND IN TASK 2 SURFACE WATER SAMPLES
MECHANICVILLE SITE

SITE IDENTIFIER	SW-1					SW-2						SW-3				
SAMPLE IDENTIFIER	SW-101	SW-201	SW-301	SW-301 DUP	SW-401	SW-102	SW-202	SW-202 DUP	SW-302	SW-402	SW-402 DUP	SW-103	SW-103 DUP	SW-203	SW-303	SW-403
ORGANICS ANALYSIS (1)	HPLC	GC/MS	GC/MS	GC/MS	GC/MS	HPLC	GC/MS	GC/MS	GC/MS	GC/MS	GC/MS	HPLC	HPLC	GC/MS	GC/MS	GC/MS
DATE OF SAMPLE COLLECTION	9/9/86	12/2/86	3/10/87	3/10/87	6/2/87	9/9/86	12/2/86	12/2/86	3/10/87	6/2/87	6/2/87	9/9/86	9/9/86	12/2/86	3/10/87	6/2/87
						OTHER CHEMICALS (MG/L)										
-METALS-																
IRON	0.23	0.47	1.09	0.99	0.037	0.23	0.40	0.45	0.79	0.36	0.33	0.22	0.24	0.41	0.78	0.33
ZINC	ND	ND	ND	ND	0.010	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	0.01
-CYANIDE-																
TOTAL CYANIDE	ND	0.01	ND	ND	ND	ND	0.01	ND	ND	0.01	ND	ND	ND	ND	ND	0.01
AMENABLE CYANIDE	ND	ND	ND	ND	ND	ND	--	--	ND	ND	ND	ND	ND	--	ND	ND
FERRO-FERRI CYANIDE	ND	0.01	ND	ND	ND	ND	0.02	0.03	ND	0.01	ND	ND	ND	0.01	ND	0.01
-OTHER-																
TOTAL RECOVERABLE PHENOLICS	ND	--	--	--	0.24	ND	--	--	--	0.013	0.005	ND	0.037	--	--	ND
TOTAL ORGANIC CARBON	5.5	11	11.9	7.3	6.4	ND	10	9	7.5	6.0	6.0	5.0	5.4	10.0	6.2	5.5
OIL AND GREASE	11	--	--	--	--	--	--	--	--	--	--	ND	--	--	--	--
SULFATE	--	16.4	--	--	--	--	19.3	18.6	--	--	--	--	--	18.4	--	--

NOTES:
(1) INDICATES SAMPLE VALUES WERE OBTAINED BY GC/MS (EPA METHODS 624 AND 625) OR BY HPLC (EPA METHODS 602 AND 610).
(2) ND = NOT DETECTED.
(3) -- = NOT ANALYZED
(4) TOTAL CYANIDE CONCENTRATION MAY BE LOWER THAN CYANIDE COMPONENTS DUE TO LOW DETECTION LEVELS AND ACCURACY OF ANALYTICAL METHODS

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TABLE A-4-2
TASK 3 SURFACE WATER ANALYTICAL RESULTS
MECHANICVILLE SITE

SITE IDENTIFIER:	UPSTREAM		ADJACENT		DOWNSTREAM	
SAMPLE IDENTIFIER:	SW-01	SW-01	SW-02	SW-02	SW-04	SW-04
DATE OF SAMPLE COLLECTION:	12/22/87	3/30/88	12/22/87	3/30/88	12/22/87	3/30/88
- VOLATILE AROMATICS -		** Volatile Organics (mg/l) (1) **				
Benzene	ND (1)	ND	ND	-- (2)		
Toluene	ND	ND	ND	--	ND	--
Ethylbenzene	ND	ND	ND	--	ND	--
Styrene	ND	ND	ND	--	ND	--
Total Xylenes	ND	ND	ND	--	ND	--
- OTHER -						
Methylene Chloride	ND	ND	ND	--	ND	--
2-Butanone	ND	ND	ND	--	ND	--
Total Volatile Aromatics	ND	ND	ND	--	ND	--
Total Volatile Organics	ND	ND	ND	--	ND	--
		** Semi-Volatile Organics (mg/l) (1) **				
- PAH -						
Acenaphthene	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)Perylene	ND	ND	ND	ND	ND	ND
Benzo(a)Anthracene	ND	ND	ND	ND	ND	ND
Benzo(a)Pyrene	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND
Indeno (1,2,3-cd)Pyrene	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND

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TABLE A-4-2 (CONT.)
TASK 3 SURFACE WATER ANALYTICAL RESULTS
TA-4-2 MECHANICVILLE SITE

SITE IDENTIFIER:	UPSTREAM		ADJACENT		DOWNSTREAM	
SAMPLE IDENTIFIER:	SW-01	SW-01	SW-02	SW-02	SW-04	SW-04
DATE OF SAMPLE COLLECTION:	12/22/87	3/30/88	12/22/87	3/30/88	12/22/87	3/30/88
- OTHER -						
bis(2-Ethylhexyl)phthalate	0.39	0.034	ND	ND	ND	ND
Total PAH	ND	ND	ND	ND	ND	ND
Total Semi-Volatile Organics	0.39	0.034	ND	ND	ND	ND
** Other Chemicals (mg/l) **						
- DISSOLVED METALS -						
Iron	0.20	0.38	1.1	1.8	0.24	0.42
Zinc	ND	0.03	0.014	0.02	ND	ND
- CYANIDE -						
Total Cyanide	ND	ND	ND	ND	ND	ND
Undistilled Cyanide (3)	ND	ND	ND	ND	ND	ND
- OTHER -						
Total Recoverable Phenolics	ND	ND	ND	ND	ND	0.011
Total Organic Carbon	6.1	4.2	6.1	4.9	4.8	4.7

NOTES:

(1) ND = Not Detected.

(2) NA = Not analyzed (laboratory reported vial was received broken).

(3) Undistilled CN = Free dissociable CN-; method used detected most, but not necessarily all, of amenable CN- present.

APPENDIX A-5

SEDIMENT ANALYTICAL DATA
MECHANICVILLE SITE

TABLE A-5-1
CHEMICALS FOUND IN TASK 2 SEDIMENT SAMPLES
MECHANICVILLE SITE

SITE IDENTIFIER	SED-1					SED-2						SED-3				
SAMPLE IDENTIFIER	SED-101	SED-201	SED-301	SED-301	SED-401	SED-102	SED-202	SED-202	SED-302	SED-402	SED-402	SED-103	SED-103	SED-203	SED-303	SED-403
ORGANICS ANALYSIS (1)	HPLC	HPLC	GC/MS	GC/MS DUP	GC/MS	HPLC	HPLC	HPLC DUP	GC/MS	GC/MS	GC/MS DUP	HPLC	HPLC DUP	HPLC	GC/MS	GC/MS
DATE OF SAMPLE COLLECTION	9/9/86	12/2/86	3/10/87	3/10/87	6/2/87	9/9/86	12/2/86	12/2/86	3/10/87	6/2/87	6/2/87	9/9/86	9/9/86	12/2/86	3/10/87	6/2/87
VOLATILE ORGANICS (MG/KG)																
-VOLATILE AROMATICS-																
BENZENE	ND (2)	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND
TOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.070	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
STYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL XYLENE	-- (3)	--	ND	ND	ND	--	--	--	ND	ND	ND	--	--	--	ND	ND
m - XYLENE	ND	ND	--	--	--	ND	ND	ND	--	--	--	ND	ND	ND	--	--
o - XYLENE	ND	ND	--	--	--	ND	ND	ND	--	--	--	ND	ND	ND	--	--
p - XYLENE	ND	ND	--	--	--	ND	ND	ND	--	--	--	ND	ND	ND	--	--
-OTHER-																
ACETONE	--	--	ND	ND	5.300	--	--	--	ND	6.600	3.800	--	--	--	ND	4.000
METHYLENE CHLORIDE	--	--	ND	ND	2.400	--	--	--	ND	3.000	2.900	--	--	--	ND	2.300
TOTAL VOLATILE AROMATICS	ND	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	0.07	ND
SEMIVOLATILE ORGANICS (MG/KG)																
-PAH-																
ACENAPHTHENE	(4)	ND	ND	ND	ND	(4)	ND	ND	ND	0.700	1.600	0.910	1.100	(4)	ND	ND
ACENAPHTHYLENE	0.740	ND	ND	ND	ND	0.900	ND	ND	ND	ND	1.300	2.700	3.500	8.800	ND	ND
ANTHRACENE	(4)	(4)	ND	ND	ND	(4)	(4)	(4)	(4)	ND	ND	1.100	1.200	(4)	(4)	ND
BENZO(b)FLUORANTHENE	(4)	0.580	ND	ND	ND	(4)	(4)	2.000	(4,5)	ND	ND	1.000	0.940	0.630	(4,5)	ND
BENZO(k)FLUORANTHENE	(4)	(5)	ND	ND	ND	(4)	(5)	4.800	(4,5)	ND	ND	0.930	1.000	(5)	(4,5)	ND
BENZO(g,h,i)PERYLENE	ND	3.100	ND	ND	ND	ND	(4)	15.000	ND	ND	ND	ND	ND	4.400	(4)	ND
BENZO(a)ANTHRACENE	(6)	(6)	ND	ND	ND	(6)	(6)	(6)	(4)	ND	ND	(6)	(6)	(6)	(4)	ND
BENZO(a)PYRENE	(4)	0.450	ND	ND	ND	(4)	(4)	6.100	(4)	ND	ND	0.740	0.800	0.650	(4)	ND
CHRYSENE	0.520	0.610	ND	ND	ND	0.460	(4)	8.500	(4)	ND	ND	2.000	2.100	(4)	(4)	ND
DIBENZO(a,h)ANTHRACENE	ND	0.930	ND	ND	ND	(4)	ND	7.100	ND	ND	ND	ND	1.600	2.300	ND	ND
FLUORANTHENE	0.960	0.470	ND	ND	ND	0.920	(4)	5.600	(4)	ND	ND	2.200	4.700	(4)	(4)	ND
FLUORENE	1.500	ND	ND	ND	ND	1.400	ND	ND	ND	ND	0.500	4.000	4.300	ND	ND	ND
INDENO(1,2,3,-cd)PYRENE	ND	(7)	ND	ND	ND	(4)	ND	(7)	ND	ND	ND	(4)	(4)	(7)	(4)	ND
NAPHTHALENE	3.600	ND	ND	ND	ND	3.300	ND	19.000	(4)	4.400	13.000	10.000	19.000	ND	ND	ND
PHENANTHRENE	0.570	0.390	ND	ND	ND	(4)	(4)	1.800	(4)	ND	ND	2.000	2.300	(4)	(4)	ND
PYRENE	0.690	0.770	ND	ND	ND	0.960	(4)	5.900	(4)	ND	ND	1.900	3.100	(4)	(4)	ND
-OTHER-																
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	(4)	ND	ND	--	--	--	(4)	ND	ND	--	--	--	(4)	ND
2-METHYLNAPHTHALENE	--	--	ND	ND	ND	--	--	--	ND	0.900	ND	--	--	--	ND	ND
DI-N-BUTYL PHTHALATE	--	--	--	--	2.100	--	--	--	--	ND	4.000	--	--	--	--	3.200
TOTAL PAH	8.580	7.300	ND	ND	ND	7.940	(3)	75.800	(4)	5.100	16.400	29.480	45.640	16.780	(4)	ND

TABLE A-5-1 (CONT.)
CHEMICALS FOUND IN TASK 2 SEDIMENT SAMPLES
MECHANICVILLE SITE

SITE IDENTIFIER	SED-1					SED-2						SED-3				
SAMPLE IDENTIFIER	SED-101	SED-201	SED-301	SED-301	SED-401	SED-102	SED-202	SED-202	SED-302	SED-402	SED-402	SED-103	SED-103	SED-203	SED-303	SED-403
ORGANICS ANALYSIS (1)	HPLC	HPLC	GC/MS	GC/MS DUP	GC/MS	HPLC	HPLC	HPLC DUP	GC/MS	GC/MS	GC/MS DUP	HPLC	HPLC DUP	HPLC	GC/MS	GC/MS
DATE OF SAMPLE COLLECTION	9/9/86	12/2/86	3/10/87	3/10/87	6/2/87	9/9/86	12/2/86	12/2/86	3/10/87	6/2/87	6/2/87	9/9/86	9/9/86	12/2/86	3/10/87	6/2/87
OTHER CHEMICALS (MG/KG)																
-METALS-																
IRON	16000	9200	10800	8320	15600	21000	19000	16000	9980	30800	23600	13000	13000	20000	13000	33100
ZINC	47	36	37	31	--	51	69	100	46	--	--	65	60	88	76	--
-CYANIDE-																
TOTAL CYANIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AMENABLE CYANIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
FERRO-FERRI CYANIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
-OTHER-																
TOTAL RECOVERABLE PHENOLICS	ND	ND	ND	ND	3.1	ND	ND	ND	ND	6.1	3.1	ND	ND	ND	ND	1.8
TOTAL ORGANIC CARBON	3000	4600	4790	3320	9700	7700	3500	7600	16100	11000	22000	4500	4600	4600	9350	15000
SULFATE	--	ND	--	--	--	--	60	40	--	--	--	--	--	30	--	--

NOTES:
(1) INDICATES WHETHER SAMPLE VALUES WERE OBTAINED BY GC/MS OR HPLC METHODS.
(2) ND = NOT DETECTED.
(3) -- = NOT ANALYZED
(4) TRACE CONCENTRATIONS DETECTED BELOW THE REPORTING LIMIT.
(5) BENZO(b)FLUORANTHENE AND BENZO(k)FLUORANTHENE, COELUTED.
(6) BENZO(a)ANTHRACENE AND CHRYSENE, COELUTED.
(7) INDENO(1,2,3-cd)PYRENE AND BENZO(g,h,i)PERYLENE, COELUTED.

TABLE A-5-2
TASK 3 SEDIMENT ANALYTICAL RESULTS
MECHANICVILLE SITE

SITE IDENTIFIER:	UPSTREAM		ADJACENT		DOWNSTREAM			
SAMPLE IDENTIFIER:	SD-01	SD-01	SD-02	SD-02	SD-04	DUP-01	SD-04	SD-DUP
DATE OF SAMPLE COLLECTION:	12/22/87	3/30/88	12/22/87	3/30/88	12/22/87	12/22/87	3/30/88	3/30/88
- VOLATILE AROMATICS -		** Volatile Organics (mg/l) (1) **						
Benzene	ND (1)	ND	ND	T	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	0.087	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	ND
- OTHER -								
Methylene Chloride	ND	R (3)	ND	R	ND	ND	R	R
2-Butanone	ND	R	ND	R	ND	ND	R	R
Total Volatile Aromatics	ND	ND	0.087	T	ND	ND	ND	ND
Total Volatile Organics	ND	ND	0.087	T	ND	ND	ND	ND
		** Semi-Volatile Organics (mg/l) (1) **						
- PAH -								
Acenaphthene	ND	ND	T	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	T	ND	ND	ND	ND	ND
Anthracene	ND	ND	T	ND	ND	ND	ND	ND
Benzo(a)Anthracene	T	ND	0.53	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	0.94	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	(5)	ND	ND	ND	ND	ND
Benzo(g,h,i)Perylene	ND	ND	T	ND	ND	ND	ND	ND
Benzo(a)Pyrene	ND	ND	0.59	ND	ND	ND	ND	ND
Chrysene	T (2)	ND	0.58	ND	ND	ND	ND	ND
Dibenz(a,h)Anthracene	ND	ND	T	ND	ND	ND	ND	ND
Fluoranthene	T	ND	T	ND	T	T	ND	ND
Fluorene	ND	ND	T	ND	ND	ND	ND	ND
Indeno (1,2,3-cd)Pyrene	ND	ND	T	ND	ND	ND	ND	ND
Naphthalene	ND	ND	0.48	ND	ND	T	ND	ND
Phenanthrene	T	ND	0.9	T	T	T	ND	ND
Pyrene	T	ND	1.1	ND	T	T	ND	

TABLE A-5-2 (CONT.)
TASK 3 SEDIMENT ANALYTICAL RESULTS
MECHANICVILLE SITE

SITE IDENTIFIER:	UPSTREAM		ADJACENT		DOWNSTREAM			
SAMPLE IDENTIFIER:	SD-01	SD-01	SD-02	SD-02	SD-04	DUP-01	SD-04	DUP-01
DATE OF SAMPLE COLLECTION:	12/22/87	3/30/88	12/22/87	3/30/88	12/22/87	12/22/87	3/30/88	3/30/88
- OTHER -								
4-Methylphenol	ND	ND	T	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	T	ND	ND	ND	ND	ND
Butylbenzylphthalate	ND	ND	T	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	T	ND	ND	ND	ND	ND
Di-n-octylphthalate	ND	25	ND	T	ND	ND	T	T
Total PAH	T	ND	5.1	T	T	T	ND	ND
Total Semi-Volatile Organics	T	25	5.1	T	T	T	T	T
** Other Chemicals (mg/l) **								
- DISSOLVED METALS -								
Iron	7700	NR (4)	8400	NR	8700	7100	NR	NR
Zinc	27	NR	45	NR	25	28	NR	NR
- CYANIDE -								
Total Cyanide (ppm) (6)	ND	NR	1.3	NR	ND	ND	NR	NR
Undistilled Cyanide	ND	NR	ND	NR	ND	ND	NR	NR
- OTHER -								
Total Recoverable Phenolics	1.3	NR	2.3	NR	1.2	0.68	NR	NR
Total Organic Carbon	1200	NR	32000	NR	18000	11000	NR	NR

NOTES:

(1) ND = Not Detected.
(2) T = Trace concentrations detected below the quanitifiable reporting limits.
(3) R = Data rejected because analysis of blank indicated sampling or lab-derived contamination.
(4) NR = Analysis not requested.
(5) Benzo(b)fluoranthene and Benzo(k)fluoranthene coeluted.
(6) Undistilled CN = Free and dissociable CN-; method used detected most, but not necessarily all, of the amenable CN- present.

TABLE A-5-3

New York Dept. of Environmental Conservation Sediment Sample of October 1988

C.T. Male Associates, P.C.
Laboratory Analysis Report
NOVEMBER 07, 1988

/S DEC/REGION 5
JDSON AVENUE EXTENSION
ARENSBURG NY 12885

CTM PROJECT #: 88.02125
No. samples analyzed: 3

CTM Task #: 881019C

:tention: MR. GERARD BRADLEY

rchase Order Number: 8806037/98354
te Sampled: 10/18/88 Time: 11:00 AM
mpled By : COOK
mple Id: [illegible]
cation : [illegible]

CTM Sample No: 1019 88C 02
Date Received: 10/18/88
Collection Method: GRAB
Matrix: SOIL

rameters and Standard Methodology Used		Results		Analyst Refer
B IN SOIL/SOLID/SLUDGE	EPA SW 846-METHOD 8080	<157	MCG/KG	RK H:69 11/3
IORITY POLLUTANT (BASE NEUT.)	FEDERAL REGISTER, DEC 3, 1979.625	COMPLETED		CM 10/31
TRACTION EPA 625 (B/N)	FEDERAL REGISTER, DEC 3, 1979.625	EXTRACTED		HC 10/21
SOLIDS	STD. METH. 15TH ED.209A	83%		HB C:17 10/21
E FOLLOWING COMPOUNDS WERE	DETECTED	SEE	BELOW	CM 10/31
PHTHALENE	40 CFR PART 136. OCT.26,1984. EPA 625	1,829	MCG/KG	CM A:67 10/31
UORENE	40 CFR PART 136. OCT.26,1984. EPA 625	1,590	MCG/KG	CM A:67 10/31
NANTHRENE	40 CFR PART 136. OCT.26,1984. EPA 625	5,487	MCG/KG	CM A:67 10/31
THRACENE	40 CFR PART 136. OCT.26,1984. EPA 625	1,639	MCG/KG	CM A:67 10/31
UORANTHENE	40 CFR PART 136. OCT.26,1984. EPA 625	1,471	MCG/KG	CM A:67 10/31
PENE	40 CFR PART 136. OCT.26,1984. EPA 625	2,345	MCG/KG	CM A:67 10/31
ZO b & k FLUORANTHENE	40 CFR PART 136. OCT.26,1984. EPA 625	954	MCG/KG	CM A:67 10/31
ZO (a) PYRENE	40 CFR PART 136. OCT.26,1984. EPA 625	914	MCG/KG	CM A:67 10/31
METHYLNAPTHALENE	EPA METHOD 625	2,664	MCG/KG	CM A:67 10/31
OTHER COMPOUNDS WERE	DETECTED BY EPA 625	SEE	ATTACHED	CM 10/31
L OTHER COMPOUNDS WERE BELOW	THE DETECTION LIMITS	SEE	ATTACHED	CM 10/31

UTHORIZED FOR RELEASE: Tom Mikulka PhD

LEGEND:

.L.A.P. ID NO 10358
HONE: 518 785-0776

ALL RESULTS ARE CALCULATED ON A DRY WEIGHT BASIS

(= LESS THAN,) = GREATER THAN
MCG/G=PPM, MG/G=PPB, ME/L=PPM, MCG/

TABLE A-5-4
NYSEG Sediment Sample Results of November 1988

UPSTATE LABORATORIES, INC.

HSL

Analysis Results
Report Number
Date:

NYSEG
(all results mg/kg)

ACID EXTRACTABLES

CLIENT I.D.	Mechanicville Anthony Kill MEE1XX8801G 11/2/88	Mechanicville Anthony Kill MEE1XX8802G 11/2/88		
ULI I.D.	30988025	30988026		
Phenol	<0.2	<0.2		
2-Chlorophenol	↓	↓		
2-Nitrophenol				
2,4-Dimethylphenol				
2,4-Dichlorophenol				
4-Chloro-3-Methylphenol				
2,4,6-Trichlorophenol	↓	↓		
2,4-Dinitrophenol	<2	<2		
4-Nitrophenol	<0.2	<0.2		
2-Methyl-4,6-Dinitrophenol	<2	<2		
Pentachlorophenol	<0.5	<0.5		
Benzyl Alcohol	<2	<2		
2-Methylphenol	<0.2	<0.2		
4-Methylphenol	<0.2	<0.2		
Benzoic Acid	<2	<2		
4-Chloroaniline	20.2	<0.2		
2-Methylnaphthalene	0.6	0.8		
2,4,5-Trichlorophenol	<0.2	<0.2		
2-Nitroaniline	↓	↓		
3-Nitroaniline	↓	↓		
Dibenzofuran	<0.5	<0.5		
4-Nitroaniline	<0.2	<0.2		

TABLE A-5-4, cont.
NYSEG Sediment Sample Results of November 1988

UPSTATE LABORATORIES, INC.

Analysis Results
Report Number
Date:

NYSEG

BASE/NEUTRAL EXTRACTIONS (mg/kg)

CLIENT I.D.	MEE1xx880G	MEE1xx8802G		
ULI I.D.	30988025	30988026		
N-Nitrosodimethylamine	<0.2	<0.2		
~~Bis(chloromethyl)ether~~				
Bis(2-chloroethyl)ether	<0.2	<0.2		
1,3-Dichlorobenzene	↓	↓		
1,4-Dichlorobenzene				
1,2-Dichlorobenzene				
Bis(2-Chloroisopropyl)ether				
Hexachloroethane				
Nitrobenzene				
N-Nitrosodipropylamine				
Isophorone				
Bis(2-chloroethoxy)methane				
1,2,4-Trichlorobenzene	↓	↓		
Naphthalene ✓	1.5	1.4		
Hexachlorobutadiene	<0.2	<0.2		
Hexachlorocyclopentadiene	<0.2	↓		
2-Chloronaphthalene	<0.2			
Dimethylphthalene	<0.2	↓		
Acenaphthylene ?	3.0	2.2		
2,6-Dinitrotoluene	<0.2	<0.2		
Acenaphthene	1.6	0.6		
2,4-dinitrotoluene	<0.2	<0.2		
Fluorene	1.0	<0.2		
Diethylphthalate	<0.2	<0.2		

TABLE A-5-4, cont.
NYSEG Sediment Sample Results of November 1988

UPSTATE LABORATORIES, INC.

Analysis Results
Report Number
Date:

NYSEG
(mg/kg)

BASE/NEUTRAL EXTRACTABLES

CLIENT I.D.	MEEIXX8801G	MEEIXX8802G		
ULI I.D.	30988025	30988026		
Chlorophenylphenyl ether	<0.2	<0.2		
N-Nitrosodiphenylamine	<0.2	<0.2		
~~1,2-Diphenylhydrazine~~				
4-Bromophenylphenyl ether	<0.2	<0.2		
Hexachlorobenzene	<0.2	<0.2		
Phenanthrene ?	2.0	4.8		
Anthracene ?	1.6	1.4		
Dibutyl phthalate ?	1.3	1.4		
Fluoranthene ?	10	7.0		
Benzidine	<0.2	<0.2		
Pyrene	7.6	5.8		
Butyl benzyl phthalate	<0.2	<0.2		
3,3'-Dichlorobenzidine	<0.2	<0.2		
* Chrysene	2.3	2.0		
* Benzo(a)anthracene	2.5	2.2		
Bis(2-ethylhexyl) phthalate	2.3	2.8		
Dioctyl phthalate	<0.2	<0.2		
* Benzo(b)fluoranthene	<0.2	<0.2		
* Benzo(k)fluoranthene	3.1	3.0		
* Benzo(a)pyrene	2.0	1.9		
* Indeno(1,2,3-cd)pyrene	0.3	0.2		
Dibenzo(a,h)anthracene *	<0.2	<0.2		
Benzo(g,h,i)pyrene	0.4	0.3		

APPENDIX A-6

AIR ANALYTICAL DATA
MECHANICVILLE SITE

TABLE A-6-1

TASK 3 AIR ANALYTICAL RESULTS - ppm
MECHANICVILLE SITE

	Office		Garage		Storeroom		Background	
Sample Identifier	OF-01	OF-02	GA-01	GA-02	ST-01	ST-02	BA-01	BA-01
Date of Sample Collection	12/28/88	12/28/88	12/28/88	12/28/88	12/28/88	12/28/88	12/28/88	12/28/88
Volatile Aromatics[1]								
Benzene	0.03	0.031	0.016	0.015	0.043	0.043	ND[2]	ND
Toluene	0.009	0.009	0.048	0.048	0.012	0.012	0.037	0.028
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	ND	ND	ND	ND	ND	ND	ND	ND
Total Volatile Aromatics	0.039	0.040	0.064	0.063	0.055	0.055	0.037	0.028

NOTES:

[1] Sample analyzed by NIOSH Method 1501 by ESA Laboratories in Bedford, MA.

[2] ND = Not detected. The minimum detection limits are: benzene - 0.013 ppm; ethylbenzene and xylenes - 0.01 ppm.

APPENDIX A-7

TASK 4 SURFACE SOIL DATA
LABORATORY RESULTS
MECHANICVILLE SITE

MECHANICVILLE SOILS PCB RESULTS

SAMPLE LOCATION	PCB	% MOISTURE
MEEIXX8901	< 6 PPB	0.0
MEEIXX8902	< 6 PPB	27.3
MEEIXX8903	< 6 PPB	13.3
MEEIXX8903A	< 6 PPB	6.7
MEEIXX8904	< 6 PPB	12.5
MEEIXX8905	< 6 PPB	11.8
MEEIXX8906	< 6 PPB	7.1
MEEIXX8906A	< 6 PPB	14.3
MEEIXX8907	< 6 PPB	13.3
MEEIXX3907A	< 6 PPB	20.0
MEEIXX8908	< 6 PPB	3.3
MEEIXX8908A	< 6 PPB	23.5
MEEIXX8909	< 6 PPB	6.7
MEEIXX8910	< 6 PPB	0.0

Sample location MEEIXX8910 = a trip blank

Analysis Results
Report Number 092089024
Date: September 20, 1989

JAL

CLIENT I.D. / EG	ULI I.D.	Amenable Cyanide	Total Cyanide (distilled)	Total Cyanide (un-distilled)	
MECHANICSVILLE:					
SS-1 MEEIXX8901 8/29/89	24389090	1.8	1.8	<1.0	
SS-2 MEEIXX8902 8/29/89	24389091	<1.0	<1.0	<1.0	
SS-3 MEEIXX8903 8/29/89	24389092	<1.0	<1.0	<1.0	
SS-3A MEEIXX8903A 8/29/89	24389093	1.9	1.9	<1.0	
SS-4 MEEIXX8904 8/29/89	24389094	<1.0	<1.0	<1.0	
SS-5 MEEIXX8905 8/29/89	24389095	<1.0	<1.0	<1.0	
SS-10 MEEIXX8910 8/29/89	24389097	9.9	9.9	<1.0	

All results are expressed as ppm as received.
Sampled by client.

Approved: _____ 9/20/89

Note: See disclaimer on cover letter.

SOIL MATRIX
METHOD 8270 -- HAZARDOUS SUBSTANCE LIST BASE/NEUTRAL/ACID EXTRACTABLES

COMPOUND (Units of Measure = ug/g dry)	SAMPLE IDENTIFICATION (DATE)	
	MEEI Blank (9/1/89)	MEEIXX8910 (9/1/89)
Acenaphthene	<0.33	<0.33
Acenaphthylene	<0.33	<0.33
Anthracene	<0.33	<0.33
Benzo(a)anthracene	<0.33	<0.33
Benzo(a)pyrene	<0.33	<0.33
Benzo(b)fluoranthene	<0.33	<0.33
Benzo(g,h,i)perylene	<0.33	<0.33
Benzo(k)fluoranthene	<0.33	<0.33
Benzoic acid	<0.33	<0.33
Benzyl alcohol	<0.33	<0.33
Bis(2-chloroethoxy)methane	<0.33	<0.33
Bis(2-chloroethyl)ether	<0.33	<0.33
Bis(2-chloroisopropyl)ether	<0.33	<0.33
Bis(2-ethylhexyl)phthalate	<0.33	0.41
4-Bromophenylphenylether	<0.33	<0.33
Butylbenzylphthalate	<0.33	<0.33
4-Chloroaniline	<0.33	<0.33
2-Chloronaphthalene	<0.33	<0.33
4-Chlorophenylphenylether	<0.33	<0.33
Chrysene	<0.33	<0.33
Dibenzo(a,h)anthracene	<0.33	<0.33
Dibenzofuran	<0.33	<0.33
1,2-Dichlorobenzene	<0.33	<0.33
1,3-Dichlorobenzene	<0.33	<0.33
1,4-Dichlorobenzene	<0.33	<0.33
3,3'-Dichlorobenzidine	<0.66	<0.66
Diethylphthalate	<0.33	<0.33
Dimethylphthalate	<0.33	<0.33
Di-n-butylphthalate	0.68	0.86
2,6-Dinitrotoluene	<0.33	<0.33
2,4-Dinitrotoluene	<0.33	<0.33
Di-n-octylphthalate	<0.33	6.6
Fluoranthene	<0.33	<0.33
Fluorene	<0.33	<0.33
Hexachlorobenzene	<0.33	<0.33
Hexachlorobutadiene	<0.33	<0.33
Hexachlorocylopentadiene	<0.33	<0.33
Hexachloroethane	<0.33	<0.33
Indeno(1,2,3-cd)pyrene	<0.33	<0.33
Isophorone	<0.33	<0.33

(Continued)

SOIL MATRIX
METHOD 8270 - HAZARDOUS SUBSTANCE LIST BASE/NEUTRAL/ACID EXTRACTABLES

COMPOUND (Units of Measure = ug/g dry)	SAMPLE IDENTIFICATION (DATE)	
	MEEI Blank (9/1/89)	MEEIXX8910 (9/1/89)
2-Methylnaphthalene	<0.33	<0.33
Naphthalene	<0.33	<0.33
2-Nitroaniline	<1.6	<1.6
3-Nitroaniline	<1.6	<1.6
4-Nitroaniline	<1.6	<1.6
Nitrobenzene	<0.33	<0.33
N-nitrosodi-n-propylamine	<0.33	<0.33
N-nitrosodiphenylamine	<0.33	<0.33
Phenanthrene	<0.33	<0.33
Pyrene	<0.33	<0.33
1,2,4-Trichlorobenzene	<0.33	<0.33
2-Chlorophenol	<0.33	<0.33
2,4-Dichlorophenol	<0.33	<0.33
2,4-Dimethylphenol	<0.33	<0.33
4,6-Dinitro-o-cresol	<1.6	<1.6
2,4-Dinitrophenol	<1.6	<1.6
2-Methylphenol	<0.33	<0.33
4-Methylphenol	<0.33	<0.33
2-Nitrophenol	<0.33	<0.33
4-Nitrophenol	<1.6	<1.6
p-Chloro-m-cresol	<0.33	<0.33
Pentachlorophenol	<1.6	<1.6
Phenol	<0.33	<0.33
2,4,5-Trichlorophenol	<1.6	<1.6
2,4,6-Trichlorophenol	<0.33	<0.33
Extraction Date	9/1/89	9/1/89
Analysis Date	10/21/89	10/21/89
Internal Standards		
Level Added = 2.0 ug/g		
(% Recovery)		
Phenanthrene-D_{10}	122	111
Surrogates		
(% Recovery)		
2-Fluorophenol	70	83
Phenol-D_5	88	89
2,4,6-Tribromophenol	44	56
Nitrobenzene-D_5	94	87
2-Fluorobiphenyl	71	78
Terphenyl-D_{14}	93	98

SOIL MATRIX
METHOD 8270 - HAZARDOUS SUBSTANCE LIST BASE/NEUTRAL/ACID EXTRACTABLES

COMPOUND (Units of Measure = ug/g dry)	SAMPLE IDENTIFICATION (DATE)	
	MEEIXX8901 * (9/1/89)	MEEIXX8902 * (9/1/89)
Acenaphthene	<0.66	<0.66
Acenaphthylene	2.1	5.2
Anthracene	1.1	2.8
Benzo(a)anthracene	4.5	5.4
Benzo(a)pyrene	3.4	4.9
Benzo(b)fluoranthene	2.7	8.7
Benzo(g,h,i)perylene	1.6	2.9
Benzo(k)fluoranthene	4.3	7.1
Benzoic acid	<0.66	<0.66
Benzyl alcohol	<0.66	<0.66
Bis(2-chloroethoxy)methane	<0.66	<0.66
Bis(2-chloroethyl)ether	<0.66	<0.66
Bis(2-chloroisopropyl)ether	<0.66	<0.66
Bis(2-ethylhexyl)phthalate	3.7	<0.66
4-Bromophenylphenylether	<0.66	<0.66
Butylbenzylphthalate	<0.66	<0.66
4-Chloroaniline	<0.66	<0.66
2-Chloronaphthalene	<0.66	<0.66
4-Chlorophenylphenylether	<0.66	<0.66
Chrysene	6.2	9.6
Dibenzo(a,h)anthracene	<0.66	<0.66
Dibenzofuran	<0.66	<0.66
1,2-Dichlorobenzene	<0.66	<0.66
1,3-Dichlorobenzene	<0.66	<0.66
1,4-Dichlorobenzene	<0.66	<0.66
3,3'-Dichlorobenzidine	<1.3	<1.3
Diethylphthalate	<0.66	<0.66
Dimethylphthalate	<0.66	<0.66
Di-n-butylphthalate	<0.66	0.99
2,6-Dinitrotoluene	<0.66	<0.66
2,4-Dinitrotoluene	<0.66	<0.66
Di-n-octylphthalate	<0.66	<0.66
Fluoranthene	7.4	5.3
Fluorene	0.71	<0.66
Hexachlorobenzene	<0.66	<0.66
Hexachlorobutadiene	<0.66	<0.66
Hexachlorocylopentadiene	<0.66	<0.66
Hexachloroethane	<0.66	<0.66
Indeno(1,2,3-cd)pyrene	1.4	2.5
Isophorone	<0.66	<0.66

(Continued)

* Elevated detection limits are the result of a dilution necessitated by sample matrix.

I.D. #89-1665

SOIL MATRIX
METHOD 8270 - HAZARDOUS SUBSTANCE LIST BASE/NEUTRAL/ACID EXTRACTABLES

COMPOUND (Units of Measure = ug/g dry)	SAMPLE IDENTIFICATION (DATE) MEEIXX8901 * (9/1/89)	MEEIXX8902 * (9/1/89)
2-Methylnaphthalene	<0.66	<0.66
Naphthalene	<0.66	<0.66
2-Nitroaniline	<3.2	<3.2
3-Nitroaniline	<3.2	<3.2
4-Nitroaniline	<3.2	<3.2
Nitrobenzene	<0.66	<0.66
N-nitrosodi-n-propylamine	<0.66	<0.66
N-nitrosodiphenylamine	<0.66	<0.66
Phenanthrene	8.5	2.6
Pyrene	16	14
1,2,4-Trichlorobenzene	<0.66	<0.66
2-Chlorophenol	<0.66	<0.66
2,4-Dichlorophenol	<0.66	<0.66
2,4-Dimethylphenol	<0.66	<0.66
4,6-Dinitro-o-cresol	<3.2	<3.2
2,4-Dinitrophenol	<3.2	<3.2
2-Methylphenol	<0.66	<0.66
4-Methylphenol	<0.66	<0.66
2-Nitrophenol	<0.66	<0.66
4-Nitrophenol	<3.2	<3.2
p-Chloro-m-cresol	<0.66	<0.66
Pentachlorophenol	<3.2	<3.2
Phenol	<0.66	<0.66
2,4,5-Trichlorophenol	<3.2	<3.2
2,4,6-Trichlorophenol	<0.66	<0.66
Extraction Date	9/1/89	9/1/89
Analysis Date	10/21/89	10/21/89
Internal Standards		
Level Added = 2.0 ug/g		
(% Recovery)		
Phenanthrene-D_{10}	143	154
Surrogates		
(% Recovery)		
2-Fluorophenol	76	78
Phenol-D_5	73	74
2,4,6-Tribromophenol	53	58
Nitrobenzene-D_5	72	70
2-Fluorobiphenyl	69	68
Terphenyl-D_{14}	95	95

* Elevated detection limits are the result of a dilution necessitated by sample matrix.

I.D. #89-1665

SOIL MATRIX
METHOD 8270 - HAZARDOUS SUBSTANCE LIST BASE/NEUTRAL/ACID EXTRACTABLES

COMPOUND (Units of Measure = ug/g dry)	SAMPLE IDENTIFICATION (DATE)	
	MEEIXX8903 * (9/1/89)	MEEIXX8903A * (9/1/89)
Acenaphthene	1.5	1.7
Acenaphthylene	<0.66	<0.66
Anthracene	1.3	1.1
Benzo(a)anthracene	2.8	2.5
Benzo(a)pyrene	1.8	1.9
Benzo(b)fluoranthene	2.3	1.9
Benzo(g,h,i)perylene	<0.66	0.69
Benzo(k)fluoranthene	2.1	2.4
Benzoic acid	<0.66	<0.66
Benzyl alcohol	<0.66	<0.66
Bis(2-chloroethoxy)methane	<0.66	<0.66
Bis(2-chloroethyl)ether	<0.66	<0.66
Bis(2-chloroisopropyl)ether	<0.66	<0.66
Bis(2-ethylhexyl)phthalate	1.1	0.92
4-Bromophenylphenylether	<0.66	<0.66
Butylbenzylphthalate	<0.66	<0.66
4-Chloroaniline	<0.66	<0.66
2-Chloronaphthalene	<0.66	<0.66
4-Chlorophenylphenylether	<0.66	<0.66
Chrysene	3.4	3.1
Dibenzo(a,h)anthracene	<0.66	<0.66
Dibenzofuran	<0.66	<0.66
1,2-Dichlorobenzene	<0.66	<0.66
1,3-Dichlorobenzene	<0.66	<0.66
1,4-Dichlorobenzene	<0.66	<0.66
3,3'-Dichlorobenzidine	<1.3	<1.3
Diethylphthalate	<0.66	<0.66
Dimethylphthalate	<0.66	<0.66
Di-n-butylphthalate	1.1	0.93
2,6-Dinitrotoluene	<0.66	<0.66
2,4-Dinitrotoluene	<0.66	<0.66
Di-n-octylphthalate	<0.66	<0.66
Fluoranthene	6.0	4.7
Fluorene	<0.66	<0.66
Hexachlorobenzene	<0.66	<0.66
Hexachlorobutadiene	<0.66	<0.66
Hexachlorocylopentadiene	<0.66	<0.66
Hexachloroethane	<0.66	<0.66
Indeno(1,2,3-cd)pyrene	<0.66	<0.66
Isophorone	<0.66	<0.66

(Continued)

* Elevated detection limits are the result of a dilution necessitated by sample matrix.

SOIL MATRIX
METHOD 8270 - HAZARDOUS SUBSTANCE LIST BASE/NEUTRAL/ACID EXTRACTABLES

COMPOUND (Units of Measure = ug/g dry)	SAMPLE IDENTIFICATION (DATE) MEEIXX8903 * (9/1/89)	MEEIXX8903A * (9/1/89)
2-Methylnaphthalene	<0.66	<0.66
Naphthalene	<0.66	<0.66
2-Nitroaniline	<3.2	<3.2
3-Nitroaniline	<3.2	<3.2
4-Nitroaniline	<3.2	<3.2
Nitrobenzene	<0.66	<0.66
N-nitrosodi-n-propylamine	<0.66	<0.66
N-nitrosodiphenylamine	<0.66	<0.66
Phenanthrene	6.6	4.1
Pyrene	13	11
1,2,4-Trichlorobenzene	<0.66	<0.66
2-Chlorophenol	<0.66	<0.66
2,4-Dichlorophenol	<0.66	<0.66
2,4-Dimethylphenol	<0.66	<0.66
4,6-Dinitro-o-cresol	<3.2	<3.2
2,4-Dinitrophenol	<3.2	<3.2
2-Methylphenol	<0.66	<0.66
4-Methylphenol	<0.66	<0.66
2-Nitrophenol	<0.66	<0.66
4-Nitrophenol	<3.2	<3.2
p-Chloro-m-cresol	<0.66	<0.66
Pentachlorophenol	<3.2	<3.2
Phenol	<0.66	<0.66
2,4,5-Trichlorophenol	<3.2	<3.2
2,4,6-Trichlorophenol	<0.66	<0.66
Extraction Date	9/1/89	9/1/89
Analysis Date	10/21/89	10/21/89
Internal Standards		
Level Added = 2.0 ug/g		
(% Recovery)		
Phenanthrene-D_{10}	169	171
Surrogates		
(% Recovery)		
2-Fluorophenol	75	74
Phenol-D_5	77	75
2,4,6-Tribromophenol	40	49
Nitrobenzene-D_5	76	70
2-Fluorobiphenyl	64	74
Terphenyl-D_{14}	98	102

* Elevated detection limits are the result of a dilution necessitated by sample matrix.

I.D. #89-1665

SOIL MATRIX
METHOD 8270 - HAZARDOUS SUBSTANCE LIST BASE/NEUTRAL/ACID EXTRACTABLES

COMPOUND (Units of Measure = ug/g dry)	SAMPLE IDENTIFICATION (DATE) MEEIXX8904 * (9/1/89)	MEEIXX8905 * (9/1/89)
Acenaphthene	<0.66	<0.66
Acenaphthylene	<0.66	<0.66
Anthracene	<0.66	<0.66
Benzo(a)anthracene	1.3	<0.66
Benzo(a)pyrene	0.86	<0.66
Benzo(b)fluoranthene	1.4	<0.66
Benzo(g,h,i)perylene	<0.66	<0.66
Benzo(k)fluoranthene	1.3	<0.66
Benzoic acid	<0.66	<0.66
Benzyl alcohol	<0.66	<0.66
Bis(2-chloroethoxy)methane	<0.66	<0.66
Bis(2-chloroethyl)ether	<0.66	<0.66
Bis(2-chloroisopropyl)ether	<0.66	<0.66
Bis(2-ethylhexyl)phthalate	<0.66	<0.66
4-Bromophenylphenylether	<0.66	<0.66
Butylbenzylphthalate	<0.66	<0.66
4-Chloroaniline	<0.66	<0.66
2-Chloronaphthalene	<0.66	<0.66
4-Chlorophenylphenylether	<0.66	<0.66
Chrysene	2.3	<0.66
Dibenzo(a,h)anthracene	<0.66	<0.66
Dibenzofuran	<0.66	<0.66
1,2-Dichlorobenzene	<0.66	<0.66
1,3-Dichlorobenzene	<0.66	<0.66
1,4-Dichlorobenzene	<0.66	<0.66
3,3'-Dichlorobenzidine	<1.3	<1.3
Diethylphthalate	<0.66	<0.66
Dimethylphthalate	<0.66	<0.66
Di-n-butylphthalate	0.87	0.67
2,6-Dinitrotoluene	<0.66	<0.66
2,4-Dinitrotoluene	<0.66	<0.66
Di-n-octylphthalate	11	<0.66
Fluoranthene	0.70	<0.66
Fluorene	<0.66	<0.66
Hexachlorobenzene	<0.66	<0.66
Hexachlorobutadiene	<0.66	<0.66
Hexachlorocylopentadiene	<0.66	<0.66
Hexachloroethane	<0.66	<0.66
Indeno(1,2,3-cd)pyrene	<0.66	<0.66
Isophorone	<0.66	<0.66

(Continued)

* Elevated detection limits are the result of a dilution necessitated by sample matrix.

I.D. #89-1665

SOIL MATRIX
METHOD 8270 - HAZARDOUS SUBSTANCE LIST BASE/NEUTRAL/ACID EXTRACTABLES

COMPOUND (Units of Measure = ug/g dry)	SAMPLE IDENTIFICATION (DATE) MEEIXX8904 * (9/1/89)	MEEIXX8905 * (9/1/89)
2-Methylnaphthalene	<0.66	<0.66
Naphthalene	<0.66	<0.66
2-Nitroaniline	<3.2	<3.2
3-Nitroaniline	<3.2	<3.2
4-Nitroaniline	<3.2	<3.2
Nitrobenzene	<0.66	<0.66
N-nitrosodi-n-propylamine	<0.66	<0.66
N-nitrosodiphenylamine	<0.66	<0.66
Phenanthrene	<0.66	<0.66
Pyrene	1.2	<0.66
1,2,4-Trichlorobenzene	<0.66	<0.66
2-Chlorophenol	<0.66	<0.66
2,4-Dichlorophenol	<0.66	<0.66
2,4-Dimethylphenol	<0.66	<0.66
4,6-Dinitro-o-cresol	<3.2	<3.2
2,4-Dinitrophenol	<3.2	<3.2
2-Methylphenol	<0.66	<0.66
4-Methylphenol	<0.66	<0.66
2-Nitrophenol	<0.66	<0.66
4-Nitrophenol	<3.2	<3.2
p-Chloro-m-cresol	<0.66	<0.66
Pentachlorophenol	<3.2	<3.2
Phenol	<0.66	<0.66
2,4,5-Trichlorophenol	<3.2	<3.2
2,4,6-Trichlorophenol	<0.66	<0.66
Extraction Date	9/1/89	9/1/89
Analysis Date	10/21/89	10/21/89
Internal Standards Level Added = 2.0 ug/g (% Recovery)		
Phenanthrene-D_{10}	143	133
Surrogates (% Recovery)		
2-Fluorophenol	75	74
Phenol-D_5	77	70
2,4,6-Tribromophenol	47	43
Nitrobenzene-D_5	64	62
2-Fluorobiphenyl	70	67
Terphenyl-D_{14}	102	94

* Elevated detection limits are the result of a dilution necessitated by sample matrix.

I.D. #89-1665

Sample Number
BLANK96

ORGANICS ANALYSIS DATA SHEET

(Page 1)

Laboratory Name: NYSEG-CORP-LAB Case No: MEB2969

Lab Sample ID No: BLANK96 QC Report No:

Sample Matrix: SOIL Contract No:

Data Release Authorized By: Date Sample Received: 09/06/89

VOLATILE COMPOUNDS

Concentration: MED

Date Extracted/Prepared:

Date Analyzed: 09/06/89

Dil Factor: 125 pH

Percent Moisture: (Not Decanted) 0.0

CAS Number		UG/KG		CAS Number		UG/KG	
74-87-3	Chloromethane	1300	U	78-87-5	1,2-Dichloropropane	630	U
74-83-9	Bromomethane	1300	U	10061-02-6	Trans-1,3-Dichloropropene	630	U
75-01-4	Vinyl Chloride	1300	U	79-01-6	Trichloroethene	630	U
75-00-3	Chloroethane	1300	U	124-48-1	Dibromochloromethane	630	U
75-09-2	Methylene Chloride	630	U	79-00-5	1,1,2-Trichloroethane	630	U
67-64-1	Acetone	1300	U	71-43-2	Benzene	630	U
75-15-0	Carbon Disulfide	630	U	10061-01-5	cis-1,3-Dichloropropene	630	U
75-35-4	1,1-Dichloroethene	630	U	110-75-8	2-Chloroethylvinylether	1300	U
75-34-3	1,1-Dichloroethane	630	U	75-25-2	Bromoform	630	U
156-60-5	Trans-1,2-Dichloroethene	630	U	108-10-1	4-Methyl-2-Pentanone	1300	U
67-66-3	Chloroform	630	U	591-78-6	2-Hexanone	1300	U
107-06-2	1,2-Dichloroethane	630	U	127-18-4	Tetrachloroethene	630	U
78-93-3	2-Butanone	1300	U	79-34-5	1,1,2,2-Tetrachloroethane	1300	U
71-55-6	1,1,1-Trichloroethane	630	U	108-88-3	Toluene	630	U
56-23-5	Carbon Tetrachloride	630	U	108-90-7	Chlorobenzene	630	U
108-05-4	Vinyl Acetate	1300	U	100-41-4	Ethylbenzene	630	U
75-27-4	Bromodichloromethane	630	U	100-42-5	Styrene	630	U
					Total Xylenes	630	U

U - Compound analyzed for but not detected. The reported value is the minimum attainable detection limit for the sample.

See page 1A for complete definitions of the data reporting qualifiers.

Sample Number
MEEIXX8901

ORGANICS ANALYSIS DATA SHEET

(Page 1)

Laboratory Name: NYSEG-CORP-LAB
Lab Sample ID No: ME0196
Sample Matrix: SOIL
Data Release Authorized By: _____

Case No: ME82989
QC Report No: _____
Contract No: _____
Date Sample Received: 08/30/89

VOLATILE COMPOUNDS

Concentration: MED
Date Extracted/Prepared: 09/06/89
Date Analyzed: 09/06/89
Dil Factor: 125 pH _____
Percent Moisture: (Not Decanted) 0.0

CAS Number		UG/KG		CAS Number		UG/KG	
74-87-3	Chloromethane	1300	U	78-87-5	1,2-Dichloropropane	630	U
74-83-9	Bromomethane	1300	U	10061-02-6	Trans-1,3-Dichloropropene	630	U
75-01-4	Vinyl Chloride	1300	U	79-01-6	Trichloroethene	630	U
75-00-3	Chloroethane	1300	U	124-48-1	Dibromochloromethane	630	U
75-09-2	Methylene Chloride	630	U	79-00-5	1,1,2-Trichloroethane	630	U
67-64-1	Acetone	1300	U	71-43-2	Benzene	630	U
75-15-0	Carbon Disulfide	630	U	10061-01-5	cis-1,3-Dichloropropene	630	U
75-35-4	1,1-Dichloroethene	630	U	110-75-8	2-Chloroethylvinylether	1300	U
75-34-3	1,1-Dichloroethane	630	U	75-25-2	Bromoform	630	U
156-60-5	Trans-1,2-Dichloroethene	630	U	108-10-1	4-Methyl-2-Pentanone	1300	U
67-66-3	Chloroform	630	U	591-78-6	2-Hexanone	1300	U
107-06-2	1,2-Dichloroethane	630	U	127-18-4	Tetrachloroethene	630	U
78-93-3	2-Butanone	1300	U	79-34-5	1,1,2,2-Tetrachloroethane	1300	U
71-55-6	1,1,1-Trichloroethane	630	U	108-88-3	Toluene	630	U
56-23-5	Carbon Tetrachloride	630	U	108-90-7	Chlorobenzene	630	U
108-05-4	Vinyl Acetate	1300	U	100-41-4	Ethylbenzene	630	U
75-27-4	Bromodichloromethane	630	U	100-42-5	Styrene	630	U
					Total Xylenes	630	U

U - Compound analyzed for but not detected. The reported value is the minimum attainable detection limit for the sample.

See page 1A for complete definitions of the data reporting qualifiers.

Sample Number
MEEIXXS902

ORGANICS ANALYSIS DATA SHEET

(Page 1)

Laboratory Name: NYSEG-CORP-LAB
Case No: ME82989
Lab Sample ID No: ME0296
QC Report No:
Sample Matrix: SOIL
Contract No:
Data Release Authorized By:
Date Sample Received: 08/30/89

VOLATILE COMPOUNDS

Concentration: MED
Date Extracted/Prepared: 09/06/89
Date Analyzed: 09/06/89
Dil Factor: 125 dH
Percent Moisture: (Not Decanted) 27.0

CAS Number		UG/KG		CAS Number		UG/KG	
74-87-3	Chloromethane	1700	U	78-87-5	1,2-Dichloropropane	860	U
74-83-9	Bromomethane	1700	U	10061-02-6	Trans-1,3-Dichloropropene	860	U
75-01-4	Vinyl Chloride	1700	U	79-01-6	Trichloroethene	860	U
75-00-3	Chloroethane	1700	U	124-48-1	Dibromochloromethane	860	U
75-09-2	Methylene Chloride	860	U	79-00-5	1,1,2-Trichloroethane	860	U
67-64-1	Acetone	1700	U	71-43-2	Benzene	860	U
75-15-0	Carbon Disulfide	860	U	10061-01-5	cis-1,3-Dichloropropene	860	U
75-35-4	1,1-Dichloroethene	860	U	110-75-8	2-Chloroethylvinylether	1700	U
75-34-3	1,1-Dichloroethane	860	U	75-25-2	Bromoform	860	
156-60-5	Trans-1,2-Dichloroethene	860	U	108-10-1	4-Methyl-2-Pentanone	1700	
67-66-3	Chloroform	860	U	591-78-6	2-Hexanone	1700	
107-06-2	1,2-Dichloroethane	860	U	127-18-4	Tetrachloroethene	860	
78-93-3	2-Butanone	1700	U	79-34-5	1,1,2,2-Tetrachloroethane	1700	
71-55-6	1,1,1-Trichloroethane	860	U	108-88-3	Toluene	860	
56-23-5	Carbon Tetrachloride	860	U	108-90-7	Chlorobenzene	860	
108-05-4	Vinyl Acetate	1700	U	100-41-4	Ethylbenzene	860	
75-27-4	Bromodichloromethane	860	U	100-42-5	Styrene	860	
					Total Xylenes	860	

U - Compound analyzed for but not detected. The reported value is the minimum attainable detection limit for the sample.

See page 1A for complete definitions of the data reporting qualifiers.

| Sample Number
| MEEIXX8903

ORGANICS ANALYSIS DATA SHEET
(Page 1)

Laboratory Name: NYSEG-CORP-LAB
Case No: ME82989
Lab Sample ID No: ME0396
QC Report No:
Sample Matrix: SOIL
Contract No:
Data Release Authorized By:
Date Sample Received: 08/30/89

VOLATILE COMPOUNDS

Concentration: MED
Date Extracted/Prepared: 09/06/89
Date Analyzed: 09/06/89
Dil Factor: 125 pH
Percent Moisture: (Not Decanted) 13.0

CAS Number		UG/KG		CAS Number		UG/KG	
74-87-3	Chloromethane	1400	U	78-87-5	1,2-Dichloropropane	720	U
74-83-9	Bromomethane	300	J	10061-02-6	Trans-1,3-Dichloropropene	720	U
75-01-4	Vinyl Chloride	1400	U	79-01-6	Trichloroethene	720	U
75-00-3	Chloroethane	1400	U	124-48-1	Dibromochloromethane	720	U
75-09-2	Methylene Chloride	720	U	79-00-5	1,1,2-Trichloroethane	720	U
67-64-1	Acetone	1400	U	71-43-2	Benzene	720	U
75-15-0	Carbon Disulfide	720	U	10061-01-5	cis-1,3-Dichloropropene	720	U
75-35-4	1,1-Dichloroethene	720	U	110-75-8	2-Chloroethylvinylether	1400	U
75-34-3	1,1-Dichloroethane	720	U	75-25-2	Bromoform	720	U
156-60-5	Trans-1,2-Dichloroethene	720	U	108-10-1	4-Methyl-2-Pentanone	1400	U
67-66-3	Chloroform	720	U	591-78-6	2-Hexanone	1400	U
107-06-2	1,2-Dichloroethane	720	U	127-18-4	Tetrachloroethene	720	U
78-93-3	2-Butanone	1400	U	79-34-5	1,1,2,2-Tetrachloroethane	1400	U
71-55-6	1,1,1-Trichloroethane	720	U	108-88-3	Toluene	720	U
56-23-5	Carbon Tetrachloride	720	U	108-90-7	Chlorobenzene	720	U
108-05-4	Vinyl Acetate	1400	U	100-41-4	Ethylbenzene	720	U
75-27-4	Bromodichloromethane	720	U	100-42-5	Styrene	720	U
					Total Xylenes	720	U

J - Reported value is less than the detection limit.
U - Compound analyzed for but not detected. The reported value is the minimum attainable detection limit for the sample.

See page 1A for complete definitions of the data reporting qualifiers.

| Sample Number
| MEEIXX8903A

ORGANICS ANALYSIS DATA SHEET
(Page 1)

Laboratory Name: NYSEG-CORP-LAB
Lab Sample ID No: MEIA96
Sample Matrix: SOIL
Data Release Authorized By:

Case No: ME82989
QC Report No:
Contract No:
Date Sample Received: 08/30/89

VOLATILE COMPOUNDS

Concentration: MED
Date Extracted/Prepared: 09/06/89
Date Analyzed: 09/06/89
Dil Factor: 125 pH
Percent Moisture: (Not Decanted) 7.0

CAS Number		UG/KG		CAS Number		UG/KG	
74-87-3	Chloromethane	1300	U	78-87-5	1,2-Dichloropropane	670	U
74-83-9	Bromomethane	1300	U	10061-02-6	Trans-1,3-Dichloropropene	670	U
75-01-4	Vinyl Chloride	1300	U	79-01-6	Trichloroethene	670	U
75-00-3	Chloroethane	1300	U	124-48-1	Dibromochloromethane	670	U
75-09-2	Methylene Chloride	670	U	79-00-5	1,1,2-Trichloroethane	670	U
67-64-1	Acetone	1300	U	71-43-2	Benzene	670	U
75-15-0	Carbon Disulfide	670	U	10061-01-5	cis-1,3-Dichloropropene	670	U
75-35-4	1,1-Dichloroethene	670	U	110-75-8	2-Chloroethylvinylether	1300	U
75-34-3	1,1-Dichloroethane	670	U	75-25-2	Bromoform	670	U
156-60-5	Trans-1,2-Dichloroethene	670	U	108-10-1	4-Methyl-2-Pentanone	1300	U
67-66-3	Chloroform	670	U	591-78-6	2-Hexanone	1300	U
107-06-2	1,2-Dichloroethane	670	U	127-18-4	Tetrachloroethene	670	U
78-93-3	2-Butanone	1300	U	79-34-5	1,1,2,2-Tetrachloroethane	1300	U
71-55-6	1,1,1-Trichloroethane	670	U	108-88-3	Toluene	670	U
56-23-5	Carbon Tetrachloride	670	U	108-90-7	Chlorobenzene	670	U
108-05-4	Vinyl Acetate	1300	U	100-41-4	Ethylbenzene	670	U
75-27-4	Bromodichloromethane	670	U	100-42-5	Styrene	670	U
					Total Xylenes	670	U

U - Compound analyzed for but not detected. The reported value is the minimum attainable detection limit for the sample.

See page 1A for complete definitions of the data reporting qualifiers.

ORGANICS ANALYSIS DATA SHEET

(Page 1)

Laboratory Name: NYSEG-JOFP-LAB Case No: MS02899

Lab Sample ID No: MS0496 NC Report No:

Sample Matrix: SOIL Contract No:

Date Release Authorized By: Date Sample Received: 08/30/89

VOLATILE COMPOUNDS

Concentration: MED

Date Extracted/Prepared: 09/06/89

Date Analyzed: 09/06/89

Dil Factor: 125 pH

Percent Moisture: (Not Decanted) 12.0

CAS Number		UG/KG		CAS Number		UG/KG	
74-87-3	Chloromethane	1400	U	78-87-5	1,2-Dichloropropane	710	U
74-83-9	Bromomethane	1400	U	10061-02-6	Trans-1,3-Dichloropropene	710	U
75-01-4	Vinyl Chloride	1400	U	79-01-6	Trichloroethene	710	U
75-00-3	Chloroethane	1400	U	124-48-1	Dibromochloromethane	710	U
75-09-2	Methylene Chloride	710	U	79-00-5	1,1,2-Trichloroethane	710	U
67-64-1	Acetone	1400	U	71-43-2	Benzene	710	U
75-15-0	Carbon Disulfide	710	U	10061-01-5	cis-1,3-Dichloropropene	710	U
75-35-4	1,1-Dichloroethene	710	U	110-75-8	2-Chloroethylvinylether	1400	U
75-34-3	1,1-Dichloroethane	710	U	75-25-2	Bromoform	710	U
156-60-5	Trans-1,2-Dichloroethene	710	U	108-10-1	4-Methyl-2-Pentanone	1400	U
67-66-3	Chloroform	710	U	591-78-6	2-Hexanone	1400	U
107-06-2	1,2-Dichloroethane	710	U	127-18-4	Tetrachloroethene	710	U
78-93-3	2-Butanone	1400	U	79-34-5	1,1,2,2-Tetrachloroethane	1400	U
71-55-6	1,1,1-Trichloroethane	710	U	108-88-3	Toluene	710	U
56-23-5	Carbon Tetrachloride	710	U	108-90-7	Chlorobenzene	710	U
108-05-4	Vinyl Acetate	1400	U	100-41-4	Ethylbenzene	710	U
75-27-4	Bromodichloromethane	710	U	100-42-5	Styrene	710	U
					Total Xylenes	710	U

U - Compound analyzed for but not detected. The reported value is the minimum attainable detection limit for the sample.

See page 1A for complete definitions of the data reporting qualifiers.

| Sample Number
| MEEIXX9905

ORGANICS ANALYSIS DATA SHEET
(Page 1)

Laboratory Name: NYSEG-CORP-LAB
Lab Sample ID No: ME0596
Sample Matrix: SOIL
Data Release Authorized By:

Case No: ME82589
QC Report No:
Contract No:
Date Sample Received: 08/30/89

VOLATILE COMPOUNDS

Concentration: MED
Date Extracted/Prepared: 09/06/89
Date Analyzed: 09/06/89
Dil Factor: 125 pH
Percent Moisture: (Not Decanted) 12.0

CAS Number		UG/KG		CAS Number		UG/KG	
74-87-3	Chloromethane	1400	U	78-87-5	1,2-Dichloropropane	710	U
74-83-9	Bromomethane	1400	U	10061-02-6	Trans-1,3-Dichloropropene	710	U
75-01-4	Vinyl Chloride	1400	U	79-01-6	Trichloroethene	710	U
75-00-3	Chloroethane	1400	U	124-48-1	Dibromochloromethane	710	U
75-09-2	Methylene Chloride	710	U	79-00-5	1,1,2-Trichloroethane	710	U
67-64-1	Acetone	1400	U	71-43-2	Benzene	710	U
75-15-0	Carbon Disulfide	710	U	10061-01-5	cis-1,3-Dichloropropene	710	U
75-35-4	1,1-Dichloroethene	710	U	110-75-8	2-Chloroethylvinylether	1400	U
75-34-3	1,1-Dichloroethane	710	U	75-25-2	Bromoform	710	U
156-60-5	Trans-1,2-Dichloroethene	710	U	108-10-1	4-Methyl-2-Pentanone	1400	U
67-66-3	Chloroform	710	U	591-78-6	2-Hexanone	1400	U
107-06-2	1,2-Dichloroethane	710	U	127-18-4	Tetrachloroethene	710	U
78-93-3	2-Butanone	1400	U	79-34-5	1,1,2,2-Tetrachloroethane	1400	U
71-55-6	1,1,1-Trichloroethane	710	U	108-88-3	Toluene	710	U
56-23-5	Carbon Tetrachloride	710	U	108-90-7	Chlorobenzene	710	U
108-05-4	Vinyl Acetate	1400	U	100-41-4	Ethylbenzene	710	U
75-27-4	Bromodichloromethane	710	U	100-42-5	Styrene	710	U
					Total Xylenes	710	U

U - Compound analyzed for but not detected. The reported value is the minimum attainable detection limit for the sample.

See page 1A for complete definitions of the data reporting qualifiers.

Sample Number
MEEIXX8910

ORGANICS ANALYSIS DATA SHEET

(Page 1)

Laboratory Name: NYSEG-CORP-LAB
Case No: MEB2989
Lab Sample ID No: ME1096
QC Report No:
Sample Matrix: SOIL
Contract No:
Data Release Authorized By:
Date Sample Received: 08/30/89

VOLATILE COMPOUNDS

Concentration: MED
Date Extracted/Prepared: 09/06/89
Date Analyzed: 09/06/89
Dil Factor: 125 pH
Percent Moisture: (Not Decanted) 0.0

CAS Number		UG/KG		CAS Number		UG/KG	
74-87-3	Chloromethane	1300	U	78-87-5	1,2-Dichloropropane	630	U
74-83-9	Bromomethane	1300	U	10061-02-6	Trans-1,3-Dichloropropene	630	U
75-01-4	Vinyl Chloride	1300	U	79-01-6	Trichloroethene	630	U
75-00-3	Chloroethane	1300	U	124-48-1	Dibromochloromethane	630	U
75-09-2	Methylene Chloride	630	U	79-00-5	1,1,2-Trichloroethane	630	U
67-64-1	Acetone	1300	U	71-43-2	Benzene	630	U
75-15-0	Carbon Disulfide	630	U	10061-01-5	cis-1,3-Dichloropropene	630	U
75-35-4	1,1-Dichloroethene	630	U	110-75-8	2-Chloroethylvinylether	1300	U
75-34-3	1,1-Dichloroethane	630	U	75-25-2	Bromoform	630	U
156-60-5	Trans-1,2-Dichloroethene	630	U	108-10-1	4-Methyl-2-Pentanone	1300	U
67-66-3	Chloroform	630	U	591-78-6	2-Hexanone	1300	U
107-06-2	1,2-Dichloroethane	630	U	127-18-4	Tetrachloroethene	630	U
78-93-3	2-Butanone	1300	U	79-34-5	1,1,2,2-Tetrachloroethane	1300	U
71-55-6	1,1,1-Trichloroethane	630	U	108-88-3	Toluene	630	U
56-23-5	Carbon Tetrachloride	630	U	108-90-7	Chlorobenzene	630	U
108-05-4	Vinyl Acetate	1300	U	100-41-4	Ethylbenzene	630	U
75-27-4	Bromodichloromethane	630	U	100-42-5	Styrene	630	U
					Total Xylenes	630	U

U - Compound analyzed for but not detected. The reported value is the minimum attainable detection limit for the sample.

See page 1A for complete definitions of the data reporting qualifiers.

APPENDIX B-1

DOSE-RESPONSE ASSESSMENT

POLYNUCLEAR AROMATIC HYDROCARBONS

In this section, various issues relating to the incremental excess cancer risk from exposure to PAHs are discussed. These issues include a discussion of PAH mixtures and how they are treated in a risk assessment, and reviews of the studies used by USEPA to derive the cancer potency factors.

Polynuclear Aromatic Hydrocarbon Mixtures

Many PAH-containing mixtures are carcinogenic in humans and animals. Some pure PAH components have been tested in animals and found to have carcinogenic activity, while others have been repeatedly tested and found to have no carcinogenic activity. Quantitative dose/response data exist only for a few well-studied PAHS. Benzo(a)Pyrene (B(a)P) is well-studied and is often used as a surrogate for PAHs as a class. USEPA and ICF-Clement Associates cancer potency factors have been derived for B(a)P for both the oral and inhalation routes.

PAHs are routine analytes at former coal gasification sites. Several are carcinogenic, while several are not considered by USEPA or the International Agency for Research on Cancer (IARC) to be carcinogenic. There are three possible approaches for performing quantitative risk assessment of this subset of PAHs for which there are analytical data:

- Total all the PAHs and apply the cancer potency factor for B(a)P.

an environmental mixture of PAHs by assuming that other PAHs are equal in potency to B(a)P. The comparative potency approach (ICF-Clement Associates, 1987a; Chu and Chen, 1984) has merit for assessing the risks of a specific PAH mixture of known composition. An important criticism of the comparative potency approach such as that proposed by ICF-Clement Associates is that it ignores the myriad of other carcinogenic PAHs normally found in PAH-contaminated samples. Table B-2 shows a list of some individual PAHs that have been identified in coal tar and related products and that have been found to be carcinogenic. Many of these compounds are present in hazardous waste samples for which risk assessment must be performed. When samples of these wastes are sent to Contract Laboratory Program laboratories for analysis, however, data on only 14 PAHs will be collected. Only six of these are considered by USEPA to be probable human carcinogens. The comparative potency approach totally ignores these compounds. The USEPA approach of totaling the carcinogenic PAHs does not explicitly consider these other probable contaminants. However, the application of the B(a)P factor to the subset of the carcinogenic PAHs may provide an appropriate margin of safety, given that not all carcinogenic PAHs are as potent as B(a)P.

TABLE B-1

PAH ANALYTES AT HAZARDOUS WASTE SITES

PAHS ON USEPA'S HSL (TCL)	PAHS CONSIDERED CARCINOGENIC BY USEPA	PAHS FOR WHICH ICF-DERIVED COMPARATIVE POTENCY FACTOR EXISTS
Benzo(a)pyrene	x	x
Indeno(1,2,3-cd)pyrene	x	x
Dibenzo(a,h)anthracene	x	
Benzo(a)anthracene	x	x
Chrysene	x	x
Benzo(b)fluoranthene	x	x
Benzo(k)fluoranthene		x
Benzo(g,h,i)perylene		x
Fluorene		
Acenaphthene		
Phenanthrene		
Anthracene		
Fluoranthene		
Pyrene		

TABLE B-2

COAL-TAR CONSTITUENTS OF INTEREST
THAT ARE NOT ROUTINE ANALYTES
AT HAZARDOUS WASTE SITES

CARCINOGENIC PAHS	
Carbazole	(USEPA category B2 carcinogen)
Quinoline	
Dibenzocarbazoles	
2-aminopyrene	
Benzo(c)acridine	(USEPA category C; IARC-limited animal data)
Benzo(e)pyrene	(IARC-limited short-term data)
Benzo(j)fluoranthene	(IARC-sufficient animal data)
Benzo(a)fluoranthene	(IARC-sufficient animal data)
Dibenz(a,h)anthracene	(IARC-limited animal data)
Dibenz(a,c)anthracene	(IARC-limited animal data)
Dibenz(a,i)pyrene	(IARC-sufficient animal data)
5,6-benzoquinoline	
Methyl pyrene	
Dibenzo(a,h)pyrene	
Dibenzo(c,g)carbazole	
Cyclopenta(c,d)pyrene	(IARC-limited animal data)
Benzo(c)phenanthrene	

Scientific reviewers of the ICF-Clement Associates approach, while applauding the authors' theoretical treatment of the topic, also pointed out the limitations of using such a method for complex environmental samples. For example, Dr. Roy Albert (ICF-Clement Associates, 1987b) made the following comment:

> The section that tests the comparative potency method using a synthetic mixture of PAHs is fine but needs to include a mixture found in real life such as products of combustion, extracts of shale tar, or cigarette smoke condensate. USEPA's use of B(a)P as a surrogate could cover unknown carcinogenic constituents in such mixtures, so may have some validity. Some realistic complex mixtures should be examined to see if the comparative potency method works. It is not necessary to include such an examination as part of this effort, but it should be done at some point.

In a similar vein, Dr. Jeffrey Harris (ICF-Clement Associates, 1987b) of Massachusetts Institute of Technology made the following comment:

> I am concerned that a great many environmental mixtures (e.g., smoke from fossil fuel combustion, leachates from hazardous waste sites) will not consist purely of PAHs. In such cases, I am not sure that the proposed methodology will address the central problem of evaluating the potency of the overall mixture. If, as suggested by the current report, most PAHs are of equal or lesser potency than B(a)P, then the real uncertainties will arise not from the PAHs but from the remaining compounds, either alone or in combination with PAHs. Suppose that a mixture contains PAHs,

which are known tumor initiators and also dioxins and PCBs, which are known tumor promoters. Refined analysis of PAH potencies will still not address the initiator-promoter interactions between PAHs and the other compounds. To take a simple example, would one expect to predict the carcinogenic potency of tobacco smoke from the PAH dose-additive model, when such smoke contains nitrosamines, metals, radioisotopes, etc.? The above objection can be rebutted, at least to some extent, if the authors can show that many relevant environmental mixtures consist of pure PAHs.

Another criticism of the comparative potency approach concerns the potential for synergistic effects when individual components are administered together. Dr. Norton Nelson (ICF-Clement Associates, 1987b) of New York University made the following comment upon reviewing the ICF-Clement Associates document:

> There are, of course, the usual concerns about cross-species extrapolation; the presence of inhibitory, enhancing as well as additive and neutral factors in the media in which the several agents are found; the uncertainty as to the sequence in which the biological action takes place in the several species and so forth and so forth [sic]. Most of these are, of course, covered in the discussion.
>
> It may be noted that published work has shown that in some instances when several carcinogenic agents, which are independently active, when administered together can produce either addition or inhibition and, perhaps, in some cases, synergistic action. This, of course, relates to the underlying premise of the additive nature of carcinogens which is a

prime assumption built into the whole process.

The ICF-Clement Associates report clearly states that their approach does not address the issue of antagonism or synergism, but such effects have been documented and can have important implications for risk assessment when complex environmental mixtures are involved. The following paragraphs summarize several selected reports of synergism found in a cursory review of the scientific literature.

In the IARC report on coal tars and derived products (IARC, 1985), there is a report on the co-carcinogenic properties on a noncarcinogenic fraction of creosote. A basic fraction of creosote was tested in mice by Sall and Shear (IARC, 1985) for modifying effects of B(a)P-induced tumorigenesis. A group of 100 female strain A mice was divided into five subgroups and painted three times a week (124 to 145 times) with a 1 percent solution of the basic fraction in benzene, 0.2 or 0.05 percent B(a)P in benzene, or 0.05-percent B(a)P in benzene containing 1 percent of the basic creosote fraction alone. Tumors were not produced in any of the mice receiving the basic creosote fraction alone. However, the latent period for tumor appearance was shorter in the groups receiving B(a)P and the basic fraction of creosote as compared with that for mice receiving B(a)P alone, suggesting that the basic fraction of creosote decreased the latency of the tumorigenic effects of B(a)P.

In addition, many studies on co-carcinogenesis have been concerned with the identification of tumor-accelerating substances present in cigarette smoke. These compounds are generally tested for co-carcinogenic activity by repeated

application to mouse skin together with low doses of B(a)P. A positive response would be obtained in cases where the tumor yield of the combination exceeds that produced by either agent alone at the same doses. Van Duuren and co-workers (USEPA, 1979) established that a pronounced co-carcinogenic effect could be obtained with catechol and the noncarcinogens pyrene, benzo(e)pyrene, B(e)P, and benzo(g,h,i)perylene. Doses of 2,000, 12, 15, and 21 ug of catechol, pyrene, B(e)P, and benzo(g,h,i) perylene, respectively, were applied three times a week for 52 weeks to female ICR/Ha Swiss mice. Each animal also received 5 ug of B(a)P in 0.1 ml acetone with each dose of test substance. Fluoranthene has also been shown to possess co-carcinogenic activity. The application of a comparative potency approach to assessing the risks of PAHs would totally ignore the co-carcinogenic properties of some of the noncarcinogenic compounds.

Summary

Jordan reviewed the toxicologic data on the tumorigenesis of B(a)P and mixtures of PAH compounds, and concluded that (1) use of the cancer potency factors for B(a)P derived by USEPA and ICF-Clement Associates for the oral and inhalation routes is appropriate, and (2) these values should be used to assess the risks of the total concentration of carcinogenic PAHs. Jordan recognizes that there are some technical limitations to this approach; however, the limitations are not serious enough to justify selecting another approach.

Although using the cancer potency factor from assays on B(a)P for the seven

carcinogenic PAHs detected at the site may overestimate actual risk, Jordan considers it the most suitable alternative for assessing risks of exposure to a mixture of PAHs. While not used to quantitatively assess carcinogenic risks in this report, Jordan will refer to the comparative potency approach developed by ICF-Clement Associates in a qualitative manner, when discussing the results of the risk assessment and interpreting their significance. Drawbacks to the use of the USEPA cancer potency factors are briefly summarized in the following paragraphs.

Derivation of the Oral Cancer Potency Factor

The current cancer potency factor (oral) for B(a)P is based on a quantitative analysis of the dose-response data presented in a study by Neal and Rigdon (1967). In this study, male and female mice (CFW strain) were repeatedly fed B(a)P in their diet. The carcinogenic endpoint was forestomach tumors.

Numerous other studies similarly demonstrate that orally administered B(a)P can cause gastric tumors in several strains of mice (Collins et al., 1943; Peacock and Kirby, 1944; Nau et. al. 1958; Rigdon and Neal, 1966; Federenko and Yanysheva, 1966). Previous studies, however, did not utilize large numbers of animals or multiple doses. Therefore, the study by Neal and Rigdon (1967), which used 608 mice and 10 dose levels, was chosen by USEPA for quantitative dose/response assessment. In this study, mice were dosed for varying periods of time with B(a)P incorporated into laboratory chow. The exact manner of preparing the diet was not reported. Animals were allowed to eat ad libitum. Dosimetry was not quantitatively performed by measuring food

consumption. The amount of B(a)P consumed was estimated assuming that each mouse consumed 4 g of food daily. This lack of quantitative dosimetry introduces uncertainty into the value of the cancer potency factor.

Stomach tissues were examined macroscopically and histologically. The frequency of papillomas and squamous cell carcinomas in the squamous portion of the stomach (forestomach) were recorded. Tumors did not occur in other parts of the GI tract. Other tissues were not examined. The authors concluded that the development of gastric tumors in CFW mice fed B(a)P is influenced by (1) the concentration of B(a)P per gram of food; (2) the number of days it is fed; and (3) the total amount of B(a)P ingested per day.

There are several aspects of the Neal and Rigdon study (1967), as well as USEPA's approach to deriving an oral cancer potency factor, which have been criticized in the scientific literature. These criticisms are presented to highlight some of the toxicological uncertainties associated with the use of the B(a)P potency factor for quantifying incremental excess cancer risk. Jordan considers these criticisms insufficient to warrant not using the potency values.

Critical comments on the Neal and Rigdon study (1967) are twofold. First, the mice were fed diets dosed with B(a)P, but actual food intake per animal was not measured. An average food intake was assumed. Second, the dosing period was not consistent across exposure groups.

A deficiency of the Neal and Rigdon study (1967) for derivation of a cancer

potency factor is that the maximum period of the experiment was only 110 days for most dosage groups, and 70 to 197 days for several dosage groups. It is likely that the dose required to produce the observed effects would have been lower had the experimental dosing period been longer (USEPA, 1982). This assumption has basis in the study itself. Other animals were dosed for shorter periods of time and were observed to have reduced effects in proportion to the dosing time. Other experimental factors that are atypical of standard bioassay protocols include variable age of first exposure and an observation period that lasted on-fifth of a lifetime.

USEPA corrected for several of these experimental deficiencies in calculating its cancer potency factor. First, USEPA restricted its analysis of the data set to that subgroup of the experimental population that had been exposed continuously for the length of the experiment. Second, USEPA adjusted the experimental dose by averaging the actual daily dose for the dosing period over the entire experiment period.

$$\text{Adjusted dose} = \text{Actual daily dose} \times \frac{110 \text{ days}}{183 \text{ days}}$$

Lastly, the unadjusted cancer potency factor from the study was translated into a human potency value. First, the risk must be adjusted to account for constant exposure throughout one's entire lifetime. It was assumed that a normal mouse lifetime was 630 days. USEPA's standard procedures for less than full lifetime follow-up yield an adjustment factor of $(630/183)^3 = 40.8$.

Second, it is standard practice to calculate species-equivalent exposure units

on a unit mass/unit surface area basis. To convert the estimate to these units, it is multiplied by the additional adjustment factor of $(70/0.034)^{1/3}$ = 12.72, where 70 and 0.034 kg are the weights of an average human and CFW mouse, respectively. After making these two adjustments, the human cancer potency factor was estimated to be 11.53 $(mg/kg/day)^{-1}$.

In fitting the linearized model, no adjustments were made for the variable ages of the animals at first dosing or the ages attained at the end of the observation period. Using the standard USEPA approach, data on animals exposed to 50 ppm B(a)P or more were discarded because of "lack of fit." USEPA obtained a 95 percent upperbound estimate on the chemical's potency to humans of 11.53 $(mg/kg/day)^{-1}$. This number represents an upperbound on the slope of the cancer dose-response curve for this chemical.

USEPA is currently considering lowering the oral potency factor to 4.3 $(mg/kg/day)^{-1}$ based on a reanalysis of the available dose-response data regarding oral exposures to B(a)P. However, at this time, there is no way to predict either the likelihood that the cancer potency factor will, in fact, be changed or the scheduled date at which any potential agency changes would be finalized.

Other toxicological issues have been raised. One issue focuses on the relevance of the tumor endpoint between animals and humans, which is related to physiological differences of the target organs in animals and humans. When applying the current USEPA oral cancer potency factor to human risk assessment, it is important to question the relevance of the tumor endpoint

from the animal study to humans. The relevance of rodent forestomach tumors to humans has been examined (USEPA, 1982). While apparently relevant with respect to route of administration, the site of tumor production and probable underlying mechanism are possibly unique to laboratory rodents because of the anatomy of the rodent stomach. The forestomach in both rat and mouse is nonglandular and has a stratified squamous epithelium with a cornified covering. The fundus portion of the human stomach (homologous to the forestomach in rodents) is glandular and has a columnar epithelium. The similarities between the epithelium of rodents and that of skin suggest that the induction of forestomach tumors in mice may be analogous to the induction of skin tumors in skin-painting bioassays. This possibility calls into question the relevance of forestomach tumors in mice to the potential for human cancer from B(a)P ingestion.

B(a)P has been shown to cause distant site tumors where administered orally. This is consistent with the wide tissue distribution that has been observed in rodents following GI absorption. Rigdon and Neal observed pulmonary adenomas, thymomas, lymphomas, and leukemia in CFW mice fed B(a)P (Rigdon and Neal, 1966; Rigdon et al., 1967). Ingestion of B(a)P caused mammary tumors in Lewis rats (USEPA, 1979) and Sprague/Dawley rats (USEPA, 1982). Ovarian, lymphoid, mammary, and heptic tumors have also been observed in mice after oral administration of a related PAH (i.e., dimethylbenzanthracene).

For human risk assessment, an oral cancer potency factor based on gastric tumors and/or distant site tumors in a species anatomically more similar to humans than rodents would be desirable. In its absence, the current USEPA

cancer potency factor may be used for oral exposures to humans. Although there is no information of cancers in humans following oral exposures to PAHs, members of this class of compounds have been shown to cause skin, lung, and perhaps bladder tumors in humans when administered by other routes of exposure (IARC, 1985; USEPA, 1982; USEPA, 1979).

Therefore, PAHs can be metabolically activated both at the site of entry (e.g., skin or lungs) and possibly at distant sites (e.g., bladder). Use of the oral cancer potency factor should be accompanied by a consideration of its limitations:

(1) The short duration of the experiment results is an unquantifiable uncertainty in the cancer potency factor.

(2) The possible oversensitivity of the mouse forestomach may overestimate the risk to humans of gastric tumors due to anatomical differences.

(3) The effect of the relative sensitivity of mouse and human stomachs regarding PAH metabolism and tumorigenesis has an unknown effect of the relative sensitivities of mice and humans to the formation of distant site tumors following oral exposures.

(4) The use of only gastric tumors in mice to derive the cancer potency factor and not the total of local and distant tumors introduces uncertainty in the estimates of total carcinogenic risks to humans

following oral exposure B(a)P.

The application of the USEPA oral cancer potency factor to dermal exposures in humans may be an appropriate use of the dose/response data. In the animals and in humans, the major anticipated site of action is the skin tissue itself. Both human and rodent skin exhibit the PAH-metabolizing activity required for tumorigenesis.

For over 200 years, it has been recognized that skin cancers are associated with occupational exposure to tars and pitches related to the destructive distillation of coal. Scrotal lesions represent a large fraction of the skin cancers reported in numerous studies. IARC (1985) has concluded that there is sufficient evidence that occupational exposures to coal tar, as they occur during the destructive distillation of coal, give rise to skin cancer in humans. In addition, there is sufficient evidence that coal tar pitches are carcinogens in humans, and limited evidence that coal tar-derived creosotes are carcinogenic in humans. These data are corroborated by the animal data. There is sufficient evidence for the carcinogenicity in experimental animals of coal tars, creosotes, creosote oils, anthracene oils, and coal tar pitches (IARC, 1985).

Little information exists on the potential for distant site tumors following dermal administration of PAHs to animals. In general, there has been inadequate reporting of the possible effects on internal organs of application to the skin of the text substances. The mouse skin assay, for instance, is restricted to observation of skin tumors.

In conclusion, it is reasonable to presume, based on the available information, that the major target organ of PAHs following dermal exposure by animals and humans is the skin itself. Because the oral cancer potency factor for B(a)P is based on gastric tumors that did not require systematic uptake of the B(a)P and because the anatomy of the rodent forestomach is similar to rodent skin, the cross-route application of a cancer potency factor is reasonable in this case. The uncertainty in the public health risk assessment process cannot be quantified. To have optimal accuracy, the risk assessor may wish to use an appropriately derived toxicokinetic factor to consider the differences in the local uptake into human skin versus uptake into the membranes of the GI tract of the CFW mouse.

The use of an oral cancer potency factor for assessing the risks due to dermal exposures to PAHs has several limitations that have unknown effects on the resulting estimates of carcinogenic risks.

Regarding the ability of a mouse oral cancer potency factor to estimate mouse skin responses, many scientists argue that the oral potency factor underestimates the potency of B(a)P as a mouse skin carcinogen. There is evidence in the literature that PAHs are more potent carcinogens in mouse skin under the experimental conditions than in the mouse GI tract (Grimmer, 1985). Jordan has performed some preliminary calculations to demonstrate this fact.

In a summary of four skin-painting experiments with C57BL/6J female mice (USEPA, 1979), doses of 0.025 umoles and higher (to 0.4 umoles) resulted in 7 to 100 percent of the animals developing tumors. The animals were treated

with B(a)P once every two weeks for 60 weeks by topical application to the shaved skin of the back. Therefore, total doses of as little as 0.19 mg per animal over 60 weeks produced significant carcinogenic responses. A similar result is observed when reviewing the results of a mouse skin study by Bingham and Falk (1969). A dose of 6.25 ug per animal given 3 times a week for 50 weeks caused 35 percent of the test animals to develop skin tumors. B(a)P was administered topically to the backs of C3H/He mice. The total dose of 0.94 mg resulted in a significant carcinogenic response. Habs et al. (1980) also showed that low doses of B(a)P can cause mouse skin tumors. B(a)P was topically applied to the backs of female NMRI mice for their lifetimes at a dose of 1.7 ug/animal, twice a week. It is not known what the lifetime of these animals was, but even assuming a full two years, the total dose per animal that caused a tumor incidence of 24 percent was only 0.35 mg per animal.

These total dermal doses of 0.2 to 0.9 mg per animal to produce a significant carcinogenic response are two orders of magnitude lower than the total orally administered dose of B(a)P that Neal and Rigdon (1967) gave over 100 days to produce a significant carcinogenic response. In that study of B(a)P in the diet, at 40 to 250 ppm, total doses of 13 to 165 mg per animal caused tumor incidences of 2.5 to 90 percent (gastric tumors).

It would appear that the application of the B(a)P oral cancer potency factor would underestimate the risk to mice dosed dermally with B(a)P.

The relevance of this finding to risk assessment is, however, questionable.

Some scientists arguethat potencies for these two dosing situations that vary drastically in their experimental details cannot be directly compared. In the oral experiment, food is consumed for a fraction of each day for the duration of the experiment; whereas, in skin-painting experiments, animals are exposed continuously to the agent. In addition, solvents are often used as vehicles in skin-painting experiments. These solvents may either injure the skin, causing modifications in uptake, or facilitate uptake directly. On the other hand, lipophilic contaminants are generally more efficiently absorbed through the membranes of the GI tract than through intact skin.

The more serious uncertainty involved in interpreting these data concerns the possible differences in sensitivity of mouse and human skin towards PAH carcinogenesis. The uncertainties involved in estimating human risks posed by dermal contact with PAHs using the mouse oral potency factor cannot be quantified.

Several studies have been reported that document the occurrence of tumors other than at the site of entry. However, studies (either for distant-site tumors or for dermal application) are not of a quality that permits the derivation of a potency factor. Because there is no cancer potency factor for dermal absorption, Jordan has used the oral potency factor.

When deriving an appropriate toxicokinetic factor to use for dermal risk assessment with PAHs, the risk assessor needs to be concerned with the local uptake into the skin and the membranes of the gastrointenstinal tract, but not the uptake and absorption into the system circulation. The oral cancer

potency factor for benzo(a)pyrene (B(a)P) is based on local site-of-entry tumors in the gastrointestinal tract of rodents. These tissues are metabolically active and can cause PAH metabolism (EPA, 1979). Some studies have correlated tumorigenesis with arylhydrocarbon hydroxylase activity (EPA, 1979) in mouse gastric mucosa. Thus, systemic uptake and hepatic metabolism is not required for PAHs to cause gastric tumors in mice.

For the skin, where the risk assessor wishes to apply an orally derived dose/response value, the situation is similar. The expected carcinogenic endpoint is primarily cancer of the skin. Skin is also metabolically active, and systemic absorption is not required for skin tumorigenesis. B(a)P has been shown to cause distant site tumors when administered orally. Rigdon and Neal observed pulmonary adenomas, thymomas, and leukemia in mice fed B(a)P (Rigdon and Neal, 1966; Rigdon, et al., 1967). The current EPA cancer potency factor, however, does not consider distant site tumors. Thus, when making the direct comparison of dermal dosing situation to the EPA cancer potency factor, only local uptake into the tissues at the site of entry needs to be considered.

An appropriate dermal toxicokinetic factor would consider the comparative rates of uptake into the tissue, the rates of both toxifying and detoxifying metabolism, and the rates of systemic uptake of the parent compound and/or metabolites between the mouse gastrointestinal tract (diet) and the human skin (soil). Another issue to consider is the residence time of contact of the xenobiotic and the biological membrane. Quantitative information is not available to accurately derive a toxicokinetic factor at this time. It is

reasonable, however, to assume that local uptake of B(a)P into the gastrointestinal tract of mice exceeds the local uptake into the skin from PAH-contaminated soils. The skin is designed as a barrier, whereas the membranes of the gastrointestinal tract are designed to allow, if not facilitate, uptake of substances. It is common for risk assessments to use dermal toxicokinetic factors of 1-10 percent when qualtitatively assessing the risks due to dermal exposures to B(a)P and using its oral cancer potency factor. Thus, it is assumed that the net rate of local uptake of B(a)P into the skin of humans is 1-10 percent of the net rate of local uptake of B(a)P into the gastric mucosa of the mouse. In the absence of data to the contrary, these estimates are reasonable.

For carcinogenic PAHs, Jordan recommends that 0.5-1.0 be assumed as an oral TKF. The Neal and Rigdon study (1967) from which the EPA oral potency factor for B(a)P was derived was a dietary study in mice. B(a)P was administered as an ingredient in standard laboratory chow. No data are available on the effects of soils versus laboratory chow as vehicles. Likewise, no data exist on the comparative uptake or metabolism of B(a)P in membranes of gastrointestinal tracts of mice versus those of humans. Since there is no a priori reason to assume great differences, it is appropriate to use a toxicokinetic factor of 0.5-1.0 for B(a)P.

Basis of the USEPA Inhalation Cancer Potency Factor for B(a)P

A cancer potency factor for humans was derived by USEPA from the study of Thyssen et al. (1981). In this experiment, Syrian golden hamsters were exposed throughout their lives to B(a)P in a sodium chloride aerosol 4.5 hours/day, 7 days/week for 10 weeks, and then 3 hours/day thereafter. Respiratory tract tumors were induced in the nasal cavity, larynx, and trachea. The incidences of respiratory tumors were zero occurrences in a sample of 27 (0/27) for controls, 0/27 for the low-dose group, 9/26 for the mid-dose group, and 13/25 for the high-dose group. The highest exposure level had an adverse impact on survival time. Due to early mortality in the highest dose group, these data were excluded from the derivation of the cancer potency factor. Based on the respiratory tumor response of male hamsters and using the linearized multi-stage model, USEPA derived a potency factor from the study of 0.73 $(mg/kg/day)^{-1}$ (USEPA, 1984a). The cancer potency factor was translated into a human cancer potency factor by multiplying this value by the cube root of the body-weight ratio. This approach is empirically accepted to adjust for species-to-species extrapolation. The factor of $(70/0.12)^{1/3}$ was used to derive the human cancer potency factor of 6.11 $(mg/kg/day)^{-1}$.

USEPA is currently considering lowering the inhalation potency factor to 0.45 $(mg/kg/day)^{-1}$ based on a reanalysis of the available dose/response data regarding inhalation exposures to B(a)P. However, at this time there is no way to predict either the likelihood that the cancer potency factor will, in fact, be changed, or the scheduled date at which any potential agency changes would be finalized.

BENZENE

Benzene has been classified by USEPA as a Class A known human carcinogen based on several studies showing increased incidence of nonlymphocytic leukemia from occupational exposure. These studies have also shown increased incidence of neoplasia in rats and mice exposed by gavage and inhalation.

Derivation of the Oral and Inhalation Cancer Potency Factors

The oral and inhalation cancer potency factors for benzene have been set by USEPA at 2.9×10^{-2} $(mg/kg/day)^{-1}$; they were derived from the human data for inhalation exposure.

The unit risk estimate is the geometric mean of four maximum likelihood point estimates using pooled data from two occupational studies (Rinsky and Young, 1981; Ott, 1978), which were then adjusted for the results of the Wong et al. (1983) study. The pooled cohorts were significantly large and were followed for an adequate period of time. Increases in leukemias were statistically significant and related to dose in one of these studies. The risk estimates derived from considering the Rinsky and Ott studies were very close in value to the risk factor based on Infante et al. (1977), Ott (1978), and Aksoy (1974).

In a retrospective cohort mortality study, Rinsky and Young (1981) observed seven deaths from leukemia among 748 workers exposed to benzene and followed for at least 24 years (17,020 person-years). This increased incidence was statistically significant; the standard mortality ratio (SMR) was 560. (An SMR

is the ratio of the number of deaths observed in the study population to the number of deaths expected if it had the same rate structure as the chosen standard population.) For the five leukemia deaths that occurred among workers with more than 5 years exposure, the SMR was 2,100. Exposures ranged from 10 to 100 ppm (8-hour TWA).

Ott (1978) observed three deaths from leukemia among 594 workers followed for at least 23 years in a retrospective cohort mortality study, but the increase was not statistically significant. Exposures ranged from less than 2 to more than 25 ppm (8-hours TWA).

Wong et al. (1983) reported on the mortality of 3,036 male chemical workers who had been exposed to benzene for at least 3 days/week for 6 months during the years 1946 through 1975. The control subjects held jobs at the same plants for at least 6 months but were never subject to benzene exposure. Dose-dependent increases were seen in leukemia and lymphatic and hematopoietic cancer. The incidence of leukemia was responsible for the majority of the increase. It was noted that the significance of the increase was due largely to a less-than-expected incidence of neoplasia in the unexposed subjects.

TOLUENE

The evaluation of toluene for evidence of human carcinogenic potential is in progress. The dose/response assessment for toluene therefore is based on noncarcinogenic health endpoints.

Derivation of the Oral Risk Reference Dose

The oral RfD is 0.3 mg/kg/day where an uncertainty factor of 100 was applied (10 for sensitive individuals and 10 for interspecies extrapolation). The principal study from which the oral RfD was derived was that of the Chemical Industry Institute of Toxicology (CIIT, 1980). This was a 24-month inhalation toxicology study of Fischer-344 rats exposed to atmospheric toluene and is the only chronic toxicity study of toluene. The concentration levels of 30, 100, or 300 ppm (113, 377, and 1,130 mg/m^3) were administered to 120 male and 120 female rats 6 hours/day for 5 days/week. Equal numbers of each sex were used as controls. After 18 and 24 months, clinical chemistry, hematology, and urinalysis testing was performed. A No-Observed-Adverse-Effect Level (NOAEL) of 300 ppm was based on the finding that all measured parameters at the end of the study were normal except for a dose-related decrease in hematocrit value in females at 100- and 300-ppm exposure levels.

The oral RfD was derived by route-to-route extrapolation and expanding the exposure from 6 hours/day, 5 days/week to continuous exposure, and multiplying by 20 m^3/day for a human breathing rate, dividing by 70-kg human weight, and assuming a 0.5 absorption factor. This absorption factor is not used for all chemicals due to inconsistency in the development methods for RfDs.

An oral study by Wolf et al. (1956) reported no subchronic adverse effects of toluene at the maximum tested dose (590 mg/kg/day). Other subchronic inhalation and oral studies in rats and mice support the NOAEL. Although confidence in the principal study for the oral RfD is rated high due to the large sample size and number of measurements, the confidence of the oral RfD is only medium because it was based on an inhalation study.

Derivation of the Inhalation Risk Reference Dose

The AIC for inhalation has recently changed from 1.5 mg/kg/day to 1.0 mg/kg/day (USEPP, 1987). This is a reevaluation of the Chemical Industry Institute of Toxicology (CIIT) (1980) study, as mentioned in the discussion of the oral RfD. The derivation of this number is not known.

ETHYL BENZENE

Ethyl benzene has not yet been evaluated by USEPA for its human carcinogenic potential. Therefore, an RfD is calculated which assumes the health effect of concern is noncarcinogenic.

Derivation of the Oral Risk Reference Dose

The oral RfD for ethyl benzene is listed in IRIS as 0.1 mg/kg/day. It is based on a rat oral bioassay by Wolf et al. (1956) which showed liver and kidney toxicity. In the selected study, four groups of 10 albino female rats were administered doses of 13.6, 136, 408, or 680 mg/kg/day respectively of ethyl benzene in an olive oil gavage over 182 days. There were 20 rat controls.

The No-Observed-Effect Level (NOEL) of 136 mg/kg/day, from which the RfD is derived, is associated with histopathological changes seen in the liver and kidney. Other health endpoints examined in the study included: growth, mortality, appearance and behavior, hematological measurements, terminal concentration of urea nitrogen in the blood, final average organ and body weights, and bone marrow counts.

The RfD was derived from the NOEL by multiplying by 5 days/7 days to extrapolate to continuous exposure. No absorption factor was applied.

The chosen study is given a low confidence rating because only one sex was included in the study and because it was not a chronic duration study. In

addition, other supporting studies of oral toxicity are not known.

STYRENE

The evaluation of the human carcinogenic potential for styrene is under review by a USEPA inter-office agency work group. Although it is currently classified by USEPA as a probable human carcinogen (i.e., Class B2), there is no USEPA cancer potency factor. Therefore, in this analysis noncarcinogenic risks are estimated. In IRIS, the RfD is calculated for noncarcinogenic endpoints for oral exposure only.

Derivation of the Oral Risk Reference Dose

The styrene oral RfD is 0.2 mg/kg/day, which is principally based on the subchronic oral study in dogs by Quast et al. (1979). This study showed evidence of a NOAEL of 200 mg/kg/day for red blood cell and liver effects. There are other supporting studies cited. There is no dose conversion factor applied to the NOAEL of 200 mg/kg/day from the Quast et al. (1979) study to obtain the RfD.

The chosen study exposed four female and four male beagle dogs to doses of zero, 200, 400, or 600 mg styrene/kg body weight/day by peanut oil gavage for 560 days. No adverse effects were noted in the dogs gavaged with doses of 200 mg/kg/day. The effects observed at the higher dose categories were increased numbers of Heinz bodies in the red blood cells and liver, and increased iron deposits. There were noteworthy differences in the variations of blood cell parameters in individual animals at the same dose level.

The supporting chronic study of Ponomarkov and Jomatis (1978) dosed rats once

per week for 120 weeks with 500 mg/kg styrene. Mice were once dosed per week for the same duration with 300 mg/kg styrene. The rats showed no significant effects. This study was deemed inappropriate for risk assessment of chronic toxicity due to the weekly dosing schedule.

Another study by Wolf et al. (1956) gave oral daily doses to rats over 185 days, which is not considered a chronic duration. While the rats receiving an oral dose of 95 mg/kg body weight/day showed no adverse effects, the rats receiving oral doses of 285 and 475 mg/kg/day showed reduced growth and increased liver and kidney weights.

Other subchronic studies in rats with orally administered doses reported Lowest-Observed-Effect Levels (LOELs) at 350 to 500 mg/kg/day and NOELs at 100 to 400 mg/kg/day.

The confidence rating for the styrene oral RfD is medium because the critical study, although well performed, used such a small number of animals. In addition, none of the studies supporting the RfD value are considered as chronic in duration.

XYLENE(S)

The carcinogenic assessment of xylene by USEPA is awaiting the review of an inter-office agency work group. The toxicity of xylene is assessed for non-carcinogenic endpoints based on an RfD.

Derivation of the Oral Risk Reference Dose

The oral RfD listed in IRIS is 2 mg/kg/day; this value is based on a NOAEL of 250 mg/kg/day, reported by the NTP (1986b) in a study of chronic health effects on gavaged rats. This was selected as the primary study because it used a chronic exposure in two species by a relevant route of administration, and comprehensive histology was conducted. The critical effects noted by the NTP were hyperactivity, decreased body weight, and increased mortality. Xylene gavage doses of zero, 250, or 500 mg/kg/day were given to groups of 50 male and 50 female Fischer-344 rats for 5 days/week for 103 weeks. During the same time, groups of 50 male and 50 female B6C3F1 mice were gavaged with zero, 500, or 1,000 mg/kg/day.

Gross necropsy and comprehensive historical examinations were performed on all animals that died or were sacrificed. There were no compound-related histopathologic lesions in any of the exposed rats or mice. Therefore, the low dose of 250 mg/kg/day was set as the NOAEL. There was increased dose-related mortality in male rats that was significantly higher in the high-dose group compared with the controls; however, this effect was not significant in the low-dose group. The authors noted that the behavioral changes associated with xylene exposure may have caused rats to resist gavage.

Two other subchronic studies, although not cited as specific supporting studies for the RfD, provide evidence of xylene's toxic effects. A rat dietary study by Bowers et al. (1982) reported a NOAEL of 10 mg/kg/day with an uncertainty factor of 1,000. An inhalation study by Jenkins et. al. (1970) on rats, guinea pigs, monkeys, and dogs was used by USEPA in 1985 to calculate an RfD of 0.06 mg/kg/day, where the effects seen at the high dose were deaths in rats and monkeys and tremors in dogs.

The only adjustment made to the NOAEL of 250 mg/kg/day to obtain the RfD of 2 mg/kg/day was to adjust the dose from 5 days/week to continuous. The uncertainty factor of 100 was chosen to give a factor of 10 for species-to-species extrapolation and 10 to protect sensitive individuals.

The oral xylene RfD is given a medium confidence level because the NTP study was considered adequate in size, duration of study, and comprehensiveness of histological examinations, but did not include clinical chemistries, analysis of blood enzymes, and urinalysis. In addition, no LOEL has yet been reported for chronic oral exposure to xylene for comparison with the NOAEL.

Derivation of the Inhalation Risk Reference Dose

The inhalation RfD is taken as the value listed in the Superfund Public Health Evaluation Manual. This value is 0.4 mg/kg/day based on a subchronic rat study (Carpenter et al., 1975 NTP; 1986b). A dose of 3,500 mg/m^3 was administered 6 hrs/day, 5 days/wk for 13 weeks. No effects were seen at this dose. Derivation of the RfD from this study is not known. An uncertainty factor of 1,000 was used.

NAPHTHALENE

The dose/response value for naphthalene is used to evaluate the potential hazards of noncarcinogenic PAHs. Currently, there is inadequate evidence that naphthalene is carcinogenic. Its dose response value is an AIC as listed in the USEPA Health Effects Assessment (HEA) Quarterly Update (9/88) and the SPHEM update (8/88). The AIC is determined for noncarcinogenic adverse health effect for naphthalene.

Derivation of Oral Risk Reference Dose

The AIC for naphthalene is 0.4 mg/kg/day, which was derived from a study by Schmahl (1955). In this study rats (strain not specified) were exposed in the in their diet to a dose that ranged from 10-20 mg/day. The rats were dosed 6 days/week for 700 days. The equivalent lifetime dose for the rats was 41 mg/kg/day. The observed toxicological effects were ocular and internal lesions.

The NOEL for the Schmahl study was 41 mg/kg/day. The AIC was derived from this NOEL by applying an uncertainty factor of 100 (for inter and intraspecies extrapolation), resulting in an oral AIC for humans of 0.4 mg/kg/day.

CYANIDE

The USEPA-verified RfD for cyanides was derived from a NOAEL observed in an animal study conducted by Howard and Hanzel (1955). In this study, groups of 10 male and 10 female albino rats were maintained for 104 weeks on diets that had been fumigated with HCN. The food was analyzed by steam distillation into sodium hydroxide solution with subsequent titration of the resulting CN-ion. Because the HCN vaporized from the food, the diet was analyzed initially and after two days. The authors determined that fresh food needed to be prepared and fed on alternate days to maintain the HCN level within specified ranges.

The average measured HCN concentrations in the diet were 76 mg/kg of food for the low-dose level and 190 mg/kg of food for the high-dose level. A similar group of rats fed the basal diet were maintained as controls. The diets provided cyanide doses of zero, 3.2, and 7.8 mg/kg/day for males; and zero, 4.3, and 10.8 mg/kg/day for females. These doses were calculated from food consumption and body weight data provided by the authors. During the two years of study, the growth curves for all groups did not vary as a result of treatment. Food consumption, hematological values, and survival were also similar in all groups during the study. Except for changes associated with aging, pathological changes in the Central Nervous System (CNS) or other organ systems were not observed.

The highest NOAEL (10.8 mg/kg/day for female rats) is the basis of the USEPA RfD (USEPA, 1989a). According to USEPA guidelines, an uncertainty factor of 100 was used to derive the RfD (10 for species extrapolation; 10 for sensitive

populations). A modifying factor of 5 was used to account for the apparent tolerance to cyanide when it is ingested with food rather than when it is administered by gavage or drinking water. The RfD is, therefore, 2×10^{-2} mg/kg/day (USEPA, 1989a). USEPA's confidence in the Howard and Hanzel (1955) study is medium. Adequate records of food consumption and body weight were maintained, and animals of both sexes were tested at two doses for two years. The data base was rated medium because a small but sufficient number of studies support the chosen study. Therefore, USEPA has medium confidence in the RfD (USEPA, 1989a).

Upon first examination of other cyanide toxicity data, it might appear that the RfD is not adequately protective of public health. Jordan reviewed supporting toxicity information on cyanides, however, and has determined that the USEPA RfD is technically sound. According to ATSDR (1988), observed oral lethal doses for humans and rats are lower than 11 mg/kg. In addition, a Lowest-Observed-Adverse-Effect Level (LOAEL) for dogs based on neurotoxic effects has been defined by a study by Hertting et al. (1960). Both USEPA and ATSDR have determined that it is inappropriate to base the derivation of an RfD on the Hertting study for several reasons. Animals dosed at 0.27 mg/kg/day exhibited degenerative changes in Central Nervous System (CNS) cells. However, these animals were given bolus doses of NaCN by gavage (capsule). It is well- documented that animals can tolerate higher doses of cyanide when administered in the diet or drinking water over long periods of exposure (USEPA, 1985d). This fact also explains the observation of oral lethal doses in mammals at levels below the rat NOAEL. In a study by Hayes (1967), rats tolerated 25 daily doses of 4 mg cyanide/kg when the chemical was

mixed in the diet. Each dose was equal to an acute oral LD50. In addition, rats tolerated higher doses of KCN when administered in drinking water than when administered in bolus by gavage with water as the vehicle (USEPA, 1985d).

USEPA has also determined that the dog is not a good model for cyanide toxicity in humans. Dogs have been shown to be the most sensitive of the usual laboratory animals to cyanide's effects (ATSDR, 1988). This is due to the low level of cyanide metabolic capacity of the dog liver. Total rhodanese activity in all other species tested is higher than in dogs. Rhodanese is the enzyme that detoxifies cyanide. This is another reason that the low LOAEL for dogs in the Hertting study is not inconsistent with the cyanide toxicological data base.

In another study, Philbrick et al. (1979) identified a LOAEL in rats at doses of 30 mg/kg/day. Myelin degeneration was observed in spinal cords of rats fed this dose level. In addition, depressed thyroid function was observed. The NOAEL defined by the Howard and Hanzel study (1955) is not inconsistent with the LOAEL defined by the Philbrick study.

Application of the Oral Cyanide Risk Reference Dose to Inhalation Exposures

USEPA has not derived an RfD or an AIC level for inhalation exposure to cyanides. Animal studies pertaining to the chronic toxicity of inhaled cyanide were not located in the scientific literature. To assess quantitatively the human health risks due to inhalation of particulate cyanide compounds, Jordan therefore evaluated the suitability of using the oral RfD.

It is well known that inhalation of HCN gas is much more toxic than ingestion of bolus doses of cyanide salts or ingestion of cyanide salts as dietary or drinking water constituents (USEPA, 1984b; ATSDR, 1988). This is due both to the efficient pulmonary uptake of HCN and to the decreased first-pass metabolic identification of cyanide when inhaled compared to ingestion. It is inappropriate to assess the risks of inhalation of HCN gas by use of the USEPA oral RfD. On the other hand, the oral RfD can be used to assess risks due to inhalation of cyanide-containing particulates if an appropriate toxicokinetic factor is applied.

There is no information available on the uptake of cyanide salts by the lungs. All available inhalation toxicology studies use cyanide in the form of HCN. It is reasonable to anticipate that particular cyanide salts are absorbed in the lungs, but to a lesser degree than HCN. This conclusion is based on the knowledge that cyanide salts are absorbed through the skin. Cyanides are moderately lipid-soluble, which allows them to rapidly penetrate the epidermis. In addition, some cyanide compounds (e.g., potassium cyanide) have a corrosive effect on the skin that increases the rate of dermal absorption (ATSDR, 1988). It is expected that particulate cyanide salts would be absorbed more efficiently through pulmonary membranes that are constantly bathed with aqueous physiological solutions than through intact skin.

In addition, it has been reported that sodium cyanide and potassium cyanide are extremely toxic when inhaled (Sax and Lewis, 1986). Jordan is unaware of any studies that described the degree of uptake of cyanide salts when inhaled; nor is there any quantitative information available concerning the relative

detoxification of cyanide when ingested versus when inhaled. To properly utilize the oral RfD in assessing inhalation risks, the effects of these competing processes need to be estimated. Jordan has defined an inhalation toxicokinetic factor to evaluate these two processes.

Jordan assumes that the degree of pulmonary adsorption of cyanide particles retained in the lungs is the same as the degree of GI absorption in the Howard and Hanzel study (1955), and that pulmonary retention of 10 um particles is 75 percent of the inhaled particles. Further, Jordan assumes that the detoxifying hepatic metabolism after ingestion is 10 times that following inhalation. Therefore, the toxicokinetic factor is 7.5 relative to GI exposure in the study from which the RfD was derived.

The toxicokinetic factor is consistent with the available information about the toxicity of HCN gas. If it is assumed that the adsorption following inhalation of HCN gas is 10 times the absorption following ingestion of cyanide salts in the gut, and that metabolism following ingestion is 10 times that following inhalation exposure, then it could be predicted that inhaled HCN is 100 times more toxic than ingested cyanide ion. This prediction is consistent with the observed human lethal doses. The oral lethal dose in humans has been reported to be approximately 1 mg/kg, whereas the inhalation lethal dose for HCN is approximately 0.02 mg/kg (ATSDR, 1988). This increase in toxicity is due partly to the high pulmonary uptake of the agent and the decreased metabolism.

Application of the Cyanide Risk Reference Dose to Dermal Exposure

Because cyanides are known to be readily absorbed through skin, it is appropriate to use the RfD to assess the risks posed by dermal contact with cyanide containing soil. As with inhalation exposures, it is expected that the metabolic detoxification is 10 times more efficient for ingestion exposure compared to dermal exposure. No information is available on the efficiency of uptake of cyanide from contaminated soil. Jordan also assumes that the dermal uptake of cyanide from cyanide-containing soil is 10 percent as efficient as uptake of cyanide from HCN-treated food in the study from which the RfD was derived. Therefore, the relevant toxicokinetic factor is one.

Application of the Cyanide Risk Reference Dose to Oral Exposures

As discussed previously, the toxicity of cyanide when given as a dietary constituent is less than when given as a pure compound by gavage. There is no information available regarding the efficiency of adsorption when soil or diet is the vehicle. A conservative approach is to assume that the uptake is the same. Therefore, Jordan recommends that a toxicokinetic factor of one be used in assessing the risks to human health posed by ingestion of contaminated soil.

Cyanide Speciation

Jordan recommends that the USEPA oral RfD for cyanides only be applied to free cyanides. These would consist of HCN and cyanide salts, which result in the free cyanide ion being released in solution. Iron-complexed cyanides (e.g., ferro- and ferricyanide) are forms of cyanide in which the cyanide ion is not dissociable. Potassium ferrocyanide, for instance, has been shown to be fatal

to rats only at very high doses (1,600 mg/kg) after oral dosing (NIOSH, 1985). The lethal dose for 50 percent of rats tested (LD50) ranges from 1,600 to 3,200 mg/kg (Clayton and Clayton, 1982). It has also been reported that dogs, which are the most sensitive of the known laboratory animals, tolerated 2,626 mg/kg of ferrocyanide given intravenously. The complex was rapidly excreted in the urine (Clayton and Clayton, 1982). No reports of adverse effects in humans from the ferro- or ferricyanide could be found in the literature surveyed. Use of the USEPA RfD to estimate the human health risks posed by exposure to iron-complexed cyanide would therefore greatly overestimate the actual risks.

TRIMETHYLBENZENE

Trimethylbenzene has not been evaluated by the USEPA for its toxicity; however, it is believed to be comparable to other compounds of the alkybenzene class, such as xylene, tolune, and ethylbenzene. Because xylene is most closely structurally related to tremethylbenzene, the oral and inhalationn RFds for xylene of 2.0 and 0.4 mg/kg/day, respectively were also used for trimethylbenzene.

Although the ACGIH TLV is lower for trimethylbenzene than for xylene, the reasoning behind this is unclear. No other study seems to indicate that the toxicity of trimethylbenzene is higher than that of xylene. The LD50s (lethal dose - 50; the dose at which 50% of the dosed animals die) for the guinea pig are 2,000 mg/kg for xylene and 1,303 mg/kg for trimethylbenzene. The oral rat LD50s are 4,300 mg/kg and 8,970 mg/kg for xylenes and trimethylbenzenes, respectively. Thus, there is no significant difference in acute toxicity between the two compounds. Klaasen et al., (1986) describes the acute toxicity of all alkylbenzenes as Central Nervous System (CNS) depressant and toxic at levels that are relatively similar. They also conclude that all alkylbenzenes are relatively nontoxic except in acute exposures to high doses, and are metabolized to less toxic compounds via a nonsaturable pathway. Thus, the possibility of trimethylbenzene or any alkylated benzenes forming toxic reactive intermediate compounds is very slim.

Jordan feels that until more information is gained on trimethylbenzenes, the assumption of a similar toxicity to xylene is conservative and applicable in this risk assessment.

APPENDIX B-2

TOXICOLOGICAL PROFILES

POLYNUCLEAR AROMATIC HYDROCARBONS

Polynuclear aromatic hydrocarbons (PAHs) are a class of several hundred compounds, all of which consist of annelated benzene rings. While each compound has specific chemical properties, their fate in the environment can be summarized broadly.

Several of the PAHs are volatile enough to exist as vapors in the atmosphere, including naphthalene, phenanthrene, anthracene, fluoranthene, and pyrene. These compounds are subject to photochemical degradation and are expected to have an atmospheric half-life of less than one day. PAHs with low vapor pressure exist in the atmosphere adsorbed to particulate matter. The half-life of these compounds may be from less than one day to several weeks, depending on the composition of the particulate matter and extent of PAH degradation from ozonolysis reactions (USEPA, 1984a). Studies have indicated that particles less than 3.0 um have the highest PAH sorption (Pucknat, 1981).

The half-life of PAHs in the soil is highly variable and can range from less than one day to several decades. Because PAHs have low water solubility and adsorb to soil particles, they are not expected to be highly mobile in soils. No significant leaching of PAHs into the groundwater is expected, particularly if the soils have high organic carbon content (USEPA, 1984a).

PAHs are ubiquitous in the environment and most are formed during the combustion of organic compounds. Major sources of PAHs include incomplete combustion of fuels for heat and manufacturing; burning of coal, gasoline, and

diesel fuel; and burning of municipal and agricultural wastes. PAHs are associated with manufactured process gas residuals (Atlantic Environmental Services, 1988). Cigarette smoke also contains PAHs. To a limited extent, these compounds also occur naturally (i.e., plants and bacteria synthesize PAHs during growth, and naturally-caused brush and forest fires produce PAHs).

The carcinogenic properties of individual PAHs have been known for over 50 years, but not all PAHs are carcinogenic. Most carcinogenic PAHs are derived from the benzo(a)anthracene structure. Benzo(a)anthracene is weakly carcinogenic; however, the addition of benzene rings to specific positions substantially increases the carcinogenicity of the new compound. The substitution of methyl groups to specific carbons of the benzene ring also increases the carcinogenicity (Klaassen et al., 1986). Of the sixteen PAHs detected at this site, six are classified as potential human carcinogens (Carcinogen Assessment Group [CAG] B2 classification).

There are numerous animal studies of the carcinogenic potential of individual PAHs; however, limited information is available on the effects of complex mixtures of PAHs in the environment. It is not certain what effect interactions of carcinogenic and noncarcinogenic PAHs have on the carcinogenic potential of the mixture. Complex mixture information is largely derived from mouse skin-painting experiments with extracts of coal tar products and gasoline or diesel exhaust. Carcinogenic responses have been reported; however, problems with study design and reporting limit the interpretation of these findings.

PAHs are lipophilic and are absorbed from the gastrointestinal (GI) tract, lungs, and across the dermal membrane. Studies of benzo(a)pyrene (B(a)P) have found that it readily crosses the membranes of the GI tract, and tissue accumulation is exponential as B(a)P concentrations increase. B(a)P has also been found to be readily absorbed from the lungs (Kotin et al., 1969; Vaino et al., 1976; Mitchell and Tu, 1979).

Once PAHs have been absorbed, metabolic activation is required to convert PAHs to the reactive electrophilic species which are responsible for tumorigenesis. PAHs are metabolized by the cytochrome P-450 system to epoxides, which are subject to epoxide hydrolases, and form stereoisomeric diols. Diol epoxides bind to DNA (Klaassen et al., 1986).

PAHs are excreted via the bile and GI tract into the feces. Animal studies of injected PAHs found trace amounts of PAHs in the urine and expired air, but the majority was excreted in the feces (Heidelberger and Jones, 1948; Heidelberger and Weiss, 1951).

The carcinogenicity of PAHs has been demonstrated in both human and animal studies. Occupational studies involving worker exposure to PAHs from emissions of coke ovens, foundry processes, coal gas production, roofing tar, and coal combustion have reported increased risk of lung and other-site cancer mortality. While not proven, PAH exposures are believed to be the cause of the increased risk. Varying degrees of increased risk have been noted among different occupations and may be attributed to different durations and

intensities of exposures, the presence of other compounds, and different PAH mixtures to which the workers were exposed.

Epidemiologic studies of community populations are confounded by many factors (e.g., exposure to other chemicals, residence time in the community, varying levels of air pollution over time, and cigarette-smoking behavior). However, when cigarette smoking was controlled for, a study of urban residents found a two-fold increase in the risk of lung cancer when compared to rural residents. This increased risk may be attributed to the higher level of PAHs in city air (USEPA, 1979).

Numerous animal studies have reported tumorigenesis resulting from inhalation, oral, dermal/skin-painting, and injection exposures to PAHs. Lung, liver, mammary gland and digestive tract tumors, and leukemia have been reported. These studies involved exposures to separate PAHs, while the human studies involved exposures to mixtures. The animal studies were also high-dose exposures with a limited number of animals. Estimation of carcinogenesis from low-dose exposure is subject to considerable uncertainty, which is compounded when the exposure is to a mixture of PAHs rather than a single compound.

Noncarcinogenic effects of PAH exposure have also been reported in animal studies. These effects include weight loss, kidney and liver function changes, bronchitis, and serum enzyme changes (Knobloch et al., 1969). Animal studies have found PAHs to cross the placenta, and teratogenic effects have been reported (Pucknat, 1981).

Because the effects of PAH exposure are dependent on metabolism of the PAHs, exposure to any compound which either inhibits or induces the enzyme systems associated with PAH metabolism may potentially magnify or reduce the effects of the exposure. People who have altered metabolism or are exposed to compounds in the environment or dietary elements that may affect the cytochrome P-450 system may have increased health risks from PAH exposure.

Occupational standards have been established for PAH exposure associated with coal tar pitch volatiles. The following PAHs found at this site have been classified as probable human carcinogens (CAG B2 classification): benzo-(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, chrysene, dibenzo-(a,h)anthracene, indeno(1,2,3-cd)pyrene. In addition, the State of New York considers benzo(k)fluoranthene to be a probable human carcinogen.

BENZENE

Benzene is a highly flammable volatile aromatic hydrocarbon that is used both as a gasoline additive and a chemical intermediate in the production of many compounds (e.g., styrene and phenol). Benzene is associated with manufactured gas process residuals (Atlantic Environmental Services, 1988). Volatilization appears to be the major transport process of benzene from surface waters and soils to the ambient air, and atmospheric transport of benzene occurs readily (USEPA, 1979). Data indicate that it may be photo-oxidized rapidly in the atmosphere. The atmospheric destruction of benzene is probably the most likely fate process. Values for benzene's log octanol/water partition coefficient (K_{ow}) indicate that adsorption onto organic material may be significant. Sorption processes are likely removal mechanisms in both surface water and groundwater. Gradual biodegradation by a variety of microorganisms probably occurs. The rate of benzene biodegradation may be enhanced by the presence of other hydrocarbons.

Benzene is a recognized human carcinogen (IARC, 1982). Several epidemiological studies provide sufficient evidence of a causal relationship between benzene exposure and leukemia in humans. Several occupational studies since 1969 on exposures to low benzene concentrations (i.e., less than 9 ppm) conducted 1969 have shown no excess leukemias among workers and no mortality findings directly attributable to benzene exposures. Benzene is a known inducer of aplastic anemia in humans, with a latency period of up to 10 years. It reduces the number of white blood cells and other blood components, which may progress to a reduction in all blood cell types. Similar adverse effects

on the blood-cell-producing system occur in animals exposed to benzene. In both humans and animals, benzene exposure is associated with chromosomal damage, although it has not been shown to be mutagenic. Benzene has been shown to be fetotoxic and to cause embryolethality in experimental animals.

Exposure to high concentrations of benzene in the air causes central nervous system (CNS) depression and cardiovascular effects. Benzene has been reported to cause subjective symptoms (e.g., headaches and nausea) with chronic exposure to as little as 100 parts per million (ppm). Acute exposures of 50 to 150 ppm for 5 hours or 500 ppm for 1 hour will cause headaches, lassitude, and fatigue. An hour-long exposure at 1,500 ppm can cause illness, and 5 to 10 minutes at 20,000 ppm may be lethal for humans (Clayton and Clayton, 1981). No data could be found on subjective symptoms caused by benzene exposures closer to the National Institute for Occupational Safety and Health (NIOSH) recommended workplace time-weighted average (TWA) standard of 1 ppm, or the American Conference of Governmental and Industrial Hygienists (ACGIH) threshold limit value (TLV) of 10 ppm, which are designed to prevent leukemia and other chronic health effects in worker populations.

Acute occupational exposures have occurred. Browning (1965) reported that severe exposures, such as would occur when working in a storage tank, cause convulsions, paralysis, unconsciousness, and death. Deaths from cardiac sensitization and cardiac arrhythmias have also been reported after relatively large exposures. Milder exposure produced giddiness, headache, and nausea, followed by unconsciousness.

Early workplace practices produced chronic exposures to benzene at levels of 500 to 1,000 ppm. These exposures caused headaches and other clinical signs of benzene poisoning. Helmer (1944) reported that 60 of 184 workers in one plant exhibited headaches, fatigue, and blood disorders. Benzene levels were measured at 140 to 220 ppm after changes in work practices and ventilation equipment was installed; initial concentrations had been estimated at more than 5,000 ppm. Greenburg et al. (1939) reported on chronic benzene poisoning in three rotogravure printing plants. Benzene concentrations ranged from 11 to 1,060 ppm, and workers were exposed for 4 to 7 days/week. Symptoms reported for the 286 of 332 workers with varying degrees of benzene poisoning included fatigue, dryness of mucous membranes, nausea or vomiting, and lethargy for medium-level exposures; and the same symptoms plus weakness, nose bleeds, loss of appetite, shortness of breath, dizziness, and lethargy for the highest concentration level.

TOLUENE

Toluene is an aromatic hydrocarbon that is flammable, practically insoluble in water, and fully miscible with many organic liquids. Toluene is produced primarily from petroleum sources. It is used to produce benzene and phenol. Also, toluene is used as a solvent and an intermediate in production of explosives and specialty organic chemicals. Toluene is associated with manufactured gas process residuals (Atlantic Environmental Services, 1988).

Almost all toluene discharged to the environment by industry is in the form of atmospheric emissions. Photo-oxidation is the primary atmospheric degradation process for toluene, and benzaldehyde is reported to be the principal organic by-product. Direct photolytic cleavage of toluene is energetically improbable in the atmosphere, and oxidation and hydrolysis are probably not important as aquatic fates.

Toluene is known to be degraded by microorganisms and can be detoxified and excreted by mammals. However, the available data do not allow estimation of the relative importance of biodegradation/biotransformation processes.

Acute and chronic inhalation exposures to 200 ppm or greater concentrations of toluene vapor cause eye irritation, headaches, nausea, and other Central Nervous System (CNS) effects in humans. In humans, acute exposures to very high concentrations can cause narcosis, but exposures to quantities sufficient to produce unconsciousness fail to produce organ damage.

Acute toluene exposure can cause subjective CNS symptoms (e.g., nausea, headache, and fatigue) as well as eye irritation, at levels equal to or exceeding 200 ppm. In a study of three subjects who were exposed for eight hours to various toluene levels, one subject reported a mild headache at levels of 50 or 100 ppm in the air. At 200 ppm the majority reported fatigue, muscular weakness, repeated headache, nausea, impaired coordination, eye irritation, and after-effects (including fatigue, general confusion, and moderate insomnia) (Von Oettigan et al., 1942). As the toluene concentration was increased, the severity of these effects increased. At 800 ppm, volunteers reported severe fatigue, pronounced nausea, mental confusion, uncoordination, and severe after-effects. In a similar experiment, two subjects exposed for eight hours reported slight exhilaration at 200 ppm, lassitude and nausea at 400 to 600 ppm, and headache, nausea, and severe lassitude at 800 ppm (Carpenter et al, 1944). In studies of 10 people, the majority of the subjects reported eye and throat irritation after a 3 to 5 minute exposure to 300 ppm toluene. The subjects considered 200 ppm to be acceptable for an 8-hour exposure (Nelson et al., 1943). Others reported that a single 7-hour exposure to 200 ppm caused CNS effects such as decreased coordination, prolonged reaction time, decrease in pulse, and decrease in systolic blood pressure (Ogata et al., 1970).

Chronic exposure to toluene was also reported to cause CNS disturbances. In 100 workers exposed to toluene for one to three weeks, and who sought medical attention, 30 percent were exposed to 200 to 500 ppm and complained of headache, nausea, anorexia, lassitude, impairment of coordination, and loss of memory (Wilson, 1942). The workers exposed to 500 to 1,500 ppm complained of

nausea, headache, dizziness, anorexia, extreme weakness, and pronounced impairment of coordination and reaction time. It was unclear whether toluene levels below 200 ppm caused adverse effects.

Other CNS alterations have been observed in workers. Parmeggiani and Sassi (1954) reported that six of 11 workers exposed to 200 to 800 ppm toluene for many years exhibited signs of nervous hyperexcitability. In another setting, one worker exposed for many years to 210 to 300 ppm showed symptoms of stupor, nervousness, and insomnia. However, in 17 other workers exposed to 80 to 160 ppm, no CNS effects were noted (Capellini and Alessio, 1971). Chronic occupational exposure to 300 to 430 ppm toluene was also reported to cause behavioral changes.

The most noted effect of toluene in animals is CNS depression following high-level exposure. Vapor levels at or below 1,000 ppm appear to have little effect on gross parameters, although more sensitive indicators (e.g., electroencephalogram [EEG] changes) were noted in rats. Several studies indicate that toluene exerts no adverse effects on the blood-forming organs in rats and dogs. However, leukocytosis, impaired leukopoiesis, and chromosomal damage in the bone marrow were reported by several other researchers for rats and mice. Most inhalation and ingestion studies produced no evidence of liver damage, but effects suggestive of liver damage were noted at higher inhalation exposures (i.e., 2,000 ppm) in rats and various animals dosed intraperitoneally. Several studies reported renal injury to rats, dogs, and guinea pigs after subchronic inhalation of toluene in excess of 600 ppm. Lung irritation effects were observed in some studies with dogs, guinea pigs, and

rats. The acute oral LD50 for rats ranges from 6 to 7.5 g/kg. Inhalation LD50 values range from 500 to 700 ppm for mice and 4,000 ppm for rats (USEPA, 1983a).

There is no conclusive evidence that toluene is carcinogenic or mutagenic in animals or humans (USEPA, 1980a). The National Toxicology Program (NTP) is currently conducting an inhalation carcinogenicity bioassay with rats and mice. Researchers have reported that toluene is embryotoxic but not teratogenic in laboratory animals. There are no accounts of teratogenic effects in humans after exposure to toluene.

ACGIH recommends a TLV of 100 ppm (375 mg/m^3) toluene. This value appears to be appropriate for the prevention of headache and nausea, as well as other CNS effects. A short-term exposure limit of 150 ppm (560 mg/m^3) has been recommended for exposures of less than 15-minute duration in an 8-hour day.

ETHYL BENZENE

Ethyl benzene is a volatile aromatic compound with a high log K_{ow}, indicating that it adsorbs onto organic particles in the soil, slowing its transport to groundwater and surface water. Small amounts of ethyl benzene can leach into groundwater from soil (especially sandy soil) and may biodegrade in subsurface soils. The half-life of ethyl benzene in air is 35 hours. The primary loss mechanisms from the soil surface is expected to be evaporation. Ethyl benzene is a chemical which is associated with manufactured gas process residuals (Atlantic Environmental Services, 1988).

To date, ethyl benzene has not been evaluated by USEPA for human carcinogenicity potential. The target organs for health impacts from acute exposures are the eyes, upper respiratory system, skin, and CNS. No data on teratogenicity or mutagenicity of ethyl benzene were located by USEPA (1980b).

Human toxicity of ethyl benzene is characterized by its irritancy to the skin, and less markedly, to the mucous membranes (ACGIH, 1986). The TLV for ethyl benzene of 100 ppm was set to protect against its irritant effects. At this concentration, no systemic effects of ethyl benzene are expected to be produced (ACGIH, 1986).

Bardodej and Bardodejava (1970) reported no toxic effects in volunteers after inhalation exposure to 100 ppm ethyl benzene for 8 hours. Their exposure to an increased concentration of ethyl benzene resulted in fatigue, headache, and mild eye and respiratory irritation.

STYRENE

Styrene is a volatile aromatic compound produced primarily from the dehydrogenation of ethyl benzene. Styrene is used to produce polystyrene, which is a thermoplastic with excellent electrical properties and thermal stability.

The target organs for toxic effects are the CNS, the respiratory system, and the eyes and skin. There is some epidemiologic evidence of greater sensitivity of the human fetus than the adult to the systemic toxic effects of styrene. These studies are described in the following paragraphs.

The frequency of spontaneous abortions among Finnish chemical workers was analyzed by Hemminki et al (1980). Information on spontaneous abortions (15,482 cases), induced abortions (71,235 cases), and births (193,897 cases) for 1973 through 1976 was obtained from the Hospital Discharge Registry of the Finnish National Board of Health. The information was linked by social security number to the membership of the Finnish Union of Chemical Workers (approximately 900 female members). The rates of spontaneous abortion were 8.5 percent (N = 52) and 15.0 percent (N = 6) among the female union members and a subgroup in the styrene industry, respectively. These rates were significantly higher ($p < 0.01$) than the rate among all Finnish women (5.5 percent, N = 15, 482).

The information on the work histories of 43 Finnish mothers of children born with CNS defects from June 1, 1976, to March 1, 1977, were obtained through

personal interviews (Holmberg, 1977). Two mothers had been employed in the reinforced plastics industry with regular exposure to styrene, polyester resin, organic peroxides, and acetone. The defects in their two children were anencephaly and congenital hydrocephaly. The overall rates of anencephaly and congenital hydrocephaly were reported to be 0.2 and 0.3 respectively, per 1,000 live births in Finland. Based on these estimates, there appeared to be more than a 300-fold increased rate of these malformations in the reinforced plastics industry during the 9-month study period, compared to the general population (2/12 versus 0.5/1,000).

Retrospective cohort mortality and case-control studies were conducted on workers exposed to styrene in the styrene-polystyrene manufacturing industry and in the styrene-butadiene synthetic rubber industry (McMichael et al., 1976; Smith and Ellis, 1977; Meinhardt et al., 1978). Inadequate data are available at present to indicate that styrene is a human carcinogen. However, an elevated incidence of tumors of the hematopoietic and lymphatic tissues have been observed. Available studies are limited because of relatively small cohort sizes or multiple chemical exposures of workers (including exposure to benzene).

Styrene is classified by USEPA as a possible human carcinogen (Group C), meaning there are no human data and limited evidence of carcinogenicity from animal studies.

XYLENE(s)

Xylenes are volatile aromatic compounds used as a solvent for prints, ink, and adhesives. There are three isomeric forms of xylene: meta-xylene, ortho-xylene, and para-xylene. Xylenes are components of detergents and other household and industrial products. Xylene is associated with manufactured gas process residuals (Atlantic Environmental Services, 1988).

Xylenes readily volatilize from surface water and surface soil. Volatilization and subsequent photo-oxidation by reaction with hydroxyl radicals in the atmosphere are probably important transport and degradation processes for xylenes in the upper layer of soil and in aquatic environments. Xylenes bind to sediment in water and to organics in soils and undergo microbial degradation. Biodegradation is probably the most degradation fate process in both soils and the aquatic environment. Xylenes have been shown to persist for up to six months in soil. Because of their low water solubility and rapid biodegradation, xylenes are unlikely to leach into groundwater in high concentrations.

Short-term exposure can cause eye, nose, and throat irritation at 200 ppm. There is some evidence that chronic exposures to less than 50 ppm can cause headaches and other CNS effects. Xylene has not been shown to be carcinogenic when administered orally to rats or mice. Xylene was found to be mutagenic in a battery of short-term assays. Xylene is not teratogenic but has caused fetotoxicity in rats and mice.

Occupational exposure to xylene has been reported to cause headache, fatigue, lassitude, irritability, and GI disturbances (e.g., nausea, anorexia, and flatulence). Other researchers have also reported neurological disturbances and injury to the heart, kidney, and CNS among xylene workers.

Short-term exposures to xylene vapors have not been demonstrated to cause noticeable subjective effects at levels less than 200 ppm. When 10 volunteers were exposed for 3 to 5 minutes to xylene at 200 ppm, the majority reported eye, nose, and throat irritation (Nelson et al., 1943). At 100 ppm, the majority reported no symptoms and indicated that an 8-hour daily exposure at this level would be satisfactory. In another study, one of six people exposed for 15 minutes to 233 ppm experienced eye irritation, and four of six reported eye irritation at 460 ppm (Carpenter et al., 1975). Activities reported to cause eye and upper respiratory tract irritation from uncharacterized xylene levels include furniture polishing and demolition of epoxy resin concrete. Unconsciousness and death have been reported to result from xylene exposure in excess of 10,000 ppm (Morley et al., 1970). The workers who died had evidence of pulmonary edema and brain hemorrhage. The survivors suffered from amnesia, renal impairment, and hepatic dysfunction.

Long-term exposure to xylene may result in subjective symptoms at levels lower than 200 ppm. One-third of 45 xylene production workers exposed daily to 10 to 45 ppm reported headaches, irritability, insomnia, rapid heartbeat, and indigestion (Sukhanova et al., 1969). Intermittent exposure over 2 months to 270 to 350 ppm xylene caused acute vomiting, giddiness, and loss of appetite in one worker (Glass, 1961).

ACGIH believes the irritant effects of xylene are minimal at 100 ppm with no significant degree of narcosis or chronic injury from exposures at that level; consequently, they recommended a TLV of 100 ppm (435 mg/m^3). A short-term exposure limit of 150 ppm has been recommended by ACGIH for exposures of less than 15 minutes in an 8-hour work day.

NAPHTHALENE

Naphthalene is a white solid, also called naphthalin, naphthene, moth flake, tar camphor, or white tar, which exhibits the characteristic mothball odor. Chemically, it is composed of two fused benzene rings (Sandmeyer, 1981). Naphthalene occurs naturally in the roots of Radix and Herba ononids (Hesse et al. 1977). It is formed in cigarette smoke by pyrolysis (Johnstone, 1963) and is a photodecomposition produce of carbaryl, a naphthylcarbamate insecticide (Addison et al., 1975). Naphthalene also occurs in crude oil, cracked petroleum products, coke oven emissions, and high temperature carbonization of bituminous coal (American Petroleum Institute, 1959). Naphthalene is associated with manufactured gas process residuals (Atlantic Environmental Services, 1988).In both solid and liquid form, naphthalene is flammable. The vapor or dust can make an explosive mixture with air. Molten naphthalene, in contact with water, may result in violent foaming or the formation of explosive mixtures (Manufacturing Chemists Association, 1956).

Ingestion of naphthalene, in the form of mothballs, has resulted in no adverse effects in a number of the cases described. The ingested material was excreted in the feces in unchanged form. The co-ingestion of fats facilitates the absorption and other systemic events (Moeschlin, 1965). In severe cases, ingestion caused gastroenteric distress, tremors and convulsions. Within 2 to 7 days, moderate to severe anemia may develop, hemoglobin damage occurs, and the serum takes on a yellowish brown color. In some cases, this leads to disruption of renal function and even death due to respiratory failure (Deichman and Gerade, 1969).

Naphthalene is acutely irritating to the eye. With skin contact, it is a primary irritant. Since naphthalene may volatilize and sublime at room temperature, inhalation is a primary exposure route. The signs and symptoms of toxicity due to inhalation of naphthalene vapors resemble those observed from oral or dermal exposure. Naphthalene vapors may cause eye and respiratory irritation, headache, nausea, and perfuse perspiration.

Chronic effects of oral administration of a naphthalene-isopropanol mixture resembled ethanol intoxication but subsided after a few days (Gadsden, 1958). The effects on the eye were more severe. Corneal ulceration and cataracts have been observed (Adams, 1930) as well as general opacities which were observed after 5 years of exposure. Repeated inhalation of naphthalene vapors may produce malaise, headache, and vomiting.

Daily oral administration of naphthalene to rabbits at 1 g/kg produced effects in the eye that were slightly visible after only three doses and definitely exhibited after 20 days. A dose of 1.5 g/kg day produced white spots in the rabbit eye periphery but were distributed over the whole retina of young animals (Shimotori, 1972). Naphthalene is rapidly metabolized in adults to alpha- and beta-naphthol and alpha- and beta-naphthoquinone. The most active metabolite is probably naphthalene-1,2-oxide (Juchau and Namkung, 1974).

Usually organic compounds that readily form epoxides are suspected mutagens or carcinogens. Although naphthalene has low DNA and RNA binding capacities (Brooks and Lawley, 1964) and previous studies have failed to show evidence of carcinogenic activity by naphthalene (Horning et al., 1976; Searle, 1976;

Skjaeggestad, 1964), NTP has recently tested naphthalene for carcinogenic activity in mice. The results of the study have not yet been published.

EPA (1982) determined that the dose at which acute effects have been observed in humans is three to five orders of magnitude higher than the exposure levels to specific subpopulations associated with mothball use and cigarette smoking. EPA, therefore, concluded that there appears to be little acute risk to humans from environmental exposure to naphthalene; however, severe adverse effects are possible from accidental ingestion of substantial quantities of naphthalene.

CYANIDE

Cyanide is a compound that may exist as a gas (e.g., hydrogen cyanide [HCN]), a salt (e.g., potassium cyanide [KCN] or sodium cyanide [NaCN]) a metal cyanide (ferro/ferri-cyanide), or as free cyanide. At coal gasification sites, cyanide is expected to be present mostly as ferro/ferri-cyanide, and to a lesser extent, as free or amenable cyanide. Most cyanides, with the exception of several metallocyanides, are relatively soluble in water. However, their environmental fate in water varies considerably by compound. The alkali metal cyanides (e.g., KCN and NaCN) readily dissociate upon release to the water and may form HCN or bond with metals present in the water. Ferro- and ferricyanides are relatively stable metallocyanides and may undergo photodissociation to the cyanide ion (CN-) and form HCN. The insoluble cyanides (i.e., copper and silver cyanide) are not expected to dissociate. They may become adsorbed to sediment, bioaccumulate in aquatic organisms, or biodegrade (ATSDR, 1988).

In both water and soils, volatilization is expected to be an important fate process. At a pH of less than 9.2, most of the free cyanide in water and soil is expected to exist as HCN (ATSDR, 1988). HCN has a vapor pressure of 264.3 mm mercury (mmHg) (0°C); however, volatilization is expected to vary with soil and water characteristics. A number of microorganisms biodegrade cyanide at low concentrations. HCN is expected to be highly mobile in soils and may leach into the groundwater when present in concentrations that may exceed the biodegradation capacity of the microorganisms.

Most atmospheric cyanide is HCN. It is expected to be resistant to photodecomposition and has a half-life of approximately 334 days (ATSDR, 1988). At coal gasification sites that have been inactive for decades, HCN would not be a major concern. Both cyanide gases and salts are used in industrial processes. HCN is manufactured at 14 sites in the U.S. and is used as an intermediate in the production of nylon and other compounds. Minor uses of HCN include insecticides and rodenticides for fumigating enclosed spaces (e.g., grain storage areas). Cyanide salts are used mainly in the electroplating and metal-finishing industries. Minor applications of the salts include the manufacture of dyes and pigments, as well as use as insecticides and rodenticides.

Cyanides also occur naturally in several foods and plants and are produced by certain bacteria, fungi, and algae. Cyanocobalamin, a form of vitamin B12, is a dietary requirement. However, most of the cyanide found in the environment is from industrial processes.

The exposure routes of concern for cyanide at this site are ingestion of cyanide-contaminated soils and inhalation of fugitive dust where cyanide has been adsorbed to the particles. There are no studies in the available literature that evaluate toxicity following these specific exposures. All the inhalation studies are of the effects of exposure to HCN; oral studies are generally on the effects of HCN, NaCN, or KCN exposure.

Epidemiological studies have also been undertaken in tropical climates where the cyanide-containing vegetable, cassava, is a dietary staple. Neurologic,

cardiovascular/respiratory, and/or thyroid effects were found following these exposures. However, care should be exercised when assuming the same effects will result from the defined routes of exposure at this site and from exposure to other cyanide compounds.

The fatal effects of exposure to high doses of cyanide over short periods of time are well known. Inhalation of 100 ppm HCN for 0.5 to 1 hour has been fatal to humans. The LD50 in humans for ingestion exposure has been reported to be 1.5 mg/kg/day of CN-. A lower fatal dose in humans has been reported at 0.6 mg/kg/day CN- (ATSDR, 1988).

Brief exposure to lower levels of cyanide has resulted in rapid, deep breathing, shortness of breath, convulsions, and loss of consciousness. Because cyanide is not sequestered in the body, these effects are reversible over time. However, longer-term exposure to these low levels has resulted in CNS, thyroid gland, and cardiovascular effects.

Cyanide is readily absorbed following inhalation and oral exposure. Human studies have reported 58 to 77 percent of inhaled HCN is retained in the lungs (Landahl & Hermann, 1950). Human and animal studies indicate cyanide is rapidly distributed by the blood following both inhalation and oral exposure.

The major metabolic pathway of cyanide is conversion to thiocyanate by either rhodanese or 3-mercaptopyruvate. There are also three minor metabolic pathways: conversion to 2-aminothiazoline-4-barboylic acid; incorporation into a 1-carbon metabolic pool; or combination with hydroxycobalamin to form

cyanocobalamin (B12) (ATSDR, 1988). Cyanide metabolites are primarily excreted in the urine. Small amounts are excreted in the expired air.

Inhalation Toxicity

Numerous occupational exposures to cyanide have been reported; however, no levels of exposure are available. Exposure to HCN resulted in palpitations, shortness of breath, pain over the heart, vertigo, and involuntary eye movements (Carmelo, 1955), cyanosis, headache, altered EEG, and left-sided blindness (Sandberg, 1967). A photographic laboratory worker was exposed to potassium cyanide when a bag of the compound burst in his face. He developed abdominal pain, pallor, and collapse, but recovered after treatment (Thomas and Brooks, 1970).

While many of the available animal studies involved inhalation of fatal doses of cyanide, several studies are available that demonstrate effects from exposure to lower doses.

When monkeys were exposed to 87 to 196 ppm HCN, severe disruptive changes in respiration and unconsciousness were noted (Purser et al., 1984). Tremors, convulsions, loss of equilibrium, dyspnea, nausea, exaggerated intestinal peristalsis, and diarrhea were noted in dogs exposed to 45 ppm HCN for varying durations (Valade, 1952).

All available human and animal studies involved exposure to HCN and not particulate matter. Acute exposure to inhaled HCN at high concentrations resulted in hyperventilation, unconsciousness, and death. The cardiovascular

effects are believed to be secondary to the CNS effects (ATSDR, 1988). A worker exposed to HCN by both inhalation and dermal routes developed left-sided blindness (Sandberg, 1967). HCN fumigators also exposed by inhalation and dermal contact developed palpitations, shortness of breath, pain over the heart, vertigo, and involuntary eye movements (Carmelo, 1955).

When rats were exposed to inhalation of HCN at low concentrations, cardiac enzyme changes resulted (O'Flaherty and Thomas, 1982). The previously cited Purser study of monkeys exposed to 87 to 196 ppm HCN from pyrolyzed polyacrylonitrile also found cardiovascular effects, including rapid induction of a semiconscious state and severe disruptive changes in respiration.

Several occupational studies of workers exposed to HCN produced thyroid abnormalities. In a case-control study of electroplating workers exposed to 6.4 to 10.4 ppm HCN for 5 to 15 years, 56 percent of the exposed group had enlarged thyroid glands and significantly elevated hemoglobin levels and lymphocyte counts. It should be noted that these workers were also exposed to volatiles, exposure levels varied, and unmatched controls were used (El Ghawabi et al., 1975).

Workers in a silver-reclaiming factory exposed an average of 10.5 months to a TWA of 16.6 mg/m^3 HCN developed headache, dizziness, and mild thyroid abnormalities (Blanc et al., 1985).

No studies of developmental effects in humans resulting form inhalation of cyanide are available.

The only available animal study is of hamsters exposed to acetonitrile, which has cyanide as a metabolic by-product. The hamsters were dosed with zero, 1,800, 3,800, 5,000, and 8,000 ppm for 60 minutes. Dose-related increases in maternal mortality, fetal resorptions, and malformations were found (Willhite, 1981).

Oral Toxicity

The risk assessment at this site quantitatively evaluates effects from ingestion of soil particles to which cyanide is adsorbed. There are a number of studies of CN- administered in the diet or by gavage; however, no studies in which soil was the vehicle are available.

Male rats were fed 30 mg/kg/day cyanide for 11.5 months and developed vacuolization and myelin degeneration of the spinal cord (Philbrick et al., 1979). No CNS effects were reported by Howard and Hanzell (1955) for rats fed up to 10.8 mg/kg/day of CN- in HCN-fumigated feed for two years.

Dogs fed 0.27 and 0.53 mg/kg/day cyanide in capsules for 16 weeks developed degenerative changes in the CNS ganglion cells, reduced ribonucleic acid (RNA) content, and inflammation (Hertting et al., 1960).

No studies describing cardiovascular or respiratory effects in humans or animals following long-term, low-dose oral exposure were found in the available literature. However, it is important to note that respiratory failure and death have resulted following continuous exposure to single, high doses of cyanide.

Qualitative surveys of African communities where people are exposed to cyanide from consumption of cassava have found a strong correlation between cassava consumption and endemic goiter and cretinism. Dietary deficiencies may have compounded this association (ATSDR, 1988).

In a 14-day study, male rats were fed the equivalent of 40 mg/kg/day CN- as potassium cyanide added to the diet. The diets varied by the amount of protein. Increased thyroid weights and increased plasma thyroid stimulating hormone levels were noted only in the low-protein diet group. These effects were not observed when protein levels were increased or when iodine was added to the drinking water of rats fed the low-protein diet (Kreutler et al., 1978).

Rats were fed the equivalent of 30 mg/kg/day CN- for 11.5 months. At the end of four months, the rats exhibited decreased plasma thyroxine and thyroxine secretion rates. At the end of the 11.5 months, these same effects were found, plus increased relative thyroid weight (Philbrick et al., 1979).

Epidemiologic studies were conducted in Zaire where cassava is a staple food. Congenital hypothyroidism was found in 15 percent of the newborns. This incidence is approximately 500 times that of industrialized countries. In addition to cassava consumption, iodine deficiencies may have contributed to this condition (ATSDR, 1988).

Numerous studies of orally exposed pregnant animals have found maternal toxicities and developmental abnormalities in the offspring. Pregnant

hamsters exposed to cyanide as D,L-amygdalin (a component of laetrile) exhibited maternal toxicity at 250 mg/kg and greater. Fetuses were examined at 15-days gestation, and dose-related abnormalities were observed in this group (Willhite, 1982).

Female rats were fed a basal casava diet containing 12 mg/kg HCN and a basal diet with 1.25 gm KCN per kg diet prior to mating, during gestation, and through lactation. The weanlings were subsequently fed these same diets. Those weanlings exposed to higher levels of cyanide in utero and during the post-weaning period had significantly decreased protein-efficiency ratios. Both the dams and weanlings fed the potassium cyanide-enhanced diet had significantly increased serum thiocyanate levels (Tewe and Maner, 1981).

Pregnant pigs were fed cassava diets with added cyanide. In the group with the highest exposure (520.7 mg/kg CN-), serum thiocyanate levels were increased in dams and fetuses. Reduced thyroid activity was found in the dams. Both the high and low groups (276 mg/kg CN-) had proliferation of glomerular cells in the kidneys.

Other Effects. No data on reproductive toxicity from cyanide exposure by any route are available in the literature. Cyanide has tested negative for mutagenic effects. There are no data available indicating that cyanide has any carcinogenic effects.

High Risk Populations. High-risk populations include those persons with a metabolic disturbance in the conversion of cyanide to thiocyanate and those

with dietary deficiencies (e.g., iodine, protein, vitamin B12, or riboflavin), as well as those nutritionally deprived.

TRIMETHYLBENZENE

Trimethylbenzenes are alkylated benzenes. This group of compounds, which include xylenes, toluene, and ethylbenzene, is a by-product of petroleum distillation and found in coke oven effluents. Trimethylbenzenes are primarily used in industry as solvents, paint thinners, and motor fuel components. One of the three trimethylbenzene isomers has been identified as an insect attractant (Clayton and Clayton, 1981). Trimethylbenzene is associated with manufactured gas process residuals (Atlantic Environmental Services, 1988).

Trimethylbenzene, as with most alkylated benzenes, seems to be relatively nontoxic except during acute exposures at very high concentrations (Klaasen et al., 1986). This is probably because alkylated benzenes are metabolized to compounds of lower toxicity, and there is no evidence that these metabolic pathways can be saturated, leading to the formation of toxic reactive intermediates. Trimethylbenzene is absorbed through the lungs and the GI tract; dermal absorption does not lead to systemic toxicity. The primary toxicologic effects seen at acute exposure to high concentration are CNS depressive effects such as nervousness, anxiety, fatigue, nausea, and irritation of the eyes, nose and throat. Skin irritation and chemical pneumonitis can occur at the site of contact (e.g., where deposition in lungs occurs). Workers exposed to trimethylbenzene in a solvent at concentrations of 10-60 ppm for many years have shown hypochromic anemia and some deviation from normal coagulation (ACGIH, 1986).

Little experimental work has been carried out on trimethylbenzene. Most studies are acute or subacute in duration, and the results were mostly CNS depressive effects with some incidence of thrombocytosis, thrombosenis, and inhibition of phagocytical activity in leukocytes.

There are no drinking water or OSHA standards for trimethylbenzene; however, the ACGIH recommends a threshold limit value of 25 ppm (125 mg/m^3) in air.

APPENDIX B

REFERENCES

Adams, D.R., 1930. Brit. J. Ophthamol; 14:545.

Addison, J.B., P.S. Silk, and I. Unger, 1975. Int. S. Environ. Anal. Chem. 4(2):135.

Agency for Toxic Substances and Disease Registry (ATSDR), 1988. "Toxicological Profile for Cyanide"; Atlanta, Georgia.

Agency for Toxic Substances and Disease Registry (ATSDR), 1987. "Toxicological Profile for Di-(2-ethylhexyl)phthalate"; December 1987.

Aksoy M., S. Erdem, and G. Din Col, 1974. "Leukemia in Shoe Workers Exposed Chronically to Benzene"; Blood; 44:837-41. (As cited in USEPA, 1989b.)

American Conference of Governmental Industrial Hygienists (ACGIH), 1986. Documentation of the Threshold Limit Values, 5th Edition; Cincinnati, Ohio; 695 pp.

American Petroluem Institute (API), 1959. "Toxicological Review of Naphthalene"; New York.

Atlantic Environmental Services, Inc., 1988. "Management of Manufactured Gas Plant Sites: Volume III Risk Assessment Appendices"; prepared for Gas Research Institute; Chicago, Illinois; Atlantic Project No. 1019-01-60; January 1988.

Bardodej, Z. and E. Bardodejava, 1970. "Biotransformation of Ethylbenzene, Styrene, and Alphamethylstyrene in Man"; Journal of Am. Ind. Hyg. Assoc.; 31(2):206-209.

Bingham, E. and H.L. Falk, 1969. "The Modifying Effect of Carcinogens on the Threshold Response"; Arch. Environmental Health, 19:779-783.

Blanc, P., M. Hogan, K. Mallin, D. Hryhorczuk, S. Heassl, and B. Bernard, 1985. "Cyanide Intoxication among Silver Reclaiming Workers"; JAMA; 253(3):367-371.

Bornmann, G. and A. Loesner, 1967. "Zur Frage Winer Cronish-toxichen Wirkung von Dichloromethan"; Z. Lebensmittle-Unters. Forsch. 136:14. (As cited in USEPA, 1983d.)

Bowers, D.E., M.S. Cannon, and D.H. Jones, 1982. "Ultrastructural Changes in Livers of Young and Aging Rats Exposed to Methylated Benzenes"; American Journal of Veterinary Research; 43(4)679-83. (As cited in USEPA, March 1989d.)

Browning, E., 1965. Toxicity and Metabolism of Industrial Solvents; Elsevier Publishing Company; New York; pp. 3-65.

Brooks, P. and P.D. Lawley, 1964; Nature 202:781.

Burek, J.D., K.D. Nitschke, T.J. Bell, et al, 1980. "Methylene Chloride: A Two-year Inhalation Toxicity and Oncogenicity Study in Rats and Hamsters"; Final Report; Toxicology Research Laboratory, Health and Environmental Sciences; Dow Chemical USA, Midland, Michigan; co-sponsored by Diamond Shamrock Corp., Dow Chemical Co., Imperial Chemical Industry Ltd., Stauffer Chemical Co., and Vulcan Materials Co.

Burek, J.D., K.D. Nitschke, T.J. Bell, et al, 1984. "Methylene Chloride: A Two-year Inhalation Toxicity and Oncogenicity Study in Rats and Hamsters"; Fund. Appl. Toxicol; 4(1):30.

Capelline, A. and L. Alessio, 1971. "The Urinary Excretion of Hippuric Acid in Workers Exposed to Toluene"; Med. Lavoro.; 62:196 - 201 (Ita.). (As cited in USEPA, 1983.)

Carmelo, S., 1955. "New Contributions to the Study of Subacute-Chronic Hydrocyanic Acid Intoxication in Men"; Ross Med. Ind.; 24:254-71.

Carpenter, C.D., C.B. Shaffer, C.S. Weil, and H.F. Smyth, Jr., 1944. "Studies on the Inhalation of 1,3-Butadiene; with a Comparison of its Narcotic Effect with Benzol, Toluol, and Styrene, and a Note on the Elimination of Styrene by the Human"; Journal of Industrial Hygiene Toxicology; 26:69-78. (As cited in USEPA, 1983a.)

Carpenter, C.P., E.R. Kinkead, D.L. Geary, Jr., L.J. Sullivan, and J.M. King, 1975. "Petroleum Hydrocarbon Studies. V. Animal and Human Responses to Vapors of Mixed Xylenes"; Toxicol. Appl. Pharmacol.; 33:543-548.

Carter, B.R., M.W. Cook, S.D. Gangolli and P. Grasso, 1977. "Studies on dibutyl phthalate induced testicular atrophy in the rat: effect on zinc metabolism"; Toxicol. Appl. Pharmacol.; 41:609-618. (As cited in USEPA, 1980c.)

Chu, M.M.L. and C.W. Chen, 1984. "Evaluation and Estimation of Potential Carcinogenic Risks of Polynuclear Aromatic Hydrocarbons"; paper presented at the Pacific Rim Risk Conference; Honolulu, Hawaii; unpublished (available from the authors, USEPA Carcinogen Assessment Group).

Chemical Industry Institute of Technology (CIIT), 1980. "A twenty-four month inhalation toxicology study in Fischer-344 rats exposed to atmospheric toluene"; Executive Summary and Data Tables; October 15, 1980.

Clayton, G.C. and F.E. Clayton (editors), 1981. Patty's Industrial Hygiene and Toxicology, Volume IIC; John Wiley and Sons; New York.

Collins, V.J., W.U. Gardner, and I.C. Strong, 1943. "Experimental Gastric Tumors in Mice"; Cancer Research; 3:29-35.

Deichman, W.B. and H.W. Gerade, 1969. "Toxicology of Drugs and Chemicals, Academic Press, New York.

Dow Chemical Co., 1980. "Methylene Chloride. A Two-year Inhalation Toxicity and Oncogenicity Study in Rats and Hamsters"; FYI-OTS-0281-0097; Follow-up Response A; USEPA, Office of Toxic Substances; Washington, D.C.

El Ghawabi, S.H., M.A. Gaafar, A.A. El-Saharti, S.H. Ahmed, K.K. Malash, and R. Fares, 1975. "Chronic Cyanide Exposure: A Chemical Radioisotope and Laboratory Study"; British Journal of Industrial Medicine; 32:215-19.

Federenko, Z.P. and N.Y. Yanysheva, 1966. Hygiene and Sanitation; 31(8):168-173. (As cited in USEPA, 1982.)

Gadsden, R.H., R.R. Mellette, and W.C. Miller, Jr., 1958. J. Am. Med. Assoc.; 168:1220.

Gerarde, H.W., 1960. Toxicology and Biochemistry of Aromatic Hydrocarbons. Elsevier Publishing Co.; London.

Glass, W.I., 1961. "Annotation: A Case of Suspected Xylol Poisoning"; New Zealand Medical Journal; 60:113.

Greenburg, O., M.R. Hayers, L. Goldwater, and A.R. Smith, 1939. "Benzene (benzol) Poisoning in the Rotogravure Printing Industry in New York City"; Journal of Industrial Hygiene Toxicology; 21:395-420.

Grimmer, G. (editor), 1985. Environmental Carcinogens: Polycyclic Aromatic Hydrocarbons - Chemistry, Occurrence, Biochemistry, Carcinogenicity; CRC Press, Inc.; Boca Raton, Florida.

Habs, M., D. Schmahl, and J. Misfeld, 1980. "Local Carcinogenicity of Some Environmentally Relevant PAHs after Lifelong Topical Application to Mouse Skin"; Arch. Geschwulstforsch; 50:266-274.

Hayes, W.T., Jr., 1967. "The 90-dose LD50 and a Chronicity Factor as Measures of Toxicity"; Toxicol. Appl. Pharmacal.; 11:327-335.

Heidelberger, C. and H.B. Jones, 1948. "The Distribution of Radioactivity in the Mouse Following Administration of Dibenzanthracene Labeled in 9 and 10 Positions with Carbon-14"; Cancer; 1:252-60.

Heidelberger, C. and S.M. Weiss, 1951. "The Distribution of Radioactivity in Mice Following Administration of 3,4-Benzopyrene-5-C"; Cancer Research; 11:885-91.

Helmer, K.J., 1944. "Accumulated Cases of Chronic Benzene Poisoning in the Rubber Industry"; Acta Medical Scand.; 118:354-375.

Hemminki, K., E. Franssila, and H. Vainio, 1980. "Spontaneous Abortion Among Female Chemical Workers in Finland"; Int. Arch. Occupational Health; 45:123-126. (As cited in USEPA, 1985d.)

Hertting, G.O., E. Kraupp, E. Schnetz, and S.T. Wieketich, 1960. "Untersuchungen uber die folgen einer chronischen verabreichung akut toxishen dosen von natriumcyanide an hunden"; Acta Pharmacol. Toxicol; 17:27-43. (As cited in ATSDR, 1988.)

Hesse, C., K. Hilp, H. Kating, and G. Schaden, 1977. Arch. Parm. 310(10): 792.

Holmberg, P.C., 1977. "Central Nervous Defects in Two Children of Mothers Exposed to Chemicals in the Reinforced Plastics Industry"; Scand. J. Work Environ. Health; 5:333-335. (As cited in USEPA, 1989e).

Horning, M.G., C.D. Kary, P.A. Gregory, and W.G. Stillwell, 1976. Toxicol. Appl. Pharm.

Howard, J.W. and R.F. Hanzel, 1975. "Chronic Toxicity for Rats of Food Treated with Hydrogen Cyanide"; J. Agric. Food Chem.; 3(4):325-29.

ICF-Clement Associates, 1985. "Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites".

ICF-Clement Associates, 1987a. "Comparative Potency Approach for Estimation of the Total Cancer Risk Associated with Exposures to Mixtures of Polycyclic Aromatic Hydrocarbons in the Environment"; prepared for the Gas Research Institute; Chicago, Illinois; (Draft).

ICF-Clement Associates, 1987b. "Scientific Peer Review Report of the Comparative Potency Approach for Estimation of the Cancer Risk Associated with Exposure to Polycyclic Aromatic Hydrocarbons"; prepared for Gas Research Institute; Chicago, Illinois; (Draft).

Infante, P.F., R.A. Rinsky, J.K. Wagoner, and R.J. Young, 1977. "Benzene and Leukemia"; Lancet; 2:867-69. (As cited in USEPA, 1989b.)

International Agency for Research on Cancer (IARC), 1982. "IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Vol. 29; Some Industrial Chemicals and Dyestuffs"; World Health Organization; Lyon, France.

International Agency for Research on Cancer (IARC), 1985. "IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Vol. 35, Polynuclear Aromatic Compounds, Part 4, Bitumens, Coal Tars and Derived Products, Shale Oils and Soots"; World Health Organization; Lyon, France.

International Agency for Research on Cancer (IARC), 1987b. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Vol.29; "Some Industrial Chemicals and of the Cancer Risk Associated with Exposure to Polycyclic Aromatic Hydrocarbons"; prepared for Gas Research Institute; Chicago, Illinois; (Draft).

Jenkins, L.J., R.A. Jones, and J. Siegal, 1970. "Long-term Inhalation Screening Studies on Benzene, Toluene, O-xylene and Cumene on Experimental Animals"; Tox. Appl. Pharmacol; 16(3) 818-23. (As cited in USEPA, 1989d.)

Johnstone, R.A., 1963. Nature 200:1184.

Juchau, M.R. and M.J. Namkung, 1974. Drug Metab. Dispos.; 2(4):380.

Klaassen, C.D., M.O. Amdur, and J. Dowell (editors), 1986. Casarett and Doull's Toxicology; Macmillan Publishing Company; New York.

Knobloch, K.S. et al, 1969. "Acute and Subacute Toxicity of Acenaphthene and Acenaphthylene"; Med. Pracy.; 210-22.

Kotin, P. et al, 1969. "Distribution, Retention, and Elimination of C-14-3,4-Benzopyrene After Administration to Mice and Rats"; Journal of the National Cancer Institute; 23:541.

Kreutler, P.A., V. Varbanov, W. Goodman, G. Olaga, and J.B. Stanbury, 1978. "Interactions of Protein Deficiency, Cyanide, and Thiocyanate of Thyroid Function in Neonatal and Adult Rats"; American Journal of Clinical Nutrition; 31:282-289.

Landahl, H.D. and R.G. Hermann, 1950. "Retention of Vapors and Gases in the Human Nose and Lung"; Arch. Ind. Hyg. Occup. Med.; 1:36-45.

Lewis, R.L.S., and D. Sweet eds., 1985. "Registry of Toxic Effects of Chemical Substances"; National Institute for Occupational Safety and Health; Cincinatti, Ohio.

Manufacturing Chemists Association, 1956. "Chemical Safety Data Sheet SD-58, Properties and Essential Information for Safe Handling and Use of Naphthalene"; Washington.

McMichael, A.J., R. Spirtas, J.F. Gamble, and P.M. Tousey, 1976. "Mortality Among Rubber Workers: Relationship to Specific Jobs"; Journal of Occupational Medicine; 18:178-185. (As cited in USEPA, 1989e.)

Meinhardt, T., R. Young, and R. Hartle, 1978. "Epidemiologic Investigations of Styrene - Butadiene Rubber Production and Reinforced Plastic Production"; Scand. J. Work. Environ. Health; 8(4):250-259. (As cited in USEPA, 1989e.)

Mitchell, C.E. and K.W. Tu, 1979. "Distribution, Retention, and Elimination of Pyrene in Rats After Inhalation"; Journal of Toxicol. Environ. Health; 5:1171-79.

Moeschline. S. ed., 1965. "Poisoning, Diagnosis and Treatment", 1st American Ed., Grune and Stratton, New York.

Morley, R., D.W. Eccleston, C.P. Douglas, W.E.J. Greville, D.J. Scott, and J. Anderson, 1970. "Xylene Poisoning--A Report on One Fatal and Two Cases of Recovery after Prolonged Unconsciousness"; British Medical Journal; 3:422-43.

National Coffee Association, 1983. "Twenty-four Month Oncogenicity Study of Methylene Chloride in Mice"; prepared by Hazelton Laboratories, America, Inc.; Vienna, Virginia; Unpublished. (As cited in USEPA, 1989g.)

National Toxicology Progam (NTP), 1982. "Carcinogenesis Bioassay of di-(2-ethylhexyl)phthalate (CAS No. 117-81-7) in F344 Rats and B6C3F1 Mice (Feed Study)"; NTP Tech. Rep. Ser. TR No. 217, NTP, Research Triangle Park, NC.

National Toxicology Program (NTP), 1986a. "Toxicology and Carcinogenesis Studies of Dichloromethane (Methylene Chloride) in F344/N Rats and B6 C3FI Mice (Inhalation Studies); NTP-TRS-306. (As cited in USEPA, 1989g.)

National Toxicology Program (NTP), 1986b. "NTP Technical Report on the Toxicology and Carcinogenesis of Xylenes (mixed) (60.2% m-xylene, 13.6% p-xylene, 17.0% ethylbenzene, and 9.1% o-xylene) (CAS No. 1330-20-7) in F344/N Rats and B6C3F1 Mice (Gavage Studies)"; NTP-TR-327; NIH Pub. No. 86-2583. (As cited in USEPA, 1989d.)

Nau, C.A., J. Neal, and V. Stembridge, 1958. "A Study of the Physiological Effects of Carbon Black: I. Ingestion"; Arch. Ind. Health, 17:21-28.

Neal, J. and R.H. Rigdon, 1967. "Gastric Tumors in Mice Fed Benzo(a)pyrene: A Quantitative Study"; Texas Rep. Biol. Med.; 25:553.

Nelson, K.W., J.F. Ege, Jr., N. Russ, L.E. Woodman, and L. Silverman, 1943. "Sensory Response to Industrial Solvent Vapors"; Journal of Industrial Hygiene Toxicology; 25:282-285. (As cited in USEPA, 1989h.)

O'Flaherty, E.J. and W.C. Thomas, 1982. "The Cardiotoxicity of Hydrogen Cyanide as a Component of Polymer Pyrolysis Smoke"; Toxicol. Appl. Pharmacol.; 63:373-81.

Ogata, M., K. Tomokuni and Y. Takatsuka, 1970. "Urinary excretion of hippuric acid and m- or p- methylhippuric acid in the urine of persons exposed to vapors of toluene and m- or p- xylene as a test of exposure"; Br. J. Ind. Med.; 27:43-50. (As cited in USEPA, 1983a.)

Ott, M.G., J.C. Townsend, W.A. Fishbeck, and R.A. Langrieu, 1978. "Mortality Among Individuals Occupationally Exposed to Benzene"; Arch. Environ. Health; 33:3-10. (As cited in USEPA 1989b.)

Ott, M.G., L.K. Skory, B.B. Holder, J.M. Bronson, and P.R. Williams, 1983. "Health Evaluation of Employees Occupationally Exposed to Methylene Chloride"; Scand. Journal of Work Environ. Health.; 9(1):8-16.

Parmaggiani, L. and C. Sassi, 1954. "Patalogia Professionale da Acetone: Manifestazioni Clinique, Indagini Negli Ambienti di Lavoro e Ricerche Fisiopa Tologiche"; Med. Lavoro; 45(89):431-468 (Ital.). (As cited in USEPA, 1983a.)

Peacock, P.R., and A.H.M. Kirby, 1944. "Attempts to Induce Stomach Tumors: II. The Action of Carcinogenic Hydrocarbons on Stock Mice"; Cancer Research; 4:88-97.

Philbrick, D.J., J.B. Hopkine, D.C. Hill, J.C. Alexander, and R.G. Thompson, 1979. "Effect of Prolonged Cyanide and Thiocyanate Feeding in Rats"; J. Toxicol. Environ. Health; 5:579-92. (As cited in ATSDR, 1988.)

Ponomarkov, V.I. and L. Jomatis, 1978. "Effects of Long-term Oral Administration of Styrene to Mice and Rats"; Scand. Journal of Work Environ. Health; 4(2):127-35; 1978. (As cited in USEPA 1989e.)

Pucknat, A.W., 1981. "Health Impacts of Polynuclear Aromatic Hydrocarbons"; Noyes Data Corp.; New Jersey.

Purser, A.W., P. Grimshaw, and K.P. Berrill, 1984. "Intoxication by Cyanide in Fires: A Study in Monkeys Using Polyacrylonitrile"; Arch. Environ. Health; 39(6):394-400.

Quast, J.F., C.G. Humiston, R.Y. Kalnins, et al, 1979. "Results of a Toxicity Study of Monomeric Styrene Administered to Beagle Dogs by Oral Intubation for 19 Months"; Toxicology Research Laboratory, Health and Environmental Sciences, Dow Chemical Co.; Midland, Michigan. (As cited in USEPA, 1989e.)

Rigdon, R.H. and J. Neal, 1966. "Gastric Carcinomas and Pulmonary Adenomas in Mice Fed Benzo(a)pyrene"; Texas Rep. Biol. Med.; 24:195-207.

Rinsky, R.A. and R.J. Young, 1981. "Leukemia in Benzene Workers"; American Journal of Industrial Medicine; 2:217-245. (As cited in USEPA, 1989b.)

Rossi, S.S. and S.W. Anderson, 1977. Marine Biol.; 39:51.

Sandberg, C.G., 1967. "A Case of Chronic Poisoning with Potassium Cyanide"; Acta Med. Scand.; 181(2):233-36.

Sandmeyer, E., 1981. "Aromatic Hydrocarbons"; in: Clayton, G.D. and F.E. Clayton; Patty's Industrial Hygiene and Toxicology; 3rd ed., vol. 2B; pp. 3333-3343.

Sax, N.I. and R.J. Lewis, 1986. Rapid Guide to Hazardous Chemicals in the Workplace; Van Nostrand Reinhold; New York.

Schmahl, D., 1955. "Testing of Naphthalene and Anthracene as Carcinogenic Agents in Rats"; Z. Virebsforsch; 60:697-710 (German with English translation).

Searle, C.E., ed., 1976. Chemical Carcinogens; American Chemical Society; Washington.

Shimotori, M., 1972. Acta Soc. Ophthamol. Jap. 76(11):1545.

Singh, A.R., W.H. Lawrence and J. Autian, 1972. "Teratogenicity of phthalate esters in rats"; J. Pharm. Sci.; 61:51-55. (As cited in USEPA, 1980c.)

Skjaeggestad, O., 1964. Acta Pathol. Microbiol. Scand.; 169:1.

Smith, C.C., 1953. "Toxicity of butylstearate, dibutyl sebacate, dibutyl phthalate and methoxy ethyloleate"; Arch. Ind. Hyg. Occup. Med.; April; 310 ff. (As cited in USEPA, 1989c.)

Smith, A.H. and L. Ellis, 1977. "Styrene Butadrene Rubber Synthetic Plants and Leukemia"; Letter to the Editor; Journal of Occupational Medicine; 19(7):441. (As cited in USEPA, 1989e.)

Sukhanova, V.A., L.M. Makar'Eva, and V.I. Boiko, 1969. "Investigation of Functional Properties of Leukocytes of Workers Engaged in Manufacture of Xylene"; Hygiene and Sanitation; 34-448-50.

Tewe, O.O. and J.H. Maner, 1981. "Long-term and Carry-over Effect of Dietary Inorganic Cyanide (KCN) in the Lifecycle Performance and Metabolism of Rats"; Toxicol. Appl. Pharmacol; 58:1-7.

Thomas, T.A. and J.W. Brooks, 1970. "Accidental Cyanide Poisoning"; Anesthesia; 25:110-14.

Thyssen J., J. Althoff, G. Kimmerle and U. Mohr, 1981. "Inhalation studies with benzo(a)pyrene in Syrian golden hamsters"; JNCI; 66:575-577. (As cited in USEPA 1984a).

U.S. Environmental Protection Agency (USEPA), 1979. "Water-Related Environmental Fate of 129 Priority Pollutants"; USEPA 440/4-79-029; Washington, D.C.; December 1979.

U.S. Environmental Protection Agency (USEPA), 1980. "Ambient Water Quality Criteria for Toluene"; USEPA 440/4-79-029; Office of Water Regulations and Standards, Criteria and Standards Division; Washington, D.C.; October 1980a.

U.S. Environmental Protection Agency (USEPA), 1980b. "Ambient Water Quality Criteria for Ethyl Benzene"; USEPA 440/5-80-048; Washington, D.C.; (As cited in Atlanta Environmental Services, Inc.; January 1988.)

U.S. Environmental Protection Agency (USEPA), 1980c. "An Exposure and Risk Assessment for Phthalate Esters"; Final Draft Report.

U.S. Environmental Protection Agency (USEPA), 1982b. "An Exposure and Risk Assessment for Benzo(a)pyrene and Other Polycyclic Aromatic Hydrocarbons"; Vol. 1 and 2; Final Draft Report.

U.S. Environmental Protection Agency (USEPA), 1983. "Health Effects Assessment for Toluene"; USEPA 600/8-82-008F; Office of Health and Environmental Assessment; Washington, D.C.; August 1983a.

U.S. Environmental Protection Agency (USEPA), 1983b. "Dichloromethane Reportable Quantity (RQ) Based on Chronic Toxicity".

U.S. Environmental Protection Agency (USEPA), 1984a. "Health Effects Assessment for Polycyclic Aromatic Hydrocarbons (PAHs)"; Environmental Criteria and Assessment Office; Cincinnati, Ohio; ECAO-CIN-H003.

U.S. Environmental Protection Agency (USEPA), 1984b. "Health Effects Assessment for Cyanide"; Environmental Criteria and Assessment Office; Cincinnati, Ohio; ECAO-CIN-H011.

U.S. Environmental Protection Agency (USEPA), 1985a. "Health Assessment Document for Dichloromethane (Methylene Chloride)"; Environmental Criteria and Assessment Office; Research Triangle Park, North Carolina.

U.S. Environmental Protection Agency (USEPA), 1985b. "Health Effects and Occurrence Documents in Support of: National Primary Drinking Water Regulations: Volatile Synthetic Organic Chemicals"; Federal Register; 50:46902. (As cited in Atlantic Environmental Services, Inc., January 1988.)

U.S. Environmental Protection Agency (USEPA), 1985d. "Health Advisory for Cyanide"; Office of Drinking Water; Washington, D.C.

U.S. Environmental Protection Agency (USEPA), 1986a. Superfund Public Health Evaluation Manual; USEPA 540/1-86/060; Office of Emergency and Remedial Response; Washington, D.C.

U.S. Environmental Protection Agency (USEPA), 1986b. "Health and Environmental Effects Profile for Naphthalene"; Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office; Cincinatti, Ohio.

U.S. Environmental Protection Agency (USEPA), 1988. Revision of SPHEM Risk Characterization Tables.

U.S. Environmental Protection Agency (USEPA), 1989. Integrated Risk Information System (IRIS) Volume II, Chemical Files: Cyanide; July 1989a.

U.S. Environmental Protection Agency (USEPA), 1989. Integrated Risk Information System (IRIS) Volume II, Chemical Files: Benzene; July 1989b.

U.S. Environmental Protection Agency (USEPA), 1989. Integrated Risk Information System (IRIS) Vol. II, Chemical Files: Dibutyl Phthalate; August 1989c.

U.S. Environmental Protection Agency (USEPA), 1989. Integrated Risk Information System (IRIS) Volume II, Chemical Files: Xylenes; July 1989d.

U.S. Environmental Protection Agency (USEPA), 1989. Integrated Risk Information System (IRIS) Volume II, Chemical Files: Styrene; December 1989e.

U.S. Environmental Protection Agency (USEPA), 1989. Integrated Risk Information System (IRIS), Volume II, Chemical Files: bis-(2-ethylhexyl)phthalate; 1989f.

U.S. Environmental Protection Agency (USEPA), 1989. Integrated Risk Information System (IRIS), Volume II, Chemical Files: Methylene Chloride; July 1989g.

U.S. Environmental Protection Agency (USEPA), 1989. Integrated Risk Information System (IRIS), Volume II, Chemical Files: Toluene; July 1989h.

U.S. Environmental Protection AGency (USEPA), 1989. Integrated Risk Information System (IRIS), Volume II, Chemical Files: Ethyl Benzene; July 1989i.

Vaino, H., P. Votila, J. Hartiala, and O. Pelkonen, 1976. "The Fate of Intratrachially Installed Benzo(a)pyrene in the Isolated Perfused Rat Lung of Both Control and 20-Methylcholanthene Pretreated Rats"; Res. Comm. Chem. Pathol. Pharmacol.; 13:259.

Valade, M.P., 1952. "Injuries to the CNS in Chronic Experimental Poisoning by Hydrocyanic Acid Gas"; Bull. Acad. Natl. Med. Paris; 136:280-285.

Von Oettigan, W.F., P.A. Neal, and D.D. Donahue, 1942. "The Toxicity and Potential Dangers of Toluene, Preliminary Report"; Journal of the American Medical Association; 118:579-584. (As cited in USEPA, 1989h.)

Weiss, G., 1967. "Toxic Encephalosis as an Occupational Hazard with Methylene Chloride; Zentralbl Arbeitsmed; (Ger.) 17:282-285.

Willhite, C.Z., 1981. "Malformations Induced by Inhalation of Acetonitrile Vapors in the Golden Hamster"; Teratology; 23(2):69a.

Willhite, C.Z., 1982. "Congenital Malformations Induced by Laetrile"; Science; 215:1513.

Wilson, R.H., 1942. "Benzene Poisoning in Industry; J. Lab. Clin. Med.; 27:1517-1521.

Wolf, M.A., V.K. Rowe, D.D. McCollister et al, 1956. "Toxicological Studies of Certain Alkylated Benzenes and Benzene"; Arch. Ind. Health; 14:387. (As cited in USEPA, 1989e, 1989h and 1989i.)

Wong, O., R.W. Morgam and M.D. Whorton, 1983. "Comments on the NIOSH Study of Leukemia in Benzene Workers"; Technical Report submitted to Gulf Canada, Ltd. by Environmental Site Associates. (As cited in USEPA, 1989b.)

APPENDIX C

RISK TEMPLATES

SEDC-MP
16-Jan-90

TABLE C-1
Direct Contact with and/or Ingestion of Sediment
Most Probable Case - Children
Noncarcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and hazard indices

The equations to calculate body dose level and hazard indices are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \{(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor})\} \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{year}} \times \frac{1\ \text{mg}}{1000\ \text{ug}} \times \frac{1\ \text{yr}}{365\ \text{days}}$$

$$\text{Hazard Index} = \frac{\text{Body Dose (mg/kg/day)}}{\text{Standard or Guideline (mg/kg/day)}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	Standard/ Guideline (mg/kg/day)	Hazard Index
noncarcinogenic PAHs	12.94	2.5	0.050	0.01	0.50	45	1	1.95E-08	1.94E-08	4.00E-01	9.74E-08
ethylbenzene	0.0174	2.5	0.050	0.05	0.10	45	1	5.30E-12	1.32E-10	1.00E-01	1.37E-09
cyanide (total)	0.4330	2.5	0.050	1.00	0.50	45	1	6.59E-10	6.55E-08	2.00E-02	3.31E-06
									SUMMARY HAZARD INDEX		3.41E-06

Note: TK - Toxicokinetic Factor

TABLE D-2
Direct Contact with and/or Ingestion of Sediment
Most Probable Case - Children
Carcinogenic effects
Mechanicville Site

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PEDC-MP
25-Jul-90

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose}_{(mg/kg/day)} = \text{Soil Concentration}_{(ug/g)} \times \{(\text{Amount Contacted}_{(g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested}_{(g/event)} \times \text{Ingestion TK Factor})\} \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{70 \text{ years}} \times \frac{1 \text{ mg}}{1000 \text{ ug}} \times \frac{1 \text{ yr}}{365 \text{ days}}$$

$$\text{Incremental Risk} = \text{Body Dose}_{mg/kg/day} \times \text{CAG Potency Factor}_{(mg/kg/day)^{-1}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
benzene	0.0330	2.5	0.050	0.05	0.10	45	1	5.0	7.18E-13	1.78E-11	2.90E-02	5.38E-13
carc. PAHs - USEPA	3.7600	2.5	0.050	0.01	0.50	45	1	5.0	4.09E-10	4.06E-10	1.15E+01	9.37E-09
carc. PAHs - IDF	3.7600	2.5	0.050	0.01	0.50	45	1	5.0	4.09E-10	4.06E-10	3.20E+00	2.61E-09

SUMMARY CARCINOGENIC RISK	
USEPA	9.37E-09
IDF	2.61E-09

Note: TK = Toxicokinetic Factor

SEDC-9W

16-Jan-90

TABLE C-9
Direct Contact with and/or Ingestion of Sediment
Realistic Worst Case - Children
Noncarcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and hazard indices

The equations to calculate body dose level and hazard indices are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \left[(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor})\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{year}} \times \frac{1\ \text{mg}}{1000\ \text{ug}} \times \frac{1\ \text{yr}}{365\ \text{days}}$$

$$\text{Hazard Index} = \frac{\text{Body Dose (mg/kg/day)}}{\text{Standard or Guideline (mg/kg/day)}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	Standard/ Guideline (mg/kg/day)	Hazard Index
noncarcinogenic PAHs	42.67	9.1	0.1	0.10	1.00	45	2	5.20E-07	4.75E-06	4.00E-01	1.32E-05
ethylbenzene	0.087	9.1	0.1	0.25	0.50	45	2	5.30E-10	2.42E-08	1.00E-01	2.47E-07
cyanide (total)	1.30	9.1	0.1	2.50	1.00	45	2	1.58E-08	3.62E-06	2.00E-02	1.82E-04
									SUMMARY HAZARD INDEX		1.95E-04

Note: TK - Toxicokinetic Factor

TABLE C-4
Direct Contact with and/or Ingestion of Sediment
SEDC-RW
Realistic Worst Case - Children
15-Jul-90
Carcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \left[\left(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}\right) + \left(\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor}\right)\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{70 \text{ years}} \times \frac{1 \text{ mg}}{1000 \text{ ug}} \times \frac{1 \text{ yr}}{365 \text{ days}}$$

$$\text{Increemental Risk} = \text{Body Dose mg/kg/day} \times \text{CAG Potency Factor (mg/kg/day)}^{-1}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
benzene	0.0950	9.1	0.1	0.25	0.50	45	2	10.0	8.26E-11	3.78E-09	2.90E-02	1.12E-10
carc. PAHs - USEPA	10.2000	9.1	0.1	0.10	1.00	45	2	10.0	1.77E-08	1.62E-07	1.15E+01	2.07E-06
carc. PAHs - ICF	10.2000	9.1	0.1	0.10	1.00	45	2	10.0	1.77E-08	1.62E-07	3.20E+00	5.76E-07

SUMMARY CARCINOGENIC RISK	
USEPA	2.07E-06
ICF	5.76E-07

Note: TK - Toxicokinetic Factor

SEDWK-MP
18-Jan-90

TABLE C-5
Direct Contact with and/or Ingestion of Sediment
Most Probable Case - Workers
Noncarcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and hazard indices

The equations to calculate body dose level and hazard indices are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times [(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor})] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{year}} \times \frac{1\ \text{mg}}{1000\ \text{ug}} \times \frac{1\ \text{yr}}{365\ \text{days}}$$

$$\text{Hazard Index} = \frac{\text{Body Dose (mg/kg/day)}}{\text{Standard or Guideline (mg/kg/day)}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	Standard/ Guideline (mg/kg/day)	Hazard Index
noncarcinogenic PAHs	12.84	1.2	0.050	0.01	0.50	70	5	6.28E-08	2.89E-08	4.00E-01	2.29E-07
ethylbenzene	0.0174	1.2	0.050	0.05	0.10	70	5	1.70E-11	1.96E-10	1.00E-01	2.13E-09
cyanide (total)	0.43	1.2	0.050	1.00	0.50	70	5	2.12E-09	9.74E-08	2.00E-02	4.98E-06
									SUMMARY HAZARD INDEX		5.21E-06

Note: TK - Toxicokinetic factor

+
SEDWK-MP
25-Jul-90

TABLE D-6
Direct Contact with and/or Ingestion of Sediment
Most Probable Case - Workers
Carcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose}_{(mg/kg/day)} = \text{Concentration}_{(ug/g)} \times \frac{\text{Soil}}{10^6} \times [(\text{Amount Contacted}_{(g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested}_{(g/event)} \times \text{Ingestion TK Factor})] \times \frac{1}{\text{Body Weight}_{(kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{70 \text{ years}} \times \frac{1 \text{ yr}}{365 \text{ days}} \times \frac{1 \text{ mg}}{1000 \text{ ug}}$$

$$\text{Incremental Risk} = \text{Body Dose}_{mg/kg/day} \times \text{CAG Potency Factor}_{(mg/kg/day)^{-1}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
Benzene	0.0330	1.2	0.050	0.05	0.10	70	5	3.0	1.38E-12	1.59E-11	2.90E-02	5.02E-13
Carc. PAHs - USEPA	3.7600	1.2	0.050	0.01	0.50	70	5	3.0	7.88E-10	3.63E-10	1.15E+01	1.32E-08
Carc. PAHs - ICF	3.7600	1.2	0.050	0.01	0.50	70	5	3.0	7.88E-10	3.63E-10	3.20E+00	3.68E-09

SUMMARY CARCINOGENIC RISK	
USEPA	1.32E-08
ICF	3.68E-09

Note: TK - Toxicokinetic Factor

SEDWK-BW
16-Jan-90

TABLE C-7
Direct Contact with and/or Ingestion of Sediment
Realistic Worst Case - Workers
Noncarcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and hazard indices

The equations to calculate body dose level and hazard indices are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times [(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor})] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{year}} \times \frac{1\ \text{mg}}{1000\ \text{ug}} \times \frac{1\ \text{yr}}{365\ \text{days}}$$

$$\text{Hazard Index} = \frac{\text{Body Dose (mg/kg/day)}}{\text{Standard or Guideline (mg/kg/day)}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	Standard/ Guideline (mg/kg/day)	Hazard Index
noncarcinogenic PAHs	42.67	4.2	0.1	0.10	1.00	70	10	1.67E-06	7.09E-06	4.00E-01	2.19E-05
ethylbenzene	0.087	4.2	0.1	0.25	0.50	70	10	1.70E-09	3.61E-08	1.00E-01	3.78E-07
cyanide (total)	1.30	4.2	0.1	2.50	1.00	70	10	5.09E-08	5.40E-06	2.00E-02	2.73E-04
									SUMMARY HAZARD INDEX		3.95E-04

Note: TK - Toxicokinetic Factor

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SEDWK-RW
25-Jul-90

TABLE C-8
Direct Contact with and/or Ingestion of Sediment
Realistic Worst Case - Workers
Carcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times [(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor})] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{70 \text{ years}} \times \frac{1\text{mg}}{1000 \text{ ug}} \times \frac{1 \text{ yr}}{365 \text{ days}}$$

$$\text{Incremental Risk} = \text{Body Dose mg/kg/day} \times \text{CAG Potency Factor (mg/kg/day)}^{-1}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
benzene	0.0950	4.2	0.1	0.25	0.50	70	10	10.0	2.66E-10	5.64E-09	2.90E-02	1.71E-10
carc. PAHs - USEPA	10.2000	4.2	0.1	0.10	1.00	70	10	10.0	5.70E-08	2.42E-07	1.15E+01	3.44E-06
carc. PAHs - ICF	10.2000	4.2	0.1	0.10	1.00	70	10	10.0	5.70E-08	2.42E-07	3.20E+00	9.57E-07

SUMMARY CARCINOGENIC RISK	
USEPA	3.44E-06
ICF	9.57E-07

Note: TK = Toxicokinetic Factor

SOILWIMP

16-Jan-90

TABLE C-9
Direct Contact with and/or Ingestion of Soil
Most Probable Case - Workers
Noncarcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and hazard indices

The equations to calculate body dose level and hazard indices are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \left[\left(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}\right) + \left(\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor}\right)\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{year}} \times \frac{1\ \text{mg}}{1000\ \text{ug}} \times \frac{1\ \text{yr}}{365\ \text{days}}$$

$$\text{Hazard Index} = \frac{\text{Body Dose (mg/kg/day)}}{\text{Standard or Guideline (mg/kg/day)}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	Standard/ Guideline (mg/kg/day)	Hazard Index
toluene	151.00	1.2	0.050	0.025	0.05	70	1	1.48E-08	1.70E-07	3.00E-01	6.15E-07
xylene	306.00	1.2	0.050	0.05	0.10	70	1	5.99E-08	6.89E-07	2.00E+00	3.74E-07
ethyl benzene	82.10	1.2	0.050	0.05	0.10	70	1	1.61E-08	1.85E-07	1.00E-01	2.01E-06
cyanide (amenable)	0.525	1.2	0.050	1.00	0.50	70	1	5.14E-10	2.36E-08	2.00E-02	1.21E-06
noncarcinogenic PAHs	2785.00	1.2	0.050	0.01	0.50	70	1	2.73E-06	1.25E-06	4.00E-01	9.95E-06
styrene	150.00	1.2	0.050	0.05	0.10	70	1	2.94E-08	3.38E-07	2.00E-01	1.83E-06
trimethylbenzene	26.70	1.2	0.050	0.05	0.10	70	1	5.23E-09	6.01E-08	2.00E+00	3.27E-08
									SUMMARY HAZARD INDEX		1.60E-05

Note: TK - Toxicokinetic Factor

TABLE D-10
Direct Contact with and/or Ingestion of Soil
SOILWKMP
Most Probable Case - Workers
25-Jul-90
Carcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \left[\left(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}\right) + \left(\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor}\right)\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{70 \text{ years}} \times \frac{1 \text{ ag}}{1000 \text{ ug}} \times \frac{1 \text{ yr}}{365 \text{ days}}$$

$$\text{Incremental Risk} = \text{Body Dose ag/kg/day} \times \text{CAG Potency Factor (mg/kg/day)}^{-1}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
benzene	104.00	1.2	0.050	0.05	0.10	70	1	2.0	5.81E-10	6.69E-09	2.90E-02	2.11E-10
carc. PAHs - USEPA	271.00	1.2	0.050	0.01	0.50	70	1	2.0	7.58E-09	3.49E-09	1.15E+01	1.27E-07
carc. PAHs - ICF	271.00	1.2	0.050	0.01	0.50	70	1	2.0	7.58E-09	3.49E-09	3.20E+00	3.54E-08

SUMMARY CARCINOGENIC RISK	
USEPA	1.27E-07
ICF	3.56E-08

Note: TK = Toxicokinetic Factor

SOILWKRW
16-Jan-90

TABLE C-11
Direct Contact with and/or Ingestion of Soil
Realistic Worst Case - Workers
Noncarcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and hazard indices

The equations to calculate body dose level and hazard indices are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \left[\left(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}\right) + \left(\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor}\right)\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{year}} \times \frac{1\ \text{mg}}{1000\ \text{ug}} \times \frac{1\ \text{yr}}{365\ \text{days}}$$

$$\text{Hazard Index} = \frac{\text{Body Dose (mg/kg/day)}}{\text{Standard or Guideline (mg/kg/day)}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	Standard/ Guideline (mg/kg/day)	Hazard Index
toluene	840.00	4.2	0.1	0.125	0.25	70	2	1.64E-06	3.49E-05	3.00E-01	1.22E-04
xylene	1400.00	4.2	0.1	0.25	0.50	70	2	5.48E-06	1.16E-04	2.00E+00	6.09E-05
ethyl benzene	440.00	4.2	0.1	0.25	0.50	70	2	1.72E-06	3.66E-05	1.00E-01	3.83E-04
cyanide (amenable)	3.20	4.2	0.1	2.50	1.00	70	2	2.50E-08	2.66E-06	2.00E-02	1.34E-04
noncarcinogenic PAHs	10851.00	4.2	0.1	0.10	1.00	70	2	8.49E-05	3.61E-04	4.00E-01	1.11E-03
styrene	780.00	4.2	0.1	0.250	0.50	70	2	3.05E-06	6.48E-05	2.00E-01	3.39E-04
trimethylbenzene	170.00	4.2	0.1	0.25	0.50	70	2	6.65E-07	1.41E-05	2.00E+00	7.39E-06
									SUMMARY HAZARD INDEX		2.16E-03

Note: TK - Toxicokinetic Factor

TABLE C-12
Direct Contact with and/or Ingestion of Soil
SOIL&RW — Realistic Worst Case - Workers
25-Jul-90 — Carcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \left[\left(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}\right) + \left(\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor}\right)\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{70 \text{ years}} \times \frac{1 \text{ mg}}{1000 \text{ ug}} \times \frac{1 \text{ yr}}{365 \text{ days}}$$

$$\text{Incremental Risk} = \text{Body Dose (mg/kg/day)} \times \text{CAG Potency Factor (mg/kg/day)}^{-1}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
benzene	640.0000	4.2	0.1	0.25	0.50	70	2	4.0	1.43E-07	3.04E-06	2.90E-02	9.23E-08
carc. PAHs - USEPA	1305.0000	4.2	0.1	0.10	1.00	70	2	4.0	5.94E-07	2.48E-06	1.15E+01	3.52E-05
carc. PAHs - ICF	1305.0000	4.2	0.1	0.10	1.00	70	2	4.0	5.94E-07	2.48E-06	3.20E+00	9.80E-06

SUMMARY CARCINOGENIC RISK	
USEPA	3.53E-05
ICF	9.89E-06

Note: TK - Toxicokinetic Factor

INHALATION RISK SCENARIOS

DISK: INHALATION
FILE: INH-MECH.WK1

DATE: 25-Jul-90

SITE: Mechanicville SUMMARY TABLE: TABLE C-13

Variables	Child
Body Weight (kilograms)	21
Duration of Total Exposure Period (years)	6

Noncarcinogenic Compound(s)	Toxicokinetic Factor (unitless)	Standard or Guideline (mg/kg/day)
Cyanide	7.50	2.00E-02
Ethylbenzene	1.00	1.00E-01
Noncarcinogenic PAHs	0.75	4.00E-01
Styrene	1.00	2.00E-01
Toluene	1.00	1.00E+00
Trimethylbenzene	1.00	4.00E-01
Total Xylenes	1.00	4.00E-01

Carcinogenic Compound(s)	Toxicokinetic Factor (unitless)	CAG Potency Factor (mg/kg/day)^-1
Benzene	1.00	2.90E-02
Bis(2-ethylhexyl)phthalate	0.75	1.40E-02
Methylene Chloride	1.00	1.40E-02
Carcinogenic PAHs - USEPA	1.00	6.10E+00
Carcinogenic PAHs - IDF	1.00	4.53E-01

Zone 1 School, 750 ft Noncarcinogenic Compound(s)	MOST PROBABLE CASE Concentration (mg/m^3)	MOST PROBABLE CASE Duration of Exposure (hrs/event)	MOST PROBABLE CASE Number of Exposure Events (events/yr)	REALISTIC WORST CASE Concentration (mg/m^3)	REALISTIC WORST CASE Duration of Exposure (hrs/event)	REALISTIC WORST CASE Number of Exposure Events (events/yr)
Cyanide	7.58E-09	8	20	2.45E-07	8	25
Ethylbenzene	5.52E-05	8	20	2.16E-03	8	25
Noncarcinogenic PAHs	1.43E-05	8	20	9.80E-04	8	25
Styrene	1.02E-04	8	20	3.93E-03	8	25
Toluene	1.02E-04	8	20	3.97E-03	8	25
Trimethylbenzene	1.81E-05	8	20	6.99E-04	8	25
Total Xylenes	2.07E-04	8	20	8.04E-03	8	25

Zone 2 Home, 100 ft (playing) Noncarcinogenic Compound(s)	MOST PROBABLE CASE Concentration (mg/m^3)	MOST PROBABLE CASE Duration of Exposure (hrs/event)	MOST PROBABLE CASE Number of Exposure Events (events/yr)	REALISTIC WORST CASE Concentration (mg/m^3)	REALISTIC WORST CASE Duration of Exposure (hrs/event)	REALISTIC WORST CASE Number of Exposure Events (events/yr)
Cyanide	2.09E-08	6	20	9.42E-07	6	25
Ethylbenzene	2.41E-04	6	20	1.01E-02	6	25
Noncarcinogenic PAHs	8.35E-05	6	20	3.77E-03	6	25
Styrene	4.42E-04	6	20	1.84E-02	6	25
Toluene	4.44E-04	6	20	1.86E-02	6	25
Trimethylbenzene	7.86E-05	6	20	3.28E-03	6	25
Total Xylenes	9.01E-04	6	20	3.77E-02	6	25

Zone 3 Home, 100 ft (sleeping) Noncarcinogenic Compound(s)	MOST PROBABLE CASE Concentration (mg/m^3)	MOST PROBABLE CASE Duration of Exposure (hrs/event)	MOST PROBABLE CASE Number of Exposure Events (events/yr)	REALISTIC WORST CASE Concentration (mg/m^3)	REALISTIC WORST CASE Duration of Exposure (hrs/event)	REALISTIC WORST CASE Number of Exposure Events (events/yr)
Cyanide	2.09E-08	10	20	9.42E-07	10	25
Ethylbenzene	2.41E-04	10	20	1.01E-02	10	25
Noncarcinogenic PAHs	8.35E-05	10	20	3.77E-03	10	25
Styrene	4.42E-04	10	20	1.84E-02	10	25
Toluene	4.44E-04	10	20	1.86E-02	10	25
Trimethylbenzene	7.86E-05	10	20	3.28E-03	10	25
Total Xylenes	9.01E-04	10	20	3.77E-02	10	25

Zone 1 School, 750 ft Carcinogenic Compound(s)	MOST PROBABLE CASE Concentration (ug/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	REALISTIC WORST CASE Concentration (ug/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)
Benzene	7.03E-05	8	20	2.73E-03	8	25
Bis(2-ethylhexyl)phthalate	0.00E+00	8	20	0.00E+00	8	25
Methylene Cloride	0.00E+00	8	20	1.31E-05	8	25
Carcinogenic PAHs - USEPA	1.41E-06	8	20	9.65E-05	8	25
Carcinogenic PAHs - ICF	1.41E-06	8	20	9.65E-05	8	25

Terminology
Inhalation
Most Probable Case
Realistic Worst Case
Young Child
Adult
Carcinogen
Noncarcinogen

Zone 2 Home, 100 ft (playing) Carcinogenic Compound(s)	MOST PROBABLE CASE Concentration (ug/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	REALISTIC WORST CASE Concentration (ug/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)
Benzene	3.06E-04	6	20	1.28E-02	6	25
Bis(2-ethylhexyl)phthalate	0.00E+00	6	20	0.00E+00	6	25
Methylene Cloride	1.48E-06	6	20	6.15E-05	6	25
Carcinogenic PAHs - USEPA	8.20E-06	6	20	3.70E-04	6	25
Carcinogenic PAHs - ICF	8.20E-06	6	20	3.70E-04	6	25

Inhalation Rate (m^3/hr)
Child

	Zone 1	Zone 2	Zone 3
Most Probable	0.8	2.0	0.4
Realistic Worst	0.8	2.0	0.4

Zone 3 Home, 100 ft (sleeping) Carcinogenic Compound(s)	MOST PROBABLE CASE Concentration (ug/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	REALISTIC WORST CASE Concentration (ug/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)
Benzene	3.06E-04	10	20	1.28E-02	10	25
Bis(2-ethylhexyl)phthalate	0.00E+00	10	20	0.00E+00	10	25
Methylene Cloride	1.48E-06	10	20	6.15E-05	10	25
Carcinogenic PAHs - USEPA	8.20E-06	10	20	3.70E-04	10	25
Carcinogenic PAHs - ICF	8.20E-06	10	20	3.70E-04	10	25

Mechanicville
Inhalation Most Probable Case
Young Child Noncarcinogen

Noncarcinogenic Compound(s)	Zone 1 Body Weight (kilograms)	Zone 1 Concentration (mg/m^3)	Zone 1 Duration of Exposure (hrs/event)	Zone 1 Number of Exposure Events (events/yr)	Zone 1 Inhalation Rate (m^3/hr)	Zone 1 Exposure (mg/kg/day)
Cyanide	21	3.58E-09	8	20	0.8	5.98E-11
Ethylbenzene	21	5.52E-05	8	20	0.8	9.22E-07
Noncarcinogenic PAHs	21	1.43E-05	8	20	0.8	2.39E-07
Styrene	21	1.02E-04	8	20	0.8	1.70E-06
Toluene	21	1.02E-04	8	20	0.8	1.70E-06
Trimethylbenzene	21	1.81E-05	8	20	0.8	3.02E-07
Total Xylenes	21	2.07E-04	8	20	0.8	3.46E-06

Noncarcinogenic Compound(s)	Zone 2 Concentration (mg/m^3)	Zone 2 Duration of Exposure (hrs/event)	Zone 2 Number of Exposure Events (events/yr)	Zone 2 Inhalation Rate (m^3/hr)	Zone 2 Exposure (mg/kg/day)
Cyanide	2.09E-08	6	20	2.0	6.54E-10
Ethylbenzene	2.41E-04	6	20	2.0	7.55E-06
Noncarcinogenic PAHs	8.35E-05	6	20	2.0	2.61E-06
Styrene	4.42E-04	6	20	2.0	1.38E-05
Toluene	4.44E-04	6	20	2.0	1.39E-05
Trimethylbenzene	7.86E-05	6	20	2.0	2.46E-06
Total Xylenes	9.01E-04	6	20	2.0	2.82E-05

Noncarcinogenic Compound(s)	Zone 3 Concentration (mg/m^3)	Zone 3 Duration of Exposure (hrs/event)	Zone 3 Number of Exposure Events (events/yr)	Zone 3 Inhalation Rate (m^3/hr)	Zone 3 Exposure (mg/kg/day)
Cyanide	2.09E-08	10	20	0.4	2.18E-10
Ethylbenzene	2.41E-04	10	20	0.4	2.52E-06
Noncarcinogenic PAHs	8.35E-05	10	20	0.4	8.71E-07
Styrene	4.42E-04	10	20	0.4	4.61E-06
Toluene	4.44E-04	10	20	0.4	4.63E-06
Trimethylbenzene	7.86E-05	10	20	0.4	8.20E-07
Total Xylenes	9.01E-04	10	20	0.4	9.40E-06

Summary Exposure (mg/kg/day)	Toxicokinetic Factor (unitless)	Standard or Guideline (mg/kg/day)	Hazard Ratio
9.32E-10	7.5	2.00E-02	3.50E-07
1.10E-05	1.0	1.00E-01	1.10E-04
3.72E-06	0.8	4.00E-01	6.98E-06
2.02E-05	1.0	2.00E-01	1.01E-04
2.02E-05	1.0	1.00E+00	2.02E-05
3.58E-06	1.0	4.00E-01	8.96E-06
4.11E-05	1.0	4.00E-01	1.03E-04

SUMMARY HAZARD INDEX	1.50E-04

Mechanicville
Inhalation Realistic Worst Case
Young Child Noncarcinogen

Noncarcinogenic Compound(s)	Body Weight (kilograms)	Zone 1 Concentration (mg/m^3)	Zone 1 Duration of Exposure (hrs/event)	Zone 1 Number of Exposure Events (events/yr)	Zone 1 Inhalation Rate (m^3/hr)	Zone 1 Exposure (mg/kg/day)	Zone 2 Concentration (mg/m^3)	Zone 2 Duration of Exposure (hrs/event)	Zone 2 Number of Exposure Events (events/yr)	Zone 2 Inhalation Rate (m^3/hr)	Zone 2 Exposure (mg/kg/day)
Cyanide	21	2.45E-07	8	25	0.8	5.11E-09	9.42E-07	6	25	2.0	3.69E-08
Ethylbenzene	21	2.16E-03	8	25	0.8	4.51E-05	1.01E-02	6	25	2.0	3.95E-04
Noncarcinogenic PAHs	21	9.80E-04	8	25	0.8	2.04E-05	3.77E-03	6	25	2.0	1.47E-04
Styrene	21	3.93E-03	8	25	0.8	8.20E-05	1.84E-02	6	25	2.0	7.20E-04
Toluene	21	3.97E-03	8	25	0.8	9.29E-05	1.86E-02	6	25	2.0	7.28E-04
Trimethylbenzene	21	6.99E-04	8	25	0.8	1.46E-05	3.28E-03	6	25	2.0	1.28E-04
Total Xylenes	21	8.04E-03	8	25	0.8	1.68E-04	3.77E-02	6	25	2.0	1.48E-03

Noncarcinogenic Compound(s)	Zone 3 Concentration (mg/m^3)	Zone 3 Duration of Exposure (hrs/event)	Zone 3 Number of Exposure Events (events/yr)	Zone 3 Inhalation Rate (m^3/hr)	Zone 3 Exposure (mg/kg/day)	Summary Exposure (mg/kg/day)	Toxicokinetic Factor (unitless)	Standard or Guideline (mg/kg/day)	Hazard Ratio
Cyanide	9.42E-07	10	25	0.4	1.23E-08	5.43E-08	7.5	2.00E-02	2.04E-05
Ethylbenzene	1.01E-02	10	25	0.4	1.32E-04	5.72E-04	1.0	1.00E-01	5.72E-03
Noncarcinogenic PAHs	3.77E-03	10	25	0.4	4.91E-05	2.17E-04	0.8	4.00E-01	4.07E-04
Styrene	1.84E-02	10	25	0.4	2.40E-04	1.04E-03	1.0	2.00E-01	5.21E-03
Toluene	1.86E-02	10	25	0.4	2.43E-04	1.05E-03	1.0	1.00E+00	1.05E-03
Trimethylbenzene	3.28E-03	10	25	0.4	4.28E-05	1.86E-04	1.0	4.00E-01	4.64E-04
Total Xylenes	3.77E-02	10	25	0.4	4.92E-04	2.14E-03	1.0	4.00E-01	5.34E-03

SUMMARY HAZARD INDEX	1.92E-02

Mechanicville
Inhalation Most Probable Case
Young Child Carcinogen

	Zone 1						Zone 2				
Carcinogenic Compound(s)	Body Weight (kilograms)	Concentration (mg/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	Inhalation Rate (m^3/hr)	Zone 1 Exposure (mg/kg/day)	Concentration (mg/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	Inhalation Rate (m^3/hr)	Zone 2 Exposure (mg/kg/day)
Benzene	21	7.03E-05	9.0	20	0.8	1.01E-07	3.06E-04	6	20	2.0	8.21E-07
Bis(2-ethylhexyl)phthalate	21	0.00E+00	9.0	20	0.8	0.00E+00	0.00E+00	6	20	2.0	0.00E+00
Methylene Chloride	21	0.00E+00	9.0	20	0.8	0.00E+00	1.48E-06	6	20	2.0	3.97E-09
Carcinogenic PAHs - USEPA	21	1.41E-06	9.0	20	0.8	2.02E-09	8.20E-06	6	20	2.0	2.20E-08
Carcinogenic PAHs - ICF	21	1.41E-06	9.0	20	0.8	2.02E-09	8.20E-06	6	20	2.0	2.20E-08

	Zone 3				
Carcinogenic Compound(s)	Concentration (mg/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	Inhalation Rate (m^3/hr)	Zone 3 Exposure (mg/kg/day)
Benzene	3.06E-04	10.0	20	0.4	2.74E-07
Bis(2-ethylhexyl)phthalate	0.00E+00	10.0	20	0.4	0.00E+00
Methylene Chloride	1.48E-06	10.0	20	0.4	1.32E-09
Carcinogenic PAHs - USEPA	8.20E-06	10.0	20	0.4	7.34E-09
Carcinogenic PAHs - ICF	8.20E-06	10.0	20	0.4	7.34E-09

Summary Exposure (mg/kg/day)	Toxicokinetic Factor (unitless)	CAG Potency Factor (mg/kg/day)^-1	Incremental Cancer Risk
1.20E-06	1.0	2.90E-02	3.47E-08
0.00E+00	0.8	1.40E-02	0.00E+00
5.30E-09	1.0	1.40E-02	7.41E-11
3.14E-08	1.0	6.10E-00	1.91E-07
3.14E-08	1.0	4.53E-01	1.42E-09

SUMMARY INCREMENTAL CANCER RISK	USEPA	2.01E-07
	ICF	4.90E-08

Mechanicville
Inhalation Realistic Worst Case
Young Child Carcinogen

	Zone 1					
Carcinogenic Compound(s)	Body Weight (kilograms)	Concentration (ug/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	Inhalation Rate (m^3/hr)	Zone 1 Exposure (mg/kg/day)
Benzene	21	2.73E-03	8	25	0.8	4.99E-06
Bis(2-ethylhexyl)phthalate	21	0.00E+00	8	25	0.8	0.00E+00
Methylene Chloride	21	1.31E-05	8	25	0.8	2.34E-08
Carcinogenic PAHs - USEPA	21	9.65E-05	8	25	0.8	1.77E-07
Carcinogenic PAHs - ICF	21	9.65E-05	8	25	0.8	1.73E-07

	Zone 2				
Concentration (ug/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	Inhalation Rate (m^3/hr)	Zone 2 Exposure (mg/kg/day)
1.28E-02	6.0	25	2.0	4.29E-05
0.00E+00	6.0	25	2.0	0.00E+00
6.15E-05	6.0	25	2.0	2.06E-07
3.70E-04	6.0	25	2.0	1.24E-06
3.70E-04	6.0	25	2.0	1.24E-06

	Zone 3				
Carcinogenic Compound(s)	Concentration (mg/m^3)	Duration of Exposure (hrs/event)	Number of Exposure Events (events/yr)	Inhalation Rate (m^3/hr)	Zone 3 Exposure (mg/kg/day)
Benzene	1.28E-02	10.0	25	0.4	1.43E-05
Bis(2-ethylhexyl)phthalate	0.00E+00	10.0	25	0.4	0.00E+00
Methylene Chloride	6.15E-05	10.0	25	0.4	6.88E-09
Carcinogenic PAHs - USEPA	3.70E-04	10.0	25	0.4	4.14E-07
Carcinogenic PAHs - ICF	3.70E-04	10.0	25	0.4	4.14E-07

Summary Exposure (mg/kg/day)	Toxicokinetic Factor (unitless)	CAG Potency Factor (mg/kg/day)^-1	Incremental Cancer Risk
6.21E-05	1.0	2.90E-02	1.80E-06
0.00E+00	0.8	1.40E-02	0.00E+00
2.99E-07	1.0	1.40E-02	4.19E-09
1.83E-06	1.0	6.10E+00	1.11E-05
1.83E-06	1.0	4.53E-01	8.29E-07

SUMMARY INCREMENTAL CANCER RISK	USEPA	1.30E-05
	ICF	2.63E-06

TABLE C-13
RISK CALCULATION SUMMARY
Mechanicville Site
Inhalation
Noncarcinogen

Compounds	Most Probable Case Child	Percent Total Risk	Realistic Worst Case Child	Percent Total Risk
Cyanide	3.50E-07	0.1%	2.04E-05	0.1%
Ethylbenzene	1.10E-04	31.4%	5.72E-03	31.4%
Noncarcinogenic PAHs	6.98E-06	2.0%	4.07E-04	2.2%
Styrene	1.01E-04	28.8%	5.21E-03	28.6%
Toluene	2.02E-05	5.8%	1.05E-03	5.8%
Trimethylbenzene	8.96E-06	2.6%	4.64E-04	2.5%
Total Xylenes	1.03E-04	29.4%	5.34E-03	29.3%
SUMMARY HAZARD INDEX		3.50E-04		1.82E-02

Inhalation
Carcinogen

Compounds	Most Probable Case Child	Percent Risk-USEPA	Percent Risk-ICF	Realistic Worst Case Child	Percent Risk-USEPA	Percent Risk-ICF
Benzene	3.47E-08	15.3%	70.8%	1.80E-06	13.9%	68.4%
Bis(2-ethylhexyl)phthalate	0.00E+00	0.0%	0.0%	0.00E+00	0.0%	0.0%
Methylene Cloride	7.41E-11	0.0%	0.2%	4.18E-09	0.0%	0.2%
Carcinogenic PAHs - USEPA	1.91E-07	84.6%		1.11E-05	86.1%	
Carcinogenic PAHs - ICF	1.42E-08		29.0%	8.28E-07		31.4%
SUMMARY INCREMENTAL CANCER RISK						
USEPA	2.26E-07			1.30E-05		
ICF	4.90E-08			2.63E-06		

DSLC-MP
16-Jan-90

TABLE C-14
Direct Contact with and/or Ingestion of Soil
Most Probable Case - Teenagers
Noncarcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and hazard indices.

The equations to calculate body dose level and hazard indices are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \left[\{\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}\} + \{\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor}\}\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{year}} \times \frac{1\ \text{mg}}{1000\ \text{ug}} \times \frac{1\ \text{yr}}{365\ \text{days}}$$

$$\text{Hazard Index} = \frac{\text{Body Dose (mg/kg/day)}}{\text{Standard or Guideline (mg/kg/day)}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	Standard/ Guideline (mg/kg/day)	Hazard Index
noncarcinogenic PAHs	24.00	9.1	0.1	0.05	0.10	45	5	7.31E-08	3.34E-06	4.00E-01	8.53E-06
Cyanide (amenable)	0.69	9.1	0.1	1.00	0.50	45	5	1.05E-08	1.92E-06	2.00E-02	9.66E-05
									SUMMARY HAZARD INDEX		1.05E-04

Note: TK - Toxicokinetic Factor

noncar PAHs
car PAHs

SSLC-MP

25-Jul-90

TABLE C-15
Direct Contact with and/or Ingestion of Soil
Most Probable Case - Teenagers
Carcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times [(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor})] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{70 \text{ years}} \times \frac{1 \text{ mg}}{1000 \text{ ug}} \times \frac{1 \text{ yr}}{365 \text{ days}} \times \frac{1 \text{ mg}}{1000 \text{ ug}}$$

$$\text{Incremental Risk} = \text{Body Dose mg/kg/day} \times \text{CAG Potency Factor (mg/kg/day)}^{-1}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
carc. PAHs - USEPA	20.00	9.1	0.1	0.05	0.1	45	5	5.0	4.35E-09	1.99E-07	1.15E+01	2.34E-06
carc. PAHs - ICF	20.00	9.1	0.1	0.05	0.1	45	5	5.0	4.35E-09	1.99E-07	3.20E+00	6.50E-07

SUMMARY CARCINOGENIC RISK	
USEPA	2.34E-06
ICF	6.50E-07

Note: TK - Toxicokinetic Factor

SSLC-BW
16-Jan-90

TABLE C-16
Direct Contact with and/or Ingestion of Soil
Realistic Worst Case - Teenagers
Noncarcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and hazard indices.

The equations to calculate body dose level and hazard indices are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times \left[(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor})\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{year}} \times \frac{1\ \text{mg}}{1000\ \text{ug}} \times \frac{1\ \text{yr}}{365\ \text{days}}$$

$$\text{Hazard Index} = \frac{\text{Body Dose (mg/kg/day)}}{\text{Standard or Guideline (mg/kg/day)}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	Standard/ Guideline (mg/kg/day)	Hazard Index
noncarcinogenic PAHs	37.41	9.1	0.1	0.05	0.10	45	10	2.28E-07	1.04E-05	4.00E-01	2.66E-05
Cyanide (amenable)	1.80	9.1	0.1	2.50	1.00	45	10	1.10E-07	2.51E-05	2.00E-02	1.26E-03
									SUMMARY HAZARD INDEX		1.28E-03

Note: TK - Toxicokinetic Factor

SSLC-RW

25-Jul-99

TABLE C-17
Direct Contact with and/or Ingestion of Soil
Realistic Worst Case - Teenagers
Carcinogenic Effects
Mechanicville Site

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose}_{(mg/kg/day)} = \text{Soil Concentration}_{(ug/g)} \times \left[\left(\text{Amount Contacted}_{(g/event)} \times \text{Dermal TK Factor}\right) + \left(\text{Amount Ingested}_{(g/event)} \times \text{Ingestion TK Factor}\right)\right] \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{70 \text{ years}} \times \frac{1 \text{ mg}}{1000 \text{ ug}} \times \frac{1 \text{ yr}}{365 \text{ days}} \quad 1000 \text{ ug}$$

$$\text{Incremental Risk} = \text{Body Dose}_{mg/kg/day} \times \text{CAG Potency Factor}_{(mg/kg/day)^{-1}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
carc. PAHs - USEPA	38.20	9.1	0.1	0.05	0.1	45.0	10	10.0	3.32E-08	1.52E-06	1.15E+01	1.79E-05
carc. PAHs - ICF	38.20	9.1	0.1	0.05	0.1	45.0	10	10.0	3.32E-08	1.52E-06	3.20E+00	4.97E-06

SUMMARY CARCINOGENIC RISK	
USEPA	1.79E-05
ICF	4.97E-06

Note: TK - Toxicokinetic Factor

APPENDIX D

AIR MODELING METHOD AND RESULTS

D.1 AIR QUALITY MODELING OF FUGITIVE AIR EMISSIONS

Emissions of contaminants are predicted for future hypothetical construction activities at the Mechanicville site. Both particle and volatile emissions are estimated.

D.1.1 Fugitive Dust Emissions

The fugitive dust emission equations used for this analysis are based on empirical studies of surface mines and storage piles for various materials (Cowherd, 1985). These equations can be used to estimate the emissions of contaminants based on the measured chemical concentrations in the surface soil at the Mechanicville site.

The emissions predicted from these equations are for inhalable particles (PM_{10}) that have an aerodynamic diameter smaller than or equal to 10um. Inhalable particles can be retained by the body upon inhalation and contribute to inhalation exposure.

Contaminant emission rates were estimated from PM_{10} emission factors, the mass fraction of contaminant in the Mechanicville site soil, and the hypothetical exposed surface area of the contaminated soil. The contaminant emission rate (Q_{10}; g/sec) of particles 10 um and smaller was determined by the following equation:

$$Q_{10}\ (g/sec) = [\ f \times E_{10} \times A_c\ ] \times 10^{-6} \qquad (D\text{-}1)$$

where:

Q_{10} = contaminant PM_{10} emission rate (g/sec)

f = mass fraction of contaminant in PM_{10} emissions (mg contaminant/kg PM_{10})

E_{10} = PM_{10} emission rate (g PM_{10}/m^2-sec)

A_c = contaminated surface area (m^2)

10^{-6} = conversion factor for (mg contaminant/kg PM_{10}) to (g contaminant/g PM_{10})

The first step in estimating the emission rate (Q_{10}) from the contaminated surface area is to evaluate the sources of the particle emissions. For the Mechanicville site, the main source of particle emissions is wind erosion.

For estimating emissions from wind erosion for surface areas not covered by vegetation, two emission factor equations have been recommended by Cowherd et al. (1985). Selection of an equation depends on whether the contaminated site's surface material is classified as having a "limited reservoir" or an "unlimited reservoir" of erodible surface particles. Nonhomogeneous exposed surfaces that are crusted and include nonerodible elements are characterized as having a "limited reservoir" of erodible particles and require high threshold wind speeds for wind erosion. Exposed surfaces with "unlimited" erosion potential are those that do not form a crust and consist of finely divided particles (e.g., sandy agricultural soil). For the "unlimited reservoir" category, a lower threshold wind speed is necessary to entrain the contaminated soil. Based on field studies, a threshold friction velocity of 75 cm/sec is considered as the dividing line between the two classes of wind erosion.

Based on a relationship derived by Gillette (1980), the threshold friction velocity for wind erosion can be estimated from the mode of the grain-size distribution for soil samples from the site. Based on representative soil samples from the Mechanicville site, a threshold friction velocity less than 75.0 cm/sec was determined using the Gillette curve as presented in Cowherd et al. (1985). Therefore, the "unlimited reservoir" emission equation was used for the Mechanicville site.

For the utility repair scenario described in Section 5.0, Jordan calculated a conservative estimate of the PM_{10} emission rate (E_{10}) for the contaminated surface with "unlimited" erosion potential; an emission factor derived by Gillette (1981) based on field measurements of highly erodible soil was used. Cowherd (1985) presents a simplified form of this equation to represent the worst-case (short-term) emission rates. This equation is:

$$E_{10}\ (g/m^2\text{-sec}) = (1.0 \times 10^{-5})\ (1 - V)[U_{6\text{-hour}}]^3 \qquad \text{(D-2)}$$

where: V = fraction of contaminated surface with vegetative cover (equal to 0.0 for bare soil)

$[\ U_{6\text{-hour}}\ ]$ = expected maximum 6-hour mean wind speed (m/sec)

Based on local climatological data presented in Cowherd et al. (1985), the fastest mile [U^+] and mean wind speed [U] recorded for Albany, New York, are 21.4 m/sec and 4.0 m/sec, respectively. Because the Mechanicville site is located approximately 15 miles north of Albany, the Albany meteorological data were assumed to be representative of the Mechanicville site. As proposed by the World

Meteorological Organization to account for different averaging periods, the expected maximum 6-hour mean wind speed during the year can be estimated by the following equation:

$$[U_{6\text{-hour}}]\ (\text{m/sec}) = [U^{+}]\text{-}2.0 \qquad \text{(D-3)}$$

For the Mechanicville site, with all of the uncovered contaminated soil assumed to be bare (V = 0.0), worst-case hourly emission rates (E_{10}) due to soil erosion were calculated for the following two wind speed conditions:

Maximum Hourly Wind Speed: 19.4 m/sec

Most Probable Hourly Wind Speed: 4.0 m/sec

The particulate emission rates (E_{10}), per unit surface area, for the two wind speed cases were calculated to be:

Maximum 6-hour Wind Speed: $E_{10} = 7.30 \times 10^{-2}$ g/m^2-sec

Most Probable Wind Speed: $E_{10} = 6.40 \times 10^{-4}$ g/m^2-sec

A summary of the assumptions and input parameters used to estimate the fugitive dust emission rates due to unlimited soil erosion are given in Table D-1.

TABLE D-1

ASSUMPTIONS AND INPUT PARAMETERS
USED IN FUGITIVE DUST EMISSION RATE CALCULATIONS
MECHANICVILLE SITE

Wind Erosion Emissions

Erosion Potential:	Unlimited
Volume of Contaminated Soil Removed:	
Utility Repair Excavation: (Realistic Worst Case)	4,800 cubic feet
Utility Repair Excavation Case: (Most Probable Case)	1,200 cubic feet
Fraction of Contaminated Surface (V) with Vegetative Cover	0.00
Roughness Height (Zo):	5.0 cm

Wind Speed Range	Wind Speed [m/s]	E_{10c} [g/m^2 -s]
High Wind Speed:	19.4	8.00×10^{-5}
Mean Wind Speed:	4.0	9.73×10^{-7}

The surface area of contaminated soil was assumed to equal that of the soil pile. The volume of contaminated soil brought to the surface and piled at the site was estimated for the following two scenarios:

Utility Repair Excavation - Realistic Worst Case: 4,800 cubic feet

Utility Repair Excavation - Most Probable Case: 1,200 cubic feet

The exposed surface areas of the soil piles were estimated based on the assumption that the storage piles were shaped similar to a solid cone.

The actual contaminant emission rates (Q_{10}), in grams per second, were obtained by Equation D-1 for the two wind speed cases.

D.1.2 Volatilization Rates from Soils

The volatilization of contaminants through the soil is a complex process involving the mass transfer of volatiles from the soil particles into the air pores in the soil, mass transfer through the soil pore spaces, and mass transfer from the soil surface into the ambient air. Before estimating the volatilization rates of organic chemicals from the contaminated soil, several empirical models were evaluated. For each model, values for several input parameters were not directly available for Mechanicville and would have had to be estimated. The volatilization rates calculated by the different models for specific contaminants ranged over several orders of magnitude. Because of the

uncertainty of the applicability of these models for the Mechanicville site, it was decided that a more simplified but conservative approach would be used.

Based on the mean contaminant soil concentration measured at the Mechanicville site, the mass of the contaminant (grams) in the soil for the two soil volume cases previously discussed was determined. The contaminant emission rates due to volatilization from the surface soils were calculated for the following two cases:

Most Probable: 10 percent of VOC mass emitted over 20-day period

Realistic Worst: 100 percent of VOC mass emitted over 30-day period

For the two cases, the emission rates due to volatilization from the exposed soil are assumed to remain constant. For the contaminants measured in the Mechanicville soil, Table D-2 provides the mean soil concentration (mg/kg) and the 20-day and 30-day average emission rates (g/sec).

D.2 AIR QUALITY DISPERSION MODELS

Once contaminant emission rates for the different scenarios have been estimated, air quality modeling is used to estimate ambient air concentrations at selected distances from the Mechanicville site. Jordan modeled the emissions from the exposed soil surface area as area sources. Jordan assumed that no plume rise will occur, and that the contaminant emissions are mixed uniformly over a height equal to the height of the soil pile.

TABLE D-2

SOIL CONCENTRATIONS AND EMISSION RATES
FOR VOLATILIZATION FROM SURFACE SOILS
MECHANICVILLE SITE

ASSUMPTIONS:
MOST PROBABLE: 10% OF VOC MASS EMITTED OVER 20 DAYS
WORST CASE: 100% OF VOC MASS EMITTED OVER 30 DAYS

SOIL DENSITY: 1440 KG/M^3
SOIL VOLUME: MOST PROBABLE: 1200 CU. FT. WORST CASE: 4800 CU. FT.

		MOST PROBABLE		WORST CASE	
CONTAMINANT COMPOUND	MEAN SOIL CONC. (MG/KG)	MASS OF CONTAMINANT IN SOIL[a] (G)	20 DAY AVG. E[b] (G/S)	MASS OF CONTAMINANT IN SOIL (G)	30 DAY AVG. E (G/S)
Benzene	104	5.09E+03	2.94E-04	2.03E+04	7.85E-03
Toluene	151	7.38E+03	4.27E-04	2.95E+04	1.14E-02
Ethylbenzene	82.1	4.01E+03	2.32E-04	1.61E+04	6.20E-03
Styrene	150	7.34E+03	4.25E-04	2.93E+04	1.13E-02
Total Xylenes	306	1.50E+04	8.66E-04	5.99E+04	2.31E-02
Trimethylbenzene	26.7	1.31E+03	7.56E-05	5.22E+03	2.01E-03
Methylene Chloride	0.5	2.45E+01	1.42E-06	9.78E+01	3.77E-05

[a] Mass of contaminant in soil (g) = mean soil concentration $\left(\frac{\text{mg contaminant}}{\text{kg soil}}\right)$ x soil density $\left(\frac{\text{kg soil}}{m^3}\right)$ x soil volume (m^3)

[b] Average E(g/s) = $\frac{\text{mass of contaminant in soil (g)}}{20 \text{ days}} \times \frac{1 \text{ day}}{24 \text{ hour}} \times \frac{1 \text{ hour}}{60 \text{ min.}} \times \frac{1 \text{ min}}{60 \text{ sec.}}$

Jordan evaluated two air dispersion modeling approaches to determine which modeling approach was appropriate for the Mechanicville site. The first modeling approach involves a simple box model to estimate ambient concentrations due to emissions from an area source. The box model is based on conservation of mass equations, requires steady-state conditions, and is widely used in exposure studies where the receptors are on-site or very close to the exposed surface area. The box itself encloses the area of interest, bounded by the ground, with a height estimated by an assumed mixing layer. Mixing within the box is assumed to be complete. The width of the box is set equal to the width of the exposed soil area. The box is oriented so that its length lies in the direction of the wind. The box model is limited in its application to area sources with a surface width much larger than the distance to the receptor of interest.

For the Mechanicville site, predicted concentrations are of interest at receptors located on-site or within 750 feet of the exposed contaminated area. The size of the exposed contaminated soil piles for the Mechanicville site are relatively small, with the largest pile estimated to have a diameter of only 31 feet. Because the distance to the receptors of interest is greater than the width of the soil pile, the box model is not appropriate for the Mechanicville site. Therefore, another modeling approach was considered for determining the ambient contaminant concentrations due to fugitive emissions.

The second modeling approach follows the basic modeling procedures described in D. B. Turner's Workbook of Atmospheric Dispersion Estimates (Turner, 1970). These procedures are based on the basic Gaussian plume equation. For a ground-level source with no effective plume rise, the Gaussian equation reduces to a

simplified form that has been widely used in screening assessments. For the Mechanicville site, the emissions from the soil piles are assumed to be spread over the area of the pile. Following Turner's recommendations, Jordan modeled the area source emissions from the soil pile as if they originated from a virtual point source. The virtual point source approach creates a point source located at an appropriate distance upwind such that the horizontal dispersion at the soil pile is equal to the soil pile width. The horizontal dispersion downwind of the facility can then be simulated as if all the soil pile emissions were being emitted from the virtual point source. The distance used in the calculation of ambient concentrations is the total distance from the virtual point to the receptor.

The calculation of the ambient concentrations due to emissions from the soil piles is simplified by using the virtual source approximation. Further simplification is possible by assuming that the emissions due to soil erosion and volatilization are initially spread over the height of the soil pile. Having calculated the contaminant emission rate of particles 10 um and smaller (Q_{10c}), the ambient contaminant concentration can be estimated by the following equation:

$$C10 = Q_{10c} / [\ pi\ *\ sigma_y\ *\ (sigma_z + H_p)\ *\ U\ ] \qquad (D\text{-}6)$$

where:

C10 = Contaminant air concentration (g/m^3)

Q_{10c} = Contaminated emission rate (g/sec)

$sigma_y$ = Horizontal dispersion coefficient (m) at distance X + Xv

$sigma_z$ = Vertical dispersion coefficient (m) at distance X

H_p = Height of soil pile (m)

U = Average wind speed (m/sec)

X_v = Virtual source distance (m)

X = Distance from edge of soil pile to receptor (m)

For the Mechanicville site evaluation, downwind receptors were placed 10, 100, and 750 feet from the edge of the soil pile. The initial virtual horizontal dispersion coefficient is estimated by dividing the width of the soil surface pile by 4.3. From extrapolation of the horizontal dispersion coefficient curve in Turner's workbook for D atmospheric stability class, the virtual source distance (X_v) was determined for two different soil volume cases:

Case Description	Exposed Soil Volume
Utility Repair Excavation - Realistic Worst	4,800 cubic feet
Utility Repair Excavation - Most Probable	1,200 cubic feet

Different wind speeds were used with Equation D-6 to represent realistic worst and most probable conditions at the Mechanicville site. To represent the most probable conditions, a wind speed of 4.0 m/sec with a D atmospheric stability class was assumed. To represent the worst case conditions, two wind speed values were assumed. To simulate realistic worst conditions from emissions due to the volatilization of contaminants in the soil pile, a wind speed of 2.0 m/sec was selected. Because fugitive emissions due to unlimited soil erosion increase with wind speed, a wind speed of 19.4 m/sec was selected to represent worst case particulate emissions.

Based on the assumptions used in this analysis, the ambient air quality concentrations calculated using Equation D-6 predict hourly values of contaminant concentrations. To relate these predictions to longer averaging time periods, conservative scaling factors recommended by USEPA (1977) were used to estimate longer duration exposure concentrations. The 1-hour average box model predictions were multiplied by 0.40 to obtain 24-hour average off-site concentrations, and by 0.70 to obtain 8-hour average on-site concentrations.

Table D-3 presents the ambient air concentrations due to fugitive dust emissions from soil erosion for the realistic worst case utility repair scenario. Table D-4 presents the contaminant ambient air concentrations for the analogous most probable case.

Based on the emission rates for volatilization from surface soil given in Table D-2, Table D-5 provides the chemical-specific average concentrations for the two contaminated soil volume cases (i.e., two utility repair scenarios). The ambient 1-hour average concentrations were calculated based on an assumed D atmospheric stability class and wind speed values of 2.0 and 4.0 m/sec. From the predicted 1-hour average concentrations, 8-hour and 24-hour average concentrations were calculated using the scaling factors given previously.

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TABLE D-3

AMBIENT AIR CONCENTRATIONS
FOR NONVOLATILE CONTAMINANTS:
REALISTIC WORST CASE
UTILITY REPAIR SCENERIO
MECHANICVILLE

ASSUMPTIONS:

	Wind Speed (m/sec)	Soil Surface Area (sq. meters)
For Unlimited Wind Erosion:	19.4	135.9

(Stability Class = D for all cases)

COMPOUND	DOWNWIND DISTANCE (feet)	REALISTIC WORST CASE AMBIENT AIR CONCENTRATIONS (ug/cu.m) WIND EROSION 1-hour	8-hour	24-hour
Acenaphthene	10	1.18E+00	8.26E-01	4.72E-01
	100	4.41E-01	3.09E-01	1.76E-01
	750	1.15E-01	8.04E-02	4.59E-02
Acenaphthylene	10	3.35E+00	2.34E+00	1.34E+00
	100	1.25E+00	8.75E-01	5.00E-01
	750	3.26E-01	2.28E-01	1.30E-01
Anthracene	10	1.67E+00	1.17E+00	6.69E-01
	100	6.25E-01	4.38E-01	2.50E-01
	750	1.63E-01	1.14E-01	6.51E-02
Carcinogenic PAHs	10	2.48E+00	1.73E+00	9.91E-01
	100	9.26E-01	6.48E-01	3.70E-01
	750	2.41E-01	1.69E-01	9.65E-02
Fluoranthene	10	2.61E+00	1.82E+00	1.04E+00
	100	9.74E-01	6.82E-01	3.90E-01
	750	2.54E-01	1.78E-01	1.01E-01
Fluorene	10	4.70E+00	3.29E+00	1.88E+00
	100	1.76E+00	1.23E+00	7.02E-01
	750	4.57E-01	3.20E-01	1.83E-01
Naphthalene	10	4.99E+00	3.49E+00	2.00E+00
	100	1.87E+00	1.31E+00	7.46E-01
	750	4.86E-01	3.40E-01	1.94E-01
Phenanthrene	10	2.94E+00	2.05E+00	1.17E+00
	100	1.10E+00	7.68E-01	4.39E-01
	750	2.86E-01	2.00E-01	1.14E-01
Pyrene	10	3.65E+00	2.55E+00	1.46E+00
	100	1.36E+00	9.54E-01	5.45E-01
	750	3.55E-01	2.49E-01	1.42E-01
2-Methylnaphthalene	10	1.19E-01	8.32E-02	4.75E-02
	100	4.44E-02	3.11E-02	1.78E-02
	750	1.16E-02	8.10E-03	4.63E-03
Total Cyanide	10	6.30E-03	4.41E-03	2.52E-03
	100	2.35E-03	1.65E-03	9.42E-04
	750	6.13E-04	4.29E-04	2.45E-04

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TABLE D-4

AMBIENT AIR CONCENTRATIONS
FOR NONVOLATILE CONTAMINANTS:
MOST PROBABLE CASE
UTILITY REPAIR SCENERIO
MECHANICVILLE

ASSUMPTIONS:

	Wind Speed (m/sec)	Soil Surface Area (sq. meters)
For Unlimited Wind Erosion:	4.0	34

(Stability Class = D for all cases)

COMPOUND	DOWNWIND DISTANCE (feet)	MOST PROBABLE CASE AMBIENT AIR CONCENTRATIONS (ug/cu.m) WIND EROSION 1-hour	8-hour	24-hour
Acenaphthene	10	3.72E-02	2.60E-02	1.49E-02
	100	9.76E-03	6.83E-03	3.91E-03
	750	1.68E-03	1.17E-03	6.71E-04
Acenaphthylene	10	1.05E-01	7.38E-02	4.22E-02
	100	2.77E-02	1.94E-02	1.11E-02
	750	4.76E-03	3.33E-03	1.90E-03
Anthracene	10	5.27E-02	3.69E-02	2.11E-02
	100	1.38E-02	9.69E-03	5.54E-03
	750	2.38E-03	1.67E-03	9.52E-04
Carcinogenic PAHs	10	7.80E-02	5.46E-02	3.12E-02
	100	2.05E-02	1.44E-02	8.20E-03
	750	3.52E-03	2.47E-03	1.41E-03
Fluoranthene	10	8.21E-02	5.75E-02	3.28E-02
	100	2.16E-02	1.51E-02	8.63E-03
	750	3.71E-03	2.59E-03	1.48E-03
Fluorene	10	1.48E-01	1.04E-01	5.92E-02
	100	3.89E-02	2.72E-02	1.56E-02
	750	6.68E-03	4.68E-03	2.67E-03
Naphthalene	10	1.57E-01	1.10E-01	6.29E-02
	100	4.13E-02	2.89E-02	1.65E-02
	750	7.10E-03	4.97E-03	2.84E-03
Phenanthrene	10	9.24E-02	6.47E-02	3.70E-02
	100	2.43E-02	1.70E-02	9.72E-03
	750	4.17E-03	2.92E-03	1.67E-03
Pyrene	10	1.15E-01	8.04E-02	4.60E-02
	100	3.02E-02	2.11E-02	1.21E-02
	750	5.19E-03	3.63E-03	2.07E-03
2-Methylnaphthalene	10	3.74E-03	2.62E-03	1.50E-03
	100	9.84E-04	6.89E-04	3.94E-04
	750	1.69E-04	1.18E-04	6.76E-05
Total Cyanide	10	1.98E-04	1.39E-04	7.94E-05
	100	5.21E-05	3.65E-05	2.09E-05
	750	8.96E-06	6.27E-06	3.58E-06

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TABLE D-5

AMBIENT AIR CONCENTRATIONS
FOR VOLATILE CONTAMINANTS:
UTILITY REPAIR SCENERIO
MECHANICVILLE

ASSUMPTIONS:

	Soil Pile Volume (cu. ft.)	Wind Speed (m/sec)
Most Probable Case:	1200	4.0
Realistic Worst Case:	4800	2.0

(Stability Class = D for all cases)

COMPOUND	DOWNWIND DISTANCE (feet)	AMBIENT AIR CONCENTRATIONS (ug/cu.m.)					
		MOST PROBABLE			REALISTIC WORST CASE		
		1-hour	8-hour	24-hour	1-hour	8-hour	24-hour
Benzene	10	2.84E+00	1.99E+00	1.13E+00	8.56E+01	5.99E+01	3.42E+01
	100	7.64E-01	5.35E-01	3.06E-01	3.20E+01	2.24E+01	1.28E+01
	750	1.76E-01	1.23E-01	7.03E-02	6.83E+00	4.78E+00	2.73E+00
Toluene	10	4.12E+00	2.88E+00	1.65E+00	1.24E+02	8.70E+01	4.97E+01
	100	1.11E+00	7.77E-01	4.44E-01	4.65E+01	3.25E+01	1.86E+01
	750	2.55E-01	1.79E-01	1.02E-01	9.92E+00	6.94E+00	3.97E+00
Ethylbenzene	10	2.24E+00	1.57E+00	8.96E-01	6.76E+01	4.73E+01	2.70E+01
	100	6.03E-01	4.22E-01	2.41E-01	2.53E+01	1.77E+01	1.01E+01
	750	1.39E-01	9.70E-02	5.54E-02	5.39E+00	3.78E+00	2.16E+00
Styrene	10	4.10E+00	2.87E+00	1.64E+00	1.23E+02	8.62E+01	4.93E+01
	100	1.11E+00	7.74E-01	4.42E-01	4.60E+01	3.22E+01	1.84E+01
	750	2.54E-01	1.78E-01	1.02E-01	9.83E+00	6.88E+00	3.93E+00
Total Xylenes	10	8.36E+00	5.85E+00	3.34E+00	2.52E+02	1.76E+02	1.01E+02
	100	2.25E+00	1.58E+00	9.01E-01	9.41E+01	6.59E+01	3.77E+01
	750	5.17E-01	3.62E-01	2.07E-01	2.01E+01	1.41E+01	8.04E+00
Trimethylbenzene	10	7.30E-01	5.11E-01	2.92E-01	2.19E+01	1.53E+01	8.76E+00
	100	1.97E-01	1.38E-01	7.86E-02	8.19E+00	5.73E+00	3.28E+00
	750	4.52E-02	3.16E-02	1.81E-02	1.75E+00	1.22E+00	6.99E-01

APPENDIX D
REFERENCES

Cowherd, C. et al., 1985. "Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites"; USEPA/600/8-85/002; prepared for USEPA, Office of Health and Environmental Assessment; Washington, D.C.

Donigian, A.S., T. Lo, and E.W. Shanahan, 1983. "Rapid Assessment of Potential Groundwater Contamination Under Emergency Response Conditions"; USEPA, Office of Health and Environmental Assessment; Washington, D.C.

Gillete, D.A. et al., 1980. "Threshold Velocities for Input of Soil Particles Into the Air by Desert Soils"; Journal of Geophysical Research; 85(C10):5621-5630.

Gillete, D.A. et al., 1981. "Production of Dust That May be Carried Great Distances"; Desert Dust: Origin, Characteristics, and Effect on Man; Troy Pewe (editor); Geological Society of America Special Paper 186; pp. 11-26.

Turner, D.B., 1970. Workbook of Atmospheric Dispersion Estimates; U.S. Department of Health, Education, and Welfare; National Air Pollution Administration; Cincinnati, Ohio.

U.S. Environmental Protection Agency (USEPA), 1977. Guideline for Air Quality Maintenance Planning and Analysis (Volume 10 - Revised): Procedures for Evaluating Air Quality Impact of New Stationary Sources; USEPA-450/4-77-001; prepared for USEPA Office of Air Quality Planning and Standards; Research Triangle Park, North Carolina.

U.S. Environmental Protection Agency (USEPA), 1983 Reference from the GRADIENT Report (Management of Manufactured Gas Plant Site - Section 1.3.2.1) giving the emission rate (PM10) equation for bulldozers.

APPENDIX E

PAH SOLUBILITIES

TABLE E-1
SOLUBILITIES OF PAHs IN WATER (mg/L)[1]

COMPOUND	VERSCHUEREN[2]	USEPA TREATABILITY MANUALS[3]	SPHERE[4]
Acenaphthene	--	3.42	3.42
Acenaphthylene	3.93	3.93	3.93
Anthracene	1.29	0.073	0.045
Benzo(a)anthracene	0.044 at 24°C	0.014	0.0057
Benzo (a)pyrene	0.003 at 20°C	0.0038	0.0012
Benzo(b)fluoranthene	--	NA[5]	0.014
Benzo(k)fluoranthene	--	0.00055	0.0043
Benzo(g,h,i)perylene	0.00026	0.00026	0.0007
Chrysene	0.006	0.002	0.0018
Dibenzo(a,h)anthracene	--	0.0005	0.0005
Fluoranthene	0.120 at 24°C	0.26	0.26
Fluorene	1.9	1.98	1.69
Indeno(1,2,3-cd)pyrene	--	0.62	0.00053
Naphthalene	30.0 at 20°C	34.4	--
Phenanthrene	0.816 at 21°C	1.29	1.00
Pyrene	0.032 at 24°C	0.14	0.132
2-Methynaphthalene	28	--	--

NOTES:

1 All values are calculated at 25°C unless otherwise noted.
2 Verschueren, K., 1983. Handbook of Environmental Data on Organic Chemicals, Van Nostrand Reinhold Company; New York, New York.
3 USEPA, 1981. "Treatability Manual Volume I: Treatability Data"; Office of Research and Development; Washington, D.C.; USEPA-600/2-82-001a; September 1981 (Revised).
4 Superfund Public Health Evaluation Manual USEPA (1986).
5 NA - Not available
mg/L = milligrams per liter