DECISION DOCUMENT FOR THE REMEDIATION OF

Cooper Industries

Muskingum County, Ohio

prepared by

THE OHIO ENVIRONMENTAL PROTECTION AGENCY

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OhioEPA

State of Ohio
Environmental Protection Agency

Division of Emergency and Remedial Response

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Decision Document for the Remediation of Cooper Industries Muskingum County, Ohio

I certify this to be a true and accurate copy of the official documents filed in the records of the Ohio Environmental Protection Agency.
By [signature] Date 3-15-04

March 2004

Bob Taft, Governor
Christopher Jones, Director

DECLARATION

SITE NAME AND LOCATION

Cooper Industries
Zanesville, Ohio
Muskingum County

STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedial action for the Cooper Industries Site in Zanesville, Ohio, chosen in accordance with the policies of the Ohio Environmental Protection Agency, statutes and regulations of the State of Ohio, and the National Contingency Plan, 40 CFR Part 300.

ASSESSMENT OF THE SITE

Actual and threatened releases of industrial waste in the degreaser area, the waste storage area and the sump area resulting in contamination of the aquifer at the Site. If these releases are not addressed by implementing the remedial action selected in the Decision Document, the releases constitute a substantial threat to public health or safety and are causing or contributing to water pollution.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy includes: 1) ground water monitoring to evaluate the effectiveness of the enhanced bioremediation implemented as a pilot study, 2) a contingency for the application of additional bioremediation activities if previous bioremediation activities are not sufficiently decreasing contamination, 3) enforcement of existing deed restrictions and 4) recording a declaration of use restrictions to reduce or eliminate potential exposure to impacted ground water.

STATUTORY DETERMINATIONS

The selected remedial action is protective of human health and the environment, complies with legally applicable state and federal requirements, is responsive to public participation and input and is cost-effective. The remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable to reduce toxicity, mobility and volume of hazardous substances at the Site. The effectiveness of the remedy will be reviewed regularly.

Christopher Jones, Director

3-15-04
Date

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DECISION SUMMARY

for Cooper Industries
Muskingum County, Ohio

1.0 SITE BACKGROUND

1.1 Site History

The Site is located on Pershing Road in South Zanesville, Muskingum County, Ohio and includes but is not limited to Tract 1 and Tract 2 of the former Cooper Power Systems property (see Figures 1 and 2). The former Cooper Power Systems plant was situated on the property (Tract 1 and Tract 2) comprising approximately 13.72 acres of the Site. Cooper Industries razed the plant during the period from May 1992 through 1993. At the present time, the property is largely vacant with the ground surface almost entirely covered with concrete and asphalt-paved surfaces. The property is used for vehicle parking during the county fair for one week every August. There is a small horse corral on the southeast portion of Tract 1. A chain-link fence surrounds the property (Tract 1 and Tract 2).

In 1994, the Muskingum County Agricultural Society (MCAS) purchased the property, which is adjacent to the Muskingum County Fairgrounds. The property was purchased based on MCAS's acceptance of certain land use restrictions, including strict limitations on any excavation at Tracts 1 and 2. In the future, the MCAS would like to use the property for additional fair display space and as space for additional pole barns.

The property is within a mixed land use area that contains industrial, commercial, residential and recreational properties (see Figure 2). The Akro property is to the north on Pershing Road. A railroad track, operated in the past by the Zanesville Terminal Railroad (also known as the New York Belt Line), is located to the west of the property. Residential properties are located to the west (across the railroad track), south and east. Also located to the east of the property is the Muskingum County Fairgrounds. Chaps Run is over 500 feet west and northwest of the property.

Industrial use of the property began prior to 1920. At that time, Tract 1 of the property was used as a foundry (the Pierce-Butler Foundry Company) that manufactured radiators until about 1938. The owner/operator of Tract 2 was the Art Cabinet Company, which manufactured "talking machines" (presumably, dictaphones or telephones).

In 1938, Line Material Industries developed an industrial manufacturing plant that by 1947 covered all of Tract 1 and the north part of Tract 2. From 1938 to the end of World War II, Line Material Industries manufactured shell casings for military ordnance and transformers used in radar and radio equipment. After World War II, the production lines were converted to the manufacture of relatively small oil-filled transformers (the oils did not contain polychlorinated biphenyls (PCBs)). In 1949, Line Material Industries was acquired by McGraw Electric Company, and McGraw Electric Company and Thomas A. Edison, Inc.

merged into the McGraw-Edison Company in 1957. McGraw-Edison Company was acquired by Cooper Industries in 1985, and the plant was integrated into Cooper Industries' new Cooper Power Systems division. Throughout this period of time, production operations focused on the manufacture of oil-filled transformers as well as voltage regulators.

During 1988, the operations at the Cooper Power Systems plant were altered to focus on the manufacture of small overhead-type transformers and voltage regulators. These operations continued until May 1992, when Cooper Industries terminated production. After the termination of production efforts, Cooper relocated most of its former operations and razed the buildings that formerly occupied Tracts 1 and 2 on the property.

Operational History

Some of the raw materials used in the production of electric power distribution transformers and line voltage regulators included carbon steel, silicon steel, aluminum, copper, various acids, various machinery lubricants and greases, mineral oil, various sealers and adhesives, various oil-based paints and coatings, paint strippers and cleaners, solvents, degreasers, cleaning agents and detergents. Based on facility records, all materials, with the exception of mineral oil, were received by truck shipments. Chemicals were typically shipped and stored within 55-gallon drums or smaller containers, and stored near the various process stations. Mineral oil was shipped by rail car (20,000-gallon tankers) and was unloaded using hoses and piping at a railroad spur located along the south side of the plant.

Based on plant records, trichloroethene (TCE) was used at the property from some time prior to 1970 until 1972. In 1972, the vapor degreaser was shut down, cleaned, flushed and refilled with 1,1,1-trichloroethane (TCA). Available records provide no information that indicates that TCE was used for industrial purposes at the property after this conversion was completed. The industrial use of the TCA continued until 1992.

Between the early 1970s and 1992, the Cooper Power Systems facility had a Permit To Install and a Permit To Operate for approximately 19 air emission sources. Ohio EPA records do not contain any notices of violation regarding the air emission permits. Upon closure of the facility, all of the permitted sources were removed.

Cooper Power Systems submitted annual hazardous waste reports from 1983 to 1992. Based on these annual hazardous waste reports, Cooper Power Systems generated approximately eight waste streams at this facility. Ohio EPA files include citations for Resource Conservation and Recovery Act rule violations on three separate occasions. Files indicate that these three rule violations were resolved by Cooper Power Systems.

Ohio EPA files include documentation on several spills (1961, 1971 and 1988) that affected Chaps Run (greater than 500 feet west and northwest of the property) during the operation of the facility. The files indicate that the facility was permitted to discharge pretreated process wastewater to the City of Zanesville sanitary sewer system. In addition, the facility had a National Pollutant Discharge Elimination System permit for the discharge of noncontact cooling water and storm water from the facility's parking lot storm drains. These permits were terminated in 1992 due to closure of the facility.

In October 1992, Ohio EPA sampled two Cooper production wells and the results verified the presence of volatile organic compounds (VOC) in both wells. The VOCs detected included TCE, TCA, tetrachloroethene (PCE), cis-1,2 dichloroethene (cis-DCE), and trans-1,2 dichloroethene (trans-DCE). Soil samples collected by Cooper Industries in May 1993 confirmed the presence of TCE, TCA and PCE in soils.

As a result of the contamination in the ground water and soils, Ohio EPA invited Cooper Industries to negotiate Director's Final Findings and Orders (Orders) whereby Cooper Industries would perform a remedial investigation and feasibility study. The Orders were finalized and became effective on November 20, 1998.

1.2 Summary of the Remedial Investigation

The Remedial Investigation was conducted by Cooper Industries and included a number of tasks to identify the nature and extent of site-related chemical contaminants. The investigation was conducted with oversight by Ohio EPA and was approved on September 26, 2000. The tasks included sampling of soil, sediment and ground water. The data obtained from the investigation were used to conduct a baseline risk assessment and to determine the need to evaluate remedial alternatives. This Decision Document contains only a brief summary of the findings of the Remedial Investigation and Feasibility Study. Please refer to the *Remedial Investigation Report* (Earth Sciences Consultants, Inc., August 2000) and *Feasibility Study Report* (Earth Sciences Consultants, Inc., June 2003), approved by Ohio EPA on July 10, 2003, for additional information on contaminant concentrations.

The nature and extent of contamination at the Cooper Industries Site in each environmental medium and the contaminants of concern attributable to the Site are described below:

1.2.1 Soil Contamination

Soil samples were collected at over 100 locations on the Site and on surrounding properties. A soil gas survey was conducted to evaluate three areas: 1) the former vapor degreaser area; 2) the former painting and metals finishing area; and 3) a former paint drum storage area and former materials handling area. A total of 67 soil borings were installed. The soil gas survey was used to determine the locations of the highest contaminant concentrations in the areas identified above. At the locations with the highest concentrations, soil samples were collected for VOC analysis.

Surface soil samples (0 to 4 feet) were analyzed for VOCs, semi-volatile compounds (SVOCs), polychlorinated biphenyls (PCBs), and total metals while subsurface samples (4 to 20 feet) were analyzed for VOCs and SVOCs.

Twenty-eight surface soil samples were analyzed for metals and compared to results from ten background samples. Surface soils had elevated concentrations of metals with respect to the background samples (refer to Table A6.a of the *Remedial Investigation Report*) The elevated concentrations of metals are more readily attributable to fill materials and/or concrete pavements and steel remnants (from the former plant's support structure) than

to specific historical releases related to plant operations. The results do not suggest that there is widespread metals contamination at the Site. Six surface samples were analyzed for PCBs and none of the samples had detectable concentrations of PCBs. Ten surface soil samples were analyzed for SVOCs and six out of the ten samples had no detectable concentrations of SVOCs. The remaining four samples had low levels of various SVOCs (refer to Table A3.a of the *Remedial Investigation Report*). Forty-one surface soil samples were analyzed for VOCs and the results show that VOCs are the most prevalent contaminants in the surface soils (see Table1). The highest concentrations of VOCs in surface soils were detected near the corner formed at the intersection of Tract 1 and Tract 2 (samples T2/TB-22, T2/TB-22A, T2/TB-22B, T2/TB-22C, T2/TB-22D and T2/TB-22E). Some VOCs detected in the soils include TCA, PCE, and TCE.

Table 1. Range of VOCs in Soils

Volatile Organic Compounds (VOCs)	Concentration Range (mg/kg)		
	Surface Soils (0 - 4 feet)	Subsurface Soils (4 - 10 feet)	Subsurface Soils (10 - 20 feet)
1,1,2 TCA	<0.005 - 0.14	<0.005 - 0.012	<0.005 - 0.041
1,1,1 TCA	<0.005 - 430	<0.005 - 0.57	<0.005 - 1.9
1,2 DCA	<0.005 - 0.013	<0.005 - 0.026	<0.005 - 0.02
1,1 DCA	<0.005 - 8	<0.005 - 0.2	<0.005 - 0.028
Chloroethane	<0.01 - 0.69	<0.01	<0.01
PCE	<0.005 - 8.9	<0.005 - 0.1	<0.005 - 0.049
TCE	<0.005 - 59	<0.005 - 1.1	<0.005 - 0.52
1,2 DCE Total	<0.01 - 28	<0.01 - 0.29	<0.01 - 0.025
1,1 DCE	<0.005 - 0.11	<0.005 - 0.11	<0.005 - 0.14
Vinyl Chloride	<0.01 - 0.15	<0.01	<0.01

Four subsurface samples were analyzed for SVOCs, and only one sample had concentrations of SVOCs above detection limits. That location had bis (2-ethylhexyl) phthalate at a concentration of 0.52 mg/kg. Seventy-one subsurface soil samples, 36 at 4 to10 feet and 35 at 10 to 20 feet, were analyzed for VOCs (see Table 1). As with the surface soils, the VOC contamination in the subsurface soils is widespread, sporadic and at low-levels across the Site.

1.2.2 Ground Water Contamination

Bedrock is found at a depth ranging from 30 to 90 feet below ground surface at the Site and the fairgrounds. The bedrock surface is overlain with glacial outwash deposits consisting of unconsolidated sand and gravel and some clay layers. Thin clay layers were found overlying the bedrock surface and a 5 to 10 foot thick layer at the surface across the Site.

Sand and gravel deposits occur between these clay layers. The water table occurs within the sand and gravel deposits at a depth of 18 to 20 feet.

The sand and gravel layer forms a buried valley aquifer from which wells at the Site and the Akro property historically produced ground water at sustained rates of 300 to 500 gallons per minute (depending on location, depth, and well construction).

Ground water flow within the investigation area generally corresponds with the topography of the underlying bedrock surface. The localized ground water flow directions are generally northeastward and northward within Tract 1 and the northern half of Tract 2 and southeastward and southward within the southern half of Tract 2. In the area immediately northeast of the Site, ground water flow is northeastward and northward. The central portion of the fairgrounds property overlies an apparent ground water flow divide. Flow is northward in the area underlying Tract 1 and the central portion of the fairgrounds, and eastward and southeastward underlying Tract 2.

Figure 3 illustrates all of the ground water monitoring locations that have been used for evaluating ground water quality during the RI and activities subsequent to completing the RI. All of these locations are screened in the buried valley aquifer underlying the Site and surrounding areas. Ground water samples were collected from various groups of wells at various times during the RI and subsequent activities. Forty-two monitoring wells are located on the Site and surrounding properties. Well installation occurred at different stages during the RI and subsequent activities. Table 2 includes a list of the main contaminants found in ground water and the maximum concentration of each of these contaminants found throughout these various sampling events. The FS includes a table, FS Table 3, summarizing ground water data generated during sampling events in November 1998, May 1999, June 1999, October 1999, June 2000, December 2000, December 2001, May 2002, December 2002, and May and July 2003. Figure 4 shows the plume boundaries based on the May and June 2003 ground water sampling events.

Table 2. Maximum Concentrations of Contaminants Detected in Ground Water

VOC	Maximum Concentration (ug/l)	Location
1,1,2 TCA	670	T2/MW-14T
1,1,1 TCA	520,000	T2/MW-14T
1,2 DCA	960	T2/MW-14T
Chloroethane	110	T2/MW-11T
PCE	200	T2/MW-14T
TCE	10,000	T2/MW-9T
trans 1,2 DCE	180	T2/MW-9T
cis 1,2 DCE	9,800	T2/MW-9T
Vinyl Chloride	28	T2/MW-14T

The RI identified three concentrated areas of ground water contamination (see Figure 5). These areas included: (1) the area in the northwest portion of Tract 2 (Western Plume Area); (2) the area in the northeast portion of Tract 2 (Eastern Plume Area); and (3) the area in the northeast portion of Tract 1, surrounding Cooper's former water supply wells (Northern Plume Area). The primary contaminant in the Western and Northern Plume Areas is TCE while the primary contaminant in the Eastern Plume Area is TCA.

1.2.3 Sediment and Surface Water Contamination

Three discrete sediment samples were collected from the 48-inch diameter storm sewer that transects the Site and one discrete sediment sample was collected from an upgradient location within Chaps Run 150 feet south of the storm sewer outfall. Samples were analyzed for VOCs, SVOCs and metals, and the results indicate that the Site is not contributing contaminants to Chaps Run.

1.2.4 Contaminants of Concern Retained for Further Consideration

The soil and ground water data was evaluated to identify the Contaminants of Concern (COCs) for the Site. Concentration of the contaminant was considered to determine if it may cause an impact to ground water, exceed background levels or exceed generic human health risk thresholds. The frequencies of detection and spatial distribution of COCs were considered. The list of COCs retained for further consideration is provided below:

- 1,1,2 - Trichloroethane (1,1,2-TCA)
- 1,1,1 - Trichloroethane (TCA)
- 1,2 - Dichloroethane (1,2-DCA)
- 1,1 - Dichloroethane (1,1-DCA)
- Chloroethane
- Tetrachloroethene or Perchloroethene (PCE)

- Trichloroethene (TCE)
- 1,1 - Dichloroethene (1,1-DCE)
- trans- 1,2 -Dichloroethene (trans-1,2-DCE)
- cis- 1,2 - Dichloroethene (cis-1,2-DCE)
- Vinyl chloride

1.3 Pilot Studies

Data collected during the RI suggested that natural attenuation was a component of contaminant destruction in ground water and that the aquifer's potential for continued biodegradation was favorable. As a result, pilot studies were implemented to evaluate the promotion or acceleration of the natural attenuation process. The extent of these pilot studies went beyond typical considerations for evaluating the performance of a technology. The studies were implemented as larger scale projects to actually improve ground water quality within each plume area.

The pilot studies were implemented within three concentrated areas of ground water contamination shown in Figure 5: 1) the area in the northwest portion of Tract 2 (Western Plume Area); 2) the area in the northeast portion of Tract 2 (Eastern Plume Area); and 3) the area in the northeastern portion of Tract 1, surrounding Cooper's former water supply wells (Northern Plume Area). The pilot studies implemented within the Eastern and Western Plume areas consisted of the enhancement of biodegradation using Hydrogen Release Compound (HRC). Within the Northern Plume Area, enhancement of biodegradation was evaluated using a Biodrain system.

1.3.1 Hydrogen Release Compound

HRC was selected as the technology to enhance biodegradation in the Eastern and Western Plume areas since HRC, when added to ground water, is capable of enhancing biodegradation without reducing or eliminating the existing anaerobic (no oxygen) ground water conditions that are promoting the natural attenuation of the contaminant plume. When HRC is injected into contaminated aquifers, contact with water causes HRC to slowly release lactic acid. Naturally occurring anaerobic microbes metabolize the lactic acid to produce hydrogen, which is used by other microbes to break down the contaminants.

In January 2001, HRC was injected in the Eastern and Western Plume Areas. The Western area consisted of two treatment grids with 49 injection points through which 2,000 pounds of HRC were injected. Periodic post-injection ground water monitoring demonstrates a general decrease in TCE concentrations. In addition, concentrations of nitrate and sulfate have decreased while concentrations of dissolved iron, manganese, gases and organic acids have increased. These factors are indicative of biodegradation. The Eastern area consisted of one treatment grid in January 2001. There were 25 injection points through which 3,000 pounds of HRC were injected. Ground water monitoring results collected after the injection of HRC revealed that the upgradient monitoring well T2/MW-8T had high concentrations of contaminants. To further delineate ground water contamination in the Eastern area, Cooper Industries conducted an additional investigation which

revealed that the TCA plume extends further upgradient of the original treatment area.

Due to this new information, a second round of HRC injection took place in December 2001 to treat the area upgradient of the original (January 2001) treatment grid. This second round consisted of 11,760 pounds of HRC injected at 49 points. The results from monitoring ground water in the Eastern Plume Area demonstrate elevated concentrations of dissolved iron and manganese and reduced concentrations of nitrate which indicate that enhanced bioremediation is occurring. In addition, gases and organic acids continue to be elevated above baseline conditions (concentrations present in wells during the sampling event(s) prior to HRC injection) which further indicates that enhanced bioremediation is occurring.

1.3.2 Biodrain

The Biodrain remedial system was selected for the Northern Plume Area to address ground water contamination in the deep portion of the aquifer. The implementation of the Biodrain system was completed in January and February 2001. The injection of microbes is performed through the use of the Biodrain wicks. Sixteen wicks were installed to a depth of approximately 70 to 80 feet below grade in the Northern Plume Area. The microbes are delivered to the wicks by mixing the microbes with recycled ground water and pumping the microbe-laden ground water into the wicks.

Ground water monitoring shows no significant decreases in TCE concentrations since the implementation of the Biodrain system. In order to determine if microbes that degrade TCE are present in the wells in the Biodrain area, samples were collected from each well and evaluated for microbial colonies. The results show an increase in the percentage of colonies in one of the wells when compared to the other three wells sampled.

2.0 SUMMARY OF SITE RISKS

A baseline risk assessment was conducted to evaluate potential risks to human health associated with contaminants present in soils at the Site. The results demonstrated that the existing concentrations of contaminants in the soils do not pose unacceptable risks to human health when evaluated in the context of its current non-residential use. Concentrations of contaminants in ground water were evaluated by comparing the concentrations to the maximum contaminant levels (MCLs). The evaluation demonstrated that several COCs exceed the MCLs which triggers the need for remedial actions.

The Muskingum County Agricultural Society (MCAS) currently uses the Site as a parking lot for the annual county fair. Although pavement covers a majority of the Site, a limited amount of exposed soil does exist at the Site. The exposed soil is principally located along the stables constructed near the southeast corner of Tract 1 and the northern boundary of Tract 2. In addition to using the property for parking, MCAS has constructed a horse corral on a portion of Tract 1. The corral is occasionally used for training horses and is

surrounded by a chain-link fence which is inside the Site perimeter fence. Approximately two to four feet of clean fill was used to construct the corral.

In the future, MCAS intends to continue to use the Site for parking space, and possibly for additional fair display and operations space. Based on current and potential future uses, direct contact with soils is an exposure pathway, and potential receptors include fair grounds workers, fair event participants and utility/construction workers. Another potential future exposure pathway, if a building is constructed on-site, is exposure to indoor air.

Since buildings are not currently located on the Site, the indoor air exposure pathway is not a complete pathway. In the event that buildings or other closed structures are constructed on the Site, an evaluation of this exposure pathway would be required in order to determine if there would be any unacceptable health risks associated with this pathway.

Potential risks associated with direct contact with soil were evaluated for the Site. Estimates of potential carcinogenic (cancer causing) risk and non-carcinogenic hazards from exposure to COCs in the soils were calculated. Cancer risk is defined as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen as compared with a person not exposed to the Site. These risks refer only to the incremental risks created by exposures from the Site. They do not include the risks of cancer from other non-site related factors to which people may be exposed. As a benchmark in developing clean-up goals at contaminated sites, an acceptable range of excess lifetime cancer risk from one in one million (1×10^{-6}) to one in ten thousand (1×10^{-4}) has been established.

Non-carcinogenic hazards are generally expressed in terms of a hazard quotient or index, which combines the concentration of chemical exposures with the toxicity of the chemicals (quotient refers to the effects of an individual chemical whereas index refers to the combined effects of all chemicals). A hazard index of 1 represents the maximum exposure at which no harmful effects are expected.

Based on the risk evaluation for commercial or industrial use of the property, the carcinogenic risk associated with soils was calculated as 1.9 in one million which falls within the acceptable risk range. For commercial or industrial use of the property, the hazard index associated with soils was calculated as 0.17 which indicates that no harmful effects are expected since the value does not exceed 1.0. The risk evaluation indicates that no remediation of soils is necessary for commercial or industrial use of the Site.

In addition to evaluating soil exposure pathways, potential ground water exposure pathways were evaluated. There are no known residential wells currently in use that appear to be affected by the Site contaminants. The absence of residential wells downgradient of the Site, and the availability of municipal water supplies limit the potential for human exposure to contaminated ground water at this time.

A potential future scenario under which exposure to contaminated ground water may occur is a scenario where the facility on the north side of Pershing Road (formerly the Akro facility) begins pumping its production wells. The building is currently vacant so it is unknown at this time whether these wells will be used once the building is re-occupied. Because the COCs in ground water exceed MCLs and there is a potential future exposure to the ground water, remedial activities are needed to address the ground water contamination.

3.0 FEASIBILITY STUDY AND REMEDIAL ACTION OBJECTIVES

A Feasibility Study was conducted by Cooper Industries to define and analyze appropriate remedial alternatives. That study was conducted with oversight by Ohio EPA, and was approved on July 10, 2003. The Remedial Investigation and Feasibility Study are the basis for the selection of the Ohio EPA's preferred remedial alternative.

As part of the remedial investigation/feasibility study (RI/FS) process, remedial action objectives (RAO's) were developed in accordance with the National Contingency Plan (NCP), 40 CFR Part 300, which was promulgated under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, and U.S. EPA guidance. The RAOs are goals that a remedy should achieve in order to ensure the protection of human health and the environment. The goals are designed specifically to mitigate the potential adverse effects of site contaminants present in environmental media.

The RAOs were developed to ensure that remedial actions reduce the risk to humans to acceptable levels. The RAOs developed for the Site are identified below.

Remedial Action Objectives
Protection against human exposure to ground water that exceeds MCLs
Reduce concentrations of COCs to MCLs throughout the impacted aquifer

4.0 SUMMARY OF REMEDIAL ALTERNATIVES

A total of four remedial alternatives were considered in the Feasibility Study. A brief description of the major features of each of the remedial alternatives follows. More detailed information about these alternatives can be found in the Feasibility Study.

4.1 No Action - No remedial action planned for the Site. The No Action alternative is included as a basis for comparison with the remaining alternatives. Under this alternative, no other activities would be performed at the Site.

4.2 Enhanced Bioremediation with a Contingency for Additional HRC Application
This alternative considers the previous injections of HRC in the Western HRC Area and Eastern HRC Area, as well as enhanced bioremediation in the Biodrain Area with a future consideration for additional HRC application (or equivalent technology) to further enhance degradation of the plume if the RAOs are not being achieved. Enhanced bioremediation is a method of increasing natural degradation of contaminants through the injection of materials that enhance biological activity. The most effective biodegradation at this Site takes place under anaerobic conditions.

An evaluation of the performance of this alternative would be determined through long-term ground water monitoring. COCs would be monitored in addition to various parameters that help determine the effectiveness of natural and enhanced biodegradation.

4.3 Chemical Oxidation - This alternative involves the oxidation of COCs through the injection of a chemical oxidant into the contaminated ground water at the Eastern, Western and Northern Plume Areas. The COCs are chemically oxidized into harmless substances. Although this technology has been successfully implemented at numerous sites, the degradation of TCA is generally not as effective as the other contaminants such as TCE. Concentrations of contaminants in the areas not treated by chemical oxidation would eventually decrease as a result of natural biodegradation.

The performance of this alternative would be evaluated through long-term ground water monitoring. This alternative would likely limit or prevent future occurrence of natural biodegradation of COCs within, and immediately surrounding, the treatment area since the oxidant destroys the anaerobic conditions that enable the biodegradation to occur.

4.4 Vapor Extraction with Air Sparging - This alternative involves the injection of air through sparging wells into the contaminated ground water in the Western and Eastern Plume Areas. The contaminants are volatilized from ground water to soil where they are removed through vapor extraction wells by vacuum. Once the contaminants are removed from the soils, a treatment system such as carbon absorption is used to treat the contaminant-laden air. Concentrations of contaminants in the areas outside the vapor extraction/air sparging zone would eventually decrease as a result of natural biodegradation.

An evaluation of the performance of this alternative would be determined through a long-term ground water monitoring program. This alternative would likely prevent the future occurrence of anaerobic degradation within the treatment area due to the injection of oxygen.

5.0 COMPARISON AND EVALUATION OF ALTERNATIVES

5.1 Evaluation Criteria

In selecting a remedy for a contaminated site, Ohio EPA considers the following eight evaluation criteria as outlined in U.S. EPA's NCP promulgated under CERCLA (40 CFR 300.430):

1. Overall protection of human health and the environment - Remedial alternatives shall be evaluated to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site.

2. Compliance with all applicable or relevant and appropriate regulations (ARARs) - Remedial alternatives shall be evaluated to determine whether a remedy will meet all of the applicable or relevant and appropriate requirements of state, federal and local environmental laws.

3. Long-term effectiveness and permanence - Remedial alternatives shall be evaluated to determine the ability of a remedy to maintain reliable protection of human health and the environment over time once pollution has been abated and RAOs have been met. This includes assessment of the residual risks remaining from untreated wastes, and the adequacy and reliability of controls such as containment systems and institutional controls.

4. Reduction of toxicity, mobility, or volume through treatment - Remedial alternatives shall be evaluated to determine the degree to which recycling or treatment are employed to reduce toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

5. Short-term effectiveness -Remedial alternatives shall be evaluated to determine the following: (1) Short-term risks that might be posed to the community during implementation of an alternative; (2) Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures; (3) Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and (4) Time until protection is achieved.

6. Implementability - Remedial alternatives shall be evaluated to determine the ease or difficulty of implementation and shall include the following as appropriate: (1) Technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional

remedial actions, and the ability to monitor the effectiveness of the remedy; (2) Administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions); and (3) Availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and the availability of prospective technologies.

7. Cost - Remedial alternatives shall evaluate costs and shall include the following: (1) Capital costs, including both direct and indirect costs; (2) Annual operation and maintenance costs (O&M); and (3) Net present value of capital and O&M costs. The cost estimates include only the direct costs of implementing an alternative at the Site and do not include other costs, such as damage to human health or the environment associated with an alternative. The cost estimates are based on figures provided by the Feasibility Study.

8. Community acceptance - Remedial alternatives shall be evaluated to determine which of their components interested persons in the community support, have reservations about, or oppose.

Evaluation Criteria 1 and 2 are threshold criteria required for acceptance of an alternative that has accomplished the goal of protecting human health and the environment and complied with the law. Any acceptable remedy must comply with both of these criteria. Evaluation Criteria 3 through 7 are the balancing criteria for picking the best remedial alternatives. Evaluation Criteria 8, community acceptance, was determined, in part, by written responses received during the public comment period.

5.2 Analysis of Evaluation Criteria

This section looks at how each of the evaluation criteria is applied to each of the remedial alternatives found in Section 4.0 and compares how the alternatives achieve the criteria.

5.2.1 Overall Protection of Human Health and the Environment

The potential risks to human health posed by the Site are associated with exposure to contaminated ground water. MCLs are the standards that must be met to insure that unacceptable risks have been addressed.

Implementation of the Enhanced Bioremediation, Chemical Oxidation or Vapor Extraction with Air Sparging alternatives could each ultimately result in attainment of MCLs which will be verified through ground water monitoring. In addition, periodic inspections will be conducted to determine if ground water use has changed and if measures are required to reduce exposure to the contaminated ground water.

While natural degradation may also eventually result in attainment of MCLs under the No Action alternative, the lack of monitoring associated with this alternative would make it impossible to confirm. Under this alternative there would be no inspections to evaluate potential changes in ground water use, and therefore no means for insuring that there is

no unacceptable exposure to contaminated ground water.

5.2.2 Compliance with ARARs

The Enhanced Bioremediation, Chemical Oxidation or Vapor Extraction with Air Sparging alternatives would comply with applicable regulations. All three would require a permit to authorize injection of fluids into ground water. A permit was obtained for injection of HRC and recycled ground water (Biodrain) prior to initiation of the pilot studies. Air pollution controls or a permit would be required for air releases from the Vapor Extraction with Air Sparging alternative.

All of the alternatives would be required to meet MCLs. The No Action alternative does not provide a mechanism to insure compliance with this requirement.

5.2.3 Long-Term Effectiveness and Permanence

The Enhanced Bioremediation, Chemical Oxidation or Vapor Extraction with Air Sparging alternatives would permanently reduce concentrations of contaminants in ground water, eliminating potential risk of exposure to receptors after RAOs are achieved. If natural biodegradation is effective enough to result in attainment of MCLs, the No Action alternative may also result in a permanent remedy, however, there is no mechanism for verification.

5.2.4 Reduction of Toxicity, Mobility or Volume by Treatment

Enhanced Bioremediation results in a reduction in the volume (concentration) of contaminants. Microorganisms break down the contaminants into harmless by-products. Monitoring is a critical component to verify that the contaminants are being destroyed and to verify that by-products that may be more harmful (vinyl chloride) are not increasing in concentration, but are also destroyed.

Chemical Oxidation also results in a reduction in concentration of contaminants but, with this remedy, an oxidant rather than microorganisms destroys the contaminants. The Vapor Extraction with Air Sparge alternative also reduces the concentration of contaminants. Under this alternative the contaminant is transferred to a carbon unit and the spent carbon is then disposed. This alternative does not necessarily result in contaminant destruction since the spent carbon may be disposed of at a licensed and permitted landfill rather than destroyed.

Under the No Action alternative, contaminants may eventually be destroyed through natural biodegradation but, without monitoring, this could not be verified.

5.2.5 Short-Term Effectiveness

The Enhanced Bioremediation, Chemical Oxidation and Vapor Extraction with Air Sparge alternatives would be implemented in the areas of highest ground water contamination at the Site. Areas outside the treatment zone would be addressed through natural bioremediation. The pilot studies indicate that with the Enhanced Bioremediation alternative, the mass of COCs will very quickly (within one year) begin to be reduced in the treatment areas. Based on case-studies at other sites, the Chemical Oxidation alternative may significantly reduce the mass of contaminants in the treatment area within six months. However, these studies also indicate that chemical oxidation is not as effective on TCA as is it is on TCE. Under the Vapor Extraction with Air Sparge alternative, the majority of the mass of contaminants in the treatment areas should be removed within the first five years of operation of the system.

Due to the significant ground water contamination at the Site, ground water flow and solute transport modeling evaluated in the FS suggests that MCLs will not be achieved throughout the impacted aquifer for 40 to 80 years. Even though complete clean-up may be achieved in 40 to 80 years, the highest concentrations of contaminants should be significantly reduced within 10 to 20 years if the source areas are treated with Enhanced Bioremediation, Chemical Oxidation or Vapor Extraction with Air Sparge. These time-frames are based on the limited data available at this time and should be revised once additional sampling events are conducted.

Under the Enhanced Bioremediation and Vapor Extraction with Air Sparge alternatives, workers could be exposed to COCs during implementation of the remedy via contact with ground water or inhalation of vapors, but these potential risks should be addressed by adhering to a site-specific health and safety plan. In addition to exposures to COCs, workers implementing the Chemical Oxidation alternative may also be exposed to chemical oxidants. These potential risks to workers can be reduced by adhering to a health and safety plan that specifically addresses proper handling of the chemical oxidants to be used at the Site.

Under the No Action alternative there would be no significant contaminant reduction and no monitoring to evaluate the alternative. Since no work would be conducted, issues regarding risks to workers implementing this alternative are irrelevant.

5.2.6 Implementability

The Enhanced Bioremediation alternative has been evaluated through pilot studies. The HRC material has been shown to reduce the concentration and the mass of the COCs at the Site. The administrative feasibility of this alternative requires no special consideration. A permit for the injection of the HRC material has been obtained previously for the implementation of the pilot studies. Resources required for the implementation of this alternative, such as direct push units and HRC material, are readily available.

The Chemical Oxidation alternative is technically feasible for implementation. Potassium permanganate has been shown to reduce concentrations of TCE and hydrogen peroxide and chelated iron material have been shown to reduce concentrations of TCE as well as TCA. The administrative feasibility of this alternative requires no special consideration. A

permit for the injection of the chemical oxidant could be readily obtained for the implementation of this alternative. Resources for the implementation of this alternative, such as direct push units and hydrogen peroxide, are readily available.

The Vapor Extraction with Air Sparge alternative would be technically feasible to implement in the Eastern and Western Plume areas. The administrative feasibility of this alternative requires no special conditions. An air discharge permit for each of the treatment systems may be required as well as a discharge permit to the local Publically Owned Treatment Works. These permits can be readily obtained. Resources required for the implementation of this alternative, such as drill rigs and process equipment, are readily available.

Since the No Action alternative does not involve any additional work, there would be no administrative or technical barriers. No resources for services or materials are necessary for this alternative.

5.2.7 Cost

Cost estimates to implement the four remedial alternatives are provided below.

Alternative	Capital Cost	Annual Short-term O&M (5 yrs)	Annual Long-term O&M (80 yrs)	Present Worth
No Action	$ 0	$ 0	$ 0	**$ 0**
Enhanced Bioremediation	$ 230,300	$ 143, 500	$ 37,500	**$ 1,271,000**
Chemical Oxidation	$ 913,100	$ 55,400	$ 37,500	**$ 1,602,100**
Vapor Extraction with Air Sparge	$ 712,400	$ 225,200	$ 40,900	**$ 2,121,700**

5.2.8 Community Acceptance

The Ohio EPA received comments from Earth Sciences Consultants, Inc. on behalf of Cooper Industries, Inc. regarding conditions that would trigger additional HRC injection. Those comments and Ohio EPA's responses are included in the Responsiveness Summary. No other comments on the Preferred Plan were received by the agency.

6.0 SELECTED REMEDIAL ALTERNATIVE

The selected alternative is Enhanced Bioremediation. The elements of the Enhanced Bioremediation alternative are as follows:

- Ground Water Monitoring to Evaluate Effects of Previous Enhanced Bioremediation Activities, and

- Monitoring Ground Water Use Activities.

The Enhanced Bioremediation, Chemical Oxidation and Vapor Extraction with Air Sparging alternatives meet the threshold criteria. All three of these remedies are protective of human health and the environment and all three comply with applicable regulations. However, the No Action alternative does not meet the threshold criteria because there is no mechanism to verify the protection of human health and the environment, and, as a result, is not an acceptable alternative. The balancing criteria were used to evaluate the remaining three criteria.

Enhanced Bioremediation, Chemical Oxidation and Vapor Extraction with Air Sparging are permanent remedies. Enhanced Bioremediation and Chemical Oxidation result in the destruction of the contaminants while Vapor Extraction with Air Sparging transfers the contaminants to carbon which may be sent to a licensed and permitted landfill rather than destroyed. Pilot studies conducted on-site indicate that Enhanced Bioremediation will be effective at significantly reducing contaminant concentrations in the source areas. Case studies for other sites indicate that Chemical Oxidation and Vapor Extraction with Air Sparging will be effective at reducing concentrations in the source areas, but studies show that Chemical Oxidation may not be as effective on TCA. All three of the remedies that meet the threshold requirements may be readily implemented. Of these three remedies, Enhanced Bioremediation is the most cost effective.

After evaluating the balancing criteria, Enhanced Bioremediation was selected since it is the most cost effective, there were no public comments opposing this remedy and a pilot study has been conducted that indicates that this alternative will be effective at significantly reducing contaminants in the source areas.

6.1 Ground Water Monitoring to Evaluate Effects of Previous Enhanced Bioremediation Activities

The selected alternative considers the previous injections of HRC in the Western and Eastern Plume Areas, as well as enhanced bioremediation in the Biodrain Area. Ground water monitoring will be conducted to determine the effectiveness of this alternative. Select existing monitoring wells, to be identified in the long-term ground water monitoring plan, will serve as the monitoring network. Additional wells will be installed if the data reveals the need for additional monitoring points. During the first five years, monitoring will be conducted semi-annually, at a minimum. Ground water monitoring will include analyses for the COCs, degradation byproducts, and geochemical indicators to determine the

effectiveness of natural and enhanced biodegradation. Details regarding the ground water monitoring will be specified in the long-term ground water monitoring plan for the Site.

This alternative provides for additional HRC injection within the contaminant plume under the following conditions:

1. there is less than a 70% reduction in TCE at the indicator monitoring wells within 5 years of the last HRC injection (occurred January 2001) in the Western Plume Area. The indicator monitoring wells include T2/MW-1T, T2/MW-9T, T2/MW-10T and T2/MW-12T. The percent reduction will be calculated based on the highest pre-injection concentrations and will be confirmed by at least two consecutive sampling events. For monitoring wells installed post-injection, the reduction will be calculated based on the concentrations detected during the initial sampling of the well.

Indicator Well	Original Concentration (ug/l)	Concentration after 70% reduction (ug/l)
T2/MW-1T	1,500	450
T2/MW-9T	10,000	3,000
T2/MW-10T	1,700	510
T2/MW-12T	860	258

2. there is less than a 70% reduction of TCA at the indicator monitoring wells within 5 years of the last HRC injection (occurred December 2001) in the Eastern Plume Area. The indicator monitoring wells include T2/MW-3T, T2/MW-7T, T2/MW-8T, T2/MW-11T, T2/MW-14T and T2/MW-15T. The percent reduction will be calculated based on the highest pre-injection concentrations and will be confirmed by at least two consecutive sampling events. For monitoring wells installed post-injection, the reduction will be calculated based on the concentrations detected during the initial sampling of the well.

Indicator Well	Original Concentration (ug/l)	Concentration after 70% reduction (ug/l)
T2/MW-3T	36,000	10,800
T2/MW-7T	39,000	11,700
T2/MW-8T	53,000	15,900
T2/MW-11T	21,000	6300
T2/MW-14T	460,000	138,000
T2/MW-15T	76,000	22,800

In addition to the five year goals provided above, other factors will be considered before determining that additional HRC injection will be required. The other factors to be considered include: concentrations of organic acids and inorganic parameters, potential spikes due to plume migration, and changes in plume dimensions. While results for each trigger well will be considered, consideration will also be given to conditions within the

entire plume area (eastern plume area or western plume area) before requiring additional HRC injection.

Furthermore, the evaluation of the effectiveness of the previous HRC injections will be conducted in conjunction with the Five-Year Review. Since the last HRC injection occurred in December 2001, the initial Five Year Review will be conducted in December 2006. As part of the Five-Year Review, Cooper will complete a Five-Year Review Report to assess the progress of the HRC enhanced bioremediation and provide recommendations regarding additional HRC injection. If the results demonstrate that the 5 year goals have not been met and are unlikely to be met before the following Five-Year Review, even with additional HRC injection, a modified or alternate remedy should be proposed in the Five-Year Review Report. After reviewing the Five-Year Review Report, Ohio EPA will determine if additional injection of HRC will be required or if a new or modified remedy is needed.

Performance Standard:

- Achieve MCLs for COCs in ground water for at least four continuous sampling events (quarterly or semi-annually).

- Periodically provide natural attenuation data and modeling results to verify that COC concentrations continue to decrease. The data must demonstrate that concentrations are decreasing at a rate that will meet MCLs in a reasonable time-frame, not to exceed the 40 to 80 year time-frame projected in the preliminary modeling presented in the FS.

6.2 Monitoring Ground Water Use Activities

Until ground water contamination has been cleaned-up, ground water use at the Site and in the surrounding area must be monitored to ensure that there is no unacceptable exposure to contaminated ground water. In order to verify that there is no unacceptable exposure to contaminated ground water, changes in ground water use on-site and surrounding the Site must be identified. The long-term ground water monitoring plan will specify the methods for determining any changes in ground water use. At a minimum, an evaluation will ensure that property use restrictions are not violated, will identify any changes in the use of the former Akro production wells, and will include a review of Ohio Department of Natural Resources records to determine if any new wells have been installed near the Site.

Two water supply wells located at the Site have been electrically disconnected and currently are not operational. Once Cooper determines that these wells are not useful for possible future remedial activities (ex. containment of plume or pump and treat), these wells will be abandoned per *State of Ohio Technical Guidance For Sealing Unused Wells* (State Coordinating Committee on Ground Water, 1996). Until these water supply wells are properly abandoned, access will be restricted to prevent exposure to contaminated ground water.

The property (Tract 2 and Tract 2) is owned by the Muskingum County Agricultural Society (MCAS). When the property was transferred from Cooper to MCAS in 1994, use restrictions were incorporated in the deed. In the deed, the MCAS agrees that it will restrict

its use of the property to the surface only, for such uses as parking of vehicles and the location of temporary structures which do not require the construction of permanent foundations. MCAS also agrees not to excavate, disturb or remove any soil, or other materials, now present on the Site, and will not permit others to do so. The deed states that the restrictions shall be permanent, shall run with the land and shall be binding on all successors and assigns. It further states that if MCAS, or any of its successors or assigns, violate any of the restrictions, then the property shall revert to Cooper.

Since the current restrictions do not specifically address ground water, a restriction to prevent the use of ground water will be placed on the property. For surrounding properties with contaminated ground water from the Site and no ground water use restrictions, ground water use notification agreements will be established. A commercial/industrial use restriction should also be placed on the property to prevent potential future residential use of the Site.

Performance Standard:

- Prevent human exposure to COCs in ground water that exceed MCLs.

- Record a declaration of use restriction with the Muskingum County recorder, prohibiting the use of ground water under the Site for potable purposes. The performance standard shall be achieved upon the recording of the deed restriction and its continued enforcement.

- Record a declaration of use restriction with the Muskingum County recorder, restricting the Site to commercial/industrial usage only. The performance standard shall be achieved upon recording the deed restriction and its continued enforcement.

7.0 GLOSSARY

Aquifer -	An underground geological formation capable of holding and yielding water.
ARARs -	Applicable or relevant and appropriate regulations. Those rules which strictly apply to remedial activities at the site, or those rules whose requirements would help achieve the remedial goals for the site.
Baseline Risk Assessment -	An evaluation of the risks to humans and the environment posed by a site.
CERCLA -	Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq. A federal law that regulates cleanup of hazardous substances sites under the U.S. EPA Superfund Program.
Decision Document -	A statement issued by the Ohio EPA giving the Director's selected remedy for a site and the reasons for its selection.
Exposure Pathway -	Route by which a chemical is transported from the site to a human or ecological receptor.
Feasibility Study -	A study conducted to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected.
Human Receptor -	A person exposed to chemicals released from a site.
Maximum Contaminant Level (MCL) -	The highest level of a contaminant that is allowed in drinking water. The level is established by U. S. EPA.
NCP -	National Oil and Hazardous Substances Pollution Contingency Plan, codified at 40 C.F.R. Part 300 (1990), as amended. A framework for remediation of hazardous materials sites specified in CERCLA.
O&M -	Operations and Maintenance. Long-term measures taken at a site, after the initial remedial actions, to assure that a remedy remains protective of human health and the environment.
Preferred Plan -	The plan that evaluates the preferred remedial alternative chosen by the Ohio EPA to remediate the site in a manner that

	best satisfies the evaluation criteria.
RCRA -	Resource Conservation and Recovery Act of 1976, codified at 42 C.F.R. Part 6901 et seq. (1988), as amended. A federal law that regulates the handling of hazardous wastes.
Remedial Action Objectives (RAO) -	Specific goals of the remedy for reducing risks posed by the site.
Remedial Investigation -	Those activities undertaken by Respondent to determine the nature and extent of the contamination at the Site caused by disposal, discharge, or release of waste materials.
Responsiveness Summary-	A summary of all comments received concerning the Preferred Plan and the Ohio EPA's response to all issues raised in those comments.
PCBs	Polychlorinated biphenyls. An oily chemical typically used in electrical equipment.
TCA -	1,1,1 Trichloroethane. A common industrial solvent and cleaner.
TCE -	Trichloroethene. A common industrial solvent and cleaner.
PCE -	Tetrachloroethene or Perchloroethene. A common industrial solvent and cleaner, often used for dry cleaning.

RESPONSIVENESS SUMMARY

for Cooper Industries
Muskingum County, Ohio

This Responsiveness Summary has been prepared to address each of the comments submitted in written form on the Preferred Plan submitted by the Ohio EPA on November 21, 2003, for remedial action at the Cooper Industries Site. A public hearing was held on December 17, 2003 and the public comment period ended on January 2, 2004. Written comments were received from Earth Sciences Consultants, Inc. on behalf of Cooper Industries. No oral comments were made during the hearing on the Preferred Plan.

Earth Sciences Consultants, Inc. submitted a comment letter that specifically addresses the criteria for determining circumstances under which the application of additional Hydrogen Release Compound (HRC) will be required. The comment letter is provided as an attachment to the Responsiveness Summary. Ohio EPA's response is provided below.

Ohio EPA Response

The comment letter addresses the criteria for determining circumstances under which the application of additional HRC will be required. The letter indicates a preference to either decreasing the five year goal from 70% reduction to 50% reduction or increasing the time-frame to meet the 70% reduction from five years to seven years. Although the original triggers (70% reduction in 5 years) in the Preferred Plan have been incorporated in the Decision Document, the Decision Document states that other factors will be considered by Ohio EPA before determining that additional HRC injection will be required. The other factors to be considered include: concentrations of organic acids and inorganic parameters, potential spikes due to plume migration, and changes in plume dimensions. While we will consider the results for each individual well, we will also consider conditions within the entire plume area (eastern plume area or western plume area) before requiring additional HRC injection.

Furthermore, the evaluation of the effectiveness of the previous HRC injections will be conducted in conjunction with the Five-Year Review. Since the last HRC injection occurred in December 2001, the Five Year Review in December 2006. As part of the Five-Year Review, Cooper will complete a Five-Year Review Report to assess the progress of the HRC enhanced bioremediation and provide recommendations regarding additional HRC injection. If the results demonstrate that the 5 year goals have not been met and are unlikely to be met before the following Five-Year Review, even with additional HRC injection, a modified or alternate remedy should be proposed in the Five-Year Review Report. After reviewing the Five-Year Review Report, Ohio EPA will determine if additional injection of HRC will be required or if a new or modified remedy is needed.

Plume Source Area TCA/TCE Averaging

The comment letter indicates that Ohio EPA should consider a total plume average for each of the two major areas because contaminants are moving down gradient along a flow path which is parallel to the location of the rows of monitoring wells. The concern is that the HRC injection will cause a release of sorbed contaminant from the soil grains, resulting in a temporary spike in concentration that moves through the down gradient wells. Ohio EPA

believes these spikes in concentrations have already occurred. In the western wells (TCE contamination), there were spikes in wells MW-1T, MW-9T and MW-10T within approximately 150 days after injection. In the eastern area (TCE contamination) there was a spike in concentration in well MW-3T–concentration followed by a spike in the further down gradient well MW-7T after the initial injection in the area around well MW-11T. There was also a second group of spikes in wells MW-11T, MW-3T and MW-7T following the second injection in the area of well MW-14T . If, for any reason, another contamination spike should occur at any well in the future, those concentrations can be tracked across the site to define what is going on site-wide without having to use a total plume average.

Over a monitoring period of 5 years, any release from the injection areas should have traveled across the entire local network of monitoring wells. By accounting for adsorption, a retarded contaminant flow rate of about 7.0 E-02 ft/day was estimated for TCA and 8.8E-02 ft/day for TCE [1]. That rate should allow a TCA contaminant spike to cross the eastern HRC area in a about 4.5 years (assuming a worst case of a-contaminant spike originating from the area near well MW-14T). Even if a release started near well MW-14T, it should migrate beyond well MW-7T within five years. In the western area, a TCE spike from near well MW-1T should reach well MW-10T in a little less than two years (still less than the 5 year performance period). Thus, if releases occur they will probably pass across the areas of concern in a five year monitoring period.

Moreover, case studies found on the Regenesis (manufacturer of HRC) web page, www.regenesis.com, demonstrate that the initial rise in VOC concentration lasts for several months and then concentrations decrease thereafter as the enhanced degradation of the contaminants by microbes commences. If concentrations fail to decrease this may be a sign that the HRC is not working.

The comment letter states that since HRC is persistent in ground water for 2-5 years, as much as a 10 year period is needed to re-establish a soil-ground water equilibrium for the VOC contaminants. It was suggested that at the end of this 10 year period an evaluation of the HRC effectiveness could be performed. Again, the Regenesis web page includes case studies showing an initial increase in VOC concentrations, but this typically lasted only a couple of months, then the concentration decreased steadily. The case studies provided by Regenesis seem to demonstrate that 2-3 months is sufficient time to re-establish a new equilibrium. In addition, this would seem to contradict the modeling assumptions of 50% reduction per year over three years in the eastern area and 10% per year reduction over three years in the western. The model did not include an initial increase of VOCs.

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[1] Based on the following conditions: Gradient (December 2002 data) of 1.4 E-03 ft/ft, conductivity of about 48 ft/day (RI value), Koc for TCA of 135 l/kg, Koc for TCE of 94 l/kg, fraction organic carbon of 0.003 and porosity of 0.3.

Evaluation of Downward Trends in TCA/TCE Concentrations

The comment letter indicates that a strong downward trend should be considered acceptable even if the trend might not reach the 70 percent reduction in five years (perhaps in six or seven years instead). Ohio EPA will evaluate the Five-Year Review Report and, if a trend is identified, Ohio EPA will consider all Site data to determine if the 70 percent reduction goal will be met within a reasonable time-frame. However, the most recent results actually show an increase in concentrations in most of the indicator wells.
In order to address concerns that a more holistic evaluation should be completed before requiring additional HRC injection, Ohio EPA added other evaluation criteria language to the Decision Document including concentrations of organic acids and inorganic parameters, potential spikes due to plume migration, and changes in plume dimensions.

TCA/TCE Reduction Potential

The comment letter states that TCA will probably be reduced at a slower rate than TCE, and indicates that the times for TCA wells (eastern) to meet remedial goals should be extended. The letter also states that the competing reaction of sulfate reduction will interfere more with the TCA elimination process because there is more sulfate near the eastern area and that the reduction potentials of sulfate and TCA occur in the same range. First, no quantitative estimates of reduction rates for either chemical are presented. Second, the reduction potentials of TCE, TCA and sulfate are as follows [2]: TCE, +540 mv, TCA, +580 mV, sulfate -220 mV . These values mean that TCA is actually more likely than TCE to undergo reductive dechlorination. These values also show that sulfate reduction is much less favorable than TCA reduction, which challenges the claim that sulfate reduction competes equally with dechlorination of TCA. Thus, a credible argument that TCA needs more time for reduction than TCE has not been made.

The letter indicates that the rate of degradation between the east and west source areas will vary because of the fact that HRC and the micobes work better on TCE than TCA and there are higher concentrations of sulfate in the eastern plume area. The sulfate competes more readily with the degradation of TCA than the TCE and the reaction of sulfate to sulfide impedes microbe populations. This seems to suggest that HRC may not be as effective in the eastern source area. As stated above, the reduction rates actually indicate that TCA is more likely than TCE to undergo reductive dechlorination. However, there may be other issues that negatively impact the success of HRC in the eastern plume area, specifically, the high concentrations of TCA. All of the monitoring wells within the injection areas show no HRC remaining and no organic acids. The exception to this is well T2/MW-14T, which has the highest concentrations of VOCs at the site and shows that HRC and organic acids are still present in this area. Two years after injection, the microbes have not used the HRC. If the 5 year goals are not meet, these issues must be explored further.

Any differences in degradation rates from the eastern and western source areas, should have been incorporated in the model presented in the Feasibility Study (approved July 10, 2003). However, the model assumes a higher rate of degradation for the eastern source

[2] Notes from “Natural Attenuation for Remediation of Contaminated Sites”, Barden and Wiedemeier , March 2000, page 4-26.

area rather than the wester source area. The modeling assumptions seem to contradict the statements made in the comment letter.

The comment letter suggests that it would be reasonable to use seven years rather than five years to achieve 70% reduction or that 50% reduction in five years could be used rather than 70%. The model submitted in the FS used 50% reduction per year for three years. With the additional data collected before the Five Year Review, the model may be refined and submitted during the Five Year Review

Evaluation of Plume Source Area Monitoring Wells

The comment letter indicates that wells installed before HRC injection should not be used in the evaluation of the 70% criteria. Case studies reviewed from the Regenesis web page show that VOC concentrations initially rise and within several months drop off drastically due to increased microbial activity resulting from the injection of HRC. Monitoring wells installed six months after injection should not be eliminated from the evaluation to determine if additional HRC injection is necessary. As stated above, other factors will be considered in determining whether additional HRC injection will be required including, concentrations of organic acids and inorganic parameters, potential spikes due to plume migration, and changes in plume dimensions. While Ohio EPA will consider the results for each individual well, consideration will also be given to conditions within the entire plume area (eastern plume area or western plume area) before requiring additional HRC injection. Moreover, Ohio EPA will wait until five years after the December 2001 injection event, before determining whether additional injections will be required. Even with an initial rise in concentrations, the five year period should be sufficient for these concentrations to significantly decrease if the HRC is effective. While the case studies demonstrate that many sites achieve 90% reduction within 18 months, Cooper has five years to demonstrate a 70% reduction.

Additionally, the modeling included in the FS, indicates that a reduction greater than 70% should be expected in five years. Looking at well T2/MW-14T, the initial concentration for TCA is 520,000 ug/l. Modeling assumptions of 50% reduction per year over three years and then 5% reduction per year thereafter, would result in a concentration of:

Year 1 - 520,000 ug/l x 50% = 260,000 ug/l
Year 2 - 260,000 ug/l x 50% = 130,000 ug/l
Year 3 - 130,000 ug/l x 50% = 65,000 ug/l
Year 4 - 65,000 ug/l x 5% = 61,750 ug/l
Year 5 - 61,750 ug/l x 5% = 59, 000 ug/l

A 70% reduction over this same time-frame would result in a concentration of 156,000 ug/l. The model indicates that an appropriate five year goal for well T2/MW-14T would be 59,000 ug/l, while Ohio EPA has established a 70% goal of 156,000 ug/l. This 70% goal

is less restrictive than the goals anticipated in the model, and provides a buffer to unexpected conditions not accounted for by the model.

Ohio EPA has made a correlation between the latest ground water quality results and rainfall amounts. In 2003, the rainfall amounts were above average and the concentrations increased in the wells at the Site. Below is a table summarizing five sites that have used HRC. The information for these sites was obtained from the Regenesis web page. It is interesting to note that many of these sites achieve 90%(+) reduction of contaminant concentrations within months of injection. In addition, there appears to be a correlation between high rainfall volumes and rising concentrations in VOCs in ground water. Since the VOC concentrations were not significantly reduced since the 2001 injections and given the correlation to rainfall, there might be unknown source of VOCs or even a dense non aqueous phase liquid (DNAPL) (given the high concentration of TCA) at the Site. If this is the case, then at the Five Year Review additional investigation to determine the nature of the source may be warranted in the eastern and/or western plume areas.

Case Study Site	Contaminants	Concentrations	Treatment Area ft^2	Volume HRC	Time to Cleanup
Massachusetts Dry Cleaner	PCE, TCE, DCE, VC	44 mg/l - 4 mg/l	1800	1890 lbs	99.9% reduction of TCE & PCE in 17 months.
Missouri Brownfield Site	TCE & TCA	1800 ug/l & 43 ug/l	99450	25000	96% reduction for TCE in 10 months
DOD landfill	TCE	135 ug/l	10800	3600	18 months TCE below MCL
New Jersey Brownfield Site	PCE, TCE	5100 ug/l and 3400 ug/l	43200	1600	99% reduction in 175 days
Calif. Manufacturing Site	TCE	4600 ug/l	18900	12000	99% reduction within 150 days
Cooper Industries Eastern Area	TCA	500 mg/l TCA	3400 (Jan/01) 2500 (Dec/01)	3000 11,000	NA
Western Area	TCE	2 mg/l TCE	1300	2000	NA

Earth Sciences Consultants, Inc.
One Triangle Lane • Export, Pennsylvania 15632 • Phone: (724) 733-3000 • Fax: (724) 325-3352

O.E.P.A.
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December 12, 2003
Project No. 4797A-01B

Ms. Kristin Vanecko
Site Coordinator
Ohio Environmental Protection Agency
Southeast District Office
2195 Front Street
Logan, OH 43138

Comments
Additional HRC Application Criteria
Preferred Plan for the Remediation of
Cooper Industries Facility
Muskingum County, Ohio

Dear Ms. Vanecko:

On behalf of Cooper Industries, Inc. (Cooper), Earth Sciences Consultants, Inc. (Earth Sciences) is providing the Ohio Environmental Protection Agency (OEPA) with these comments regarding the recently published "Preferred Plan (Plan) for the Remediation of Cooper Industries, Muskingum County, Ohio" dated November 19, 2003. The comments specifically address the suggested criteria for determining whether the application of additional Hydrogen Release Compound (HRC) is appropriate.

OEPA Criteria for Additional HRC Application

As indicated in Section 8.1 of the Plan, the criteria for the application of additional HRC in the western plume source area are based on the concentrations of trichloroethylene (TCE) in monitoring wells T2/MW-1T, T2/MW-9T, T2/MW-10T, and T2/MW-12T that are located within this source area. A 5-year monitoring period with semi-annual sampling was selected for evaluation of the recommended criteria since the modeling presented in the Feasibility Study (FS) indicates that the site plume will not migrate significantly during the next 5- to 10-year period. If less than a 70 percent reduction in the concentrations of TCE in any of these plume source area wells compared to the pre-injection TCE concentrations is achieved, then the application of additional HRC within the western plume source area would be required.

The criteria presented in the Plan for the application of additional HRC in the eastern plume source area is based on the concentrations of 1,1,1-trichloroethane (TCA) in monitoring wells T2/MW-3T, T2/MW-7T, T2/MW-8T, T2/MW-11T, T2/MW-14T, and T2/MW-15T that are located within this source area. A 5-year monitoring period with semiannual sampling was selected for evaluation of the recommended criteria since the modeling presented in the FS indicates that the site plume will not

migrate significantly during the next 5- to 10-year period. If less than a 70 percent reduction in the concentrations of TCA in any of these source area wells compared to the pre-injection TCA concentrations is achieved, then the application of additional HRC within the eastern plume source area would be required.

General Comment Regarding OEPA Criteria for Additional HRC Application

As stated in the Plan, the review criteria for the additional application of HRC is specifically tied to a reduction in specific western and eastern plume source area wells. However, Section 8.1 of the Plan also provides the performance standard for the entire site plume. The site-wide performance standard includes periodically evaluating volatile organic compound (VOC) data, natural attenuation data, and modeling results to demonstrate that the TCE, TCA, and daughter product concentrations are decreasing at a rate that will meet maximum contaminant levels (MCL) in a reasonable timeframe, not to exceed the 40- to 80-year timeframe projected in the modeling provided in the FS.

Cooper and Earth Sciences believe that it is in the best interest of all parties involved to include the site-wide performance standard as an additional criteria for determining whether the application of additional HRC is necessary. Ultimately, the application of additional HRC is to be performed to enhance the overall degradation of the site plume, as necessary, to assure the attainment of the site-wide performance standard. By only using the data available in specific western and eastern plume source area wells, no consideration is being given to whether it is necessary to inject additional HRC so that the MCLs may be achieved in the 40- to 80-year timeframe. If the site-wide plume data is considered, it may be determined that the application of additional HRC in the western and eastern plume source areas will have little or no effect and/or that other alternatives should be considered.

Specific Comments Regarding OEPA Criteria for Additional HRC Application

Based on our review of the OEPA criteria for additional HRC application, several technical issues were identified that suggest modification to the criteria so that it more accurately indicates that effectiveness of the enhanced bioremediation that has been implemented in the western and eastern plume source areas. These suggested modifications will improve the ability of the concerned parties to determine if additional HRC application will be justified to meet the objectives for the site. The comments are organized into the following topics:

- Plume Source Area TCA/TCE Averaging
- Evaluation of Downward Trends in TCA/TCE Concentrations
- TCA/TCE Reduction Potential
- Evaluation of Plume Source Area Monitoring Wells

<u>Plume Source Area TCA/TCE Averaging</u>

The criteria presented in the Plan evaluates each well individually on whether it meets the required 70 percent reduction in TCE and TCA concentrations in the western and eastern plume source areas respectively. However, as shown in the original concentration for each well presented in the Plan, the concentration of TCA/TCE varies significantly from well to well within each plume source area. Based on plume migration alone, it is expected that variation in concentrations at each well will occur independent of the effects of HRC on an individual well. Consequently, while enhanced bioremediation of the more highly contaminated water of the plume may have occurred, migration of

the plume from more contaminated upgradient areas may mask the "true" effectiveness of the HRC application at an individual well and therefore may underestimate the performance of the HRC injections.

In addition to plume migration issues, it has been documented by Regenesis, the HRC manufacturer, that an increase in the concentrations of TCA/TCE occurs in the groundwater after injection of HRC because TCA/TCE are desorbed from the saturated soils to the HRC/groundwater environment. If the pre-HRC injection concentrations are to be used for reduction comparisons at each well, then the evaluation of the need for additional HRC application should be determined when conditions within the western and eastern plume source areas have returned to a soil-groundwater equilibrium similar to pre-HRC injection conditions. Since HRC is persistent in the groundwater for a period of 2 to 5 years, as much as a 10-year period from the initial HRC injection may be required to reestablish a static soil-groundwater equilibrium state. At the end of this 10-year period, a comparison of the TCA/TCE concentration and mass could be performed to determine the effectiveness of the initial HRC injections.

As an example of the aforementioned plume migration and TCA/TCE mobilization issues, the results of monitoring wells T2/MW-8T and T2/MW-11T are presented for discussion. Monitoring well T2/MW-8T is hydraulically upgradient of monitoring well T2/WM-11T and is also upgradient of the initial HRC injection grid in the eastern source area. Monitoring well T2/MW-11T is located within the initial HRC injection grid in the eastern plume source area but was installed approximately 6 months after the injection of HRC. Well T2/MW-8T had an initial TCA concentration of 53 milligrams per liter (mg/l) on January 5, 2001 prior to HRC injection. Although fluctuations in the concentration of TCA have occurred in well T2/MW-8T, the last three sampling events, May 14, 2002, December 9, 2002, and May 14, 2003, have shown a decrease in the concentration of TCA from 83 mg/l to 60 mg/l to 39 mg/l. In comparison, well T2/MW-11T had TCA concentrations of 77 mg/l, 75 mg/l, and 46 mg/l during these last three sampling events.

However, a review of the groundwater chemistry data for each of these wells leads to different conclusions as to why these reductions occurred. Well T2/MW-11T had significant increases in dissolved manganese, dissolved iron, and carbon dioxide concentrations with corresponding decreases in nitrate, sulfate, and oxidation-reduction potential. These groundwater conditions associated with this well indicate the establishment of favorable conditions in which dechlorination of TCA will occur. However, well T2/MW-8T had insignificant or no change in the concentrations for dissolved manganese, dissolved iron, carbon dioxide, nitrate, sulfate, and in the oxidation-reduction potential. Therefore, it is likely that the observed changes in TCA concentration that have occurred in well T2/MW-8T were the result of natural fluctuations (due to water level changes or plume migration). Given the higher TCA concentration of 83 mg/l present in T2/MW-8T during the May 14, 2002 sampling event, it is possible that the concentration of TCA in well T2/MW-11T may increase due to plume migration even though significant dechlorination of TCA is occurring in well T2/MW-11T.

To accommodate the dynamics of the plume, it is suggested that the evaluation criteria be based on a comparison of the average baseline TCA/TCE concentrations for the wells within each source area to the average TCA/TCE concentrations for the same wells at the end of the 5-year period. Using the average concentration for the wells within each of the plume source areas would better account for the total mass of TCA/TCE within each of the plume source areas. As stated previously, if individual wells are evaluated separately, conditions associated with a specific well may result in misleading

conclusions. This misleading interpretation could result in the unnecessary application of additional HRC in a source area that had already achieved significant reduction in the TCA/TCE mass.

Evaluation of Downward Trends in TCA/TCE Concentrations

The Plan currently does not include any provision for the evaluation of the data obtained during the 5-year period other than whether a particular well has achieved a 70 percent reduction in TCA/TCE concentration. However, each of the aforementioned plume source areas may obtain a less significant reduction in TCA/TCE concentration during the 5-year period and yet illustrate that this objective will be met given more time. It is also possible that achieving less than a 70 percent reduction will not impact the overall migration of the site plume or have any additional impact on the risk to human exposure. Although the plume source areas do not obtain a 70 percent reduction from the pre-injection baseline concentrations, the overall site plume may have significant mass reduction due to natural degradation occurring that results in the overall plume having reduced TCA/TCE concentrations at the plume boundary.

For these reasons, a provision should be included in the criteria for the evaluation of all groundwater data prior to committing to additional HRC application. Additional documentation should be able to be provided to evaluate the concentration gradient of the overall site plume to indicate whether a downward trend in TCA, TCE, and daughter product concentrations is occurring in the site plume as well as in the western and eastern plume source areas. If (1) a downward trend in the plume source areas and the site plume is occurring, (2) no additional risks to human health are present, and (3) the plume degradation is progressing on a time table that allows the TCA/TCE and their daughter products to be reduced below MCL within the 40- to 80-year timeframe estimated by the site model, then additional application of HRC should not be required. Additional applications of HRC should only occur if its use would have a significant favorable impact on site conditions in order to achieve the MCLs within less than 80 years or if its use would reduce any new risks to human health exposure.

TCA/TCE Reduction Potential

The Plan currently considers the reduction of TCE and TCA in the western and eastern plume source areas, respectively, equally in the evaluation of the need for additional HRC application. An additional HRC application would be required in either of these areas if a 70 percent reduction of TCA/TCE concentrations does not occur in each associated plume source area well in a 5-year period. However, the western plume source area originally consisted of a TCE plume with a maximum initial concentration of 10 mg/l. Approximately 2 years after the initial injection of HRC, the maximum concentration of TCE in this area has been reduced to approximately 2 mg/l. The other substantial constituent of concern present at the site, TCA, is present in the western plume source area at an approximate concentration of 0.7 mg/l which is significantly lower than TCE. The other competing electron acceptors present in the groundwater in the western plume source area include manganese, iron, nitrate, and sulfate. The sulfate concentration is the western plume source area is generally between 40 and 130 mg/l.

Alternatively, the eastern plume source area originally consisted of a TCA plume with a much higher maximum initial concentration of 460 mg/l. Over the last 2 years after the initial injection of HRC, the concentration of TCA in this area has been reduced to approximately 300 mg/l. TCE is present in the eastern plume source area at relatively low concentrations of approximately 1.6 mg/l. The other competing electron acceptors present in the groundwater in the eastern plume source area include

manganese, iron, nitrate, and sulfate. The sulfate concentration in the eastern plume source is generally between 150 and 300 mg/l, which is much higher than in the western source area.

Given the general groundwater chemistry presented for the western and eastern source areas, a higher concentration of competing electron acceptors are present in the eastern source area as compared to the western source area. To evaluate the reactivity of the competing electron acceptors, a review of the groundwater oxidation-reduction potential (ORP) and Gibbs free energy for each reaction is necessary. The greater the Gibbs free energy of a reaction (and the higher the ORP for the reaction to occur), the more likely that reaction will be favored when compared to a reaction with a lower Gibbs free energy (and a lower required ORP). Generally speaking, the reduction-oxidation reaction for the dechlorination of TCE is favored in comparison to the reduction-oxidation reaction for the dechlorination of TCA and the dechlorination of TCE will occur at a higher ORP than the dechlorination of TCA. Additionally, the sulfate reduction-oxidation reaction will compete equally with the reduction-oxidation reaction for the dechlorination of TCA and will occur within the same ORP range.

It is expected that all three of the referenced reactions may occur simultaneously and, therefore, will be competing for the limited supply of electrons required for the dechlorination reaction to occur. In addition, the sulfate reduction reaction produces sulfide which is toxic to microorganisms and may cause a reduction in the dechlorination reaction rate for TCA. Based on the favored status of the TCE dechlorination reaction, the competing status of the sulfate reduction reaction, and the potential toxicity effect of sulfide, the rate of TCA dechlorination will be much slower than the TCE dechlorination rate. As such, it appears that requiring a 70 percent reduction over 5 years for the TCA concentrations within the eastern plume source area could be considered inappropriate when compared to the western plume source area.

In addition to the expected slower dechlorination rate for TCA, a second HRC injection was performed in the eastern plume source area approximately 10 months after the initial HRC injection to enhance the subsurface conditions and further promote the occurrence of enhanced bioremediation. Therefore, given the slower TCA dechlorination rate in the eastern plume source area and the more recent injection of HRC, a time period greater the 5 years (i.e., 7 years) may be necessary to achieve a 70 percent reduction in TCA concentration. Alternatively, a lower initial reduction of TCA (i.e., 50 percent) could be proposed for the eastern plume source area within the 5-year period to account for the additional factors in this plume source area.

Evaluation of Plume Source Area Monitoring Wells

The Plan provides a set of wells for the western plume source area and the eastern plume source area that are to be evaluated to determine whether the application of additional HRC is necessary. The current Plan indicates that for all listed wells, the initial sampling concentrations are to be utilized for calculating the percent reduction. However, monitoring wells T2/MW-11T and T2/MW-12T in the eastern and western plume source areas, respectively, were not installed and sampled until approximately 6 months after the initial injection of HRC. Therefore, in accordance with the Plan, the initial sampling event concentrations are to be used as the baseline concentrations.

However, because approximately 6 months passed since the initial injection of HRC, using these data as baseline concentrations would not accurately reflect the TCA/TCE reduction that may have occurred in the area of these wells. These wells were installed in the center of the HRC injection grid

for each of the plume source areas and therefore would have likely seen the greatest influence with regard to degradation of TCA/TCE during the initial 6-month period. Based on this information, it is suggested that these wells be removed from the evaluation criteria.

Alternatively, an estimated concentration could be used based on concentrations at adjacent wells. Estimated pre-injection baseline concentrations for monitoring wells T2/MW-11T and T2/MW-12T were presented in Tables 6 and 5, respectively, of the FS. Using historical information from adjacent wells in the eastern plume source area, monitoring well T2/MW-11T had been estimated to have a HRC pre-injection concentration for TCA of 44 mg/l. Similarly, monitoring well T2/MW-12T had been estimated to have a HRC pre-injection concentration for TCE of 4.3 mg/l based on historical information from adjacent wells in the western plume source area.

Summary

As provided in the general comments regarding the OEPA criteria, two criteria should be considered for determining the necessity for an additional application of HRC. These criteria include (1) a review of the site plume VOC data, natural attenuation data, and modeling results to demonstrate progress in meeting the site-wide performance standard and (2) the percent reduction of TCA/TCE in the eastern plume source area and western plume source area respectively. Additional HRC application will not be necessary in the 5-year period if either of these criteria has been met.

In addition, several technical issues were identified that may suggest modifications to the plume source area evaluation criteria to more accurately reflect the effectiveness of enhanced bioremediation activities in these plume source areas. In summary, the technical issues identified addressed the following topics:

- The proposed criteria may not provide a sufficient monitoring period for the comparison of the TCA/TCE concentrations to the pre-injection TCA/TCE concentrations. A sufficient monitoring period should be provided to allow a static soil-groundwater equilibrium state to occur for the comparison to pre-injection TCA/TCE concentrations.

- Since migration within the plume source areas may result in higher TCA/TCE concentrations migrating downgradient to monitoring wells with lower pre-injection concentrations, averaging of the concentrations in the monitoring wells within each plume source area should be performed. Averaging of the concentrations would more accurately reflect the reduction in TCA/TCE concentrations in each of the plume source areas.

- The additional HRC application criteria for the eastern plume source area should be modified to reflect the additional presence of competing electron acceptors in this area as well as the more recent injection of HRC. A 50 percent reduction over the 5-year period has been proposed for this area given these additional factors. Alternatively, a 70 percent reduction could be used with an extended time (i.e., 7 years).

- Monitoring wells T2/MW-12T and T2/MW-11T were not installed until after the initial injection of HRC. If pre-injection TCA/TCE concentrations are to be utilized, then these wells should be removed from the criteria. Otherwise, an estimated baseline concentration for these wells should be used.

Cooper thanks the OEPA for considering these comments regarding the criteria to determine the need for additional HRC injection as presented in the Plan. At your convenience, we would like to schedule a meeting with OEPA to further discuss these comments. In the meantime, if you should have any questions concerning the comments presented, please do not hesitate to contact us.

Respectfully submitted,

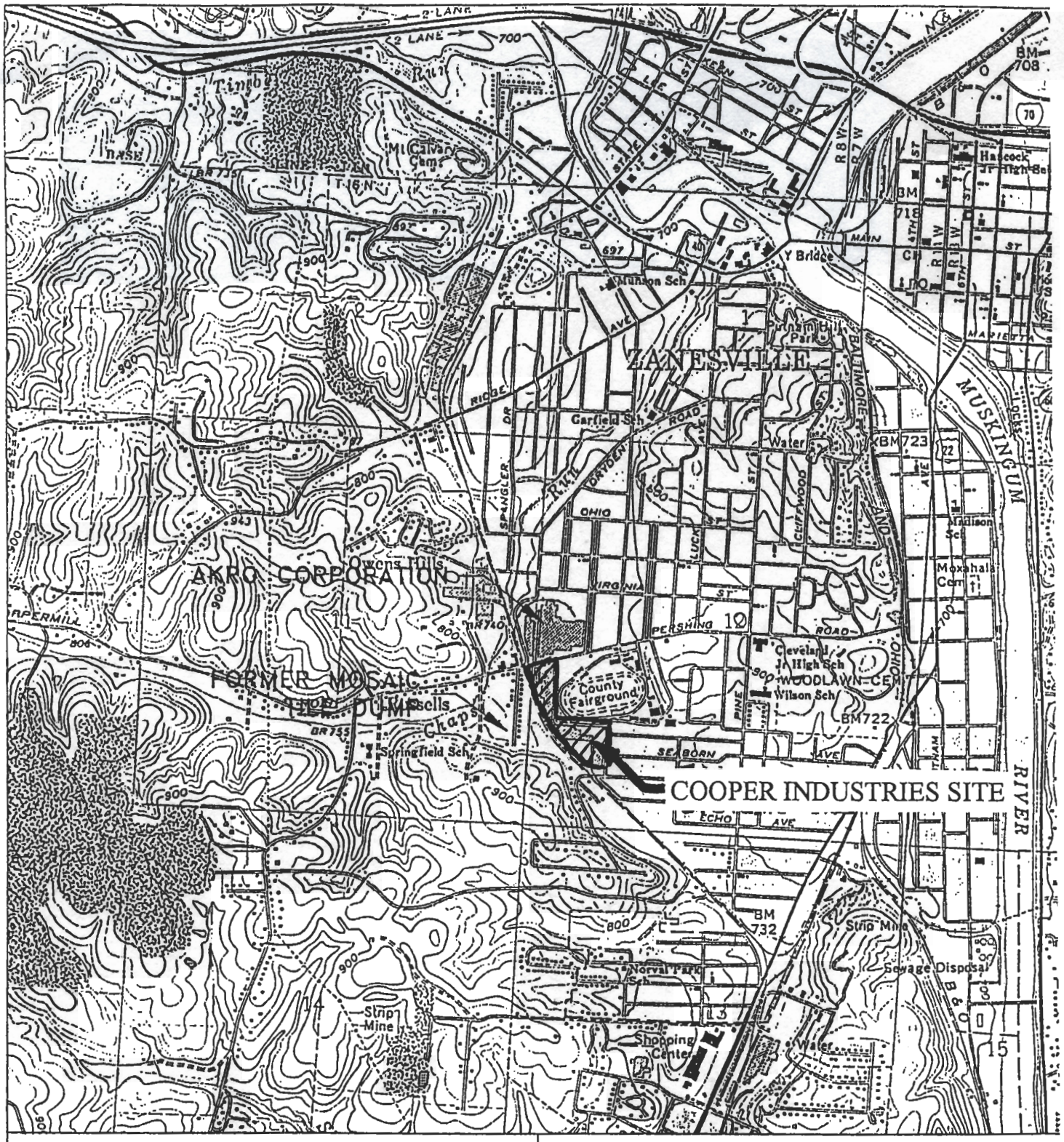
Dean M. Steinbach, P.E.
Project Manager

DMS:klb

cc: M. O'Brien
R. Hendricks

4797a\corr\vanecko

FIGURES



SCALE – FEET

0 2000

OHIO

QUADRANGLE LOCATION

N

REFERENCE

USGS 7.5-MIN TOPOGRAPHIC QUADRANGLE
ZANESVILLE WEST, OHIO
DATED 1961, PHOTOREVISED 1985

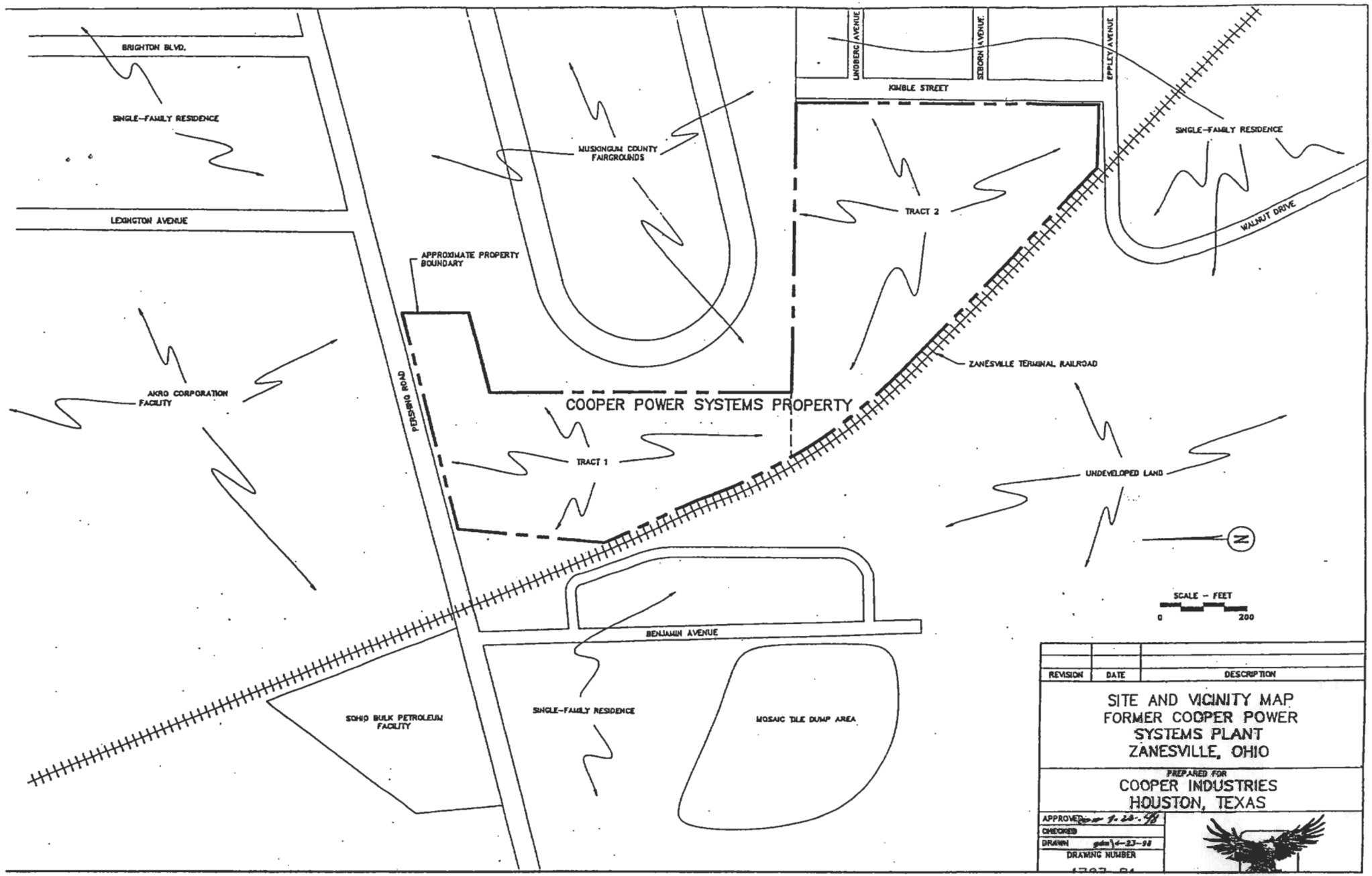
REVISION	DATE

Decision Document

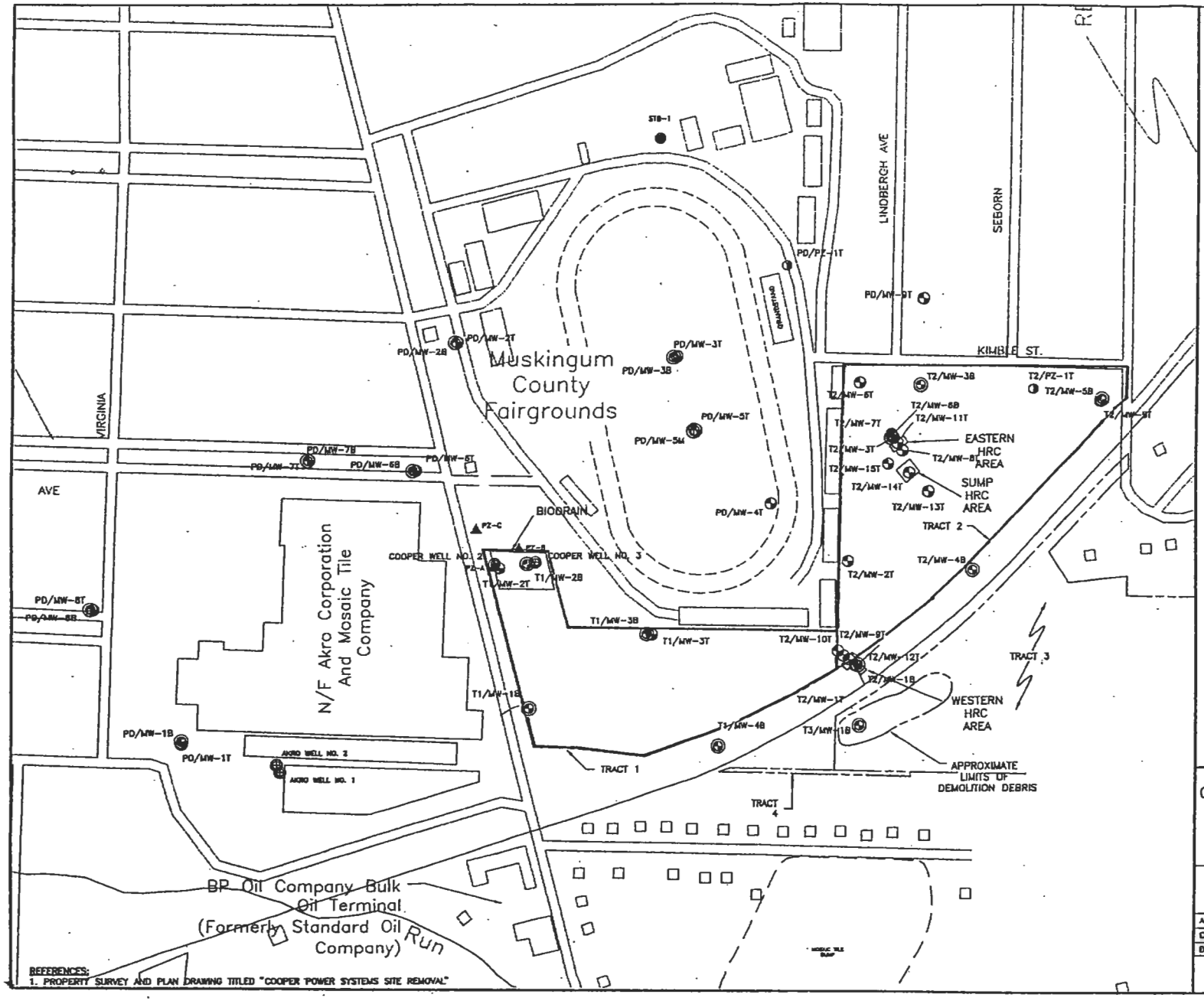
SITE LOCATION MAP
FORMER COOPER POWER
SYSTEMS PLANT
ZANESVILLE, OHIO

PREPARED FOR
COOPER INDUSTRIES
HOUSTON, TEXAS

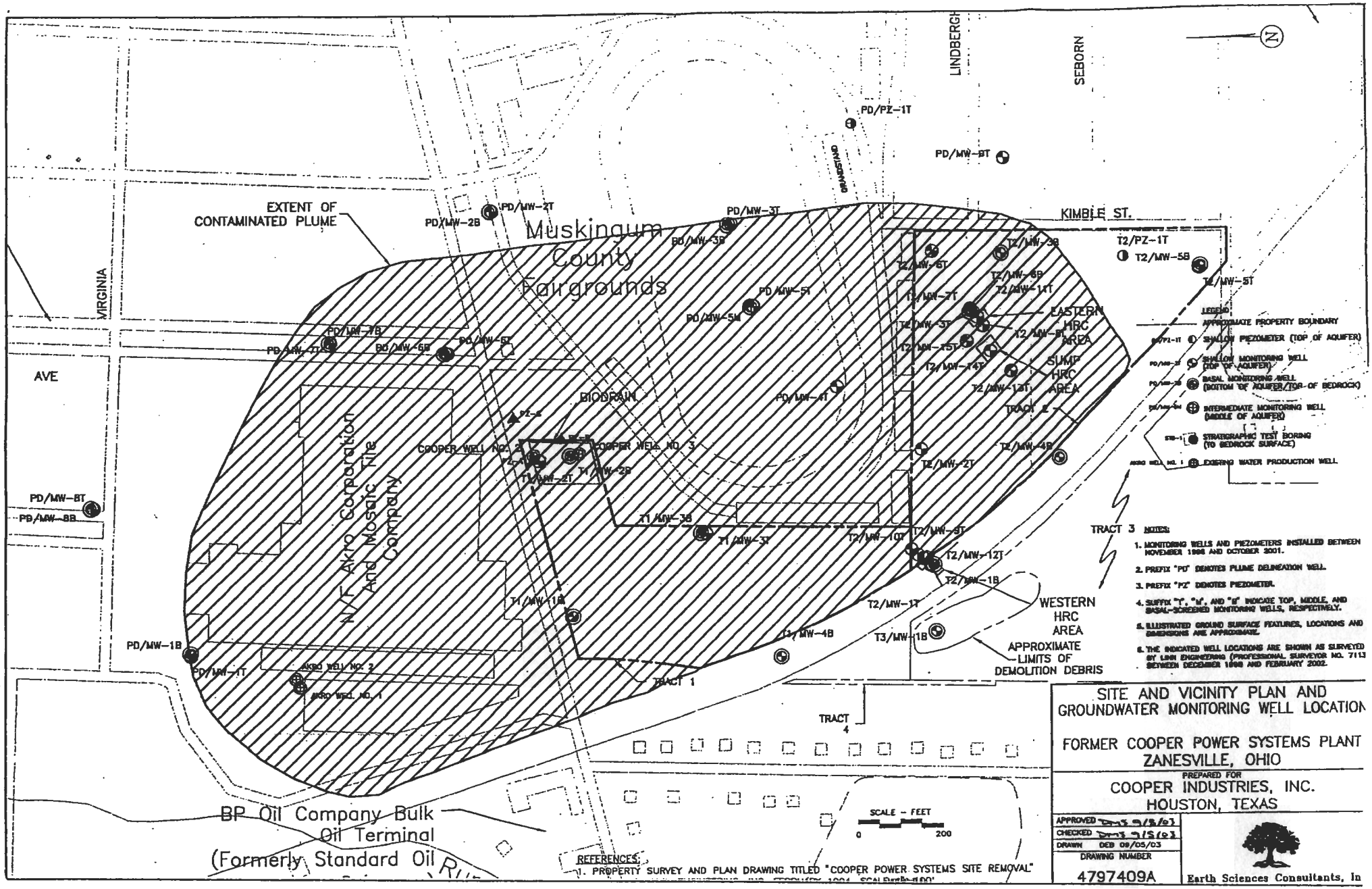
APPROVED	DLW 7-21-98
CHECKED	
DRAWN	gdm \ 3-5-98
DRAWING NUMBER	4797-A1



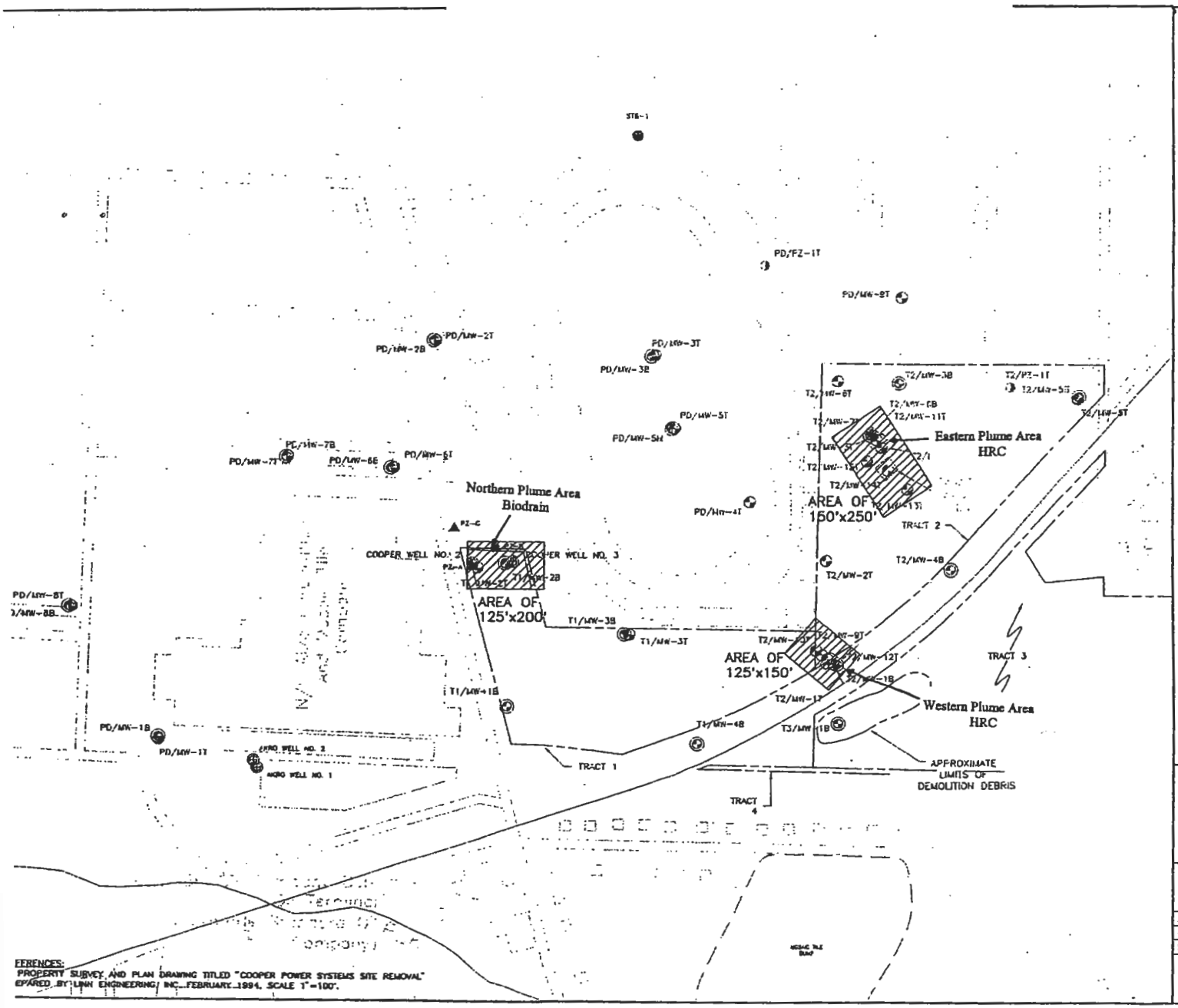
Decision Documen
Figure 2



Decision Document Figure 3



Decision Document Figure 4



LEGEND

APPROXIMATE PROPERTY BOUNDARY

PD/PZ-1T — SHALLOW PIEZOMETER (TOP OF AQUIFER)

PD/MW-2T — SHALLOW MONITORING WELL (TOP OF AQUIFER)

PD/MW-2B — BASAL MONITORING WELL (BOTTOM OF AQUIFER/TOP OF BEDROCK)

PD/MW-5M — INTERMEDIATE MONITORING WELL (MIDDLE OF AQUIFER)

STB-1 — STRATIGRAPHIC TEST BORING (TO BEDROCK SURFACE)

AERO WELL NO. 1 — EXISTING WATER PRODUCTION WELL

Pilot Study Areas

NOTES:

1. MONITORING WELLS AND PIEZOMETERS INSTALLED BETWEEN NOVEMBER 1998 AND OCTOBER 2001.
2. PREFIX "PD" DENOTES PLUME DELINEATION WELL.
3. PREFIX "PZ" DENOTES PIEZOMETER.
4. SUFFIX "T", "M", AND "B" INDICATE TOP, MIDDLE, AND BASAL-SCREENED MONITORING WELLS, RESPECTIVELY.
5. ILLUSTRATED GROUND SURFACE FEATURES, LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
6. THE INDICATED WELL LOCATIONS ARE SHOWN AS SURVEYED BY LINN ENGINEERING (PROFESSIONAL SURVEYOR NO. 7113) BETWEEN DECEMBER 1998 AND FEBRUARY 2002.

SCALE - FEET
0 250

SITE AND VICINITY PLAN

Pilot Study Areas

FORMER COOPER POWER SYSTEMS PLANT
ZANESVILLE, OHIO

PREPARED FOR
COOPER INDUSTRIES, INC.
HOUSTON, TEXAS

APPROVED	DMS 7/28/03
CHECKED	DMS 7/28/03
DRAWN	DEB 7/30/03
DRAWING NUMBER	4797214

Earth Sciences Consultants, Inc.

FERENCES:
PROPERTY SURVEY AND PLAN DRAWING TITLED "COOPER POWER SYSTEMS SITE REMOVAL" EPARED BY LINN ENGINEERING, INC., FEBRUARY 1994, SCALE 1"=100'.

Decision Document Figure 5