Declaration for the Decision Document

Former Gould Manufacturing Facility
Bridgeport, Ohio

Introduction

The Former Gould Manufacturing property is located near Bridgeport, Belmont County, and was previously used as a bearing manufacturing facility. A large solvent (trichloroethylene) release from an underground line in 1980 and disposal of solvents and metal sludges resulted in contamination of soil and ground water at this Site.

This Decision Document presents the selected remedial action to address contamination problems identified at the Former Gould Manufacturing Facility. Ohio EPA's remedial action was selected on the basis of analysis presented in the Preferred Plan and Remedial Investigation/Feasibility Study reports, and comments received from the public. The Decision Document also includes a Responsiveness Summary which contains responses to comments received at the public hearing conducted on January 17, 2001, and received during the public comment period which ended on January 26. No substantial public comment was received and the remedy selected in the Decision Document is essentially the same as presented in the Preferred Plan.

Community Participation

Documents and information related to the investigation of the Former Gould Manufacturing facility Site, including the Remedial Investigation, Feasibility Study, Preferred Plan, and subsequent documents are public documents and are available for review at the Ohio EPA, Southeast District Office in Logan, Ohio. A document repository has also been established at the Bridgeport Public Library, 661 Main Street, Bridgeport. The document repository contains copies of the Remedial Investigation and Feasibility Reports, and the Preferred Plan. A copy of this Decision Document, and all subsequent final design documents and Site reports will be added to the repository after they are approved by Ohio EPA.

Description of the Selected Remedy

Restoration of contaminated ground water is one of the primary objectives of Site cleanup. However, attainment of drinking water standards may not always be achievable at certain sites (or portions of sites), due to site specific and technological limitations, and the presence of free-phase Dense Non-Aqueous Phase Liquid (DNAPL). Most of the trichloroethylene (TCE) present at the Former Gould Manufacturing Facility is free phase DNAPL, and while additional DNAPL will be recovered, complete removal of the DNAPL source area is not technically feasible. DNAPL source removal will be combined with extraction of source area ground water to promote ground water cleanup. As long-term goals, ground water cleanup levels (MCLs) have been established for the portion of the plume located outside of the DNAPL area. Ground water cleanup will be further enhanced with phytoremediation, where several hundred hybrid poplar trees will be planted on approximately 2.8 acres of the Site to remove additional contaminants. A portion of the TCE plume discharges to neighboring Wheeling Creek. Ohio Water Quality Criteria have been established as remedial goals for Wheeling Creek and these levels are expected to be attained in less than five years.

Site soil will be excavated in several locations to meet industrial cleanup levels for lead and background concentrations for arsenic. The former sprayfield area is visibly impacted by metal plating sludges and the top six inches of soil in this area will also be excavated. Excavated soil will be treated on-Site by stabilization/solidification followed by off-Site disposal.

The current deed restricts residential use of the property including use of the property for any school, day-care center or playground use. The deed also restricts any non-residential use of the property where adults or children could be exposed to the Site soil or groundwater, and the deed further restricts development, operation or use of any well for potable use on or within the property.

Summary of the selected remedy:

- **Maintenance of current property deed restrictions and Site fencing**
- **Removal of free product trichloroethylene (TCE) using recovery wells**
- **Extraction and treatment of source area ground water using pumping wells**
- **Phytoremediation of groundwater outside of the source area utilizing several hundred hybrid poplar trees**
- **Excavation of Site soil which exceeds lead and arsenic cleanup levels, followed by treatment and off-Site disposal**
- **Monitoring of ground water, surface water, soil, and sediment**

The estimated cost for the selected remedy is $3,602,000.

This remedy provides a cost effective, permanent solution to the contamination problems at the Former Gould Manufacturing Facility and reduces the toxicity, mobility, and volume of contaminants through treatment. In addition, the selected remedy provides short-term effectiveness, is readily implementable, and utilizes innovative technology (phytoremediation).

Plans for monitoring ground water, surface water, soil, and sediment to assess progress towards meeting cleanup goals, and criteria to measure the effectiveness of phytoremediation will be developed during Remedial Design. Ohio EPA will regularly review the effectiveness of the selected remedy. Other remedial alternatives evaluated in the Preferred Plan may be considered if the chosen remedy fails to demonstrate satisfactory progress towards meeting cleanup goals.

Christopher Jones, Director
Ohio Environmental Protection Agency

5-16-01
Date

Decision Summary

for the
Former Gould Manufacturing Facility
Bridgeport, Ohio

May 2001

Ohio Environmental Protection Agency
Southeast District Office
2195 Front Street
Logan, Ohio 43138

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1.0 SITE BACKGROUND

1.1 Site Description

The Former Gould Manufacturing Facility (Manufacturing Facility or Site) is located in northeastern Belmont County, Ohio, about 2.5 miles west of Bridgeport on U.S. Route 40 (Figure 5). The Site is situated on a 16.5-acre parcel of land, bordered on the north and west by an old railroad right-of-way (the railroad tracks have been removed), on the south by an undeveloped parcel of land, and on the east by Wheeling Creek. The Site is situated on the relatively flat, narrow flood plain of Wheeling Creek, and the majority of the Site is located within Wheeling Creek's 10-year flood zone. The Site may be found on the Lansing, Ohio, United States Geological Survey 7.5 minute quadrangle map.

1.2 Site History

Aerial photographs from 1959 indicate that the Former Gould Manufacturing Facility property had been used as a drive-in movie theater. Since 1965 the property has been owned by five separate entities. These include:

- Clevite Corporation (Clevite) (1965-1969)
- Gould Electronics, Inc (Gould) (1969 - September 1981)
- Imperial Clevite - (September 1981 - February 1987)
- J. P. Industries, Inc (JPI); (February 1987 - November 1987) and,
- Sylvan and Rosalie Dlesk (the Dlesks) (November 1987 - present)

Gould acquired the Site in 1969 as part of Clevite, and owned and operated the Site as a bearing manufacturing facility until 1981. In September 1981, Gould sold the facility to Imperial Clevite, who continued the operations. The facility was then transferred from Imperial Clevite to J.P. Industries, Inc. (JPI) in February 1987, and JPI sold the Site to the Dlesks in November 1987. In 1989, Ohio EPA entered into an Administrative Order with Gould and the Dlesks to conduct a Remedial Investigation, Feasibility Study and Site cleanup. Presently, Capitol Manufacturing Company (Capitol) leases the facility from the Dlesks. Capitol is a division of Harsco and is a manufacturer of pipe couplings and metal pipe accessories. The manufacturing building and parking areas are separated from the northern, vacant old field portion of the property by a chain-link fence topped with barbed wire.

1.3 Waste Disposal Areas

Waste disposal activities predominantly occurred on the northern and northeastern portion of the Site, in an area of fields and woodlands. Waste disposal areas identified at the Site include:

- **Materials transfer shed area.** This area was located north of the docking area, and was reportedly used for drum cleaning, storage, and transfer of drummed materials. Soil surrounding the shed was observed to be oil-stained and sparsely vegetated.

- **Concrete/asphalt walkway area (former fill area).** Extending north from the transfer shed. Scrap materials were reportedly dumped and burned, and buried in pits along the walkway. Historical aerial photographs indicated that the walkway was present from at least 1966.

- **Trichloroethylene (TCE)[1] area.** Located outside an east-facing door on the northeastern side of the Manufacturing Facility building where waste TCE was reportedly dumped.

- **Former spray field.** Located over a broad, open area north of the Manufacturing Facility building. Metal hydroxide (plating) sludges were reportedly sprayed on the field as means of disposal. A 1973 aerial photograph showed this area devoid of vegetation, and vegetation is still sparse in this area.

- **Former trench area.** Trench along the northwestern edge of the property where metal hydroxide (plating) sludges were stored.

- **Drum area**. A relatively small area near the west bank of Wheeling Creek where drums and metals scraps were disposed. This area is located directly east of the materials transfer shed. In 1991, this area was excavated and approximately eighteen 55-gallon drums, along with metal and other debris were removed and disposed of.

1.4 Chemical Release Areas

Several chemical releases have been reported at the Site since 1980 and included the following:

- On June 26, 1980, 30-50 gallons of hydrochloric acid were spilled on the northwest side of the facility during unloading of a tank truck into a storage tank. The spill was diluted with water, treated with soda ash, and flushed with additional water.

- On August 20, 1980, an estimated 2,500 gallons of TCE leaked from an underground pipeline on the northwest side of the facility. The line was approximately 3 feet below ground surface, and attempts to recover TCE were generally unsuccessful. This TCE release appears to be the primary source of Volatile Organic Compound (VOC) contamination at the Site.[2]

- On July 15, 1982, an estimated 3,000 to 5,000 gallons of plating solution were released to the ground. The solution was reported to contain elevated metals and a low pH. Reportedly, the release eventually discharged to Wheeling Creek.

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[1]TCE is a type of chlorinated solvent that is more dense than water and is referred to as a DNAPL (dense non-aqueous phase liquid). Trichloroethene is another name for Trichloroethylene.

[2]In some instances, the words TCE and VOC are used interchangeably because TCE is by far the most predominant VOC at the Site.

- On January 30, 1987, 1,000 to 2,000 gallons of hydrochloric acid was released from a plastic underground pipe located near the northwest corner of the plant. Most of the acid was neutralized and pumped to the plant's wastewater treatment holding tanks, but some escaped from the containment area during a heavy rain. The underground pipe that leaked was removed and the surrounding soil was excavated, neutralized with lime, and disposed of. An investigation of the January 30, 1987 spill was conducted by O.H. Materials (OHM) of Findlay, Ohio.

2.0 SUMMARY OF THE REMEDIAL INVESTIGATION

The Remedial Investigation (RI) was conducted at the Site to accomplish the following objectives:

- Characterize Site geology and hydrogeology;
- To assess the nature and extent of contamination at the Site, and identify potential migration pathways;
- Identify potential sources of contamination; and
- Conduct a Baseline Risk Assessment

2.1 Site Geology And Soils

Site geology generally consists of Quaternary alluvium overlying sandstone and relatively deeper shale bedrock. Fill material was identified in the vicinity of the Manufacturing Facility building, and it is likely this material was placed during construction of the building. Filling also probably occurred as part of development activities in several other areas of the Site (e.g., parking lot and driveway). Alluvial deposits at the Site are comprised of clay, sand, and gravel with thickness ranging from 15 to 20 feet. The upper 4 to 5 feet of the deposits predominantly consist of clay, with the lower interval consisting of more sand and gravel. Coal fragments have also been observed within the sediments. Sandstone bedrock and deeper shale bedrock underlie the clay, sand, and gravel deposits. The sandstone bedrock surface generally slopes gently downward to the east across the central and southern portions of the Site. The bedrock surface rises steeply at Wheeling Creek and outcrops at the creek bed and on the east bank. The sandstone and shale unit is partially weathered and fractured at the sandstone/alluvium interface, but becomes more competent (less fractured) with depth. Based on observations of rock cores and results of aquifer tests, the fractures in the bedrock decrease significantly at about 35 feet below the ground surface. At 50 to 55 feet below ground surface, a shale unit was identified in some deep borings and has been inferred to be continuous beneath the Site.

2.2 Site Hydrogeology

Ground water occurs in the alluvial and fractured sandstone bedrock units. The unconsolidated alluvial sediments and the fractured sandstone bedrock (to depths of 35 feet below ground surface) appear to be hydraulically connected and are referred to as the water table aquifer. As discussed above, fracture intensity in the sandstone bedrock decreases with depth. Since the bedrock is relatively flat lying and fracturing decreases with depth, vertical migration of the ground water beneath the Site is limited. At depths greater than approximately 35 feet below ground surface, the bedrock behaves as a confining layer beneath the alluvial/shallow bedrock aquifer. The presence of confinement at the 35 foot depth is based upon aquifer test observations and the measured water quality characteristics in the bedrock. Additionally, a shale bedrock confining layer was encountered 53 feet below ground surface in the building area. This may also limit vertical ground water flow.

The aquifer conditions at the Site have been characterized as follows:

- Storage Properties - Estimates of the water storage properties of the geologic units are based on the observed specific yields. The specific yield of the alluvial and fractured bedrock aquifers ranged from 0.035 to 0.146 during the 72-hour aquifer test. These specific yield values are indicative of unconfined conditions. The specific yield of the deep bedrock aquifer (≥ 35' below ground surface) ranged from 0.0002 to 0.011, which is characteristic of a confined or semi-confined condition.

- Gradient - As estimated in the RI and confirmed during the aquifer test, ground water in the alluvial and shallow bedrock portions of the Site aquifer flows north-northeast toward Wheeling Creek, under a horizontal gradient of 0.0018 to 0.004 foot per foot (ft/ft).

- Vertical Movement - The vertical component of the hydraulic gradient at the Site changes from slightly downward on the hydraulically upgradient (south) portion of the Site to upward on the northern portion of the Site, where the ground water discharges to Wheeling Creek.

- Velocity - The following estimates of ground water velocity were provided in the RI based on a limited number of modified slug tests:
  - Alluvial Unit - 1.40×10^{-2} foot per day (ft/day)
  - Fractured Bedrock Unit - 4.69×10^{-2} ft/day
  - Deep Bedrock Unit - 1.24×10^{-3} ft/day

  The velocity estimates were revised based on data from the 72-hour pumping test. Ground water velocities are estimated as follows:
  - Alluvial Unit - 1.15 ft/day
  - Fractured Bedrock - 3.44 ft/day

- Transmissivity - The transmissivity of the water table aquifer was estimated as follows based on the 72-hour aquifer test:
  - Alluvial/Fractured Bedrock Unit - 1.63 to 4.57 feet squared per minute
  - Deep Bedrock Unit - 0.93 to 2.68 feet squared per minute

2.3 Nature And Extent of Contamination

2.3.1 Soil

Soil borings were installed at various locations and depths at the facility, including several borings under the Manufacturing building, to collect samples for analysis. The analytical results indicate that Site soils are impacted with various Volatile Organic Compounds (VOCs) and metals. The VOCs include predominantly trichloroethylene (TCE) and its associated biodegradation compounds. The metals included primarily lead and copper. These contaminants were found throughout Site soil, however, they are generally concentrated within waste disposal areas and chemical release/spill areas.

2.3.1.1 Volatile Organic Compounds in Soil

VOCs detected in soil include: TCE, 1,2-DCE, 1,1,2,2-tetrachloroethane (1,1,2,2-PCA), 1,1,1-TCA, tetrachloroethene (PCE), benzene, toluene, ethylbenzene, xylene, and vinyl chloride. TCE was detected most frequently and generally at the highest concentrations. Benzene, toluene, ethylbenzene, and xylene (BTEX) were detected on-Site in a few locations, and off-Site during installation of monitoring wells. Figures showing the horizontal and vertical distribution of VOCs in soil are provided in the RI report. Soils contaminated with VOCs are widespread, with the highest concentration (2,000 milligrams/kilogram (mg/kg)) found in the walkway area (the former fill area).

2.3.1.2 Metals in Soil

Lead and copper contamination is widespread in Site soil, and the highest concentrations are found in the waste disposal areas and chemical release/spill areas. Lead was detected in soils up to 77,000 mg/kg in the walkway area (the former fill area). Lead concentrations in soil decrease significantly below 2 feet in most areas with the exception of the walkway area, which has elevated lead concentrations down to six feet (Figure 1). Copper was detected in soils up to 170,000 mg/kg in the walkway area (the former fill area), with lesser concentrations found in the former sprayfield and other areas. The highest arsenic concentration in soil (170 mg/kg) was detected in the walkway area (the former fill area). Arsenic was also found at levels slightly above background concentrations in a few areas immediately north and west of the Manufacturing Facility building (Figure 2).

2.3.2 Ground water

Monitoring wells were installed throughout the Site, including inside the Manufacturing building, to assess and monitor ground water quality and flow direction. Nineteen wells were installed in the alluvial zone, 35 wells were installed in the shallow bedrock zone, and four wells were installed in the deeper bedrock zone. Ground water samples indicated the presence of VOCs, primarily TCE (and its degradation products). The aqueous (dissolved) phase plume of VOCs, primarily TCE, is widespread throughout the Site property, with the highest concentrations in the vicinity of the building and immediately downgradient. The dissolved phase plume is discharging to Wheeling Creek. Vertical movement of ground water in the area of the plume appears to be limited by either the presence of the shale bedrock confining layer which was encountered approximately 53 feet below ground surface near the building, or by decreased fracturing of the sandstone bedrock with depth (approximately 35 feet below ground surface). The downward migration is further limited by Wheeling Creek, which is the discharge location for the aqueous phase plume.

In addition to the presence of VOCs in ground water, free product TCE (DNAPL) was also encountered in the fractured bedrock immediately adjacent to the Manufacturing Facility building, near the location of the 2,500 gallon release of TCE from an underground pipeline in 1980. Two wells were installed in 1992 to extract TCE free product and recovery operations are currently ongoing. An average of 0.5 gallons of TCE free product is removed monthly, which is containerized and periodically shipped off-Site.

Petroleum related compounds (BTEX) were detected in three on-Site monitoring wells located near the northeast corner of the Manufacturing Facility property boundary (MW-15, MW-16, MW-16A), and in monitoring wells located upgradient of the Site (MW-20, MW-20A), on the Carson Petroleum property. The source of the BTEX appears to be the Carson property, and BTEX compounds have not been identified as chemicals of concern at the Site. According to the Ohio Department of Commerce, Division of State Fire Marshal, Bureau of Underground Storage Tank Regulations, corrective action activities are currently ongoing at the Carson property regarding a prior gasoline release from an underground storage tank. The Bureau of Underground Storage Tank Regulations has responsibility for corrective actions at the Carson property.

2.3.3 Surface Water and Stream Sediment

Wheeling Creek surface water and sediment samples were collected upstream, adjacent to, and downstream of the Site, to assess potential impacts to the waterway. Five rounds of surface water samples were conducted at seven locations in the creek (see RI report for specific sample locations). Samples indicated TCE and 1,2-Dichloroethylene (1,2-DCE, a TCE degradation product) in surface water adjacent to the Site and at downstream locations. Concentrations of TCE in surface water ranged from non-detect to a maximum of 120 micrograms per liter (ug/l), which was detected adjacent to the facility. The maximum detection of 1,2-DCE in surface water was 5 ug/l which was also found adjacent to the facility. Metals in surface water were found to be similar to background (upstream) metal concentrations.

Wheeling Creek contains very little sediment in the vicinity of the Site, as the creek bed appears to be a shale and sandstone outcrop. Four rounds of sediment samples were obtained for metal analysis and three for VOC analysis. TCE was found in sediments up to a maximum concentration of 4 mg/kg, while 1,2-DCE was detected at a maximum concentration of 4.1 mg/kg. Both of these sediment samples were obtained adjacent to the facility. The maximum concentration of lead (140 mg/kg) and copper (53 mg/kg) in sediment was detected at the downstream edge (northeastern edge) of the property boundary. Chromium was detected in sediment at 86 mg/kg at a location downstream of the property boundary.

3.0 SUMMARY OF BASELINE RISK ASSESSMENT

As part of the Remedial Investigation, a baseline human health risk assessment (BRA) and ecological assessment (EA) was conducted to evaluate potential risks to human health and the environment which may exist at the Site.

3.1 Human Health Risk Assessment

The BRA evaluated the following chemicals of concern (COCs) in soil, ground water, surface water, and stream sediment:

Metals

- arsenic;
- copper;
- lead;
- nickel; and
- zinc.

Volatile Organic Compounds (VOCs)

- 1,2-dichloroethylene (1,2-DCE);
- 1,1,2,2-tetrachloroethane (1,1,2,2-PCA);
- 1,1,2-trichloroethane (1,1,2-TCA); and
- trichloroethylene (TCE).

Selection of a chemical of concern indicates a need to further examine the compound in the risk assessment, in order to evaluate potential health risks from exposure, and does not necessarily suggest that it poses a human health concern for the Site. In addition to the above compounds, benzene, toluene, ethylbenzene, and xylenes (BTEX) have been detected in Site ground water in the northeast corner of the property. These compounds appear to originate from an off-Site source and are not Site-related COCs.

3.1.2 Toxicity Assessment

Pathways by which humans could be exposed to these contaminants were evaluated and quantified for both current and potential future exposure scenarios. Following the evaluation of current and future receptors and exposure pathways, the concentrations of chemicals of concern in each medium from which exposure could occur were estimated from sampling results and modeling, and the potential human exposure levels were projected. The estimation of human exposure (intake) was calculated as the average amount of a chemical taken into the body per unit of body weight per day (milligram per kilogram per day, mg/kg/day).

The toxicity of the chemicals of concern was assessed by identifying the adverse health effects associated with exposure to each contaminant. Toxicity values for many frequently occurring environmental chemicals have been developed by the United States Environmental Protection Agency (U.S. EPA) for use in risk assessments. Separate toxicity values for carcinogenic (cancer causing) and non-carcinogenic health effects have been developed. The "slope factor" represents the excess cancer risk per unit intake of a chemical over a lifetime $(mg/kg/day)^{-1}$. A "reference dose" represents the amount of chemical intake (mg/kg/day) that is not expected to result in noncancerous adverse health effects. Available toxicity values were used in the BRA to characterize the risk associated with current and potential future exposure to chemicals of concern.

3.1.3 Risk Characterization

Risk characterization was conducted following the evaluation of exposure and toxicity information. Both carcinogenic and non-carcinogenic risks were characterized. Excess lifetime cancer risk (ELCR) was defined as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen(s) present at the Site, in addition to the probability of cancer risks from all other causes. As a benchmark in developing clean-up goals at contaminated sites, an acceptable range of ELCR of from one in one million ($1x10^{-6}$) to one in ten thousand ($1x10^{-4}$) has been established, with $1x10^{-6}$ being the "point of departure". The point of departure represents the starting point for all remedial objectives. This risk goal can be "departed from" for reasons including, but not limited to, technical infeasibility, engineering impracticality, and high cost. Cost, however, is not the primary consideration.

The "Hazard Quotient" (HQ) was used to determine the severity of non-cancerous hazards posed at the Site. The HQ was determined by dividing the daily intake by the reference dose. If the HQ was less than or equal to 1, then the estimated exposure to a substance was judged to be below the threshold that could result in a toxic effect. An HQ greater than 1 indicated that a toxic effect may result. To assess the cumulative effect of similar noncancerous substances, the HQ for all of the chemicals of potential concern at the Site were added, with the result being the Hazard Index (HI).

3.1.4 Hypothetical Future Residential Scenario

At Ohio EPA's request, a hypothetical future residential land use scenario was presented in the Baseline Risk Assessment to represent a future residential exposure scenario in the absence of institutional controls. This scenario assumes that residents would live for many years on the property, with residential types of exposures such as drinking and showering in Site ground water, exposure to Site soil, wading in the stream, etc.

The BRA indicated the risk to the future residential child as:

Total Excess Carcinogenic Risk	Total Noncancer Hazard Index
3×10^{-3}	80

The BRA indicated the risk to the future residential adult as:

Total Excess Carcinogenic Risk	Noncancer Hazard Index
3×10^{-3}	30

For both child and adult, use of ground water posed the most significant increased cancer risk and highest hazard index due to the presence of TCE. Ingestion of arsenic in soil and inhalation of TCE from surface water during wading also posed carcinogenic risk to the child and adult future residents.

An Integrated Exposure Uptake/Biokinetic (IEUBK) model developed by U.S. EPA was used to estimate the risk to children due to the presence of lead at the Site. The IEUBK model predicts the distribution of blood-lead levels in children under seven years of age as a function of exposure to lead in a residential setting. The results of the modeling indicate that lead concentrations in soil at the Site may pose an unacceptable risk to a hypothetical residential child.

3.1.5 Trespasser Scenario

Total Excess Carcinogenic Risk	Total Noncancer Hazard Index
1×10^{-5}	<1

The trespasser risk is based on an exposure frequency of 52 days/yr for 24 years. The total estimated increased carcinogenic risk for a trespasser (1×10^{-5}) was due primarily to ingestion of arsenic in soils and inhalation of TCE from surface water during wading.

3.1.6 Industrial Land Use Scenario

Acute industrial exposure (exposure frequency of 10 days/yr for 1 year):

Total Excess Carcinogenic Risk	Total Noncancer Hazard Index
8×10^{-9}	<1

Subchronic industrial exposure (exposure frequency of 20 days/yr for 1 year):

Total Excess Carcinogenic Risk	Total Noncancer Hazard Index
2×10^{-8}	<1

Chronic industrial exposure (exposure frequency of 250 days/yr for 25 years):

Total Excess Carcinogenic Risk	Total Noncancer Hazard Index
5×10^{-6}	<1

The total estimated increased carcinogenic risk for an adult worker (5×10^{-6}) results from ingestion of arsenic in soil and dust.

Industrial lead exposure was evaluated using a future industrial groundskeeper scenario for a pregnant worker and other male and female workers, using the Bowers model and the Society for Environmental Geochemistry (SEGH) model, as outlined in Appendix I of the FS report. The industrial groundskeeper scenario models a future grounds worker who performs occasional excavation work. Lead concentrations found in scattered surface soil areas exceeded acceptable lead concentrations estimated by the models, indicating a potential lead exposure hazard for a future industrial groundskeeper.

3.1.7 Risk Assessment Conclusions and Land Use Considerations

Potential risks posed by chemicals detected at the Site were evaluated under a hypothetical future residential land use scenario, the current and future industrial land use scenario, the trespasser scenario, and a future industrial groundskeeper scenario. The risk estimates for each scenario are summarized above. Under the hypothetical future residential use scenario, where groundwater is used for potable purposes (drinking, showering, etc.), both the carcinogenic and non-carcinogenic risks are well outside the acceptable risk range. The BRA indicated that potable use of ground water is clearly the risk driver for the hypothetical future residential use scenario. Use of a blood lead model to predict lead exposure to children in a residential setting indicated that the lead concentrations in soil at the Site may also pose an unacceptable risk to a hypothetical residential child.

Under the current and future industrial land use scenario and trespasser scenario, the carcinogenic risks are within the acceptable risk range ($1x10^{-4}$ to $1x10^{-6}$), but exceed the 1×10^{-6} point of departure risk goal. The current and future industrial land use scenario and trespasser scenario did not exceed the non-carcinogenic hazard index of 1. The increased carcinogenic risk for a trespasser (1×10^{-5}) was due primarily to ingestion of arsenic in soils and inhalation of TCE from surface water during wading. The increased carcinogenic risk for an adult worker (5×10^{-6}) results from ingestion of arsenic in soil and dust. Use of models to estimate industrial lead exposure indicated that lead concentrations found in scattered surface soil areas at the Site may also pose an unacceptable hazard to a future industrial groundskeeper.

The Baseline Risk Assessment did not specifically evaluate risk from chronic exposure to free phase TCE, a dense non-aqueous phase liquid (DNAPL). Free phase TCE is located in an area extending under and generally east of the Manufacturing Building and is found over 20 feet below the ground surface in the fractured sandstone bedrock. A small quantity (about 0.5 gallon) of TCE free product is recovered monthly via recovery wells, and any potential exposure to TCE during recovery operations would likely be short term. Short term exposure risks are managed with a Site specific health and safety plan.

Local zoning does not prohibit residential development of the property or development of the ground water for residential use. Several residential communities are located within five miles of the Site, and commercial property and vacant land is found nearby. While local zoning does not prohibit residential development of the property, the FS report indicated that Belmont County's Flood Damage Prevention Regulations (and federal regulations) restrict most new construction in the flood way, unless an exemption is obtained.

Future residential use of the Site property is believed to be unlikely. Continued industrial use of the Site is the most likely future land use since there is an active manufacturing facility on the property (Capitol Manufacturing), the majority of the Site is located within the 10-year flood zone of Wheeling Creek, and deed restrictions have been imposed on the property. The current deed restricts residential use of the property including use of the property for any school, day-care center or playground use. The deed also restricts any non-residential use of the property where adults or children could be exposed to the Site soil or ground water, and the deed further restricts development, operation or use of any well for potable use on or within the property. The City of Bridgeport supplies public water service in the vicinity of the Site.

3.1.8 Ecological Assessment Summary

An ecological assessment was conducted to provide a description of terrestrial and aquatic ecology at and adjacent to the Site; potentially affected terrestrial and aquatic habitats, identification of threatened or endangered species, and effects of contaminants on the ecology of the Site and surrounding area.

Findings based on the ecological assessment include:

- The former sprayfield area had physical and chemical evidence of metals (primarily lead and copper) accumulation in the vegetation, based on observations of vegetation features and metal concentrations found in plant tissue.

- No species under state or federal protective status, or unusual assemblages of plants or animals were found at the Site.

- A lack of macroinvertebrate fauna was noted both upstream and downstream of the Site, and no fish were noted during three different days of attempting to obtain samples. This is believed to be due to high flow velocities, substrate conditions, and water quality degradation in Wheeling Creek due to prior coal mining activities.

- Wheeling Creek surface water - TCE exceeded Ohio EPA water quality criteria in two samples. TCE was detected at a concentration of 120 ug/l from a sample adjacent to the Site, and at 76 ug/l from the downstream edge of the property boundary. These two samples exceeded the Ohio EPA water quality criteria of 75 ug/l. No other VOCs exceeded water quality criteria. Concentrations of metals in surface water were similar to background (upstream) concentrations.

- Wheeling Creek stream sediment - Concentrations of lead (66 mg/kg and 68 mg/kg) found in two sediment samples adjacent to the Site exceeded its ER-L value*, and one lead sample (140 mg/kg) from the downstream edge of the property boundary exceeded its ER-M value*. Chromium at one location downstream of the property boundary exceeded sediment background concentrations but only slightly exceeded its ER-L value*. Copper, arsenic, and zinc concentrations in sediment exceeded background concentrations but did not exceed their ER-L values*. Maximum concentrations of TCE (4 mg/kg) and 1,2-DCE (4.1 mg/kg) in sediment did not exceed concentrations developed by equilibrium partitioning modeling**.

**The effects range-low (ER-L) and effects range-medium (ER-M) values were obtained from the document "Potential Biological Effects of Sediment Sorbed Contaminants Tested in the National Status and Trends Program" (U.S. National Ocean Service, Long and Morgan, 1990). In that report, sediment concentration guidelines were developed to assess the potential for adverse biological effects due to exposure of biota to toxicants in sediments. The ER-L values represent an approximation of the concentration at which adverse effects would be first detected. The ER-M values represent an estimate of the concentrations at or above which effects were often detected.*

***The modeled sediment concentrations for TCE (23 mg/kg) and trans-1,2-DCE (35 mg/kg) were based on the U.S. EPA guidance document "Interim Sediment Criteria Values for Non-Polar Hydrophobic Organic Contaminants." The calculation is outlined in Appendix I of the FS report.*

4.0 REMEDIATION GOALS

4.1 Remedial Response Objectives

Remedial response objectives are general objectives for remedial action at the Site and include the following:

- Be protective of human health and the environment by preventing exposure to soil, ground water, surface water, and sediment impacted with Chemicals of Concern (COCs) at concentrations above established remediation goals;
- Prevent off-Site migration of the groundwater plume or discharge of COCs that would cause exposure at concentrations above established remediation goals;
- Monitor ground water, surface water and sediment concentrations relative to remediation goals;
- Implement a remedial alternative consistent with applicable regulations and in a reasonable time frame; and
- Minimize the impact of the remedial alternative on the existing plant operations (i.e., Capitol Manufacturing).

4.2 Remediation Goals

Remediation goals are target cleanup concentrations for each contaminant and are intended to be acceptable exposure levels that are protective of human health and the environment. The following were developed:

- Soil remediation goals for lead and arsenic
- Ground water remediation goals
- Wheeling Creek surface water remediation goals
- Wheeling Creek sediment remediation goals

4.2.1 Soil Remediation Goals

Lead in Soil

Lead modeling was used to development an industrial remediation goal for lead in soil (see Appendix I of the FS report). Lead models calculate soil lead concentrations based on target blood lead levels and various other assumptions. The lead modeling conducted for the Site considered both a pregnant grounds worker, and other male and female workers using a future industrial groundskeeper scenario. The Bowers and the Society of Environmental Geochemistry models were used to evaluate potential soil lead remediation goals. Based on model results and available information, an industrial remediation goal of 2,000 mg/kg has been selected for lead in soil.

Arsenic in Soil

Although arsenic remediation goals for several exposure scenarios were evaluated, the background concentration of arsenic in soil at the Site was calculated to be 18.1 mg/kg. The background arsenic concentration is within the 1×10^{-4} to 1×10^{-6} risk range, and would be protective of ground water. The remediation goal for arsenic will be based on the background concentration of 18.1 mg/kg.

4.2.2 Ground Water Remediation Goals

Maximum Contaminant Levels (MCLs) are standards promulgated under the Federal Safe Drinking Water Act establishing a maximum allowable concentration of a contaminant in drinking water. MCLs were established as ground water remediation goals.

	MCL
1,1,2-Trichloroethane (1,1,2-TCA)	0.005 mg/l
cis-1,2Dichloroethylene (cis-1,2-DCE)	0.070 mg/l
trans-1,2Dichloroethylene (trans-1,2-DCE)	0.100 mg/l
Trichloroethylene (TCE)	0.005 mg/l

4.2.3 Surface Water and Sediment Remediation Goals

Surface Water Remediation Goals

Remediation goals were developed for Wheeling Creek surface water using Ohio EPA Water Quality Criteria. Metals in surface water were found to be similar to background (upstream) metal concentrations. The only Site-related constituents detected in surface water samples were the compounds TCE and total 1,2-DCE (which includes cis-1,2-DCE and trans-1,2-DCE). No water quality criteria have been established for cis-1,2-DCE. The following remediation goals were established for surface water:

TCE	75 ug/l
Trans-1,2-DCE	310 ug/l

Sediment Remediation Goal

A sediment remediation goal for lead in Wheeling Creek sediment was developed using the document "Potential Biological Effects of Sediment Sorbed Contaminants Tested in the National Status and Trends Program" (U.S. National Ocean Service, Long and Morgan, 1990). In this report, sediment concentration guidelines were developed to assess the potential for adverse biological effects due to exposure of biota to toxicants in sediments. The effects range-low (ER-L) value was determined as the concentration equivalent to the lower 10 percentile of the available data in which effects were detected. The ER-L value of 35 mg/kg for lead represents an approximation of the concentration at which adverse effects would be first detected. The remediation goal for lead in Wheeling Creek sediment was established at 35 mg/kg.

5.0 SUMMARY OF REMEDIAL ALTERNATIVES

Provided below is a brief description of the alternatives which were evaluated in detail in the Feasibility Study (FS). More information regarding all the alternatives can be found in the FS.

5.1 No Further Action Alternative

The No Further Action alternative provides no further remedial action beyond continuing existing site activities and maintaining current conditions. This alternative provides a basis for comparison with other alternatives.

This alternative includes:

- Monthly Site visits with periodic sampling of surface and ground water, and maintenance of the existing Site fencing and current deed restrictions.
- Operation and maintenance of the existing DNAPL recovery system. The DNAPL recovery system, which was installed in 1992, consists of two DNAPL product recovery wells and associated equipment. Over 250 gallons of DNAPL have been removed thus far, with current removal rates averaging about 0.5 gal/month.

Each component of the No Further Action alternative will be included as part of all other alternatives.

5.2 Limited Action Alternative

This alternative includes:

- The components contained in the No Further Action Alternative (monthly Site visits, periodic sampling, maintenance of the current deed restrictions and Site fencing (installed in 1996), and maintenance of the existing DNAPL recovery system).
- Installing two additional DNAPL recovery wells.
- Pumping of ground water in the DNAPL source area to minimize the contribution of TCE to the aqueous phase plume, and to help hydraulically contain and stabilize the DNAPL source.
- Extraction and treatment of the aqueous phase (dissolved) ground water plume outside of the source area with a series of wells located downgradient of the DNAPL source area.

5.3 RCRA Cap with Components of the Limited Action Alternative Plus a Slurry Wall or Grout Curtain

This alternative includes:

- The components of the No Further Action Alternative (monthly Site visits, periodic sampling, maintenance of the current deed restrictions and Site fencing (installed in 1996), and maintenance of the existing DNAPL recovery system).

- Most of the components of the Limited Action Alternative (includes installing two additional DNAPL recovery wells and extraction and treatment of the dissolved phase ground water outside of the source area). No pumping of ground water in the DNAPL source area would occur.

- A RCRA cap installed over those areas of the Site where VOC soil contamination exceeds the Preliminary Remediation Goal that is protective of ground water, or metal contaminated areas which exceed PRGs. This results in a capped area of about 6.6 acres. About 0.6 acres of the capped area would be located on paved areas.

- Physical containment of the DNAPL source area utilizing a combination slurry wall and grout curtain installed downgradient from the area containing DNAPL. The slurry wall would be located from the ground surface to approximately 18 feet below ground surface. The grout curtain would be installed in the fractured bedrock beneath the slurry wall, from approximately 18 feet to 45 feet below ground surface.

5.4 Industrial Land Use with the Limited Action Alternative and Capping

This alternative includes:

- The components of the No Further Action Alternative (monthly Site visits, periodic sampling, maintenance of the current deed restrictions and Site fencing (installed in 1996), and maintenance of the existing DNAPL recovery system).

- The components of Limited Action Alternative (pumping of ground water in the DNAPL source area, installation of two additional DNAPL recovery wells, and extraction and treatment of the dissolved phase ground water outside of the source area).

- A RCRA cap - The RCRA cap(s) will be installed over those areas where the contaminant concentrations exceed industrial Preliminary Remediation Goals for lead and arsenic in soil. The metals areas for an industrial scenario include six separate areas with total surface area of approximately 27,000 feet squared (ft^2). The two largest areas are located along the walkway and former trench area.

5.5 Soil Flushing with the Limited Action Alternative, plus Capping for the Industrial Scenario, or Excavation, Stabilization/Solidification and Off-Site Disposal of Soil for the Residential Scenario

This alternative includes:

- The components of the No Further Action Alternative (monthly Site visits, periodic sampling, maintenance of the current deed restrictions and Site fencing (installed in 1996), and maintenance of the existing DNAPL recovery system).

- The components of Limited Action Alternative (pumping of ground water in the DNAPL source area, installation of two additional DNAPL recovery wells, and extraction and treatment of the dissolved phase ground water outside of the source area).

- Soil flushing of volatiles - Active soil flushing will be used to treat soils outside the Manufacturing Facility building area with TCE concentrations greater than 10,000 micrograms/kilogram (μg/kg) that do not contain lead or arsenic above Preliminary Remediation Goals (either residential or industrial). Passive soil flushing will be used in areas with TCE concentrations less than 10,000 μg/kg that do not contain lead or arsenic above Preliminary Remediation Goals (either residential or industrial).

- For the residential scenario, excavation and stabilization/solidification with off-site disposal of soils which exceed residential Preliminary Remediation Goals for lead and arsenic in soil (approximately 7,700 cubic yards (cy)). Some or all of this soil may require treatment for VOCs using Low Temperature Thermal Desorption or similar treatment before off-site disposal. For the industrial scenario, a RCRA cap would be installed over areas which exceed industrial Preliminary Remediation Goals for lead and arsenic in soil.

5.6 Soil Vapor Extraction with the Limited Action Alternative, plus Capping for the Industrial Scenario, or Excavation, Stabilization/Solidification and Off-Site Disposal of Soil for the Residential Scenario

This alternative includes:

- The components of the No Further Action Alternative (monthly Site visits, periodic sampling, maintenance of the current deed restrictions and Site fencing (installed in 1996), and maintenance of the existing DNAPL recovery system).

- The components of Limited Action Alternative (pumping of ground water in the DNAPL source area, installation of two additional DNAPL recovery wells, and extraction and treatment of the dissolved phase ground water outside of the source area).

- Soil vapor extraction of soils contaminated with TCE above the Preliminary Remediation Goal that is protective of ground water (approximately 66,300 cy) .

- For the residential scenario, excavation and stabilization/solidification with off-site disposal of soils which exceed residential Preliminary Remediation Goals for lead and arsenic in soil (approximately 7,700 cy). Some or all of this soil may require treatment for VOCs using Low Temperature Thermal Desorption or similar treatment before off-site disposal. For the industrial scenario, a RCRA cap over areas which exceed industrial Preliminary Remediation Goals for lead and arsenic in soil.

5.7 Partial Soil Excavation with Low Temperature Thermal Desorption, with the Limited Action Alternative, plus Stabilization/Solidification and Off-Site Disposal of Soil

Low Temperature Thermal Desorption (LTTD) is a technology which involves heating excavated soil in treatment equipment to temperatures ranging from 200 to 600 degrees to volatilize water and organic contaminants. The system can be designed to concentrate the contaminants for reuse or disposal, or the contaminants can be destroyed using an afterburner. High destruction and removal efficiencies are reported for this treatment. This treatment is not effective for metals.

This alternative includes:

- The components of the No Further Action Alternative (monthly Site visits, periodic sampling, maintenance of the current deed restrictions and Site fencing (installed in 1996), and maintenance of the existing DNAPL recovery system).

- The components of Limited Action Alternative (pumping of ground water in the DNAPL source area, installation of two additional DNAPL recovery wells, and extraction and treatment of the dissolved phase ground water outside of the source area).

- Treatment of soil using LTTD - Approximately 66,300 cubic yards of soil contaminated with TCE would be excavated and treated with LTTD. LTTD would be expected to remediate treated soils to non-detectable levels of TCE (and other volatiles), allowing most of the treated soils to be backfilled on-site.

- Following treatment of soil with LTTD, for a residential scenario, about 7,700 cy of soil which exceed residential PRGs for lead and arsenic in soil would be stabilized/solidified and disposed off-site. For an industrial scenario, about 3,400 cy of soil which exceed industrial PRGs for lead and arsenic in soil would stabilized/solidified and disposed off-site.

5.8 Phytoremediation with Components of the Limited Action Alternative, plus Excavation Stabilization/Solidification and Off-Site Disposal of Soil

Phytoremediation is the use of vegetation (e.g., plants or trees) for remediation of contaminated soils and ground water. Plants may use several processes when remediating soil and ground water such as adsorption or immobilization of metal contaminants in soil, or breakdown of contaminants through plant metabolic processes and uptake and transpiration of contaminants.

This alternative includes:

- The components of the No Further Action Alternative (monthly Site visits, periodic sampling, maintenance of the current deed restrictions and Site fencing (installed in 1996), and maintenance of the existing DNAPL recovery system).
- Components of Limited Action Alternative (pumping of ground water in the DNAPL source area and installation of two additional DNAPL recovery wells).
- Phytoremediation of the aqueous (dissolved) phase plume outside of the source area, utilizing hybrid poplar trees to be planted on approximately 2.8 acres of the Site (Figure 4). An area of the Site (approximately 1.9 acres) adjacent to the proposed planted area, is already densely vegetated with trees and no additional tree planting is anticipated in that section.
- Soil excavation and treatment - Soil which is contaminated with lead above an industrial PRG and arsenic above a background concentration within the upper two feet of soil (approximately 2,200 cy) will be excavated, treated on-Site by stabilization/solidification and disposed off-site. Treatment of this soil before disposal, using an appropriate VOC reduction technology (e.g., LTTD), may be necessary to meet disposal restrictions. The top six inches of soil in the former sprayfield area will also be excavated to address an area visibly impacted by metal plating sludges. Most of the excavated areas are in locations of the Site that will be planted with hybrid poplar trees as part of the phytoremediation remedy.

6.0 COMPARISON AND EVALUATION OF ALTERNATIVES

In selecting the remedy for this Site, Ohio EPA considered the following eight criteria as outlined under U.S. EPA's National Contingency Plan (NCP) promulgated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 40 CFR 300.430:

1. **Overall protection of human health and the environment** addresses whether a remedy provides adequate protection, and describes how risks are eliminated, reduced or controlled through treatment, engineering controls, and/or institutional controls.

2. **Compliance with all State, Federal and Local laws and regulations** addresses whether a remedy will meet all of the applicable, or relevant and appropriate State, Federal, and Local environmental statutes and regulations.

3. **Long-term effectiveness and permanence** refers to the ability of a remedy to maintain reliable protection of human health and the environment over time.

4. **Reduction of toxicity, mobility, or volume through treatment** is the anticipated performance of the treatment technologies to yield a permanent solution. This includes the ability of the selected alternative to reduce toxic characteristics, remove

contaminants, and/or decrease the ability of the contaminants to migrate through the environment through treatment.

5. **Short-term effectiveness** involves the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period.

6. **Implementability** is the technical and administrative feasibility of a remedy, including the availability of goods and services needed to implement the chosen solution. This criteria refers to the ease or difficulty of implementing the alternative.

7. **Cost** includes capital and operation and maintenance costs.

8. **Community acceptance** will be assessed following review and consideration of any public comments received on the Preferred Plan.

The eight criteria are categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The first two criteria, overall protection of human health and the environment and compliance with ARARs, are the threshold criteria that must be satisfied in order for an alternative to be eligible for selection as the preferred remedial alternative. Criteria three through seven are the primary balancing criteria that are used to weigh major trade-offs among alternatives. Community acceptance is the modifying criterion that is taken into account after public comment is received on the Preferred Plan. The sections below discuss how each of the evaluation criteria is applied to each of the Remedial Alternatives found in Section 5.0, and compares how the alternatives achieve the criteria.

6.1 Overall Protection of Human Health and the Environment

The No Further Action Alternative provides no further remedial action beyond continuing existing site activities and maintaining current conditions. This alternative would not address soils contaminated at a level above Preliminary Remediation Goals (PRGs), or prevent risks associated with site soils. Contaminated ground water is only addressed through prohibition of use (by continuation of current deed restrictions). This alternative does not reduce VOC contaminated ground water discharge to Wheeling Creek. This alternative would not provide overall protection of human health and the environment, and is not considered further as a stand-alone alternative. The Limited Action Alternative would not address soils contaminated at a level above PRGs, or prevent risks associated with site soils. Accordingly, this alternative would not provide overall protection of human health and the environment, and is not considered further as a stand-alone alternative. All other alternatives appear to provide overall protection of human health and the environment.

6.2 Compliance with State, Federal and Local Laws and Regulations

Remedial actions at the Site must comply with Federal, State, and Local laws and regulations. Examples of these include, but are not limited to, the Clean Air Act, the Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Water Act, the Resource Conservation and Recovery Act (RCRA), the Ohio Revised Code (ORC), and the Ohio Administrative Code (OAC). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that remedial actions meet legally applicable or relevant and appropriate requirements (ARARs) of other environmental laws. It is expected that all alternatives would comply with identified chemical, action, and location-specific ARARs. Some alternatives may call for special engineering to meet requirements (e.g., alternatives utilizing caps), and in some cases, a waiver from specific state regulatory requirements may be requested.

6.3 Long-Term Effectiveness and Permanence

All alternatives utilize additional recovery wells to remove DNAPL, and all alternatives will require long-term operation of the DNAPL recovery system. All alternatives, except the RCRA Cap Alternative, also utilize long-term hydraulic containment of the DNAPL zone by pumping ground water from the source area. This pumping will minimize the contribution of TCE to the aqueous phase plume. The RCRA Cap Alternative utilizes a grout curtain/slurry wall to physically contain the DNAPL source. The degree of effectiveness of the grout curtain/slurry wall would be difficult to determine until the system was installed.

The majority of site risk results from potential exposure to ground water, and all alternatives maintain deed restrictions that prohibit residential development and ground water use at the site. All alternatives (except the Phytoremediation Alternative) incorporate ground water extraction and treatment of the aqueous (dissolved) phase ground water plume. The effective long-term operation of any ground water extraction system is dependent on periodic and thorough maintenance procedures. The Phytoremediation Alternative utilizes trees to produce a hydrologic sink (extraction) similar to that created by a conventional pump and treat system. Although short-term care may be increased, once established, trees would likely require less long-term maintenance with a greater degree of permanence than a pump and treat system. As trees develop, ground water treatment effectiveness would improve. All alternatives would limit ground water TCE plume discharge to Wheeling Creek over the long-term. Even with partial DNAPL source removal and extraction of DNAPL source area ground water, all alternatives would require a very long time to attain ground water remediation goals outside of the DNAPL source area.

For soils, the alternative incorporating Partial Soil Excavation with LTTD involves significant VOC soil treatment followed by onsite backfilling of the treated soil. However, the backfilled soil may be re-contaminated by high levels of VOCs remaining in ground water and the DNAPL source area, which would significantly reduce the long-term effectiveness and permanence of the alternative. The Phytoremediation Alternative and the residential scenario under the Soil Flushing and Soil Vapor Extraction Alternatives provide similar long-term effectiveness and permanence by treating metal contaminated soil with stabilization/solidification followed by off-site disposal. Because of the many variables involved with phytoremediation, quantifying the potential mass of VOC soil removal by the Phytoremediation Alternative is difficult, although long-term VOC reductions in soil are expected. The industrial scenarios under the Soil Flushing and Soil Vapor Extraction Alternatives provide treatment of VOC contaminated soil, but no treatment of metal contaminated soils, only capping. The RCRA Cap and Industrial Land Use Alternatives utilize an engineered cap over portions of the site to prevent soil exposure. Leaching potential of soils is reduced with a cap, but no soil treatment is involved and caps are not considered as effective, in the long-term, or permanent as alternatives utilizing treatment. The long-term effectiveness and permanence of any alternative utilizing capping is highly dependent on proper long-term operation and maintenance.

6.4 Reduction of Toxicity, Mobility, or Volume through Treatment

All alternatives would reduce volume of the DNAPL source area by removing DNAPL through additional recovery wells. Recovered DNAPL will be recycled or treated as appropriate. All alternatives, except the RCRA Cap Alternative, will remove highly contaminated ground water from the DNAPL source area. This extracted ground water will be treated onsite, and would reduce the mobility and volume of the DNAPL source. The RCRA Cap Alternative utilizes a grout curtain/slurry wall to physically contain the DNAPL source, which provides no reduction in toxicity, mobility, or volume of the source through treatment.

All alternatives maintain deed restrictions that prohibit residential development and ground water use at the site. Institutional controls (deed restrictions) provide no reduction in toxicity, mobility, or volume of the source through treatment. All alternatives (except the Phytoremediation Alternative) incorporate ground water extraction and treatment of the aqueous (dissolved) phase ground water plume. This action would reduce the mobility and volume of the plume through treatment. The Phytoremediation Alternative utilizes trees to extract contaminated ground water similar to a conventional pump and treat system, and would reduce the mobility and volume of the contaminated plume through treatment. All alternatives would limit ground water TCE plume discharge to Wheeling Creek over the long-term.

For soils, the alternatives utilizing Partial Soil Excavation with LTTD, Phytoremediation, and the residential scenario under the Soil Flushing and Soil Vapor Extraction Alternatives would treat metal contaminated soil with stabilization/solidification followed by off-site disposal. The above alternatives would also treat VOC contaminated soils. Although long-term VOC reductions in soil are expected with the Phytoremediation Alternative, quantifying the potential mass of VOC soil removal is difficult because of the variables involved. The industrial scenarios under the Soil Flushing and Soil Vapor Extraction Alternatives provide treatment of VOC contaminated soil, but no treatment of metal contaminated soils, only capping.

The RCRA Cap and Industrial Land Use Alternatives utilize an engineered cap over portions of the site to prevent soil exposure. A properly constructed cap attempts to isolate the site, or specific areas of the site, so that rainwater infiltration is minimized and compounds of concern are immobilized within. Constructed caps control exposure to contaminants but provide no reduction in toxicity, mobility, or volume of contaminated soil through treatment; contaminated soils remain onsite.

6.5 Short-term Effectiveness

Most portions of the alternatives could be installed in one year or less. All alternatives, except the RCRA Cap Alternative, utilize pumping of ground water from the DNAPL source area. This pumping will quickly begin to isolate the DNAPL source area and minimize the contribution of TCE to the aqueous phase plume. Treatment of extracted ground water will require specifically designed pollution controls to manage VOC releases, along with monitoring. The RCRA Cap Alternative utilizes a grout curtain/slurry wall to physically contain the DNAPL source. Installation of the grout curtain/slurry wall could be relatively quick but the degree of short-term effectiveness would be difficult to determine until the system was installed.

All alternatives, except the Phytoremediation Alternative, incorporate ground water extraction and treatment of the aqueous (dissolved) phase ground water plume, which could quickly begin to remove and contain the plume. Treatment of extracted ground water will require specifically designed pollution controls to manage VOC releases and discharges, along with monitoring. The Phytoremediation Alternative utilizes trees to extract and treat contaminated ground water similar to a conventional pump and treat system, and establishment of the trees generally requires about 2 years before treatment becomes significant.

All alternatives require some amount of soil excavation and/or cap construction. Earth moving or excavation may increase the potential for airborne contaminant release or exposure to workers or off-Site receptors. Generally, the more excavation involved, the more potential for exposure, and the alternative utilizing Partial Soil Excavation with LTTD would have the largest potential for short term exposure. All short term exposure potentials are managed with an effective, site specific health and safety plan developed during Remedial Design.

6.6 Implementability

The alternatives incorporate technologies that are readily implemented, although some may require special engineering, treatability testing during Remedial Design, and other site specific considerations. Because of findings in the FS report, additional DNAPL recovery will be pursued through installation of vertical wells, which are easily implemented, unless an effective DNAPL recovery technology becomes apparent during Remedial Design.

6.7 Cost Summary

Alternative	Capital Cost[3]	Annual O&M[4]	Total Present Worth[5]
No Further Action	0	85,000	1,000,000
Limited Action Alternative	1,000,000	150,000	2,700,000
RCRA Cap with Components of the Limited Action Alternative plus a Slurry Wall/ Grout Curtain	3,900,000	170,000	5,800,000
Industrial Land Use with the Limited Action Alternative and Capping	1,400,000	150,000	3,100,000
Soil Flushing with the Limited Action Alternative, plus Capping for the Industrial Scenario, or Excavation, Stabilization/Solidification and Off-Site Disposal of Soil for the Residential Scenario			
residential	6,200,000	150,000	7,900,000
industrial	1,900,000	150,000	3,600,000

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[3] Direct capital costs include equipment, labor, and materials necessary for the installation or construction of the remedial alternative, including disposal costs and overhead.

[4] Annual Operation and Maintenance costs are those post-constructive yearly costs necessary to ensure continued effectiveness of the remedial alternative.

[5] The present worth is determined by multiplying the operating cost by a discount factor (8% annual interest rate for 30 years) and adding the capital costs.

Alternative		Capital Cost	Annual O&M	Total Present Worth
Soil Vapor Extraction with the Limited Action Alternative, plus Capping for the Industrial Scenario, or Excavation, Stabilization/Solidification and Off-Site Disposal of Soil for the Residential Scenario				
	residential	9,500,000	500,000(0-10yrs) 150,000(10-30yrs)	13,500,000
	industrial	5,200,000	500,000(0-10yrs) 150,000(10-30yrs)	9,200,000
Partial Soil Excavation with LTTD with the Limited Action Alternative, plus Excavation, Stabilization/Solidification and Off-Site Disposal of Soil for the Industrial and Residential Scenarios				
	residential	16,300,000	150,000	18,000,000
	industrial	15,000,000	150,000	16,700,000
Phytoremediation with Components of the Limited Action Alternative plus Excavation, Stabilization/Solidification and Off-Site Disposal of Soil				
		2,588,000	101,000	3,602,000

6.8 Community Acceptance

The Ohio EPA received comments from interested parties during the public comment period which ended on January 26, 2001, and at the public meeting conducted on January 17 at the Village of Bridgeport Council Chambers. The only oral and written comments received were from Gould Electronics. The comments and Ohio EPA responses are included in the Responsiveness Summary. No substantial public comment was received and the remedy selected in this Decision Document is essentially the same as presented in the Preferred Plan.

7.0 OHIO EPA'S SELECTED REMEDY

Discussion

Restoration of contaminated ground water is one of the primary objectives of site cleanup, and as stated in the National Contingency Plan, usable ground waters are expected to be returned to their beneficial uses wherever practicable. However, experience has shown that restoration to drinking water quality may not always be achievable at certain sites, or portions of sites, due to hydrogeologic limitations such as complex bedrock, contaminant-related factors such as the presence of Dense Non Aqueous Phase Liquid (DNAPL), and limitations of available remediation technologies. The Former Gould Manufacturing Facility Site possesses these limitations to various degrees.

Most of the TCE mass present at the Site is free phase DNAPL, with lesser amounts of TCE found in soil and even less dissolved in ground water. It is believed that over 2,000 gallons of DNAPL currently exists at the Site. It is also acknowledged that DNAPL recovery from the Site has been difficult, but even partial removal of the contaminant source can greatly reduce the long-term reliance on both active and passive ground water remediation.

Where long-term sources of contamination (the DNAPL) are adequately contained, restoration of the aqueous plume outside the DNAPL zone to required cleanup levels is expected. The FS report concluded that the DNAPL has reached equilibrium and downgradient movement has slowed or stopped. This factor, combined with free phase DNAPL removal, and extraction and treatment of source area ground water, will promote remediation of the aqueous phase ground water plume outside of the source area.

The selected remedy has been developed considering the following ground water performance standards:

- prevention of exposure to contaminated ground water through use of institutional controls (deed restrictions);
- removal of the DNAPL source area to the extent practicable;
- extraction and treatment of source area ground water to minimize contribution of TCE to the aqueous phase plume;
- attainment of ground water remediation goals (MCLs) in the portion of the aqueous phase plume outside of the DNAPL area, as a long-term goal.

The Selected Remedy

Ohio EPA's selected remedy for the Site is outlined below. This remedy provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. The remedy satisfies the two threshold criteria (overall protection of human health and the environment, and compliance with all State, Federal, and Local laws and regulations), provides a permanent solution to the contamination problem at the Site and reduces the toxicity, mobility, and volume of contaminants through treatment. In addition, the remedy provides short-term effectiveness, is readily implementable, and utilizes innovative technology. Because complete DNAPL source removal is not currently technically feasible, attainment of ground water cleanup goals in the aqueous phase plume will take a long time to reach. Therefore, use of phytoremediation (an innovative technology), combined with free phase DNAPL removal, and extraction and treatment of source area ground water is a cost effective, permanent, and long-term solution to the ground water concerns at the Site.

The **Selected Remedy** includes the following:

- Maintenance of current property deed restrictions. The deed places restrictions on any residential use of the property including use of the property for any school, day-care center or playground use. The deed also restricts any non-residential use of the property where it would be reasonable to expect that adults or children would be exposed to Site soil or groundwater, and further restricts the development, operation or use of any well for potable use on or within the property. Site fencing which was installed in 1996 will also be maintained and inspected periodically.

- Removal of free product TCE (DNAPL) to the extent practicable, by enhancing the current product recovery wells and/or installation of additional vertical product recovery wells, unless an effective alternative DNAPL recovery technology becomes apparent during Remedial Design.

- Extraction and treatment of source area ground water using pumping wells. This action will minimize the contribution of TCE to the aqueous phase plume and help stabilize the DNAPL source area.

- Phytoremediation of VOCs in soil and ground water outside of the source area, utilizing hybrid poplar trees to be planted on approximately 2.8 acres of the Site (Figure 4). Planting strategies (hybrid types, tree densities, etc.,) will be determined during Remedial Design. An area of the Site (approximately 1.9 acres) adjacent to the proposed planted area, is already densely vegetated with trees and no additional tree planting is anticipated in that section (Figure 4).

- Excavation of Site soil which exceeds lead and arsenic remediation goals within the upper two feet of soil (Figures 1 and 2). Excavated areas will be sampled to confirm attainment of remedial goals. This soil will be treated on-Site by stabilization/solidification and disposed off-Site. Disposal of soil containing VOCs will be in accordance with all applicable laws and regulations. The top six inches of soil in the former sprayfield area will also be excavated to address an area visibly impacted by metal plating sludges. Most of the excavated areas are in locations of the Site that will be planted with hybrid poplar trees as part of the phytoremediation remedy.

- Periodic monitoring of ground water, surface water, and sediment will be conducted to assess progress towards meeting remediation goals, and to measure the effectiveness of phytoremediation. Performance monitoring plans and criteria will be developed during Remedial Design. Ohio EPA will regularly review the effectiveness of the selected remedy. Other remedial alternatives evaluated in the Preferred Plan may be considered if the chosen remedy fails to demonstrate satisfactory progress towards meeting cleanup goals.

The costs for the selected remedy is estimated as follows:

- Capital Cost - $2,588,000
- Annual O&M Cost - $101,000
- Total Present Worth - $3,602,000

Remediation Goals (Cleanup Levels)

Soil (milligrams/kilogram, mg/kg)

Lead[1]	2000 average, maximum of 4,500
Arsenic[2]	18.1

1- Based on modeling
2- Background concentration

Ground Water (milligrams/liter, mg/l)[1]

1,1,2-Trichloroethane (1,1,2-TCA)	0.005
cis-1,2-Dichloroethylene (cis-1,2-DCE)	0.070
trans-1,2-Dichloroethylene (trans-1,2-DCE)	0.100
Trichloroethylene (TCE)	0.005

1- Ground water remediation goals are the Maximum Contaminant Levels (MCLs). MCLs are standards promulgated under the Federal Safe Drinking Water Act establishing a maximum allowable concentration of a contaminant in drinking water.

Wheeling Creek Surface Water (micrograms/liter, ug/l)[1]

TCE	75
trans -1,2-DCE	310

1- Ohio EPA Water Quality Criteria

Wheeling Creek Sediment (milligrams/kilogram, mg/kg)[1]

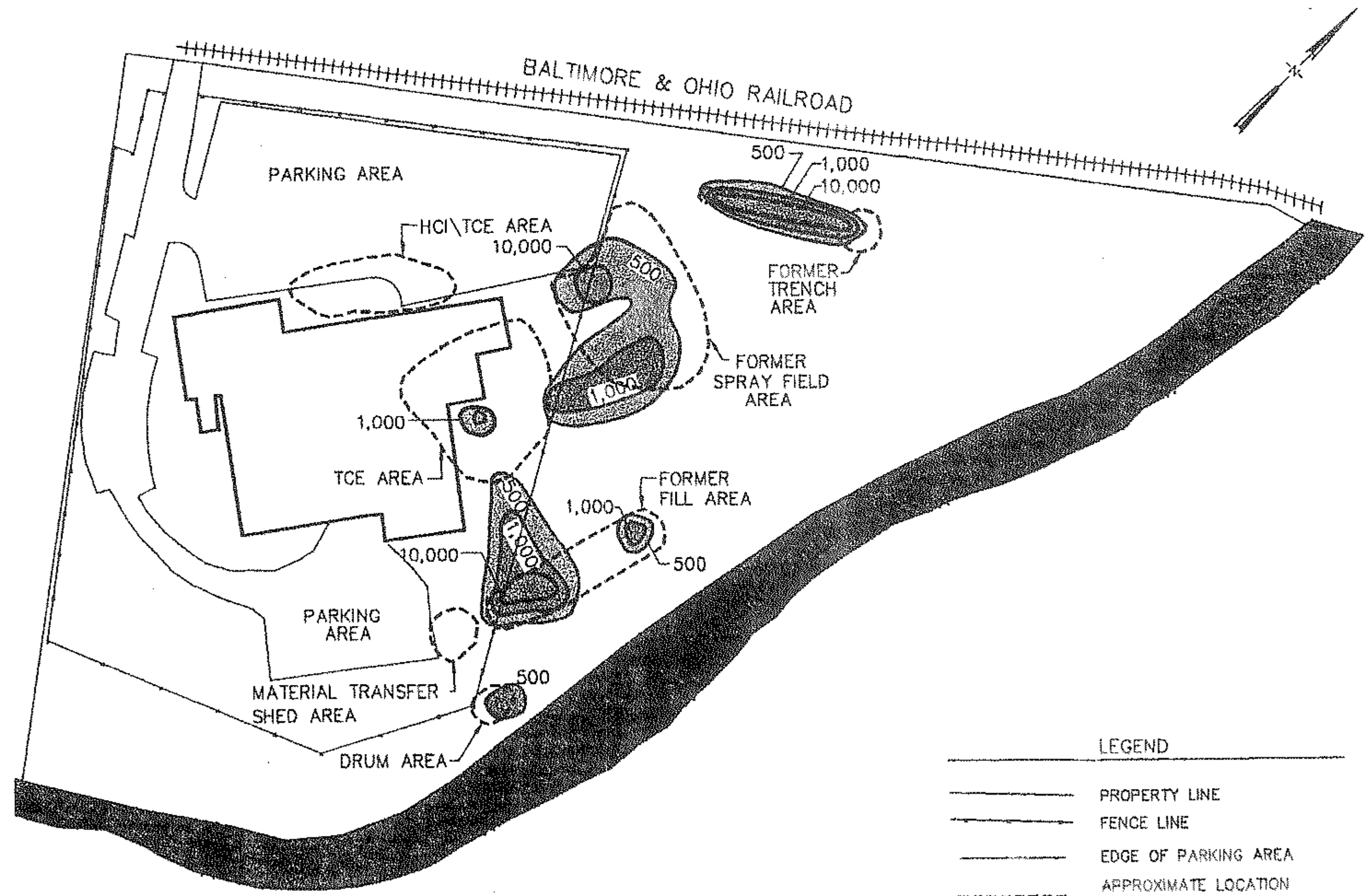
Lead	35

1-This is the effects range-low (ER-L) value from U.S. National Ocean Service, Long and Morgan, 1990. The ER-L value represents the concentration at which adverse biological effects would be first detected due to exposure of biota to lead in sediments.

Figures

LEAD IN SOIL - ISOPLETH DRAWING (0' - 2')

Figure 1



BASE MAP SOURCE: CLAYTON ENVIRONMENTAL CONSULTANTS, APRIL 29, 1987, AND M.A.N. MAPPING SERVICE, INC., AERIAL PHOTO APRIL 5, 1988.

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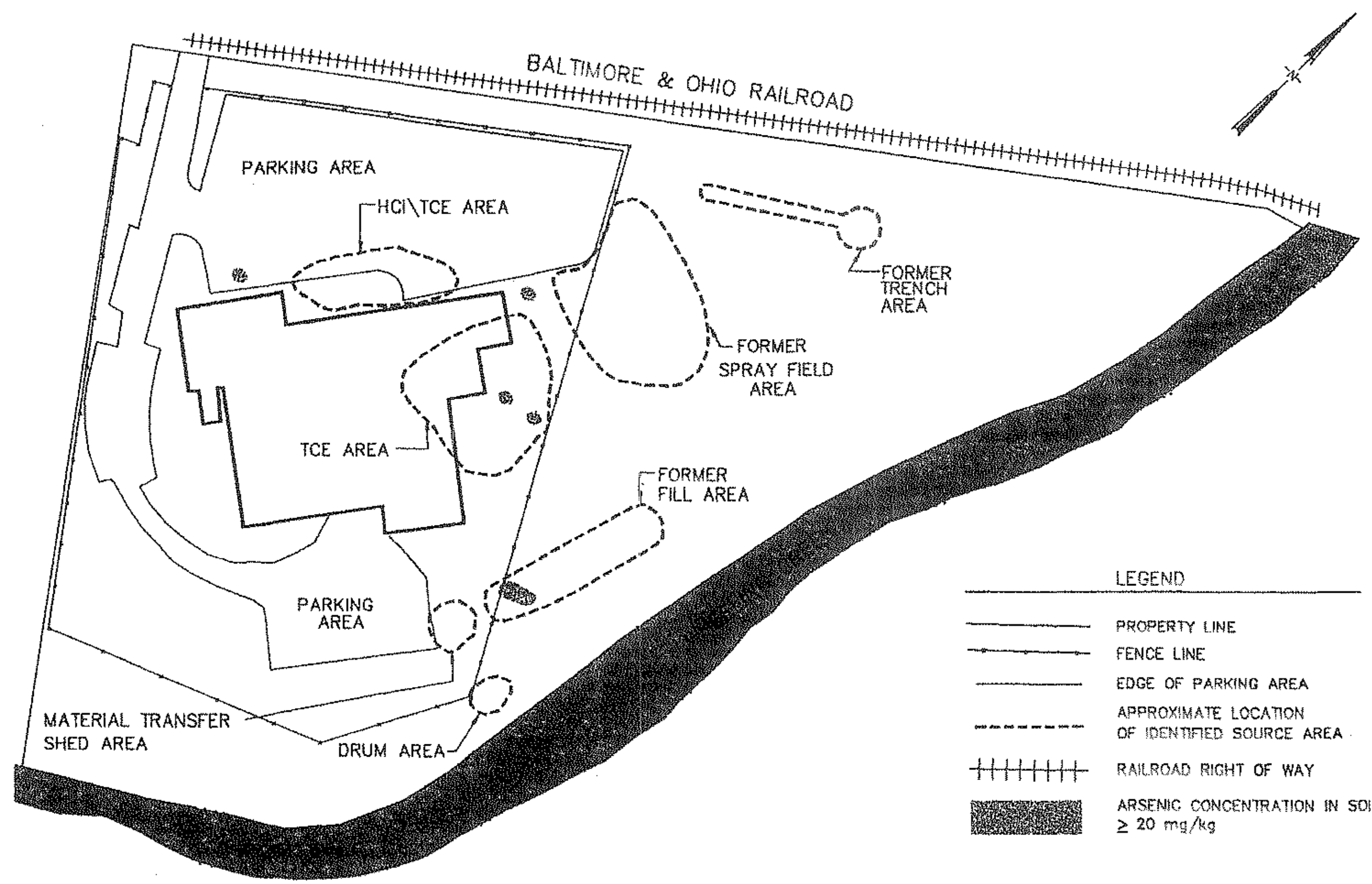
ARSENIC IN SOIL - ISOPLETH DRAWING (0' - 2')

Figure 2



BASE MAP SOURCE: CLAYTON ENVIRONMENTAL CONSULTANTS, APRIL 29, 1987, AND M.A.N. MAPPING SERVICE, INC., AERIAL PHOTO APRIL 5, 1988.

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VOCs (PRIMARILY TCE) IN GROUNDWATER – ISOPLETH DRAWING OF SHALLOW BEDROCK UNIT

NOTES

- BEDROCK LOCATED ABOUT 20 FEET BENEATH THE GROUND SURFACE.
- TOP 5 FEET OF BEDROCK HIGHLY FRACTURED–LESS FRACTURES WITH DEPTH
- FREE PHASE DNAPL RESIDES WITHIN FRACTURED BEDROCK
- RESIDUAL DNAPL RESIDES PRIMARILY IN FRACTURED BEDROCK. BEDROCK FRACTURES GREATLY REDUCED AT ~ 40 FEET (VERY COMPETENT)
- 10,000 μg/kg VOCs CORRESPONDS TO ESTIMATED LIMIT OF DNAPL AREA
- VOCs IN BEDROCK HAVE HIGHER CONCENTRATIONS THAN IN ALLUVIAL AQUIFER

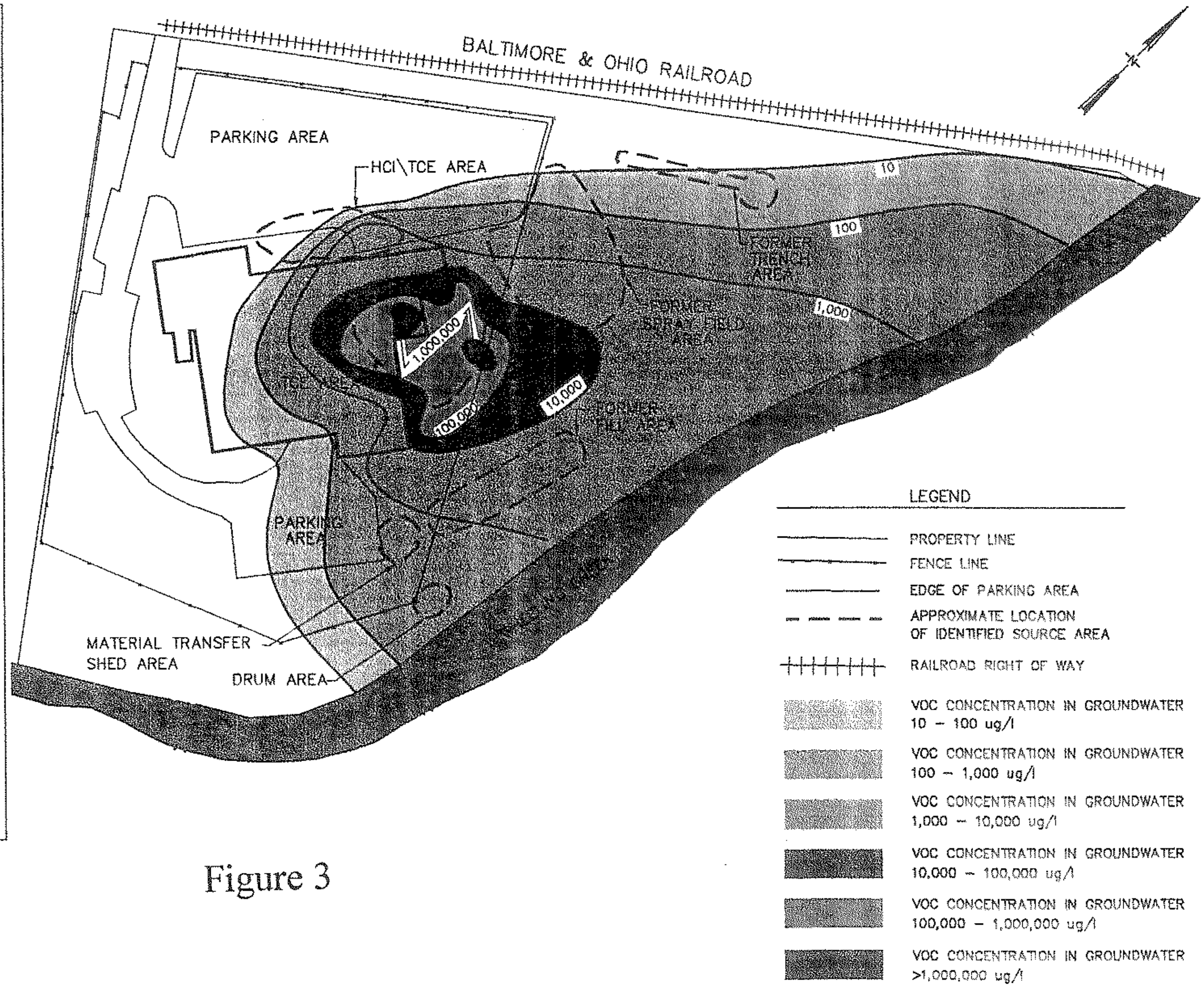

Figure 3

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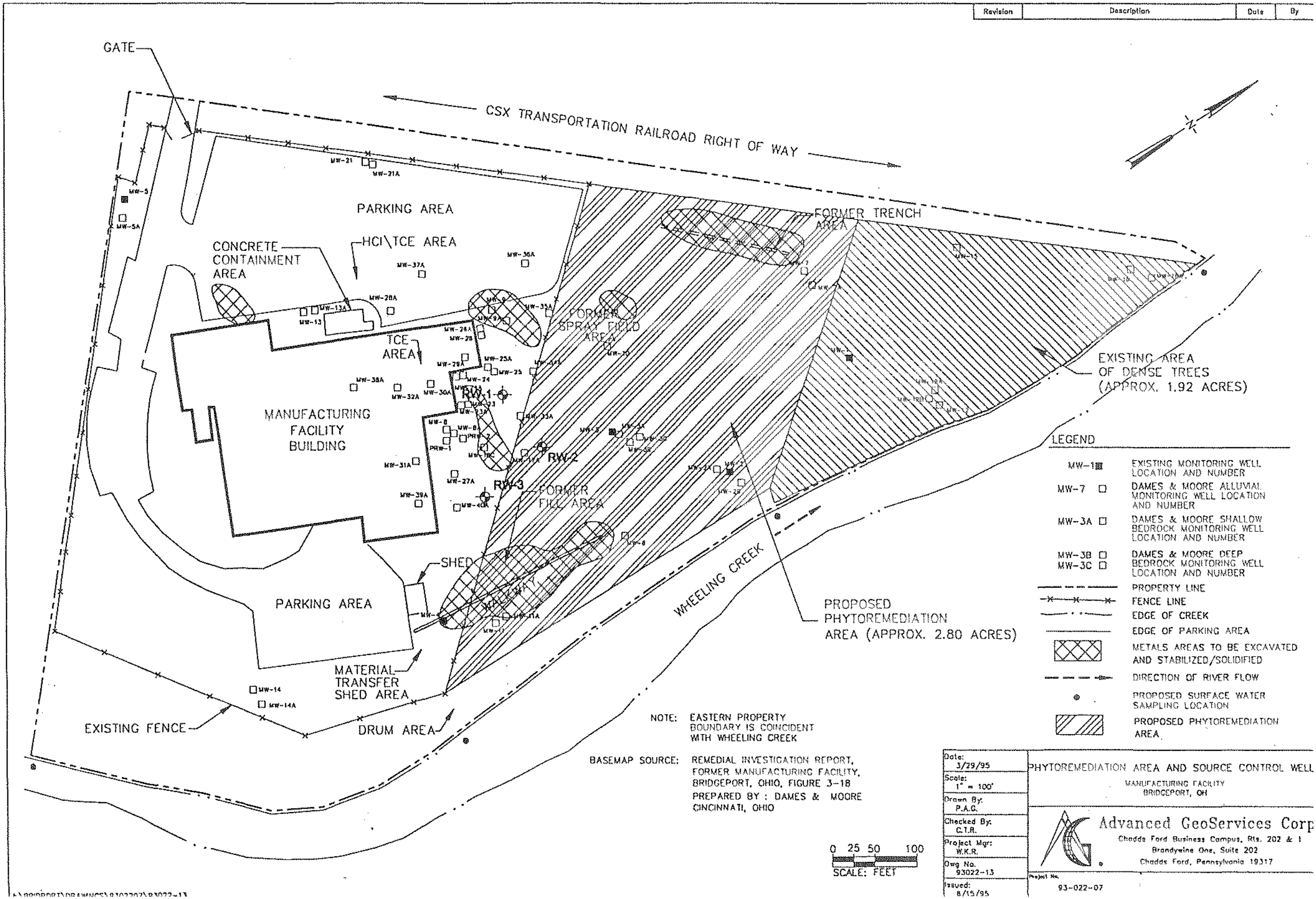
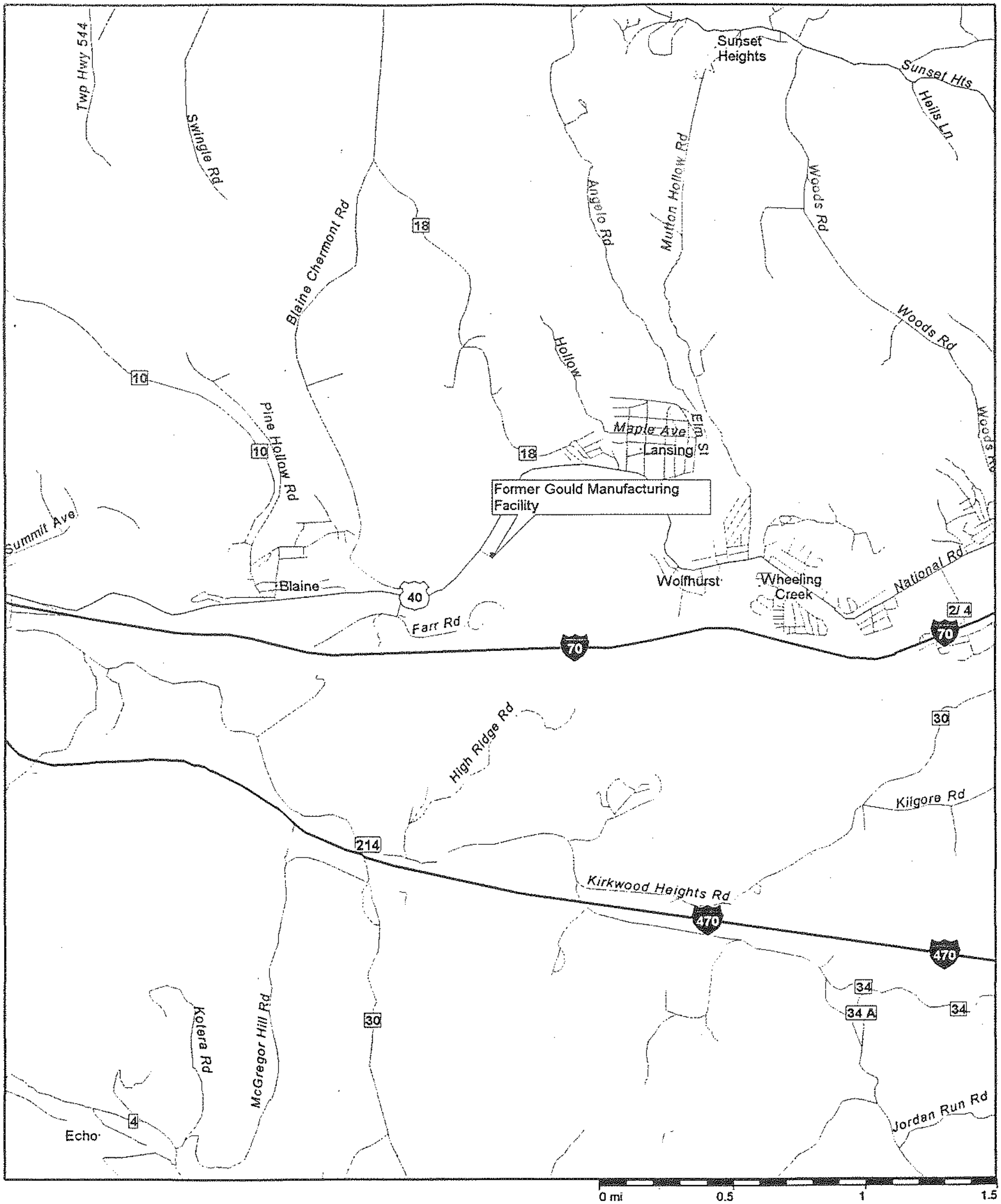
Figure 4


Revision
Description
Date
By
GATE
CSX TRANSPORTATION RAILROAD RIGHT OF WAY
PARKING AREA
CONCRETE CONTAINMENT AREA
HCI\TCE AREA
TCE AREA
MANUFACTURING FACILITY BUILDING
FORMER SPRAY FIELD AREA
FORMER TRENCH AREA
FORMER FILL AREA
RW-1
RW-2
RW-3
SHED
PARKING AREA
MATERIAL TRANSFER SHED AREA
EXISTING FENCE
DRUM AREA
WHEELING CREEK
EXISTING AREA OF DENSE TREES (APPROX. 1.92 ACRES)
PROPOSED PHYTOREMEDIATION AREA (APPROX. 2.80 ACRES)
LEGEND
MW-1 EXISTING MONITORING WELL LOCATION AND NUMBER
MW-7 DAMES & MOORE ALLUVIAL MONITORING WELL LOCATION AND NUMBER
MW-3A DAMES & MOORE SHALLOW BEDROCK MONITORING WELL LOCATION AND NUMBER
MW-3B MW-3C DAMES & MOORE DEEP BEDROCK MONITORING WELL LOCATION AND NUMBER
PROPERTY LINE
FENCE LINE
EDGE OF CREEK
EDGE OF PARKING AREA
METALS AREAS TO BE EXCAVATED AND STABILIZED/SOLIDIFIED
DIRECTION OF RIVER FLOW
PROPOSED SURFACE WATER SAMPLING LOCATION
PROPOSED PHYTOREMEDIATION AREA
NOTE: EASTERN PROPERTY BOUNDARY IS COINCIDENT WITH WHEELING CREEK
BASEMAP SOURCE: REMEDIAL INVESTIGATION REPORT, FORMER MANUFACTURING FACILITY, BRIDGEPORT, OHIO, FIGURE 3-18
PREPARED BY : DAMES & MOORE CINCINNATI, OHIO
0 25 50 100
SCALE: FEET
Date: 3/29/95
Scale: 1" = 100'
Drawn By: P.A.G.
Checked By: C.T.R.
Project Mgr: W.K.R.
Dwg No. 93022-13
Issued: 8/15/95
PHYTOREMEDIATION AREA AND SOURCE CONTROL WELL
MANUFACTURING FACILITY BRIDGEPORT, OH
Advanced GeoServices Corp
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317
Project No. 93-022-07



Sunset Heights
Sunset Hts
Hells Ln
Twp Hwy 544
Swingle Rd
Angelo Rd
Mutton Hollow Rd
Woods Rd
Woods Rd
Woods Rd
18
Blaine Chermont Rd
Hollow
10
Pine Hollow Rd
10
Maple Ave
Elm St
Lansing
18
Former Gould Manufacturing Facility
Summit Ave
Blaine
40
Wolfhurst
Wheeling Creek
National Rd
2/ 4
70
Farr Rd
70
30
High Ridge Rd
Kilgore Rd
214
Kirkwood Heights Rd
470
470
34
34 A
34
Kotera Rd
McGregor Hill Rd
30
Jordan Run Rd
4
Echo
0 mi
0.5
1
1.5

Figure 5

Responsiveness Summary

for the
Former Gould Manufacturing Facility
Bridgeport, Ohio

Attachment to the Decision Summary

Responsiveness Summary

This responsiveness summary has been prepared to address written comments received within the public comment period, and oral comments submitted at the public hearing conducted on January 17, 2001, where the Preferred Plan was presented at the Village of Bridgeport Council Chambers. The only oral and written comments received were from Gould Electronics.

Oral comments received during the public hearing on January 17, 2001 from Jim Cronmiller with Gould Electronics (excerpt from transcript):

1. *Mr. Cronmiller: I wanted to say that we will be the responsible company who will work with Ohio EPA and implement the final remedy that is chosen. We feel that this remedy is a fair remedy and a reasonable remedy for the site, and we look forward to continuing our work with Ohio EPA at this site.*

Written comments received from Gould Electronics:

2. *Gould is in general agreement with the selected remedy for the Site, and assumes the remedy described in the Decision Document will be effectively the same as that which was presented in the Preferred Plan document. To the extent that Ohio EPA elects to consider any additional or more extensive remedial options than those presented in the Preferred Plan, Gould hereby requests notice of such changes and an opportunity to comment on the record.*

Ohio EPA Response:
After the public comment period, Ohio EPA will select a final cleanup alternative on the basis of analysis presented in the Preferred Plan and Remedial Investigation/Feasibility Study reports, comments received from the public, and any other new and significant information received or generated. The selected alternative is presented in the Decision Document. In this instance, the remedy selected in the Decision Document is substantially the same as presented in the Preferred Plan.

3. *Section 4.4.7 of the OEPA's Preferred Plan discusses the potential risks associated with the site. This section incorrectly presents the deed restriction as only prohibiting residential development of the property. In fact, two sets of deed restrictions have been placed on the property. The first Quitclaim Deed dated November 1994 and placed on the property by the owners, Sylvan and Rosalee*

Dlesk, contained covenants restricting the use of the property for any residential use whatsoever and the development of water for potable purposes. The second Quitclaim Deed was filed in response to the OEPA's concern that non-residential use involving children could still occur under the first set of restrictions. The second Quitclaim Deed, dated December 1996, supersedes the first and restricts the following:

- *Any residential use whatsoever;*
- *The use of the property for any school, day-care center or playground use whatsoever;*
- *Any non-residential use of the property where it would be reasonable to expect that adults or children would be exposed to the premises' soil or groundwater; and*
- *The development, operation or use of any well for potable use on or within the property.*

The difference between the two restrictions is significant. A copy of the expanded deed restriction was provided as Attachment 1 of AGC's January 7, 1997 Response to Comments Document.

Ohio EPA Response:
The Decision Document has been revised appropriately.

3. *The reference in Section 5.2.1 to the Bower's model incorrectly states the Bower's model result for non-pregnant industrial grounds workers as ranging between 7,600 or 20,100 mg/kg. The correct range is 7,600 to 21,000 mg/kg.*

Ohio EPA Response:
After reviewing the comment, Ohio EPA has determined that no correction is necessary.