RECORD OF DECISION

BEE CEE MANUFACTURING SITE
MALDEN, MISSOURI

PREPARED BY:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII

KANSAS CITY, KANSAS

SEPTEMBER 30, 1997

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Bee Cee Manufacturing Site
Malden, Dunklin County, Missouri

STATEMENT OF BASIS AND PURPOSE

This decision document presents the remedial action selected to cleanup groundwater contamination at the Bee Cee Manufacturing site in Malden, Missouri. This remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and 40 C.F.R. Part 300, the National Contingency Plan. The decision is based on the Administrative Record file for the site.

The remedy selected is the same remedy that the State of Missouri presented in the Proposed Plan. The Proposed Plan was prepared by and approved by the state. The remedy selected is unchanged from that plan.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Bee Cee Manufacturing site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The remedy selected to remediate contaminated groundwater at the Bee Cee Manufacturing site is Natural Attenuation, Groundwater Monitoring and Institutional Controls. The preferred remedy adequately protects human health and the environment from the risks posed by the site because the contaminant plume is not likely to migrate off the Malden Industrial Park property until the concentration of chromium in the groundwater is reduced below levels of concern. Additionally, the area is served by Malden's municipal water supply system. This eliminates any need for installing individual water supply wells at or near the site. Hexavalent chromium in the groundwater will attenuate to concentrations below remediation goals due to natural processes. Institutional controls will be required to prevent future use of the groundwater in this part of the industrial park and to warn potential purchasers of the contamination. Additional groundwater monitoring wells will be installed to assess the concentration and migration of the contaminant plume.

All federal and state applicable or relevant and appropriated regulations and requirements (ARARs) that will pertain to remedial action at this site will be complied with by this alternative.

STATUTORY DETERMINATIONS

The selected remedy for the Bee Cee Manufacturing site is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the action for the site. It is also cost-effective. This action constitutes the final remedy for the site. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Eventually, there will be no hazardous substances above health-based levels remaining at the site. Within five years of installing the groundwater monitoring system, EPA will conduct a review to ensure that the remedy for the Bee Cee Manufacturing site is providing adequate protection of human health and the environment

Diane K. Callier

for Dennis Grams, P.E.
Regional Administrator
U.S. EPA, Region VII

9/30/99
Date

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RECORD OF DECISION

DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

1.1 SITE NAME AND LOCATION

The Bee Cee Manufacturing facility is located in the town of Malden, Dunklin County, Missouri, in Township 23 North, Range 10 East, Section 28 (U.S. Geological Survey, 1978). The site is located within the boundaries of the Malden Municipal Airport and Industrial Park, which was formerly a U.S. Military Base.

The site is located north of Harper Drive, northeast of the former Bee Cee Manufacturing Company building (site facility), and includes an open field used by the Malden Fire Department as a training area. A man-made ditch, draining from west to east, is located approximately 500 feet north of the site facility.

This site covers approximately five acres and previously consisted of the metal plating facility and a gravel-filled infiltration pit. The foundation of the manufacturing plant remains onsite. The gravel in the pit has been removed and the excavation was backfilled with clean soil. Figure 1 shows the location of the site.

1.2 TOPOGRAPHY

Site elevations range from 290 feet above mean sea level (MSL) to 293 feet MSL. The topographic elevations of the site vary throughout, and there does not appear to be one particular surface drainage pathway. The topographic relief is approximately 1.5 feet (excluding the ditch north of the site).

The site is located physiographically in the southeast Mississippi lowlands subdivision of the Gulf Coastal Plain Province. Most of Dunklin County is a nearly level part of the current Mississippi River Alluvial Plain. The surface soils in and around Malden consist of generally loamy and sandy alluvium. Levees constructed along the major rivers and a system of flood control canals protect the county from flooding. Some areas still experience inundation during rainy seasons because of locally poor drainage and level topography.

Most of the regional surface-water drainage is through a system of flood-control canals. The construction of these canals changed almost all of the Mississippi river delta area in southeastern Missouri from a swamp to a major agricultural area by lowering groundwater levels and providing surface drainage. The drainage system consists of a headwater diversion canal, three detention basins in which flood waters are temporarily

impounded, and thousands of miles of parallel, lesser channels spaced at one mile intervals generally from west to east. This drainage system has reclaimed more than 2,000,000 acres of southeast Missouri lowlands.

Regionally the surface-water drainage is controlled by canals and tributaries leading to the Mississippi River. The surface water generally drains from north to south and then flows east toward to the Mississippi River. Surface drainage in the immediate area of the site is generally south to north, toward a drainage ditch on the north boundary of the site. Surface water then flows under low gradient to the east.

The alluvium is considered to be an aquifer (referred to in this report as the "alluvial aquifer"), and is approximately 100-150 feet in thickness in some areas. It consists of sand, gravel, silt and clay that were deposited by the Mississippi River and the ancient Ohio River and their tributaries. The groundwater surface is generally about 10 feet below the ground surface. Through the measurement of groundwater levels in four of the five on-site monitoring wells, it was determined during field investigations that the upper-most alluvial aquifer flow direction is toward the southeast.

1.3 ADJACENT LAND USES

The land within a quarter mile of the site is part of an industrial park. While most of it is vacant, some areas are used for small industrial plants and warehouse space. The nearest home is just over a quarter of a mile south of the site. Malden's municipal water supply well No. 4 is located within one mile of the site. Water from the site is not likely to impact this well since it is side gradient from the site and is completed in an artesian aquifer about 800 feet below ground surface.

2.0 SITE HISTORY

Bee Cee Manufacturing occupied the site from 1964 until early 1983 and produced aluminum moldings for storm windows and doors. The window and door moldings were cleaned and etched in preparation for application of a finishing coat of paint. A series of five open vats were used to hold cleaning, etching and rinsing fluids. The aluminum moldings were dipped from one tank to another during the manufacturing process. The chemicals in the various vats were identified under the trade names Alodine 4780 and Ridoline 72.

Waste liquid from the process was allowed to flow through a series of pipes directly onto the surface soil immediately north of the east end of the facility. Personnel from the Water Pollution Control Unit of the Missouri Department of Natural Resources' (MDNR) Southeast Regional Office reported chromium wastes on the surface at the site during an investigation conducted July 13, 1981. In a letter from MDNR dated July 27, 1981, Bee Cee Manufacturing was warned to cease the discharge of untreated process water.

Bee Cee Manufacturing declared bankruptcy in 1983, and the site was taken over by Missouri Aluminum Products Company. This company cut and assembled storm doors, but did not include chemical cleaning of aluminum in the process as did Bee Cee Manufacturing.

Falcon Door and Window (Falcon) next occupied the site. Falcon only assembled aluminum door and window frames and did not generate any hazardous wastes from their process. According to a bill of sale dated April 15, 1985, Falcon Communications purchased certain assets from Missouri Aluminum Products Company. The vats were not purchased by Falcon. However, Falcon arranged to have the material that remained in the tanks removed.

The contents of the five vats was sampled and analyzed by William A. Green and Associates (WAGA) of Malden, Missouri, for pH, hexavalent, trivalent and total chromium, aluminum, nickel, and lead to determine compliance with discharge requirements to the local Publicly Owned Treatment Works (POTW). According to a Falcon letter to MDNR dated December 20, 1985, the Malden Board of Public Works authorized discharging the contents of vats one, two, four, and five, to the POTW provided that the pH was adjusted to between 6 and 9 prior to discharge.

The sludge in the four vats was removed. However, the vats were left in place. A recommendation was made for the chromic acid solution in vat three, to be removed by a hazardous waste disposal company. Falcon Door and Window requested authorization from MDNR for removal of the waste material contained in the tank.

According to a letter written by WAGA to Falcon on March 20, 1986, Mid-America Transport Services, a licensed hazardous waste transporter, removed, and transported the chromic acid solution. According to the letter, the tank walls were rinsed; however, a small amount of aluminum solution and less than one gallon of rinse water remained on the tank bottom. The chromic acid solution was transported to Chem Clear, Inc., in Chicago, Illinois, on March 20, 1986, as stated in a copy of the Uniform Hazardous Waste Manifest.

During the time that the building was occupied by the various tenants, several sampling events and evaluations of the groundwater (from nearby wells), soil, and "sludge" at the site were conducted. The MDNR Division of Environmental Quality Laboratory Services Program collected samples from the following four sources: (1) selected city wells; (2) liquid discharge from a pipe extending out of and onto the north side of the building (from the area of the building that contained the chemical cleaning process vats); (3) discolored soil north of the building; and (4) the five process vats. Water samples were also collected by the Missouri Department of Health (MDOH) at several nearby residential, irrigation, and public water supply wells from 1984 to 1991. Southeast Missouri State University conducted a test-pit survey at the site in 1986.

A report prepared by MDNR on June 27, 1984, indicated that the sludge north of the building was sampled and analyzed according to the Toxicity Extraction Procedure (TEP). The reported chromium concentration was 2.5 milligrams per liter (mg/l). According to the report, the regulatory TEP Limit for chromium was 5.0 mg/l. The discharge liquid from the building was also analyzed and found to have a chromium concentration of 0.62 mg/l. Several wells located near the site were also sampled; however, only three metals (aluminum, barium, and lead) were detected at concentrations which were above their associated detection limit. Aluminum and chromium were each detected at concentrations above detection levels at a residential well with concentrations at 1.0 and 0.032 mg/l, respectively. Samples taken from the two wells at the nearby golf course had concentrations of barium above the detection level.

Seven city wells were monitored from March 1984 to September 1991 by MDOH. The groundwater analytical data from samples taken from those wells indicated no concentrations of chromium above the detection limit of 0.005 mg/l.

A preliminary removal assessment was conducted by the Environmental Protection Agency (EPA) on February 12, 1992. The Bee Cee Manufacturing building interior and exterior were inspected for future removal procedures by representatives of EPA and MDNR. The potential source area for chromium contamination was the soil north of the east end of the metal treating facility where chemical-process liquids were disposed. The soils in this area were sampled in April 1992; approximately 40 soil samples were collected for analysis.

The EPA approved an Action Memorandum For the Removal of Contaminated Surface Soil at the Bee Cee Site on July 1, 1992. The action level for the soil was set at 2000 milligrams per kilogram (mg/kg) for total chromium and 180 mg/kg for hexavalent chromium. The scope of the removal included contaminated soil and the portion of the Bee Cee Manufacturing building that contained five vats used for metal plating processes.

On July 27, 1992 , EPA's on-scene coordinator (OSC) mobilized to the site. Removal of the contaminated soil and process tanks and portions of the building was completed on August 20, 1992.

Following listing of the site on the National Priorities List (NPL) in 1991, a Remedial Investigation (RI) of the site was conducted. Parts of this investigation occurred concurrently with the Removal Investigation and Removal Action. Later, a Further Investigation of Groundwater (FIG) was conducted. Both investigations were conducted to better define the contamination of the site. Field activities for the RI were conducted from April 13 through 24, and June 8 through 12, 1992. Field activities for the FIG were conducted from April 12 through April 17, 1993.

Based on conclusions and recommendations contained in the RI, FIG and Risk Assessment, a Feasibility Study (FS) was ordered. The FS was completed in October 1994. Information from the FS was used to select the most appropriate remedy for the remediation of the contaminated groundwater at the Bee Cee site. This selection was detailed in the Proposed Plan, which was completed and released for public comment in April 1997.

3.0 PUBLIC PARTICIPATION IN THE REMEDY SELECTION

The FS and Proposed Plan, which were included as part of the Administrative Record (AR), were made available to the public at the Malden Public Library and at the offices of EPA in Kansas City, Kansas, and at the MDNR in Jefferson City, Missouri. The notice of availability for the AR and the announcement of a public meeting held on May 1, 1997, was published in the Malden Democrat. The public comment period was held from April 16, 1997, to May 16, 1997. At the public meeting, representatives from the MDNR and the EPA received public comments and answered questions about problems at the site and the remedial alternatives under consideration. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this Record of Decision (ROD).

This decision document presents the selected remedial action for the Bee Cee Manufacturing site in Malden, Missouri. This remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability (CERCLA) Law of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The response action selected in this ROD will address the contamination at the site not addressed during the prior removal action. This response action involves monitoring and attenuation of hexavalent chromium-contaminated groundwater. It also involves enacting institutional controls to restrict access to contaminated groundwater at the site. The contaminant plume is estimated to be 400 feet long by 400 feet wide, with a maximum depth of 25 feet. The plume is estimated to have traveled 438 feet from the point of release. Analytical results of groundwater samples from the site indicate the on-site presence of total chromium at levels above current water quality standards. Hexavalent chromium has been detected at levels that do not exceed current water quality standards; however, these concentrations are in excess of the risk-based level calculated by the MDOH. Analytical results also indicate the presence of arsenic at concentrations above current groundwater quality standards, but sampling results from the background well indicate these levels of arsenic may represent naturally occurring concentrations.

5.0 SUMMARY OF SITE CONTAMINATION AND REMEDIAL ACTIVITIES

5.1 REMEDIAL INVESTIGATION

Following listing of the site on the National Priorities List, a RI of the site was conducted. Field activities for the RI at the Bee Cee site were conducted from April 13 through 24, and June 8 through 12, 1992. Groundwater at the site was evaluated during both field investigation episodes. Site field investigation activities included:

- Conducting soil sampling, including x-ray fluorescence (XRF) on-site screening of surface soil and "slam bar" (sample driving method) core sampling;
- Conducting a groundwater sampling cone penetrometer (geoprobe) survey to optimize the location of the planned monitoring wells;
- Installation of groundwater monitoring wells to collect groundwater samples for chemical analysis;
- Measuring groundwater elevations in all monitoring wells within a 24-hour period;
- Conducting a pumping test to evaluate the hydraulic connection between the deep aquifer (city wells), the shallow aquifer (deep monitoring well) and the upper-most alluvial aquifer (shallow monitoring wells);
- Conducting three slug tests on three monitoring wells (MW-3, MW-4 and MW-5) to evaluate the hydraulic properties (hydraulic conductivity) of the upper-most alluvial aquifer;
- Conducting a site survey to locate all monitoring wells, soil sample locations, and sampling cone penetrometer locations, both horizontally and vertically, and tying them into the Missouri State Plane Coordinate System;
- Air samples were also collected for seven days over a ten-day period'; and
- In addition to the soil sampling, sediment samples were collected from the ditch north of the site.

Additional field investigation activities (Further Investigation of Groundwater (FIG)) were conducted from April 12 through 17, 1993. Site field activities included:

- Conducting a groundwater geoprobe survey to evaluate the extent of groundwater contamination in the upper-most alluvial aquifer and evaluate whether or not the shallow aquifer has been impacted by chromium contamination emanating from the site;
- Installing five (5) temporary sand points (piezometers) to collect groundwater samples for chemical analysis and evaluating the groundwater gradient and flow direction;
- Measuring groundwater elevations in all monitoring wells and the sand points within a 24-hour period to evaluate the gradient and groundwater flow direction;

- Conducting a site topographic survey to locate all additional geoprobe and sand point locations, and tying them to the Missouri State Plane Coordinate System; and
- The collection of groundwater samples for chemical analysis from the five (5) monitoring wells which were installed during the initial field investigation.

5.2 SOIL AND FACILITIES CONTAMINATION

The potential source area for chromium contamination was the soil north of the east end of the metal treating facility where chemical-process liquids were disposed. The soils in this area were sampled in April 1992, and were evaluated by the collection of 40 soil samples at depths of 0-3, 3-6, 6-9, 9-12, 12-18, 24-36, 36-48, and 48-54 inches below ground surface. During the RI, the soils were tested for total metals, soil pH, cyanide, and hexavalent chromium. In addition, four samples were tested for toxicity characteristic leaching procedure (TCLP) metals. The hexavalent chromium was analyzed by SW 846 Method 7196 A following TCLP extraction.

A visibly stained surface area adjacent to the building footprint that contained the process tanks was considered the contamination zone. Prior to the RI activities, EPA performed a screening survey using an XRF spectrometer to study the areal and vertical extent of chromium contamination at the facility. A slam bar was used to retrieve samples at depths below the ground surface. Nine locations were analyzed at three-inch intervals with the XRF. Chromium contamination extended to 30 inches below the ground surface at some locations. The XRF study indicated a larger area of surface contamination than indicated by visible staining (E&E, 1992).

The Technical Assistance Team (TAT) of Ecology and Environment, Inc., was tasked by EPA to provide technical support in conjunction with potential removal activities at the site. TAT's technical support included screening the soil with an XRF Spectrometer, confirmation soil sampling, analytical laboratory procurement, contractor monitoring, and site documentation (E&E/TAT, 1992).

A preliminary removal assessment was conducted by EPA on February 12, 1992. The XRF chromium model was developed by calibrating laboratory analyses of six samples from the February 12, 1992, field investigations with XRF measurements. The soil samples represented surface, subsurface and residual waste from inside the Bee Cee Manufacturing building. Total chromium concentrations were measured in the range of 7.24 to 24,100 mg/kg in surficial soils (0 to 3 inches).

The EPA assisted with the RI by conducting soil screening with the XRF Spectrometer which had been calibrated for total chromium during the initial field investigation in February 1992. The results from the screening were used to identify the contaminated zones. If the concentration of total chromium equaled or exceeded 200 mg/kg in the surficial soil of an area, it was designated as a contaminated zone. A 10- by 10- foot

grid pattern was used for the initial testing. Isoconcentration maps were created to delineate specific areas of chromium contamination with sampling locations. Field measurements showed that there was contaminated surficial soil further to the east than was initially anticipated. Therefore, a 20-foot extension was added to the eastern border of the grid.

Beginning June 9, 1992, sampling of the monitoring wells, slug tests, and a deep and alluvial interconnectivity test were conducted. At this time, the Bee Cee Manufacturing building interior and exterior were inspected for future removal procedures by EPA and MDNR.

The EPA collected four additional soil samples that were analyzed for total chromium, hexavalent chromium, and Toxicity Characteristic Leaching Procedure (TCLP) chromium analyses. The results of the analyses indicated that, although high levels of total chromium were detected in the soil, the levels of hexavalent chromium were quite low. The hexavalent chromium ranged from <1.5 - 10.7 mg/kg and the total chromium ranged from 4,080 - 23,100 mg/kg (E&E, 1992). The TCLP level did not exceed 5.0 mg/l of total chromium, which is the Resource Conservation and Recovery Act (RCRA) regulatory level for chromium-contaminated soil to be classified as a hazardous waste.

5.2.1 REMOVAL ACTION

The EPA approved an Action Memorandum For the Removal of Contaminated Surface Soil at the Bee Cee site on July 1, 1992. The action level for the soil was set at 2000 mg/kg for total chromium and 180 mg/kg for hexavalent chromium. The scope of the removal included contaminated soil and the portion of the Bee Cee Manufacturing building that contained five vats used for metal plating processes.

On July 27, 1992 , EPA's on-scene coordinator (OSC) mobilized to the site. The building's siding was sampled for asbestos content analysis. Several containerized products remaining in the building were put into an inventory.

The analytical results from the asbestos samples showed that the siding on the building contained 40 percent chrysotile asbestos. Therefore, it was necessary to complete an asbestos abatement project as part of the removal. Thirty-eight plastic bags (approximately 3.26 cubic yards) of asbestos-containing material were removed from the exterior of the building and disposed of as special waste.

On August 3, 1992, EPA began the removal of the vats inside the building. Demolition of the building began and was completed on August 5, 1992. The EPA collected three soil samples from underneath the concrete pad of the building. The samples were submitted for total chromium, hexavalent chromium, and TCLP chromium analyses. The soil used to backfill the building excavation was obtained from an off-site location. It was analyzed for heavy metal contamination before it was placed at the site.

On August 8, 1992, EPA completed the demolition of the various scrap metal parts and vats. On August 10, 1992, a salvage operator removed two loads of scrap steel from the site. A total of 17 truckloads (62 tons) of debris from the building demolition was disposed of offsite as special waste.

The contaminated surficial soil at the Bee Cee Manufacturing site was divided into fourteen sections, ranging in area from 1,200-4,800 square feet (ft^2), which would be removed and sampled for verification. The EPA excavated sections of soil with three to six- inch lifts, followed by confirmation screening with the XRF. RES began loading soil from Section 1 (south of the Bee Cee Manufacturing building) on August 12, 1992. The soil was also considered a special waste, transported by the same waste hauler, and deposited in the same landfill as the building debris.

During the excavation of the soil, EPA uncovered a 14 foot x 27 foot x 6 foot gravel pit in the contaminated zone. The gravel appeared to have been used during Bee Cee's operation to facilitate percolation of the wastewater discharge from the facility. The gravel was excavated and disposed of along with the soil. A total of 26 truckloads (356 tons) of soil were removed. Thirty seven (37) loads of backfill were delivered and placed at the site.

The backfilled area of the site was seeded and covered with straw. A cement block wall was constructed to enclose the east end of building. Site restoration was completed on August 20, 1992. All containerized materials were either shipped back to the manufacturer, land filled, or recycled.

5.3 GROUNDWATER CONTAMINATION

Based on slug tests conducted on monitoring wells completed in the upper-most alluvial aquifer, a hydraulic conductivity range of 3 to 13 ft/year was calculated (SvE, 1993b). The observed hydraulic gradient across the site was approximately 0.001 ft/ft. Based on these values and an estimated effective porosity of 0.35, an average linear flow velocity of 0.009 to 0.04 ft/day can be calculated.

An approximation of the distance from the chromium plume to its outer edge can be calculated by considering that the distance down gradient from the source to the leading edge or chromium plume is equal to the average linear groundwater velocity multiplied by the estimated time since chromium entered the groundwater, assuming the hydraulic properties of the aquifer remain constant.

According to the March 5, 1981, MDNR report, Bee Cee Manufacturing occupied the building from 1964 to early 1983. Assuming that discharges of chromium-containing solution began in 1964, an estimated 30 years have elapsed since the first discharge. Using the maximum average linear velocity for ground water at the site of 0.04 ft/day, an estimated travel distance of 438 feet can be calculated for the down gradient part of

the chromium plume. This value does not take into consideration factors that would retard the movement of solute, such as interaction with aquifer materials.

During the Further Investigation of Groundwater (FIG) field investigation, groundwater samples (for laboratory analyses) were collected from 18 shallow and four deep cone penetrometer borings; five sand points; and five monitoring wells. The results of those analyses indicated that each of the target analytes (arsenic, beryllium, chromium, lead, zinc and hexavalent chromium) were detected above detection limits in at least one of the groundwater sampling locations.

Five (5) additional groundwater samples were collected from nearby residential and irrigation wells completed in the upper-most alluvial aquifer. Each of these samples were analyzed for arsenic, beryllium, chromium, lead, and zinc. Hexavalent chromium was analyzed at one location. Zinc was detected at each location at concentrations ranging from 23.4 to 64.7 micrograms per liter (μg/l), which are below the associated Secondary Drinking Water Standard of 5000 μg/l. Lead was detected at one location at a concentration of 4.0 J μg/l, which is below the Action Level of 15 μg/l.

5.4 SUMMARY AND RECOMMENDATIONS

Risk-levels for hexavalent chromium and total chromium in groundwater were established in the Risk Assessment by the MDOH for the Bee Cee site. While detected levels of total chromium were below the risk-level of 3,500 parts per billion (ppb), the risk-level of 18 ppb for hexavalent chromium was exceeded. The most recent analytical results show the presence of hexavalent chromium at concentrations up to 52 ppb.

Even though the source has been removed, concentrations of hexavalent chromium in groundwater at the site exceed site-specific risk-based concentrations. However, use of the site can be controlled, and there are no known shallow groundwater users down gradient of the site. Therefore, only monitoring and prohibiting the use of the contaminated groundwater plume are considered necessary. Active remediation of the groundwater at the Bee Cee site was found to be unnecessary.

6.0 SUMMARY OF SITE RISKS

This section explains the risk assessment process. The risks to human health and the environment at the Bee Cee Manufacturing site are described in the site-specific *Risk Assessment for Exposure to Contaminated Groundwater.* This document was prepared for MDNR by the Missouri Department of Health using EPA guidance. The Risk Assessment followed the following four step process: 1) identification of contaminants which are of significant concern at the site; 2) an exposure assessment which identified exposure pathways and calculated contaminant intake; 3) a toxicity assessment for chemicals of potential concern at the site; and 4) a risk characterization, which integrated the three earlier steps to summarize the potential and current risks posed by

hazardous substances at the site. Risks at the site do pose a threat to human health, but no environmental risk were identified.

Two risk assessments were prepared by MDOH to analyze the potential adverse health effects from exposure to the contaminants at the site. The initial Baseline Risk Assessment evaluated adverse health effects to both current and future on-site populations resulting from exposure to hazardous substances in surface soil and groundwater. Airborne contaminants were considered for risk analysis under an assumption that suggested that the increased level of activity would result in an increased level of airborne particulates and would represent a worst case scenario. However, because nickel, total chromium, and hexavalent chromium were not detected above their associated detection limits, the air pathway was excluded from the Baseline Risk Assessment.

Following the August 1992, Removal Action to remove contaminated soils and other potential sources from the site, a second risk assessment was completed. Since the removal was considered successful, soil was not considered as a medium of concern in the second risk assessment. Only data collected during the FIG were used in order to identify potential health risks from exposure to groundwater. The study focused on health risks posed by ingestion of and bathing in site groundwater by a future on-site resident. Since hexavalent chromium is a metal and nonvolatile, risk of inhalation does not exist; therefore, the air pathway was not considered.

The concept of the Reasonable Maximum Exposure (RME) is an important aspect of calculating the risk for a site. The RME is an estimate of the highest exposure that is reasonably expected to occur at a site. Residential exposure is the most conservative scenario and tends to result in the highest risk estimates. Even though the primary land use in the area is industrial, the residential scenario was evaluated because the potential exists for future land use to become residential. It should be noted that the land for a considerable distance around the site is part of the Malden Industrial Park. While a residential scenario is possible, this fact makes it improbable.

Two RMEs were evaluated in this risk assessment: A 70 kg (kilogram) adult living on the site for 30 years (RME3) and a 15 kg (age 0 to 6) child living on the site for 7 years (RME4); The adult ingests 2 L (Liter) of contaminated groundwater a day and bathes with contaminated groundwater 12 minutes each day over a 30-year period while living on the site. The child ingests 1 L of contaminated groundwater a day and bathes with contaminated groundwater 12 minutes a day over a 6-year period while living on the site.

Noncarcinogenic and carcinogenic risks were evaluated using metal concentrations from the two most contaminated groundwater samples. Results of the initial Baseline Risk Assessment were used to select the Contaminants of Concern (COCs) to be

evaluated in the FIG Risk Assessment. Metals retained as contaminants of concern included:

- Total Chromium
- Hexavalent Chromium
- Arsenic
- Lead
- Zinc

Beryllium was eliminated from the COC list because it was detected in only one monitoring well (MW-1), which is the background (up gradient) well for the site.

The analytical data from two monitoring wells (MW-3 and MW-5), were used as the exposure point concentrations for risk calculations. These two wells exhibited the highest concentrations of COCs during the FIG. Only total chromium was detected at concentrations that exceeded the Maximum Contaminant Levels (MCL) established in the Safe Drinking Water Act. Hexavalent chromium, the more toxic form, was detected at the MCL (100 μg/L) and substantially above a risked based level (18 μg/L).

The risk of cancer from exposure to a chemical is described in terms of the probability that an individual exposed for 30 years will develop cancer over a 70-year lifetime. Typically, cancer risks of $1x10^{-6}$ (one in one million) or lower are considered to be so small that they are of no practical concern. Higher cancer risk levels may be cause for concern, and the EPA typically requires site remediation if risks exceed $1x10^{-4}$ (one in ten thousand). The major contributor to carcinogenic risks at the site was determined to be arsenic; however, arsenic has been determined to be a naturally occurring substance at the site.

The total excess lifetime cancer risk calculated for the adult resident for RME 3, based on exposure to wells MW-3 and MW-5, were $2.2x10^{-4}$ and $2.9x10^{-4}$, respectively. The total excess lifetime cancer risk calculated for the child resident for RME 4, based on exposure to wells MW-3 and MW-5, were $1.2x10^{-4}$ and $1.6x10^{-4}$, respectively. These total excess lifetime cancer risks for the hypothetical adult and child resident, based on the analytical data for both monitoring wells, exceed 1 in 10,000 (1.0×10^{-4}). The carcinogenic risk is based totally on exposure to arsenic in groundwater. It should be noted that although arsenic was detected in three of the four monitoring wells onsite, it was detected at levels significantly below the Maximum Contaminant Level of 50 μg/l. The available information on site history does not indicate the use of arsenic-containing compounds in any of the former manufacturing processes. Naturally occurring or background concentrations of arsenic in the groundwater cannot be ruled out. Previously completed sampling of the Malden public wells did not include arsenic as a parameter to be analyzed for; however, arsenic was detected in the discharge material from the Bee Cee Manufacturing building and several wells located near the site during the MDNR Abandoned Hazardous Waste Site Sampling event on June 27, 1984. The report indicated that all the wells near the site had concentrations of arsenic less than

the detection level of 0.005 mg/l. The discharge sample indicated that the arsenic value was less than the detection level of 2.5 mg/l.

The risk of adverse noncarcinogenic effects from chemical exposure is expressed in terms of a Hazard Quotient (HQ). The HQ is the ratio of the estimated daily intake of a chemical to the Reference Dose (daily dose which may be ingested, inhaled or absorbed without adverse health effects occurring). The Hazard Index (HI) is the summation of all chemical-specific HQs within an exposure pathway and the Total Hazard Index is the sum of all pathway-specific HI values. Any of these values (HQ, HI, Total HI) exceeding 1.0 indicates the potential for adverse health effects to occur in exposed individuals.

The Total Hazard Indices calculated for the adult resident for RME 1 were 1.8 and 2.1, respectively. The Total Hazard Indices calculated for the child resident for RME 2 were 4 and 4.8, respectively. Those values greater than 1 indicate that unacceptable noncarcinogenic health risks from exposure to groundwater may be present for future adult and child residents. The data suggest that the noncarcinogenic risks from ingestion and dermal exposure to groundwater is dominated by arsenic and hexavalent chromium. Zinc and trivalent chromium in groundwater contribute relatively minor amounts to the total noncarcinogenic risks.

Total Hazard Indices for both RMEs exceed 1.0. Consequently, noncarcinogenic health risks may be present for a future adult or child resident living on the site.

The Lead Integrated Uptake Biokinetic Model (IUBK) was used to estimate human intake of lead from groundwater at this site. To ensure lead concentrations were not sufficient to pose a health threat, the highest concentration of lead found in groundwater was used in the IUBK. Predicted blood lead levels greater than 10 micrograms per deciliter (ug/dL) in over 5 percent of the potentially exposed population are considered to present a health hazard. Because predicted levels were well below 10 ug/dL, a health hazard is not expected to be caused by ingestion of lead in groundwater.

Preliminary Remediation Goals (PRGs) for a site may be established by: (1) adoption of standards or recommendations from regulations, such as Maximum Contaminant Levels (MCLs) or water quality criteria; or (2) calculation of PRGs based on health-related criteria. The approach used in this plan was to develop PRGs from health-related criteria derived from the risk assessment process. The PRGs, as indicated in Table 1, represent contaminant concentrations to be achieved to satisfy the remedial action objectives, with considerations for background concentrations near the site. Background concentrations are considered because in some cases they may be higher than risk-based concentrations or MCLs that were established when public health criteria was considered.

6.1 CONCLUSIONS

Hexavalent chromium in shallow groundwater at the site presents an unacceptable risk for non-carcinogenic effects. If the response action selected in this ROD is not implemented, the hexavalent chromium contamination in the shallow groundwater at the site will present an imminent and substantial endangerment to public health.

Calculations in the risk assessment show that the shallow groundwater at and near the site presents an unacceptable carcinogenic risk due to its arsenic content. However, concentrations of arsenic detected in groundwater from the site were lower than the concentration detected in the background monitoring well. Therefore, remediation of arsenic is not appropriate for this site.

Zinc and trivalent chromium concentrations do not present unacceptable health risks according to the calculations in the risk assessment. There is no health risk at the site from exposure to the soil. This is because the contaminated soil was removed from the site in July 1992.

7.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) define the allowable exposures to contaminants of concern found at a Superfund site. The primary contaminant of concern at the Bee Cee Manufacturing site is hexavalent chromium. In consideration of this fact, the following Remedial Action Objective was developed for the site:

Prevent ingestion of water containing hexavalent chromium in excess of MCLs or preliminary remediation goals (PRGs).

PRGs are site-specific clean-up goals calculated for a specific contaminant by MDOH based upon the risk assessment. MCLs and PRGs identified for this site by MDOH are presented in Table 1.

The MDOH identified both carcinogenic and non-carcinogenic risks from exposure to hexavalent chromium at the site; therefore, the RAO was developed to prevent such exposure. MDOH also identified carcinogenic risks from exposure to arsenic. However, the level of arsenic detected in monitoring wells on the site was less than the concentrations found in the background well. Therefore, remediation of arsenic is not considered appropriate for this site.

8.0 DESCRIPTION OF ALTERNATIVES

The remedial alternatives evaluated in detail in the FS report are described in the following subsections. These descriptions identify engineering components, institutional controls, implementation requirements, estimated costs, and major Applicable or Relevant and Appropriate Requirements (ARARs) associated with each alternative.

Common Elements: Alternatives three through six have a number of common elements. These include the construction of extraction wells, neutralization and reduction in the treatment process, and groundwater monitoring as an institutional control on a temporary basis during remediation. A description of each common element is presented below.

A) Neutralization and Reduction

Alternatives three through six involve neutralization and reduction. In these alternatives, the extracted groundwater is pumped to an influent holding tank and discharged to a chemical reduction tank. Hexavalent chromium is reduced to the trivalent form using either electrochemical reduction or chemical reduction. Trivalent chromium is a more stable substance than hexavalent chromium. By reducing chromium from the hexavalent form to the trivalent form, it becomes less reactive and therefore safer and easier to manage.

When using chemical reduction, sulfuric acid would be added to a reduction tank to reduce the pH of the groundwater. Following pH reduction, a chemical such as ferrous sulfate would be added to react with hexavalent chromium and reduce it to trivalent chromium.

In Alternatives six and seven, sulfuric acid would be added to regenerate the resin. Regenerate solution exiting the exchangers would be routed to the chemical reduction tank where a chemical such as ferrous sulfate would be added, and the chromium in the regenerate solution would be reduced and precipitated out of solution.

B) Groundwater Monitoring

Groundwater monitoring would serve to detect changes in the migration of contaminants and to indicate the effectiveness of any remedial actions. However, it would not treat or reduce the contamination. Monitoring wells would be added to the existing network of monitoring wells to provide additional definition of the contaminated plume. In addition, a sampling and chemical analysis plan would be implemented. Costs would be dependent on the number and depth of wells added and the frequency and magnitude of sampling.

C) Extraction Wells

Groundwater extraction wells would be installed in Alternatives three through six. These wells would be constructed similar to domestic or municipal water supply wells. Groundwater would be drawn up from the aquifer underlying the site and piped to the on-site treatment system. The exact size, location, and pumping capacity will be determined through hydrogeological analysis during the remedial design phase.

D) Discharge of Treated Groundwater

The preferred option for discharge of the treated groundwater produced by alternatives three through six is to the Malden Industrial Park POTW. This POTW is currently operating near full capacity and frequently exceeds the design hydraulic loading rate. This is especially true during wet weather when infiltration problems have caused the hydraulic loading rate to be exceeded by 40 percent. Contribution of the site groundwater treatment facility to this problem can be averted by implementing one or both of the following options: Utilizing a holding tank to store treated groundwater for discharge during non-peak hours; and/or Installing an alarm and shutdown system to halt groundwater treatment and discharge during heavy rain events. The treatment facility is currently meeting its National Pollutant Discharge Elimination System (NPDES) Permit discharge limits and no problems are expected by increasing the flow rate by 20 gallons/minute from the discharge of the site groundwater treatment facility.

8.1 Alternative 1: No Action

Development of the no-action alternative is required by CERCLA. It serves as a baseline for comparison with active cleanup alternatives. Under this alternative, no action would be taken to remove the groundwater contaminants. Since this alternative does not change the contamination concentration or exposure, the risk remaining at the site would be equivalent to the estimated risks based on the risk assessment results. Consequently, this alternative is not protective of human health and the environment. A five-year review of the site would be required under CERCLA. Thus, funds would be expended to conduct the review.

Capital Costs:	$20,000
Annual O&M (Operation and Maintenance) Costs:	$ 0
Total PW (Present Worth):	$20,000
Time of Implementation:	30 years
Set-Up Time:	six months

8.2 Alternative 2: Natural Attenuation, Groundwater Monitoring and Institutional Controls

Under this alternative, no active restoration measurers would be taken to correct the existing groundwater contamination. Because the source of contamination has been removed, natural attenuation will result in the concentration of hexavalent chromium in the plume to be reduced below the PRGs for the site. Natural attenuation is the process whereby contaminants of concern, such as hexavalent chromium are diluted and\or degraded to concentrations or substances that are considered non-hazardous. The mechanisms for achieving this are hydrologic forces, chemical reactions and biological processes that are already present and occurring.

This alternative does not provide for control of on-site contaminated groundwater; therefore, the contaminants present in the groundwater would continue to migrate. Long-term monitoring of groundwater conditions would continue on an annual basis to track migration and hexavalent chromium concentrations of the contaminant plume. Additional monitoring wells would be installed at or near the leading edge of the plume. Information from the monitoring would be used to identify potential concerns to off-site groundwater users. It should be noted that the area is served by a municipal water system and there are presently no known groundwater users within a mile of the site.

Institutional controls in the form of deed restrictions, and zoning ordinances would be used to advise future owners of the potential health risks from exposure to the groundwater. However, because the source of contamination has been removed, there would be minimal exposure to the contaminants of concern, provided that contact with shallow groundwater at the site is restricted. It would not be necessary to construct a fence around the site. Potential danger to site workers who may be excavating or drilling into the saturated zone would remain.

As previously stated, the contaminant plume will attenuate over time. As part of the RI\FS, computer-generated modeling was used to predict the behavior of the plume of contaminated ground water over the next 30 years. This information is contained in a report entitled Simulation of Contaminant Migration at the Bee Cee Manufacturing site. The report suggests that hexavalent chromium concentrations in the plume may still exceed the current maximum contaminant level of 100 ppb after 30 years. It also indicates that migration of the plume over the past 30 years has been relatively limited and will continue to be so. While the boundaries of the plume currently exceed the boundaries of the property on the Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites in Missouri (the Registry), it is not likely that it will migrate off of the property controlled by the City of Malden as part of its Industrial Park.

Public health evaluations would be conducted every five years and would allow MDNR to assess the ongoing risks to human health and the environment posed by the site. Groundwater monitoring would occur on an annual basis. As required by the National Contingency Plan (NCP), a risk re-evaluation using groundwater analytical data would be conducted every five years. The evaluations would be based on the analytical data collected from the groundwater monitoring activities.

There is a limited amount of construction related to the implementation of Alternative 2. The on-site monitoring wells would be used for groundwater sampling and monitoring over a period of 30 years. Additional monitoring wells are proposed under this alternative.

The costs associated with Alternative 2 consist of groundwater monitoring equipment, installation of additional monitoring wells, analysis of ground water samples and preparation of the deed restrictions.

Capital Cost:	$ 63,000
Operation and Maintenance (annual):	$ 18,000
Total Cost (present worth):	$261,000
Time of implementation:	
Set-up:	six months
Groundwater Monitoring:	30 years

8.3 Alternative 3: Groundwater Extraction, Treatment Using Ion Exchange, and Discharge

Alternative 3 is a groundwater extraction and treatment alternative utilizing five extraction (recovery) wells and an ion exchange treatment system, with the effluent being monitored and discharged to the Malden City POTW. The time period estimate for aquifer restoration under this alternative is four years. Groundwater monitoring is assumed for a period of six years.

The recovery wells would be installed to address the chromium plume. The potential exists for either the number or spacing of the recovery wells to change as more exact well yield data are collected during the design phase. The wells would be constructed of six-inch Polyvinylchloride (PVC) casing, stainless-steel screens, and the well heads protected by flush-mounted vaults and locked covers. The estimated discharge rate for each recovery well is assumed to be four gallons per minute (gpm) or a total of 20 gpm for five extraction wells.

Extraction well pumps will deliver contaminated groundwater to an on-site treatment facility where the contaminants of concern are removed. Ion exchange is a process in which wastewater is passed through a bed of insoluble exchange material called resin. As wastewater is passed through the resin, chromium ions are exchanged on the surface with other negatively charged ions of less toxic elements. As a result,

chromium is removed from the wastewater and bound up in the resin particles. Extracted groundwater would be pumped into an influent holding tank for flow equalization. The influent would then be sent to an anion exchanger where hexavalent chromium is removed by the ion exchange process. Following hexavalent chromium removal, trivalent chromium would be removed in a cation exchanger.

Periodically, the ion exchange resin will become saturated with chromium and require regeneration. Regeneration would be conducted onsite without removing the resin from the exchangers. To regenerate the ion exchange resin, sulfuric acid and sodium hydroxide would be passed through the anion exchanger, and only sulfuric acid would be passed through the cation exchanger. Regenerate solution exiting the exchangers would be routed to the chemical reduction/precipitation batch tank. Sulfuric acid and ferrous sulfate would be added to reduce and precipitate the chromium out of the regenerate solution as chromium hydroxide. The resulting solution would be routed to the filter press and the sludge would be shipped offsite for disposal.

As part of this alternative, monitoring wells would be sampled to verify the effectiveness of the remediation effort and to track the contaminant plume's movement. Four additional wells for detection of the contaminant plume's movement at the site are proposed. These wells would allow down gradient monitoring of the contaminant plume. Monitoring of the extraction well's discharge would also be performed in order to evaluate the effectiveness of the extraction system to contain and reduce the level of contaminants in the shallow groundwater.

By extracting and treating the contaminated groundwater, Alternative 3 provides a high level of protection to human health and the environment. Direct contact and ingestion of contaminated groundwater is eliminated by this action.

The cost associated with Alternative 3 consists of groundwater monitoring equipment and analyses, plus treatment system equipment and operation.

Capital Cost:	$674,000
Operation and Maintenance (annual):	$ 92,000
Total Cost (present worth):	$970,000
Time of implementation:	
Set-up:	six months
Groundwater Monitoring:	six years
Groundwater Extraction:	four years

8.4 Alternative 4: Extraction, Treatment Using Reverse Osmosis, and Discharge

This alternative would use an extraction well system similar to the one described in Alternative 3. Following extraction, the groundwater would be pumped to a reverse osmosis treatment system.

Reverse osmosis treatment is carried out by placing untreated water into a module and forcing it between a pressurized tube and a stack of membranes. From there the influent flows through the various open channels across the surface of the membranes. When the membrane process is operated on the cross-flow principle, the solution to be treated is pumped under pressure along a membrane and is divided by this means into two partial flows - a permeate or filtrate which flows through the membrane and a concentrate or residual solution. In the latter, the contaminants in the water are held back by the membrane and are thus concentrated. The high pressure cross-flow method ensures that solutes are not deposited on membrane surfaces even though their concentration increases along the flow path. The short feed water path across the membrane followed by a 180 degree flow reversal creates turbulence and eliminates polarization concentration, thereby minimizing membrane fouling and scaling. The permeate drains from the membrane's intermediate layer into a manifold for final discharge into the city's POTW.

The treatment system would generate approximately 0.5 gallons/minute of waste concentrate. This concentrate would be collected and processed through a filter press for dewatering and final disposal. It would be expected that this system would generate 15 cubic yards of filter cake waste material during the life of the project. This material would be classified as a hazardous waste for disposal purposes. The system is designed to operate continuously and only shut down for maintenance and backwashing once every two weeks for two hours. This backwash cycle can be initiated manually or through a Programmic Logic Controller (PLC). The PLC monitors and controls the system through pressure differentials, and tank levels will automatically shut the system down if conditions outside the range of operating parameters are detected. An alarm will then be activated to alert the operator of system difficulties. An option for the PLC is to have the alarm notify appropriate authorities in the case of an alarm condition through the use of a modem and telephone line during periods when an operator is not onsite.

Minimal chemical usage is required for the backwash cycle, and no chemicals are required for the treatment process. This is not an operator-dependent system, and the opportunity for operator error is very low.

This system would not require a full-time operator; however, a daily check of the system would be recommended for visual inspection of the treatment plant and extraction wells along with performing routine maintenance and filter press operations. Based on the influent parameters and the stability of groundwater, it is expected that the membranes with the reverse osmosis unit would last the entire duration of the project (four years) and would not need to be replaced.

For purposes of cost estimation, it is assumed the system will operate continuously for a four-year period. Labor requirements are estimated at 10 hours/week.

Monitoring of the groundwater to ensure that the contaminant plume is controlled under this action would also be required.

Capital Costs:	$721,000
Annual O&M:	$ 41,000
Total Present Worth:	$954,000
Months to Implement:	
Set-up:	10 months
Groundwater Monitoring:	six years
Groundwater Extraction:	four years

8.5 Alternative 5: Extraction, Treatment Using Electrochemical Precipitation and Discharge

This alternative would use a similar extraction well system as Alternatives 3 and 4. Following extraction, the groundwater would be submitted to an electrochemical precipitation treatment system.

The electrochemical precipitation process uses sacrificial electrodes to produce an insoluble ferrous ion, which adsorbs and coprecipitates heavy metals that are present in the waste stream. The free ferrous ion released from the electrodes attracts contaminants and makes them part of the insoluble matrix formed as the ion comes out of solution. If there is any hexavalent chromium present, the ferrous ion is oxidized to ferric ion while the hexavalent chromium is reduced to trivalent chromium and removed by adsorption onto the amorphous iron oxyhydroxide that is formed. The contaminant removal mechanisms include new compound formation, surface complexation and electrostatic attractions, that can work in combination to give needed removal efficiencies.

The precipitate is removed from the water by adjusting the pH, adding coagulant aids and utilizing an inclined plate clarifier. Discharge from the incline plate clarifier will pass through a multi-media filter system for final polishing of the effluent before discharge into the POTW. The complete process increases the amount of sludge produced by adding approximately four ppm metal hydroxide for every one ppm of contaminate treated. Sludge is drawn off the bottom of the clarifier at the rate of 10 percent of the total flow rate (two gpm), The sludge is then pumped into a holding tank and processed through a filter press for dewatering and final disposal. The filtrate which passes through the press is returned to the influent tank of the system. The sludge generation rate is estimated at 0.5 $ft.^3$/day. The sludge is not expected to contain hexavalent chromium, and classification of the waste will be determined from TCLP metal analysis.

The treatment system would not require a full-time operator. However, a daily check of the system would be needed. This would include visual inspection of the system and extraction wells, replenishment of chemicals for pH adjustment and coagulant aid. Cleaning of the filter press is estimated to be done twice per week.

Initial start up of the precipitation option systems requires significant effort. After start up, maintenance of the system would not be as operator dependent as the start up, with the exception of chemical handling, routine maintenance and filter press operation.

A PLC monitors and controls the system and will automatically shut down the system in the event parameters exceed the operating range. An alarm will then be activated to alert the operator of system difficulties. An option for the PLC is to have the alarm notify appropriate authorities in the case of an alarm condition through the use of a modem and telephone line during periods when an operator is not onsite.

For purposes of cost estimation, it is assumed the system will operate continuously for a four-year period. Labor requirements are estimated at 20 hours/week.

Monitoring of the groundwater to ensure that the contaminant plume is controlled under this action would also be required. The cost associated with Alternative 5 consists of groundwater monitoring equipment and analyses, plus treatment system equipment and operation.

Capital Cost:	$444,000
Operation and Maintenance (annual):	$ 87,000
Total Cost (present worth):	$720,000
Time of implementation:	
Set-up:	six months
Groundwater Monitoring:	six years
Groundwater Extraction:	four years

8.6 Alternative 6: Extraction and Treatment Using Chemical Precipitation

A typical chemical precipitation process involves the precipitation of heavy metals in an alkaline solution. This is accomplished as the metal ion combines with the hydroxide ion to form an insoluble metal hydroxide solid. This reaction is carried out at a high pH. This process is pH dependant and is reversible. The lowest effluent concentrations achievable are limited to the solubility of the metal hydroxides formed, under ideal conditions, for each individual metal. Problems with treating a wastewater stream with multiple metals begin when the metals have a different pH range for minimum solubility; therefore, the operating pH chosen is a compromise of all the metals involved.

The process described for this study is a modification of the typical chemical precipitation process. The following is a process of iron coprecipitation technology for heavy metals removal. This is more of a physical than chemical removal mechanism.

This process involves sparging air into a neutral pH wastewater stream mixed with a ferrous iron solution to form an insoluble dense iron matrix.

Discharge from the extraction wells is collected in an influent equalization tank. A ferrous iron solution is added to the stream as it is transferred to the air sparging reactor. The heavy metals are naturally adsorbed to the surface of the iron solids. In the reaction zone, sodium hydroxide is added to control the pH to 7.8 and air is sparged to rapidly oxidize the ferrous (Fe^{+2}) iron to ferric (Fe^{+3}) iron. Hexavalent chromium is reduced to trivalent chromium as the ferrous iron is oxidized to the ferric state. The ferric iron forms an insoluble solid for precipitation. The heavy metals are "occluded" into the dense iron matrix, are insulated from the solution by the iron and are not allowed to resolubilize. This phenomenon makes it possible to remove heavy metals from water to concentrations below their thermodynamic solubility limits. After completion of this reaction, the solids-laden water is transferred to a clarifier where polymer is added to assist in gravity settling of the solids. Effluent from the clarifier is at a neutral pH and will not need adjustment before final discharge into the city's POTW. Some of the sludge from the clarifier is transferred back into the air sparged reactor to act as a catalyst for the oxidation of ferrous to ferric iron. The remainder of the sludge is processed through a filter press for dewatering and final disposal. Chemicals used during this process include sodium hydroxide, polymer, and ferrous chloride.

Chelating agents, if present, act exactly contrary to the intent of a wastewater treatment system by keeping the metals in solution while water treatment processes are intended to remove the metals from solution. Because the removal mechanism of this process is more physical than chemical, it is able to remove chelated metals from solution by enveloping the metal and its associated chelator in iron and subsequently precipitating the iron solids.

This system would not require a full-time operator; however, a daily check of the system would be recommended for visual inspection of the treatment plant and extraction wells, along with replenishing chemicals, performing routine maintenance, and filter press operations.

The sludge generation rate is estimated at 1.3 $ft.^3$/day. The sludge is not expected to contain hexavalent chromium and classification of the waste will be determined from TCLP metal analysis.

For purposes of cost estimation, it is assumed the system will operate continuously for a four-year period. Labor requirements are estimated at 20 hours/week.

Monitoring of the groundwater to ensure that the contaminant plume is controlled under this action would also be required.

The processes described in Alternatives 5 and 6 are similar processes in that they both use a ferrous ion which is oxidized to a ferric ion to adsorb the contaminants followed by solids precipitation. The procedure of introducing the ferrous ion into the wastewater stream is the main difference between these two processes.

The cost associated with Alternative 6 consists of groundwater monitoring equipment and analyses, plus treatment system equipment and operation.

Capital Cost:	$378,000
Operation and Maintenance (annual):	$101,000
Total Cost (present worth):	$710,000
Time of implementation:	
Set-up:	six months
Groundwater Monitoring:	six years
Groundwater Extraction:	four years

8.7 Alternative 7: Containment and In Situ Remediation

Under this alternative, a "funnel and gate" system for in situ treatment of the contaminated groundwater would be used. The system would consist of a low hydraulic conductivity cutoff wall with a gap that contains a reactive porous media. Cutoff walls (the funnel) modify groundwater flow patterns so that groundwater flows primarily through the porous reactor (gate). The University of Waterloo, Ontario, Canada has a patent pending on this relatively new and innovative process. Research is currently being conducted on development of a reactor material specific for chromium. Bench-scale studies have been conducted to assess the ability of iron-bearing solids to remove dissolved hexavalent chromium from contaminated groundwater. Indications are that hexavalent chromium can be reduced and removed from solution by forming insoluble trivalent chromium. This process would therefore reduce the toxicity of the groundwater by removing the chromium from solution. No information on porous reactor materials for removal of arsenic in groundwater is available at this time.

In order to further evaluate the effectiveness of this system, treatability studies would be required in order to determine the size and appropriate porous reactor material. Groundwater modeling of the funnel and gate system would also be necessary.

Monitoring of the groundwater to ensure that the contaminant plume is controlled under this action would also be required.

At this time, information on the cost of this alternative and the time necessary for remediation are not available.

9.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Alternative remedial actions were developed to respond to the contamination at the Bee Cee site. The alternatives described in the preceding section were evaluated using criteria related to the factors set forth in Section 121 of CERCLA and the NCP (National Oil and Hazardous Substances Pollution Contingency Plan). The nine criteria are described below.

Threshold Criteria:

Overall Protection of Human Health and the Environment. This criterion addresses whether a remedy provides adequate protection to human health and the environment and describes how risks from each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance With ARARs. This criterion addresses whether a remedy will comply with chemical-specific, action-specific, and location-specific ARARs and with other criteria, advisories and guidance such as To Be Considered (TBCs), or provide grounds for a waiver. TBCs are further discussed in Section 11.2.4.

Primary Balancing Criteria:

Long-Term Effectiveness and Permanence. This criterion refers to the magnitude of residual risk, including the ability of a remedy to maintain reliable protection of human health and the environment over time once clean-up goals have been met, and the adequacy and reliability of engineering and institutional controls.

Reduction in Toxicity, Mobility, and Volume through Treatment. This criterion assesses the anticipated performance of the treatment technologies that may be employed in a remedy.

Short-Term Effectiveness. This criterion refers to the period of time with which the remedial response objectives are achieved, as well as the remedy's potential to have adverse impacts on human health and the environment during the construction and implementation periods.

Implementability. This criterion assesses the technical feasibility for constructing and operating a remedy; the technical and administrative reliability of a remedy, including the availability of materials and services needed to implement the chosen remedy, and the ease of undertaking additional action, if necessary.

Cost. This criterion includes the capital, operation and maintenance (O&M), and present worth cost of a remedy.

Modifying Criteria:

State Acceptance. This criterion assesses whether, based on its review of the FIG/FS and Proposed Plan, the state agency concurs, opposes, or declines to comment on the preferred alternative.

Community Acceptance. This criterion assesses the degree of community acceptance of a remedy. The degree of community acceptance can generally be determined as a result of a review of comments received during the public comment period.

9.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Of the six alternatives, Alternatives 1 (No Action) and 2 (Groundwater Monitoring and Institutional Controls) provide limited to no protection for human health and the environment under a future use scenario where groundwater at the site is utilized. However, Alternative 2 does provide sufficient monitoring and controls to prevent access to and warn the public of the potential health risks from exposure to the groundwater. These controls are supplemented by the fact that the area is served by Malden's municipal water supply system. In effect, this eliminates the need for installation of individual water supply wells at or near the site. Alternative 2 is considered to be more protective than Alternative 1, but less protective in comparison with the extraction and treatment alternatives. Because Alternative 1 would not be protective of human health and environment, it was not considered as a viable option for the site.

Alternatives 3, 4, 5 and 6 ranked essentially the same because they are all highly protective of the environment. Each of the groundwater extraction and treatment alternatives would provide protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, or institutional controls at the site.

The technology for containment and insitu remediation as discussed in Alternative 7 is relatively new and sufficient information is not available to properly evaluate it.

9.2 COMPLIANCE WITH ARARs

All treatment alternatives would comply with federal and state ARARs. Disposal of the sludge and solid wastes generated at the site would need to be managed in accordance with the Solid Waste Disposal Act, Department of Transportation (DOT) Hazardous Materials Transportation Act, Missouri Solid and Hazardous Waste Laws and Rules and the Resource Conservation and Recovery Act. Discharges of treated

groundwater from the site would need to be managed in accordance with the Clean Water Act, Missouri Clean Water Law, Missouri Water Quality Standards, and Missouri Water Pollution Control Regulations. All activities at the site must comply with the Occupational Safety and Health Act (OSHA).

9.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Residual risk at the site is not managed by Alternative 1. Alternative 2 would effectively manage residual risk at the site on a permanent basis since access would be restricted. The reduction and management of residual risk would be effective in Alternatives 3, 4, 5, and 6. Each of those alternatives would remove the risk from the site and transfer it to a controlled disposal facility.

All of the treatment alternatives would essentially eliminate the long-term risks associated with the contaminated groundwater extracted and treated during remediation.

Based upon groundwater extraction predictions, each of these alternatives provide protection, but risks would remain for approximately four years until groundwater clean-up goals are achieved.

9.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternatives 1 and 2 do not utilize treatment. Therefore, they are not discussed here.

Four of the six alternatives (3, 4, 5 and 6) utilize extraction and treatment as a remedial response for the groundwater. All extraction and treatment alternatives are capable of restoring the contaminated groundwater to the PRG. Each of the treatment processes provides reduction in the mobility and volume of contaminants. However, only Alternatives 5 and 6 reduce the toxicity of hexavalent chromium, which gives these two alternatives a higher ranking with respect to this criteria.

9.5 SHORT-TERM EFFECTIVENESS

Alternatives 1 and 2 cause no community or site worker risks during implementation of the remedy. Community risk would be low during the installation of the extraction and monitoring wells and the treatment facility. There would be a greater risk to workers, but compliance with OSHA requirements and guidelines for hazardous waste site activities would minimize these. Analysis for air emissions would not be necessary because the contaminant is a heavy metal and will not volatilize into the air pathway.

Environmental impacts resulting from the installation of the wells and treatment system would include noise pollution and minimal fugitive dust emissions during construction. During extraction and monitoring well construction, sedimentation and erosion controls

would be implemented to minimize contact with contaminated soil removed from the contaminated aquifer.

As with community risks, risks to workers and the environment would be similar in all alternatives; however, in the active restoration alternatives (Alternatives 3, 4) workers and equipment would be removed from the site faster than under the containment solutions. The time required for design and construction would be similar for all alternatives.

9.6 IMPLEMENTABILITY

Alternative 2 can be implemented easily. Approval from local governmental agencies for establishing institutional controls will be necessary.

The technical feasibility of all other alternatives except Alternative 7 is similar because process technologies employed in these alternatives are proven and reliable. The ability to construct and operate the elements of Alternatives 3 through 6 is high. The materials and services for implementing these alternatives are available on a regional if not local basis. Because of the lack of information about alternative 7, its implementability is not known.

9.7 COST

The estimated total present worth cost of the selected remedy, Alternative 2, is $261,000. Alternative 1 has the lowest total present worth cost ($20,000). The total present worth cost of Alternatives 3, 4, 5, and 6 are $970,000; $1,280,000; $720,000; and $710,000 respectively.

9.8 STATE ACCEPTANCE

The remedy selected here, Alternative 2, is the same as that proposed by the state in the Proposed Plan.

9.9 COMMUNITY ACCEPTANCE

Community acceptance is specifically addressed in the attached Responsiveness Summary. The Responsiveness Summary provides a review of the significant public comments received on the FS and Proposed Plan, and responses to the comments. In general, the community agrees with the remedy selected in this ROD.

10.0 SELECTED REMEDY

Upon review of the alternatives in the FS, EPA has selected Alternative 2, Natural Attenuation, Groundwater Monitoring and Institutional Controls, as the remedy for the Bee Cee site. The selected remedy adequately protects human health and the environment from the risks posed by the site because the contaminant plume is not likely to migrate off the Malden Industrial Park property until the concentration of chromium in the groundwater is reduced below levels of concern. Additionally, the area is served by Malden's municipal water supply system. This eliminates any need for installing individual water supply wells at or near the site. Hexavalent chromium in the groundwater will attenuate to concentrations below remediation goals due to natural processes. Institutional controls will be required to prevent future use of the groundwater in this part of the industrial park and to warn potential purchasers of the contamination. Additional groundwater monitoring wells will be installed to assess the concentration and migration of the contaminant plume.

The capital costs for this alternative is $63,000 with an annual O&M cost of $18,000. The Total Present Worth for Alternative 2 is $261,000 and is shown to be cost-effective.

11.0 STATUTORY DETERMINATION

Under its legal authority, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements. These specify that when complete, the selected remedial action for the site must comply with ARARs unless a statutory waiver is justified. The selected remedial action must also be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatments that permanently and significantly reduce the volume, toxicity, or mobility of the hazardous waste as their principal element. If the evaluation of two or more specific remedies is equal, or nearly so, remedies employing treatment as a principle element should be selected. However, when a non-treatment remedy is clearly superior based on the evaluation of all the required criteria, selection of such a remedy is indicated.

The following subsections discuss how the selected remedy for the Bee Cee Manufacturing site meets these statutory requirements of Section 121 of CERCLA, as amended by SARA, and to the maximum extent possible, the NCP.

supplies. They are applicable at the Bee Cee Manufacturing site because the underlying aquifer may be used as a drinking water supply. The following are the chemical-specific requirements for the Bee Cee site.

Safe Drinking Water Act (42 U.S.C. 300f et seq.)National Primary Drinking Water Standards Maximum Contaminant Levels (MCLs) 40 CFR Part 141: Maximum contaminant concentration allowed in regulated public water supplies. Based on chemical's toxicity, treatability, cost effectiveness, and the analytical limits of detection.

National Secondary Drinking Water Standards; Secondary Maximum Contaminant Levels (SMCLs)) 40 CFR Part 141: Aesthetic criteria established for finished water supplies.

Missouri Safe Drinking Water Act 640.100-140 RSMo: Defines MCLs and SMCLs for the State of Missouri.

Missouri Public Drinking Water Regulations 10 CSR 60-4.010: Defines MCLs and SMCLs for the State of Missouri.

11.2.3 LOCATION-SPECIFIC ARARs

No location-specific ARARs apply to the Bee Cee Manufacturing site. There is no evidence of the occurrence of sensitive or native communities within a one-mile radius of the site. Proposed activities will not adversely affect wetlands. The site is not on an active flood plain.

11.2.4 TO BE CONSIDERED

These policies and strategies are not promulgated regulations, therefore compliance with their provisions cannot be mandated. However, due to their relevance to protection of human health and the environment, they were considered in the selection of the remedy.

Site specific risk based Preliminary Remediation Goals: The PRG is a TBC. A memorandum from the MDOH provided PRGs for the Bee Cee Manufacturing site. The PRG for Hexavalent Chromium at this site is 18 ppb.

U.S. EPA Groundwater Protection Strategy:

Corrective Action Cleanup Standards Policy for RCRA, UST, and CERCLA Sites.

11.3 COST-EFFECTIVENESS

The selected alternative is cost-effective because it has been determined to provide overall effectiveness proportional to its cost, estimated at a present total worth of $261,000. Of the alternative evaluated, only Alternative 1: No Action, has a lower cost than the selected alternative. The lack of protectiveness of human health makes the No Action alternative unsuitable. Alternative 5 was the next lowest cost of the action alternatives. This alternative cost, nearly a half million dollars more, for modest gains in long-term protection. Therefore, it was not considered as cost-effective as the selected remedy.

11.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized at the Bee Cee Manufacturing site to meet water quality requirements. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that this selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; and cost.

11.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. However, the principal threat to human health is from ingestion or dermal contact with contaminated groundwater. Since contact with the groundwater is very unlikely, EPA does not believe treatment is warranted in this instance.

12.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the Bee Cee site identified Alternative 2 as the preferred remedy. It was released for public comment on April 17, 1997. No written comments were received. Oral comments received during the public meeting held on May 1, 1997, are addressed in the attached Responsiveness Summary. Upon review of these comments, it was determined that no significant changes to the proposed remedy were necessary.

FIGURE 1

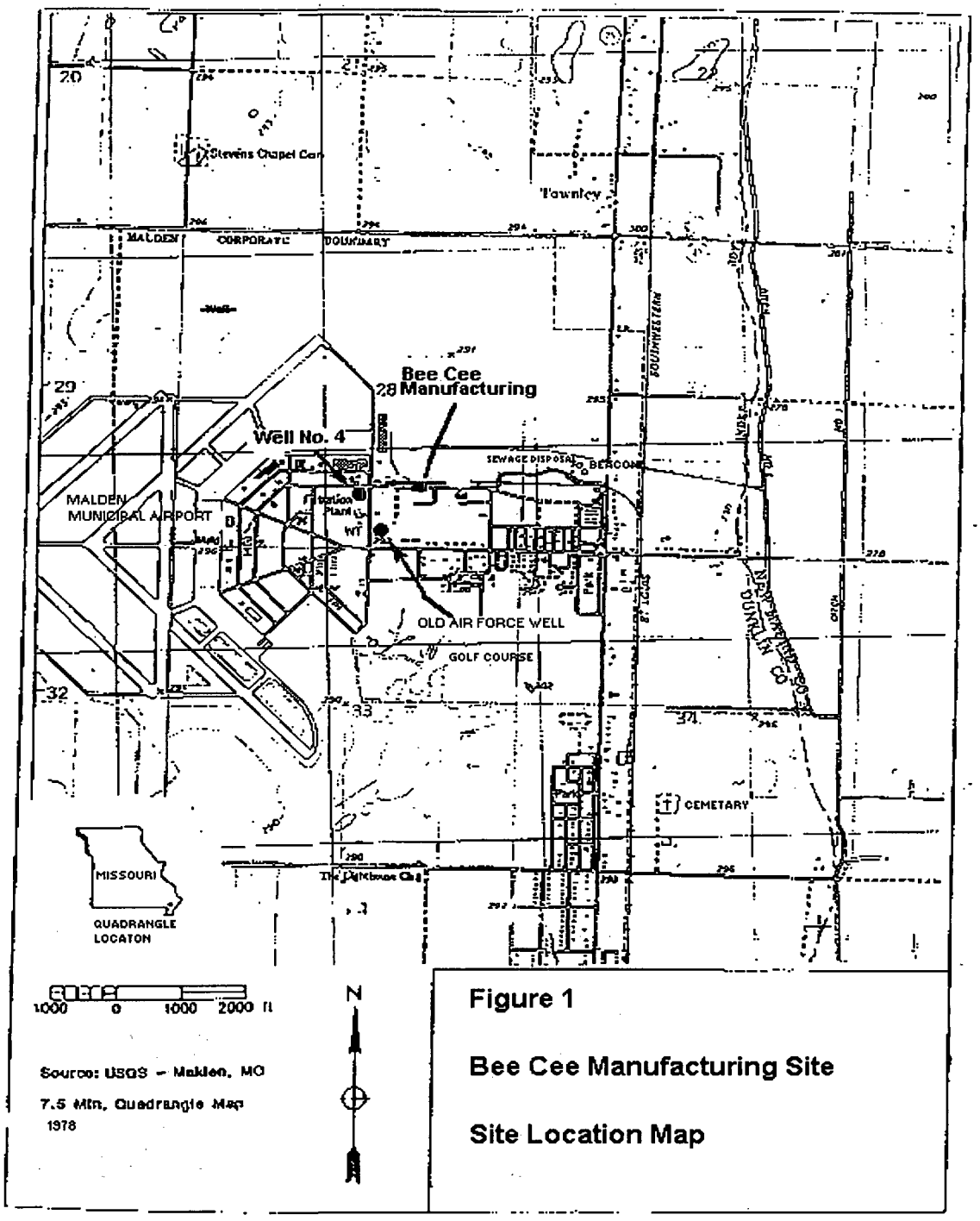
Bee Cee
Manufacturing
Well No. 4
MALDEN
MUNICIPAL AIRPORT
OLD AIR FORCE WELL
GOLF COURSE
CEMETERY
MISSOURI
QUADRANGLE
LOCATON
1000 0 1000 2000 ft
N
Source: USGS - Malden, MO
7.5 Min. Quadrangle Map
1978
Figure 1
Bee Cee Manufacturing Site
Site Location Map

TABLE 1
GROUNDWATER

Concentration Ranges, Background Concentrations, MCL, MCLGs, Preliminary Remedial Goals, and Detection Limits

Units: mg/l

Chemical	Concentration Range	Background Concentration (RI/FIG Data)	MCL	MCLG	SMCL	Preliminary Remediation Goals[5]
Arsenic	0.001 - 0.013	0.0043/0.010*	0.05	NS	--	0.0005
Chromium VI	0.05 - 0.1	<0.05*/<0.05*	NS	NS	--	0.018
Chromium, Total	0.003 - 2.95	0.024/0.0407	0.1	0.1	--	3.5
Lead	0.002 - 0.0826	0.050/0.0826	0.015[1]	0.0	--	--
Zinc	0.004 - 0.121	0.0706/0.119	NS	NS[2]	5.0	1.0

*** None Detected at the detection limit; therefore, a concentration less than the associated detection value could exist**

[1] Action Level - Treatment Technology Level
[2] NS=None Specified
[4] Detection levels elevated in FIG as result of Matrix Interference
[5] As calculated in the Baseline Risk Assessment
MCL - Safe Drinking Water Act - Maximum Contaminant Level, May 1994
MCLG - Safe Drinking Water Act - Maximum Contaminant Level Goal, May 1994
SMCL - Safe Drinking Water Act - Secondary Maximum Contaminant Level, May 1994

BEE CEE SITE

RESPONSIVENESS SUMMARY

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BEE CEE SITE RESPONSIVENESS SUMMARY

Community Relations Summary

Requirements of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) for public participation in selecting the remedy for a Superfund site include releasing the Feasibility Study (FS) and the Proposed Plan for review and comment by interested individuals or groups.

The Missouri Department of Natural Resources (MDNR) met these requirements in April and May of 1997 by placing both documents in the Administrative Record for the site. The Administrative Record (AR), including the FS and the Proposed Plan was made available to the public at the Malden Public Library and at the offices of EPA in Kansas City, Kansas, and at the MDNR in Jefferson City, Missouri.

The notice of availability for the AR and the announcement of a public meeting held on May 1, 1997, was published in the Malden Democrat, a newspaper of general circulation in the vicinity of the site. The public comment period was held from April 16, 1997, to May 16, 1997. The public meeting was held as scheduled at the Malden City Hall.

At the public meeting, representatives from the MDNR and the EPA received public comments and answered questions about problems at the site and the remedial alternatives under consideration. Summarized responses to the comments received during this public meeting are included in this document in the section entitled Summary of Public Comments. No written comments were received.

BEE CEE SITE

RESPONSIVENESS SUMMARY

Summary of Public Comments

A full copy of the transcript of this meeting is included in the Administrative Record for the Bee Cee Site.

QUESTION : How big a spot are we talking about out there?

RESPONSE: According to the groundwater investigation, the plume of contaminated groundwater extends over an area about 400 feet by 400 feet. The exact depth of the contaminated water is not known but we do not believe the contamination is deeper than 25 feet into the ground. At the time that the remedy is implemented there will be some checks made to be sure that we do know the actual area and depth of the contaminant plume.

QUESTION : You also mentioned the dirt that was moved to a landfill. Does that put the landfill in jeopardy, too?

RESPONSE: Because of the characteristics of the waste it was handled as special waste. It was done according to solid waste disposal regulations and laws at that time. Future liability depends on whether they improperly handled the removed waste at the landfill. However, according to the information available on the removal it was done properly.

QUESTION : Is there any possibility of this spreading, creeping out and moving on, making a bigger area, expanding more and more?

RESPONSE: There is. The plume will spread. As it does, there will be some natural processes and dilution that will take place. As it does, the concentration of the contaminants will lessen. This will actually reduce the risk or danger posed by the groundwater at the site.

COMMENT: I became involved in this thing fifteen years ago. I was serving as chairman of the Airport Board when Bee Cee went defunct and 999 came along. And I was present when the gentleman from the University of Missouri at Rolla came down and suggested that the city put down the wells to triangulate the site. The one well, the depth of the existing well at the air base was an Artesian well, 800 feet. It would have been several hundred thousand dollars in expenditures, which nobody had. At that point in time, this gentlemen, whose name I don't recall, indicated that the contamination extended probably no more than six inches into the dirt. The possibility it

would enter in the aquifer was certainly real. It was chromium dioxide. Subsequent to that, there was a large article in the St. Louis Post Dispatch with a big arrow pointing to the Malden Industrial Park as a Superfund site. You know, we lived with that hanging over us like Love Canal or Times Beach. This is the fourth meeting like this I know that I have attended in the last fifteen years and nothing has been done. I have met with your counterparts before. You all moved with glacial speed. Either there is a problem or there is not a problem. If there is a problem, you need to address it. If there is not a problem, and you might have told me and I think there is a problem with this heavy metal poisoning and it is nothing to fool around with.

I had a conversation out there subsequent to the original one where I suggested we get a front end loader and dig up the original contaminated soil and store it in 55 gallon drums and you could decide where to put it. One of your counterparts said there was no acceptable landfill in this area. This gentleman says the Lemmons Landfill at Dexter was an acceptable landfill. So I mean fifteen years now have gone by, you have removed at least the initial contamination. We still have a site that is contaminated. What you are saying is you are going to monitor this thing some more.

You now talk about the plume that extends. My point is, you talk about the plume and this thing is going to spread. It seems to me if there was any sort of remedial action taken at the time you wouldn't have the plume.

RESPONSE: Before the soil was removed, contaminants had already leached into the groundwater. At the time the removal was done, a gravel filled pit was discovered in the area where the discharge had occurred. This pit was constructed by Bee Cee to facilitate percolation of the discharged waste water into the surrounding soil. This resulted in accelerated migration of contaminants into the site groundwater.

QUESTION : Why did it take ten years from the initial contamination to remove the soil? If this is a Superfund site (it should get).... priority attention.

RESPONSE: In general, it takes a number of years for a site to progress through the Superfund evaluation process (a preliminary assessment, site inspection, removal site evaluation). Planning for a removal may also take considerable time. While I do not know all of the specific reasons that it took this long to complete the removal at Bee Cee, the following information provides some insight.

The initial action in 1981 was taken under the federal Clean Water Act (CWA). Enforcement of the CWA was delegated by EPA to the state. At the time of the initial MDNR response, the problem at the site was only noted to be a discharge of contaminated water to the soil surface. A full-scale investigation was not done at that time. Bee Cee ceased the discharge of contaminated water after the CWA investigation. Falcon's 1986 purchase of the Bee Cee plant triggered the Superfund investigation. When they took over the site, Falcon found numerous products left on the site by the previous operators. EPA and MDNR began investigating the long term

problems at the site after they worked with Falcon to eliminate the immediate concerns.

COMMENTS : Well, it really took from 1981. I haven't heard (anything) here tonight that I didn't hear in 1981. "It is a contaminated site: and "... the primary contaminant was chromium dioxide, a heavy metal". "They ceased operation." "The ground was contaminated". "The water supply was probably contaminated." "We should be drilling test wells." All this stuff. Now that was sixteen years ago. And as I say, I don't know where you folks stand in the chain of command with Department of Natural Resources and EPA and all that. Apparently either we have not pursued this aggressively enough with the authorities or you guys in your jobs have not pursued it aggressively enough. Either there is a problem or there isn't a problem. If it is a serious problem, you need to straighten it up and get us off the Superfund site.

I don't know when the Superfund site designation came. I know in '81 I talked to a gentleman that went through the same scenario with me about what the contaminant was and what should be done about it.

RESPONSE: The site was listed on the Superfund National Priorities List in 1993. If there had been a house next door or any human exposure or there was any danger to anyone, it probably would have received a higher priority.

COMMENT : There was a house at that time just east of that site and the people who lived there, I can't tell you their names. They had pets of ducks, geese, rabbits and pens. They made some comments about that fact that he was there. They had a shallow well they used for lawn and gardening. I don't think the house is there. It has been torn down now. It was to the east of that site. But my point is, this has been dragging on for years. I went to a meeting in the old city hall in the '80s with your counterparts. There were five people there as I recall. We did this same thing. I will apologize for the sarcasm, this dog and pony show, and nothing happened. Nothing happened. Falcon, when they bought that site in '86, they were good corporate citizens. They made a real effort to do something about it and to do something about it in the restrictions of the law. I don't know what engendered this meeting here tonight. Why are we here tonight?

RESPONSE: EPA removed the soil. After they removed the soil more testing was done and chromium contamination was found in the groundwater. Now we have to make a decision on the groundwater. Should we do something here? We took a look at again and made the decision, hey, there is something here. Let's look at it again. That is kind of why were are here. The groundwater issue, the soil has supposedly been removed and cleaned up and that media has been handled. We worry about the groundwater. That is what we did. We assessed the groundwater. You removed the soil and all that is taken care of. We still have the groundwater issue. We look at it and see if it is going to be a health risk. That is why we examined it. I note that these things do drag on. It fells like nothing has been done. The soil is removed now. So it is possible you can have a building on top of it and open it back up for business and the

land can be utilized again. We were looking at future residential, if you are able to put a well on this site. Is there contaminated groundwater that will travel to another well. This is what we say we need to look at.

We are not denying it is taking a long period of time. The main reason we are here tonight is because the state of Missouri and EPA have come to conclusions on what to do with the site. The purpose of this public meeting is to explain the remedy and get comments from the public and to find out what they think about the plan before we decide what to do with the site.

COMMENT: One of the city's main water wells is probably less than a hundred yards from that site.

COMMENT: The question I would like to see answered on some sort of reasonable scale so we as ordinary people can understand, what is the risk? You said there is a Risk Assessment study. I haven't read it and probably won't read it.

RESPONSE: In simple terms what we do is we take a concentration that we know affects people. If I give you chromium, let's say I used you as a test subject, and give you this much chromium and I watch you. There is no effect. I give you a little higher dose and we continue to do this until we get a dose that affects you. That gives us the magic concentration number. What we do is to protect human health we divide that by ten hundred thousand. We take that single dose down and we say do not ever take more than this does. Then we take that dose, compare it to what is out there in the water. And what is out there in the water is a little bit higher than that magic number. We have is a cushion there to what we know will affect you and what we accept as acceptable for you to drink. It is above the acceptable limit. We call that one. We say one unit. Don't take more than one of these. The numbers come out to four. Four times the acceptable limit might have health effects on you. But with no one out there, there is no exposure.

I can't tell you, and I wish we could say this concentration you are going to develop a skin rash in three days. We just can't say that. We don't know enough about the chemical's habits. There is not a lot of testing done. This not an exact science. We don't know. That is not acceptable to us. We are not going to take the chance. So to us, that amount is -- I can't say nothing is going to happen. I can't tell you what is going to happen. I can tell you that at that dose we have some effects in animals we study in the labs, which can affect workers handling that. So we say it is not acceptable risk. There is that risk at this site.

But that risk is only if you drink the groundwater. There is nothing on the surface. Walking across it or if you play in the dirt or eat the dirt. There is no risk there.

We take an adult and child and family. And we do a family. We say you are drinking two liters of water a day. You may drink two liters of water from your home. A lot of people don't. That is what we are going to do. We want to protect people so we are going to say you do. Say you wash your hands you are drinking and you bathe in this, 350 days out of the (year). You have got it all over your head, face, (every) pore of you is soaking in it thirty minutes a day. We figure out how much is getting into your body. And that is where we get the risk. If you are drinking two liters of water a day, wash your clothes, wash your body, wash your hands, bathing for thirty minutes a day, there is going to be some risk to you.

Some people say, you know, say that is unreasonable, that no one is going to do that. No one bathes thirty minutes. I have a daughter that can stay in the bathtub for an hour slide back and forth. That doesn't happen. We want to make sure. We just assume you are water lovers. So we can look at that. That is not happening out there. There is no home out there. There is no well dug into it. So there is no risk now because there is no one there to ingest that chemical. And that is what we say. Is that understandable?

COMMENT: So to answer Mr. Sante's questions, putting it on a scale of zero to ten, right now risk is zero.

COMMENT: Zero risk to the people and citizens of Malden.

QUESTION: If you went to use the land, would there still be restrictions on any deed?

RESPONSE: Yes, the Proposed Plan calls for deed restrictions on the property until the contamination has attenuated.

QUESTION: Is there a process to remove the restriction, get a dispensation?

RESPONSE: When monitoring results show that the contaminated groundwater plume is remediated, the restrictions can be removed.

QUESTIONS: What would be considered acceptable if somebody went out there and built a house? What would it will take for them to be able to do that? At this point how much more clean up would you have to do?

RESPONSE: We have an (MCL) number for groundwater. That means you can drink it at the level of chromium in the groundwater that is safe to drink. We would like to see the numbers get down to that level.

QUESTION: How far are you from that number?

RESPONSE: The preliminary remediating goals for the site is 18 parts per billion for hexavalent chromium. For total chromium the preliminary remediation goal is 3,500

parts per billion. The last analysis for total chromium showed between 100 and 150 parts per billion. We are well within the limit on levels of total chromium. The problem is the hexavalent chromium. The hexavalent chromium is running in the 20 to 30 parts per billion range. We need to see the concentration down to 18 parts per billion.

QUESTION : What would it take to get that down?

RESPONSE: Time and natural attenuation.

QUESTION : What was the original test?

RESPONSE: DNR person could not recall the exact concentrations int he original samples. However, they were not significantly higher.

QUESTION : What was the Risk Assessment on that?

RESPONSE : The Risk Assessment was done to be conservative and protect, we take the samples shoe everything from zero to whatever the highest number is. We take the highest number and we assume that it is contaminated everywhere. Again, that is overprotective. That is kind of how we do it. I can tell you for chromium the concentration was 100 parts per million.

QUESTION : What was hexavalent?

RESPONSE : 100 parts per million.

QUESTION : So it dropped from 100 down to 18 and 25?

QUESTION : In a period of time of fifteen years?

COMMENT : Roughly fifteen years is correct.

QUESTION : At this rate another four or five years it should be kind of down?

RESPONSE: We hope that is what will happen.

QUESTION : Is there anything that could be put on the ground to neutralize the groundwater?

RESPONSE : I can address that. I will get into discussing the alternatives. I worked on the feasibility study.

QUESTION : When does the thirty-year clock start? Does it start twenty-five years ago or fourteen years ago when the test wells were put in?

RESPONSE: Thirty years is an considered the longest that it will take for the contaminant plume to attenuate to the preliminary remediation goals calculated for the site. If the preliminary remediation goals are achieved any time during that thirty years, we will stop the monitoring and move forward with all the other things to get this site delisted. To determine when the time starts is probably less significant than when it ends? The clock has been running as far as the attenuation is occurring. This is a process that naturally occurs whether or not we have anything to do with it. So, the question is not when we start counting. It is when will the process actually occur and when will the concentration of hexavalent chromium get down to the calculated preliminary remediation goals. The rate of (attenuation) will probably be slowing down as the concentrations get closer and closer to the remedial goals.

Technically, based on the Superfund contract, the thirty years starts in the near future when we have implemented the proposed remedy. I think we are going to hit, using common sense here, we are going to get through that a lot faster than thirty years. But that is just the figures we have. We hope it will take four or five or less.

QUESTION : When it reaches that (the remedial goals) will the monitoring continue or will you all stop?

RESPONSE: Once we determined the concentrations are down to 18 parts per billion, we would be monitoring for two more years. The State would then notify EPA that the site is clean and recommend moving forward with delisting the site. If monitoring was done on a quarterly basis, achievement of the remediation goals might be declared quicker than that.

QUESTION : This monitoring, is it on a monthly basis or quarterly or yearly or what?

RESPONSE: Monitoring would occur on an annual basis. In fact, with the site at this stage it is monitored annually by MDNR now. We have five monitoring wells on the site. A specialist from the Environmental Services Program comes down once a year and collects groundwater samples from each of the monitoring wells. He takes them to our lab at Jefferson City where they are analyzed to find out how much hexavalent they contain. The samples are also analyzed to find out what the concentration of all forms of chromium is.

QUESTION : There are five (wells) on site now?

RESPONSE: That is correct. The proposed plan calls for four more wells. That is an approximate number. It is possible we may need more or fewer monitoring wells. Please note that we know that the contaminated plume has exceeded our monitoring well field. It has migrated outside of the area we have covered by monitoring wells. That is why we know we need more wells.

QUESTION : You need four more wells?

RESPONSE: We estimate that four more wells are needed. Those wells would be placed at the edge of the property more or less.

QUESTION : These wells are six feet deep; is that correct?

RESPONSE: State personnel were not certain of the exact depth of the monitoring wells. Right now we believe the contamination is around 25 feet deep. It will be somewhere 10 feet and 60 feet.

QUESTION : That (60 feet) would be the maximum?

RESPONSE: We believe that is the maximum depth.

QUESTION : The size of it (of the plume) will increase in all directions or is it moving like in the south or to the north -- is that a silly question?

RESPONSE: That is an excellent question. Looking at the big picture, the whole plume is moving southeast. If you take a small area, like you were looking at one little group of about ten molecules, they are moving also moving southeast. As they are moving, they are also dispersing, so the plume is getting wider as it travels. Also, the concentration at any given point in the plume is reducing because of that dispersal.

The contractor that performed the Feasibility Study created a computer model of the behavior of the plume. The information from the groundwater model gives us a lot of encouragement that the proposed remedy will work. The model showed that the area of unacceptable contamination will probably never get off the airport property. By the time it reaches the property limits it will have attenuated below the level of concern.

QUESTION : If say that we were fortunate enough to get some big manufacturing company that wanted to come to this area, could we build over that?

RESPONSE: A manufacturing facility could probably be built on the site. That is not a definitive answer.

COMMENT : That is better than saying absolutely no.

RESPONSE: MDNR would require the developer to submit a change of use request for the site. We would evaluate whether, through excavation or getting into the contaminated groundwater, anyone would be at risk. Even if they were going to get into the contamination during construction, it is possible that special precautions could be taken to deal with that so that the construction could go on. It could be cost effective to do the construction and just take special precautions. People work on hazardous waste sites every day. They can do this without significant harm to themselves because they take special precautions to avoid contact with contaminants, or to reduce the contamination before they get into it.

The fact that this area is served by a municipal water system makes the possibility of building on the sight more acceptable. The city's wells (according to a geologic study), don't draw water from the aquifer where this contamination is. We would probably not want them to put in wells for the employees to drink or work in all day, or open up a car wash using that water.

QUESTION: Is this people from this general area that live around here or people from Jefferson City or New York?

RESPONSE: Comments would not be restricted to people from this area. For instance, at the Quality Plating Plant near Sikeston, there were a significant number of people from the Cape Girardeau area, from Southeast Missouri State University that had comments and input on the proposed plan for that site. If any environmental organization wanted to comment, they would be free to do so and their comments would be welcome.

QUESTION: What was the estimated cost on this project?

RESPONSE: $261,000 on the remedy we proposed.

QUESTION: Who pays for that? Is the city of Malden responsible for that?

RESPONSE: The State has deferred that part of the project to EPA. Under Superfund, the normal process is to attempt to recover all expenditures on a Superfund site from those who are liable for the site. That is generally owners, operators, or others who have contributed to the contamination. In this case, the only viable owners and operators that we know of that exist are the city of Malden and the 999 Corporation.

EPA also realizes the realities of life and economics. We know a community the size of Malden does not have the resources to finance the selected remedy. I don't think the city will write EPA a check for $261,000. We look at the ability to pay. We look at fairness and reasonableness issues. And in the instance where there is a shortfall, EPA will not elect to try to recover costs. There is no future in going after money where there is no money. We will not go ahead and pay more taxpayer's dollars (in legal costs) to get dollars we already spent and we know we are not going to get back.

That is not to say, we wouldn't seek some participation by the city and the formal discussions will take place further down the road once we know where we can go and how we can go about it. But we understand the reality of life... that no community in this country is -- flush (with money) right now. And it is unlikely that Malden will be able, to or asked to participate to the full amount that the law would allow us to do. We want to be reasonable.

COMMENT: That is good to hear. As a taxpayer of Malden, that is very good to hear.

COMMENT: As the mayor of Malden --

RESPONSE: At this point we don't have anything solid and we are not beginning negotiations. We don't do that at a proposed plan meeting anyway. EPA will have discussions with the mayor and a city council to let them know how the process goes. EPA has modified the process somewhat, particularly for small communities, to try and find reasonable ways to fulfill the requirements of the law and at the same time be fair and equitable with the communities