Five-Year Review Report

Ace Services Site
Colby, Thomas County, Kansas

September 2008

United States Environmental Protection Agency
Region 7
Kansas City, Kansas

With assistance from

United States Army Corps of Engineers
Kansas City District

Approved by:

Cecilia Tapia, Director
Superfund Division
U.S. EPA Region 7

Date:

9-19-08

Executive Summary

A Five-Year Review has been completed at the Ace Services Site (Site) in Colby, Kansas. This is the first Five-Year Review at the Site.

The Site is located near the edge of Colby, Kansas, at 500 East Fourth Street in Thomas County. The surrounding area is primarily light industrial and commercial, although there are a few residences within two blocks. The hexavalent-chromium (Cr(VI)) groundwater plume originates in the general area of the former Ace Services business and originally extended approximately 1.5 miles east-southeast. The width of the plume varied from 500 to 1000 feet. There are also residential areas overlying the plume.

Northwest Manufacturing Company operated a plating facility at the Site from 1954 to 1969. Ace Services was formed in 1969 and operated a chromium electroplating operation at the Site through 1989. The Kansas Department of Health and Environment (KDHE) first began an investigation into improper plating waste management practices by Ace Services in 1971. In 1975 a Wastewater Treatment facility (WWT) was erected on the east side of the plating building. Plating waste was subsequently treated in the WWT and discharged to an unlined evaporation lagoon to the east of the plating building.

In 1980 elevated chromium levels were detected in Colby, Kansas Public Water Supply (PWS) well PWS-8 located about one-fourth mile east of the Ace Site and in other nearby private wells. PWS-8 was removed from service. During a follow up investigation KDHE again observed improper waste handling practices. Additionally, lead and chromium contamination was found in the lagoon soil. Ace Services contracted with Zerr Engineering of Colby, Kansas, for the excavation of 500 to 1,000 cubic yards of contaminated soil from the lagoon area.

The Ace Site was added to the National Priority List (NPL) in September 1995. The Record of Decision (ROD) was signed in May 1999 and amended in September 2001. The remedy in the ROD requires remediation of the chromium groundwater plume to the maximum contaminant level (40 CFR 141 62) of 100 µg/l total chromium. Although the 1999 ROD and 2001

Amended ROD are silent with respect to Operable Units (OU), Site work was divided into two OUs: OU1, Buildings/Soil, and OU2, Groundwater.

OU1 consisted of the first phase of cleanup at the Site and included cleaning and scarification of the floor surfaces in the plating and machine shop buildings as well as debris removal from inside and outside the buildings. Testing of the building interior surfaces showed that decontamination met the standards specified in the ROD. These buildings were later demolished during OU2 to make room for the larger groundwater treatment equipment necessitated by the larger contamination plume.

OU2 consisted of two phases of cleanup at the Site. The first phase for OU2 included demolition and removal of the existing plating and machine shop buildings and removal of contaminated soils. During the demolition, much more contamination, than was originally anticipated, was discovered in the concrete foundations of the building and in the soil beneath the plating shop. This soil was removed as deep as could be excavated (about 15 feet below present grade), and the excavation backfilled with clean soil. One area of the excavation did not meet the cleanup standards set in the ROD, but the U.S. Environmental Protection Agency (EPA) determined that the depth of the remaining contamination prevented exposure. The building slab over this area was considered to act as a cap to prevent precipitation or infiltration from causing further migration of the contamination due to leaching through the soils to the groundwater. The second phase of OU2 included construction of a new groundwater extraction and treatment system utilizing ion exchange to remove chromium from the extracted groundwater with discharge limits of 17 µg/l hexavalent and 100 µg/l total chromium and a groundwater cleanup level of 100 µg/L total chromium. In addition, KDHE offered hook up to the City water system to private wells within or near the plume during OU2 Site work.

The treatment facility was built and began operating on August 12, 2003. It has operated nearly continuously since that time except for a one week period in October 2003 when KDHE discovered that 1,2-DCA contamination from the High Plains cooperative association (COOP) plume was found in extraction wells EX-1I, EX-2I, and PWS-8. Extraction wells EX-1, EX-2,

and PWS-8 remained offline until the High Plains COOP installed a granular activated carbon (GAC) system to remove the volatile organic compounds prior to entering the Ace Service treatment system. All wells were brought back into operation on August 24, 2004. The addition of the GAC system has had little impact on the operation of the Site treatment system except for the more frequent need to change out the bag filters which become clogged with carbon fines shortly after a carbon change out occurs and the additional pumping pressure needed to move water through the entire treatment system including the GAC.

The Site groundwater extraction and treatment system is operated by the City of Colby, Kansas, through an agreement with EPA Region 7. The City staff has done an excellent job operating and maintaining the system. The treatment system has provided approximately 50 percent of the demand for potable water to the City of Colby, Kansas (the City). Black and Veatch Special Projects Corporation performs operational oversight and periodic evaluation of both the extraction and treatment system performance. Adjustments to the system are made as needed to maximize capture of the plume. Since August 2003, the extraction system has reduced the size of the total chromium plume exceeding 100 µg/L by over 90 percent. The treatment system has effectively removed chromium from the extracted groundwater, with no chromium exceedances in effluent discharge to the Prairie Dog Creek or to the City drinking water system. A total of approximately 1.488 billion gallons of groundwater water have been treated by the Site groundwater treatment system since inception. A total of 1,231.56 kilograms of chromium have been removed during treatment. The City has beneficially reused approximately 0.994 billion gallons of the treated groundwater in their potable water supply system.

Exposure pathways have been effectively eliminated through hook up of private wells to the City water system and a City enforced permit requirement for installation of any future wells. The Site property is zoned light industrial. The ROD called for a deed restriction on the Site property which has not yet been implemented due to historical ownership concerns related to multiple trusts. This does not present a protectiveness issue while the treatment facility is operation. Due to fluctuating monitoring results near the Site building, there is an investigation being planned to

determine if source material remains that may contribute to groundwater contamination in the future.

The remedy at the Site currently protects human health and the environment because exposure pathways to groundwater have been removed through hook up of private wells to the City water system, an institutional control in the form of a permit requirement for installation of new wells, and the Site property zoned as light industrial. The groundwater contaminant plume has been reduced by greater than 90 percent of its original extent within a period of five years.

Table of Contents

Section

Figures

Attachments

List of Abbreviations

ARARs	Applicable or Relevant and Appropriate Requirements
ARW	Ace Recovery Well
AWQC	Ambient Water Quality Criteria
BRA	Baseline Risk Assessment
BVSPC	Black & Veatch Special Projects Corp.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COOP	Cooperative Association
Cr	chromium
Cr(III)	trivalent chromium
Cr(VI)	hexavalent chromium
E&E	Ecology and Environment
EPA	U.S. Environmental Protection Agency
EX	extraction well
Fe(II)	ferrous iron
Fe(III)	ferric iron
GAC	granular activated carbon
gpm	gallons per minute
GWTP	Groundwater Treatment Plant
GWTS	Groundwater Treatment System
HDPE	High Density Polyethylene
HI	Hazard Index
KDHE	Kansas Department of Health and Environment
KS	Kansas
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
mg/kg	milligram per kilogram
mg/L	milligrams per liter
msl	mean sea level
MW	monitoring well
NAWQC	National Ambient Water Quality
NCP	National Contingency Plan
NPL	National Priority List
O&M	operation and maintenance
PLC	programmable logic controller
POTW	Publicly Owned Treatment Works
PRG	Preliminary Remediation Goal
PWS	public water supply
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RID	Reference Doses
RPM	Remedial Project Manager

ROD	Record of Decision
RSE	Remedial System Evaluation
RTU	Remote Terminal Unit
SARA	Superfund Amendments and Reauthorization Act
TCLP	Toxicity Characteristics Leaching Procedure
µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
VOCs	Volatile Organic Compounds
WWT	Wastewater Treatment
XRF	X-ray Fluorescence

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Ace Services Site		
EPA ID *(from WasteLAN)*: KSD046746731		
Region: 7	**State: KS**	**City/County: Colby/Thomas**
SITE STATUS		
NPL status: √ Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction √ Operating ☐ Complete		
Site Wide FYR √ YES ☐ NO	**Construction completion date:** 09 / 22 / 2003	
Has Site been put into reuse? ☐ YES √ NO		
REVIEW STATUS		
Lead agency: √ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____		
Author name: Rob Weber		
Author title: Remedial Project Manager	**Author affiliation: U.S. EPA Region 7**	
Review period: 09 / 22 / 2003 to 09 / 22 / 2008		
Date(s) of Site inspection: 11 / 29 / 2007 and 04 / 22-23 / 2008		
Type of review: √ Statutory ☐ Policy √ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion		
Review number: √ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify) _____		
Triggering action: ☐ Actual RA On-site Construction at OU #____ ☐ Actual RA Start √ Construction Completion ☐ Previous Five-Year Review Report ☐ Other (specify)		
Triggering action date *(from WasteLAN)*: 09 / 22 / 2003 (PCOR)		
Due date *(five years after triggering action date)*: 09 / 22 / 2008		

Issues:

1. Treatment plant Audit Reports do not address results of effluent discharge to the tributary to Prairie Dog Creek and City Drinking Water System

2. Source area soils may have a potential to continue contributing to the groundwater contaminant plume.

3. The ROD calls for placement of deed restrictions to prevent future use of contaminated groundwater, to prevent residential use of the Site and buildings, and to prevent removal of floors and soils beneath the building. These deed restrictions have not been implemented to date due to historical ownership concerns related to multiple trusts.

Recommendations and Follow-up Actions:

1. Add section to Audit Report addressing results of discharges to tributary Prairie Dog Creek and City Drinking Water System.

2. Based on recommendations from a Remediation Systems Evaluation, a source area investigation will be conducted to determine the nature of contamination in source area soils and if the potential exists for the contaminants in these soils to leach to groundwater. Remediation system enhancements may be considered based on the results of the soil investigation.

3. The absence of a deed restriction does not present a current protectiveness issue due to the operation of the groundwater treatment plant on-site. Institutional controls have been implemented for the Site through public education and warnings about use of the groundwater in the plume area. The City also has implemented a permit system which limits new wells in the City. The City has zoned the Site as light industrial. Future use of the Site is expected to remain commercial or industrial, and future use of the Site facility will be to house the treatment plant at least for the duration of the remedial action. An investigation is planned to determine if there are still residual source materials on the Site property contributing to the groundwater contamination. A future determination during the next Five-Year Review will be made to assess whether or not a deed restriction can be implemented without disruption of the treatment system.

Protectiveness Statement(s):

Operable Unit 1

The remedy at OU1 is protective of human health and the environment. The metal and plating shop buildings and associated foundations remedy included scarification of the floor surfaces in the plating and machine shop buildings as well as debris removal from inside and outside the buildings. OU1 actions were conducted in accordance with Site decision documents. The exposure pathways, the Site buildings, for this OU no longer exist and were removed as part of the OU2 activities.

Operable Unit 2

The remedy at OU2 currently protects human health and the environment. The metal and plating shop buildings and foundations were removed. Soils beneath these structures were excavated to a depth of 15 feet below grade. A new groundwater treatment building was constructed above the residual soils, will serve as a cap, and will remain for at least the duration of the remedial action. The lagoon area surface soils were excavated and clean fill was placed on the surface of the Site. The groundwater contaminant plume has been reduced to greater than 90 percent of its original extent. Downgradient private well receptors have been provided an alternate water supply and the remaining private wells are periodically monitored.

However, in order for the remedy to be protective in the long-term, the following actions will need to be taken to ensure long-term protectiveness. An investigation is planned to determine if there are residual source materials on the Site property that are contributing to the groundwater contamination. The results of the investigation may lead to additional investigations and/or Site remediation system enhancements. An evaluation during the next Five-Year Review period will be made to assess whether or not a deed restriction can be implemented without disruption of the treatment system. The absence of a deed restriction does not present a current protectiveness issue due to the operation of the groundwater treatment plant on-site. Institutional controls have been implemented for the Site through public education and warnings about use of the groundwater in the plume area. The City also has implemented a permit system which limits new wells in the City. The City has zoned the Site as light industrial. Future use of the Site is expected to remain commercial or industrial, and future use of the Site facility will be to house the treatment plant at least for the duration of the remedial action.

Site Wide

Because the remedial actions at all OUs are protective, the Site is protective of human health and the environment.

Other Comments:

Not applicable

1.0 Introduction

The purpose of Five-Year Review is to determine whether the remedy at a Site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

The United States Environmental Protection Agency (EPA) is preparing this Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) section 121(c) and the National Contingency Plan (NCP). CERCLA § 121(c) states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

EPA interpreted this requirement further in the NCP; 40 CFR § 300.430(f)(4)(ii) states:

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

EPA Region 7 has conducted a Five-Year Review of the remedial actions implemented at the Site in Thomas County, Kansas. This review was conducted from December 2007 through September 2008. This report documents the results of the review.

This is the first Five-Year Review for the Site. The triggering action for this review is the date of the preliminary closeout report for the groundwater extraction and treatment system in September 2003. The Five-Year Review is required due to the fact that chromium contamination remains on-site above levels that allow for unlimited use and unrestricted exposure.

2.0 Site Chronology

A chronology of significant Site events and dates are included in Table 1.

Table 1: Chronology of Site Events

EVENT	COMPLETION DATE
Discovery	08/01/1980
Preliminary Assessment	10/01/1982
Site Inspection	11/06/1982
Preliminary Assessment	09/28/1989
Site Inspection	09/28/1989
Aerial Survey	04/18/1990
Expanded Site Inspection	11/27/1991
NonNational Priorities List Potentially Responsible Party Search	09/08/1992
Removal Assessment	10/15/1993
Hazard Ranking System Package	05/06/1994
Information Repository Established	07/08/1994
Removal Action – Soil Building Surface Decontamination	07/14/1994
Listing on National Priorities List	09/29/1995
Remedial Investigation/Feasibility Study	05/05/1999
Record of Decision	05/05/1999
Remedial Design	08/1999
Remedial Action – Building Decontamination	02/04/2000
Record of Decision Amendment	09/13/2001
Remedial Design – Groundwater Pump and Treat	01/09/2002
Remedial Action – Building Demolition	4/30/2002
Remedial Action – Groundwater Treatment Plant Operational and Functional	08/12/2003
Interim Remedial Action Report	09/19/2003
Preliminary Close-Out Report	09/22/2003
Long-Term Response Action	Ongoing

3.0 Background

3.1 Physical Characteristics

The Site is located near the edge of Colby, Kansas, at 500 East Fourth Street in Thomas County (Figure 1). The geographic coordinates for the Site are approximately 100°02'10" West Longitude and 39°23'47" North Latitude. The Site lies in the southwest quarter of section 31, Township 7 South, Range 33 West. The facility is next to a small church and a hardware store. The Thomas County courthouse is approximately two and one-half blocks west of the Site. The surrounding area is primarily light industrial and commercial, although there are a few residences within two blocks.

Prior to the start of the remedy, a hexavalent-chromium (Cr(VI) groundwater plume originated in the general area of the former Ace Services business and extended approximately one and one-half miles east-southeast. The width of the plume varied from 500 to 1,000 feet. The northern plume boundary was approximated by U.S. Highway 24, and the leading edge is just east of the City boundary along Highway 24. These Site boundaries are based on the maximum extent of the 100 micrograms per liter (µg/L) total-chromium isoconcentration line. Remedial activities have significantly reduced the extent of the chromium plume to isolated areas that continue to exceed the action-level of 100 µg/L total chromium (Cr(III)).

3.2 Land and Resource Use

At the time of the ROD, the Site was used as a storage facility and was surrounded by residential and commercial areas. Future use of the Site is to continue to be industrial or commercial. Comments presented by the community did not include concern for use of the Site as anything other than these uses. The remedy proposes institutional controls to prevent future use of the Site as residential.

The Ogallala aquifer below the Site is used as a primary potable water resource for the region, and specifically is a municipal source for Colby, Kansas, and for individual residences in the Site area that are not connected to the municipal water system of Colby, Kansas. A Colby, Kansas

municipal water supply well (PWS-8) has been contaminated and was taken out of service because of the contamination. The community has expressed a strong interest in being able to return the well to service in the near future.

3.3 History of Contamination and Enforcement Activities

Northwest Manufacturing Company operated a plating facility at the Site from 1954 to 1969. Ace Services was formed in 1969 and operated a chrome electroplating operation at the Site through 1989. The Site included two buildings, the plating shop building and an office/machine shop building. The plating building featured three concrete/cinder block troughs where vats of plating solution were located during operations. The Kansas Department of Health and Environment (KDHE) first began an investigation into improper plating waste management practices by Ace Services in 1971. In 1975 a wastewater treatment facility (WWT) was erected on the east side of the plating building. Plating waste was subsequently treated in the WWT and discharged to an unlined evaporation lagoon to the east of the plating building.

In 1980, elevated chromium levels were detected in Colby, Kansas Public Water Supply (PWS) well PWS-8 located about one-fourth mile east of the Site and in other nearby private wells. PWS-8 was removed from service. During a follow up investigation KDHE again observed improper waste handling practices. Additionally, lead and chromium contamination was found in the lagoon soil. In 1981, Ace Services contracted with Zerr Engineering of Colby, Kansas, for the excavation of 500 to 1,000 cubic yards of contaminated soil from the lagoon area.

In 1988 KDHE issued an Administrative Order requiring Ace Services to clean up the Site. Ace Services did not comply with that order. Ace Services terminated operations at the Site in 1989 after losing corporate status due to failure to pay taxes and fees.

In 1992, KDHE coordinated the removal of plating wastes from the plating shop building. Investigations undertaken as part of this removal determined that the floors and walls of the troughs were contaminated with lead and chromium. It was further determined that the

contamination may have migrated into the underlying soils. This assessment also found that elevated levels of lead and chromium were still present in the lagoon soils east of the WWT.

In 1994 EPA conducted a removal action to clean up the contaminated soils, concrete and structures at the Site. This action established clean up goals for soils of 1,500 mg/kg total chrome and 500 mg/kg total lead. The WWT was demolished and removed in this action. The walls and floors of the three plating troughs were removed and the underlying soils were excavated. Not all of the contaminated soils could be removed at that time due to concerns for undermining the building structure. Once the contaminated soils that could be accessed were removed, the trough excavations were backfilled with clean soil and topped with concrete level with the remaining floor slab in the building.

As part of the 1994 removal, an attempt was made to reduce the Cr(VI) in the surface layer of the concrete floor slab to less toxic Cr(III) by applying a sulfuric acid solution followed by sodium metabisulfite. The 1994 cleanup also included an assessment of the lagoon area which determined that there were soils contaminated in excess of the cleanup goals. Approximately 500 tons of soil were excavated from the lagoon and disposed of.

The Ace Site was added to the National Priority List (NPL) in September 1995. Sampling conducted in 1996 and 1999 indicated that areas of the plating shop floor slab surface were still contaminated. These areas were scarified (progressively ground down) removing approximately 1-inch from the top of the concrete surface.

The Ogallala Aquifer underlies the area in and around Colby, Kansas. A portion of this aquifer has been contaminated with hexavalent chrome from releases at the Site. Extensive groundwater sampling was performed from 1980 through 2000 with much of the sampling being done between 1996 and 2000. The sampling efforts indicated that the chromium plume was approximately a mile long, one-fourth mile wide and 130 feet thick with the western edge of the plume beginning in the proximity of the Site. Concentrations of Cr(VI) in the plume ranged up to about 4,000 µg/L. The ROD required remediation of the groundwater chrome plume to the

maximum contaminant level (40 CFR 141 62) of 100 µg/L total chromium. The prescribed method of remediation was a pump and treat system utilizing ion exchange to remove chromium from the extracted groundwater with discharge limits of 17 µg/L hexavalent and 100 µg/L total chromium and a groundwater cleanup level of 100 µg/L.

3.4 Basis for Response Action

The baseline risk assessment estimates what risks the Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. Actual or threatened releases of hexavalent chromium from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

The evaluation of noncarcinogenic risks for current downgradient residents and future on-site and off-site residents through the groundwater exposure pathway resulted in hazard indices of 0.42 and 20.0, respectively. A hazard index calculated for a Site in excess of 1.0 indicates that potential adverse health effects may occur from exposure to the Site contaminants. For the Site, the hazard index exceeded 1.0 for future residents drinking and bathing in groundwater contaminated with hexavalent chromium.

4.0 Remedial Actions

4.1 Remedy Objectives

The primary focus of the remedial actions is to remediate the contaminated groundwater and on-Site building interiors, which are the major risks posed from the Site, and limit future use of the facility to industrial or commercial purposes.

Remedial action objectives developed for contaminated groundwater are to prevent ingestion, inhalation, or direct contact with groundwater having chromium concentrations in excess of current regulatory drinking water standards and to prevent further migration of chromium to prevent further degradation of natural resources.

Remedial action objectives developed for contaminated soil are to maintain prevention of exposure to soils having total chromium or lead concentrations in excess of current action levels and to prevent migration of chromium and lead that would result in groundwater contamination.

Remedial action objectives developed for the contaminated buildings are to prevent exposure to indoor air or interior dusts/concrete having total chromium, hexavalent chromium lead, arsenic, cadmium, manganese, or nickel concentrations in excess of industrial health-based screening levels and to prevent migration of chromium and lead that could result in groundwater contamination.

EPA has assumed that this facility will continue to be used for industrial or commercial purposes. The cleanup levels have been determined to allow future use of the facility as an industrial or commercial facility. The levels of contamination remaining on-site render the property unsuitable for other land uses, such as residential. Access restrictions would be implemented during remediation efforts to minimize exposure to humans.

4.2 Remedy Selection

The 1999 ROD concluded that the presence of lead in dust in on-site buildings and contamination on interior surfaces posed potential health concerns for industrial or commercial uses. The major components of the selected remedy for on-site buildings included the following:

- Institutional controls, as permitted by law, to prevent residential use of the Site and buildings and to prevent removal of floors and soils beneath the building.
- Removal of contaminated interior concrete surfaces by grit blasting.
- Decontamination of building interiors by dusting, vacuuming, and wiping.
- Disposal of decontamination debris as appropriate, if necessary at a Resource Conservation and Recovery Act (RCRA) facility.

The 1999 ROD also concluded that the presence of hexavalent chromium in the groundwater at the Site presents a threat to any future on-site or off-site resident users of groundwater. The major components of the selected remedy for groundwater include the following:

- Institutional controls including deed restrictions, as permitted by law, to prevent use of contaminated groundwater.
- Active restoration of the aquifer by pumping and treating the contaminated groundwater.
- Treatment of contaminated groundwater by electrochemical reduction and precipitation techniques.
- Discharge of treated groundwater to the on-site tributary to Prairie Dog Creek. Alternatively and as appropriate, treated and untreated groundwater will be discharged to the local Colby, Kansas, publicly owned treatment works (POTW) and, at the option of state and local authorities, the treated groundwater may be beneficially reused rather than discharged.
- In situ bioremediation of contaminated groundwater is possible, as indicated by the results of treatability studies during design.
- Groundwater monitoring and periodic review of results.

The 2001 Amended ROD addresses groundwater hexavalent chromium Cr(VI) contamination in the groundwater. Evaluation of soil data determined that removal actions performed at the Site have eliminated health concerns from exposure to contaminated surface soils at the Site. In addition, the buildings that had metals contamination on the interior surfaces have been demolished and removed from the Site.

The presence of Cr(VI) in the groundwater at the Site presented a threat to any future on-site or off-site residential users of groundwater. The major components of the selected remedy for groundwater as outlined in the September 2001 Amended ROD (amendment to the May 1999 ROD) included the following:

- Institutional controls including deed restrictions, to the degree possible, to prevent use of contaminated groundwater.
- Active restoration of the aquifer by pumping and treating the contaminated groundwater.
- Treatment of contaminated groundwater by ion exchange.
- Discharge of treated groundwater to the on-site tributary to Prairie Dog Creek. Alternatively and as appropriate, treated and untreated groundwater will be discharged to the local Colby, Kansas POTW and, at the option of state and local authorities, the treated groundwater may be beneficially reused rather than discharged.
- Groundwater monitoring and periodic review of results.
- Provision of City water supply hookups to owners of affected residential wells by a water main and installation of meters and house connections.

4.3 Remedy Implementation

Although the 1999 ROD and 2001 Amended ROD are silent with respect to operable units (OU), the remedy was implemented in two OUs: OU1, Buildings/Soil, and OU2, Groundwater.

OU1 consisted of the first phase of cleanup at the Site and included cleaning and scarification of the floor surfaces in the plating and machine shop buildings as well as debris removal from inside and outside the buildings. Testing of the building interior surfaces showed that decontamination met the standards specified in the ROD. These buildings were later demolished during OU2 to make room for the larger groundwater treatment equipment necessitated by the larger contamination plume.

OU2 consisted of two phases of cleanup at the Site. The first phase for OU2 included demolition and removal of the existing plating and machine shop buildings and removal of contaminated soils. During the demolition, much more contamination was discovered in the concrete foundations of the building, and in the soil beneath the plating shop, than was originally anticipated. This soil was removed as deep as could be excavated (about 15 feet below present grade) and the excavation backfilled with clean soil. One area of the excavation did not meet the

cleanup standards set in the ROD, but EPA determined that the depth of the remaining contamination prevented exposure. The building slab over this area was considered to act as a cap to prevent precipitation or infiltration from causing further migration of the contamination due to leaching through the soils to the groundwater. The second phase of OU2 included construction of a new groundwater extraction and treatment system utilizing ion exchange to remove chromium from the extracted groundwater with discharge limits of 17 µg/L hexavalent and 100 µg/L total chromium and a groundwater cleanup level of 100 µg/L total chromium. In addition, KDHE offered hook up to the City water system to private wells within or near the plume during OU2 Site work.

A summary of how each of the components of the selected remedy was implemented at the Site based on the ROD and its amendment is provided below following each set of bulleted items:

- Removal of contaminated interior concrete surfaces by grit blasting.
- Decontamination of building interiors by dusting, vacuuming, and wiping.
- Disposal of decontamination debris as appropriate, if necessary at a Resource Conservation and Recovery Act (RCRA) facility.

On-site construction activities began on November 30, 1999, and the final inspection for the remedial action for building decontamination was completed on February 24, 2000. Hazardous debris were collected from the machine shop and plating shop buildings and from outside the building areas. The machine shop and plating shop surfaces were dusted, wiped, vacuumed, and/or scarified. Waste materials were recycled or disposed of in RCRA solid and hazardous waste facilities. These activities were documented in the Final Remedial Action Report: Buildings (BVSPC, 2000). The metal shop and plating shop were demolished as part of the groundwater treatment system installation presented below:

- Institutional controls, as permitted by law, to prevent residential use of the Site and buildings and to prevent removal of floors and soils beneath the building.
- Institutional controls including deed restrictions, to the degree possible, to prevent use of contaminated groundwater.

Institutional controls have been implemented for the Site through public education and warnings about use of the groundwater in the plume area. The City also has implemented a permit system which limits new wells in the City. The City has zoned the Site as light industrial. Future use of the Site is expected to remain commercial or industrial, and future use of the Site facility will be to house the treatment plant at least for the duration of the remedial action.

The 1999 ROD called for placement of deed restrictions to prevent future use of contaminated groundwater, to prevent residential use of the Site and buildings, and to prevent removal of floors and soils beneath the building. These deed restrictions have not been implemented to date due to historical ownership concerns related to multiple trusts. This does not present a current protectiveness issue due to the operation of the groundwater treatment plant on-site. An investigation is planned to determine if there are still source areas on the Site property contributing to the groundwater contamination.

- Active restoration of the aquifer by pumping and treating the contaminated groundwater.
- Treatment of contaminated groundwater by electrochemical reduction and precipitation techniques.
- In situ bioremediation of contaminated groundwater is possible, as indicated by the results of treatability studies during design.
- Treatment of contaminated groundwater by ion exchange.

Both the 1999 ROD and the 2001 Amended ROD envisioned active aquifer restoration through pump-and-treat. In the 2001 Amended ROD, an ion exchange treatment process was chosen in lieu of the electrochemical process described in the 1999 ROD. This option was selected because of the increased amounts of extracted groundwater to be treated, the reduction in expected average concentrations in that water, and the associated change in cost-effectiveness in favor of ion exchange. A component of the 1999 ROD was an option to consider in situ bioremediation to enhance remediation efforts in the groundwater. This was eliminated given that it was determined to interfere with the ion exchange treatment system by creating an anaerobic environment in the groundwater affecting the performance of the system and requiring an additional ion-exchange resin bed at significant additional cost. The benefits from the additional treatment did not justify the additional costs and performance reductions.

Design of the pump and treat system as outlined in the 2001 Amended ROD was completed by BVSPC in January 2002. Prior to beginning construction, the existing machine shop, plating shop, and underlying concrete slabs were demolished and removed. The demolition work also included removal of 1,000 cubic yards of soil contaminated with Cr(VI) from around the former troughs and foundation piers in the plating shop. This portion of the remedy eliminated the concern for exposure to contaminants within the existing buildings. The demolition effort is documented in the Demolition Summary Report (BVSPC 2003a).

The groundwater treatment system (GWTS) consists of a groundwater extraction system and a treatment plant. The groundwater extraction system is comprised of a total of 13 extraction wells screened in shallow, intermediate, and deep zones of the aquifer. Twelve of the wells are new and one (PWS-8) is a former PWS well that was taken out of service due to chromium contamination. This well was retrofitted as an extraction well for the remediation system. The locations of the extraction wells were determined via computer flow modeling during the design phase to optimize control and capture of the chromium plume. Each well head is enclosed in a small heated and ventilated well house building. The well house also contains the motor control center, program logic control (PLC) remote terminal unit (RTU) cabinet, flow meter, modulating flow control valve, and all other piping, electrical, and control appurtenances for the well. Each well pumps into a buried HDPE pipeline system, which conveys the water to the influent storage tank at the groundwater treatment plant (GWTP). Each well is controlled from the PLC system in the main office at the GWTP via a fiber optic link.

The treatment plant is provided with two 250,000 gallon above-ground storage tanks. One tank stores raw groundwater from the extraction wells and the other stores treated water from the GWTP. The tanks provide about 4 hours of storage capacity to allow for flow balancing in the treatment system.

The GWTP uses an ion exchange system to remove hexavalent chrome from the extracted groundwater. The ion exchange system consists of two parallel process trains, each consisting of three ion exchange beds. Each bed is loaded with 560 cubic feet of Type II strong base anion exchange resin in chloride form. As water passes through the bed, the hexavalent chrome (as chromic acid) is exchanged for a chloride ion in the resin. Each three-bed train can be operated independently at any flow rate selected by the operator. The ion exchange system operates in a lead-lag configuration to provide full redundancy to assure that effluent quality is always met. In each train, contaminated groundwater flows through the lead bed where the chrome is removed. The water then flows through a lag bed, which serves as redundant backstop in case there is some chrome breakthrough from the lead bed. The third bed in each train is in standby. Water does not flow through the standby bed. When the resin in the lead bed becomes fully saturated with chrome, the beds are advanced so the lag bed goes into lead service and the formerly standby bed goes into lag service. The spent resin in the former lead bed is then removed and replaced with new virgin resin and that bed is placed in standby. Each process train is designed for a nominal flow of 250 gallons per minute (gpm) giving the plant a nominal capacity of 250 gpm if only one treatment train were to be operated. Final testing of the treatment system demonstrated that the actual capacity of the completed system is in excess of 1,100 gpm (BVSPC 2003b).

A pair of raw water pumps (one per train) draws contaminated groundwater from the influent storage tank and pumps the water through a 5 micron filter then through the treatment train and out to the effluent storage tank. Back wash, air pump, rinse, recycle, sluicing and transfer vessel systems are provided to facilitate resin management and transfer.

The treatment plant has large overhead doors at opposite sides which allow a full-sized 18 wheel tanker truck to park inside the building for resin transfers. This allows for the transfer of spent resin to a waste tanker and transfer of fresh resin from a tanker directly to the process vessels during any kind of weather and at any time of day.

The treated water effluent storage tank is provided with a dual out-fall. The initial planned primary means of discharge from the effluent tank was via a gravity discharge to the adjacent tributary to Prairie Dog Creek. Alternatively, a pair of treated water pumps are provided to pump the effluent tank directly into the City drinking water system as approved by KDHE. A chlorination system is provided to chlorinate water pumped to the City system.

The groundwater pump and treat system has been operating since August 2003.

- Discharge of treated groundwater to the on-site tributary to Prairie Dog Creek. Alternatively and as appropriate, treated and untreated groundwater will be discharged to the local Colby, Kansas POTW and, at the option of state and local authorities, the treated groundwater may be beneficially reused rather than discharged.

The groundwater pump and treat system started operation in August 2003. Treated water was discharged exclusively to the unnamed tributary to Prairie Dog Creek until June of 2005. In June 2005, after the system had proved effective at removing chromium to safe levels for human ingestion, discharge began to the City drinking water system. Since June 2005, the majority of discharges have been beneficially reused through discharge to the City drinking water system. A total of approximately 1.488 billion gallons of groundwater have been treated by the Site groundwater treatment system since inception. A total of 1,231.56 kilograms of chromium have been removed during treatment. The City has beneficially reused approximately 0.994 billion gallons of the treated groundwater in their potable water supply system.

- Groundwater monitoring and periodic review of results.

A semi-annual groundwater monitoring program that includes sampling all wells has been established for the Site. This consists of sampling 48 monitoring wells, six observation wells, nine residential wells, the Ace Recovery Well (at three depth intervals), 12 extraction wells, and PWS-8 (the former PWS well). The samples are analyzed for total chromium and field parameters including temperature, specific conductivity, pH, turbidity, dissolved oxygen, and oxidation-reduction potential. Monitoring wells are sampled using a conventional purge (three volumes or more) and sample method and extraction wells are sampled through a sample port. Laboratory analysis is provided by the Region 7 Laboratory.

The results of the sampling events, and an evaluation of the performance of the extraction system in achieving cleanup of the groundwater, is provided in the Long-Term Response Action, Cleanup Status Reports submitted on a semi-annual basis as part of a contract with BVSPC.

- Provision of City water supply hookups to owners of affected residential wells by a water main and installation of meters and house connections

KDHE made public water available to residents with private wells located within or in proximity to the chromium plume. A majority of the residents with private wells chose to switch to public water thereby eliminating this potential exposure pathway. Although the residential wells have been discontinued for potable use, monitoring of these wells continues. Monitoring data indicates that all of the monitored wells have been below detectable levels of chromium since October 2006. Monitoring also showed there were no exceedances of the action level for chromium in the residential wells for the period covered by this Five-Year Review report.

4.4 Operational and Functional Activities

The treatment facility was built and began operating on August 12, 2003. It has operated nearly continuously since that time except for an occasional power outage or equipment breakdown. The longest shutdown occurred during a one week period in October 2003 when KDHE discovered that 1,2-DCA contamination from the High Plains COOP plume was found in wells EX-1I, EX-2I, and PWS-8. After one week, the majority of the extraction system resumed operations. Extraction wells EX-1, EX-2, and PWS-8 remained off-line until the High Plains COOP installed a granular activated carbon (GAC) system to remove the volatile organic compounds (VOCs) prior to entering the Ace Service treatment system. All extraction wells were brought back into operation on August 24, 2004. The addition of the GAC system has had little impact on the operation of the Ace treatment system except for the more frequent need to change out the bag filters which become clogged with carbon fines shortly after a carbon change out occurs.

Process monitoring is conducted twice daily (morning and afternoon) at three locations: plant influent, plant effluent, and the effluent to the City. In the morning, an additional seven

samplings are collected: downstream of the influent tank, downstream of the bag filter BF-1, downstream of bag filter BF-2, downstream of ion exchange train A lead vessel, downstream of ion exchange train A lag vessel, downstream of ion exchange train B lead vessel, downstream of ion exchange train B lag vessel. All samples are analyzed for hexavalent chromium and pH. In addition, influent and effluent samples are analyzed for total chromium. The daily analysis of the samples is performed at the GWTP with a Hach kit. Once a week, the morning samples are split and sent to the independent laboratory contracted through an EPA cooperative agreement with the City.

As part of the EPA contract with BVSPC a Long-Term Response Action Audit is performed to monitor key plant operations and evaluate the plant operator's conformance to specified requirements for system operation. The audit addresses equipment and operations associated with both the extraction and treatment systems. The audits include a Site visit to observe the City operators and obtain key plant operating data. Any record-keeping deficiencies or needed repair and maintenance items are noted along with recommended corrective actions. Findings and recommendations are summarized in reports on a semi-annual basis (reduced from quarterly).

In addition to the audit reports, a Cleanup Status Report is also developed on a semi-annual basis (formerly quarterly). The purpose of this report is to evaluate the effectiveness of the extraction system in remediating the chromium plume. Based on findings from the evaluation, pumping rates are modified as necessary to capture the target plume as the target plume extent varies, as well as to avoid over pumping which increases the cost of treatment plant operation.

Table 2 below shows the annual operation and maintenance (O&M) costs for system operation over this Five-Year Review period:

Table 2: Annual System Operations/O&M Costs

Federal Fiscal Year (FY)	Total Cost Estimate
FY2003	$83,923.25
FY2004	$628,571.83
FY2005	$1,083,197.08
FY2006	$1,295,435.76
FY2007	$995,993.70
FY2008 (ongoing at the time of this report)	$746,079.40 (ongoing at the time of this report)

5.0 Progress Since Last Review

This is the first Five-Year Review for the Site. During this Five-Year Review period, significant progress has been made at reducing the size of the chromium plume that exceeds the action level (100 µg/L total chromium). In all three aquifer zones, shallow, intermediate, and deep, the estimated area of the chromium plume exceeding the action level has been reduced by greater than 90 percent. See Figures 2, 3, and 4 comparing the limits of the chromium plume prior to the start of the remedy in April 2003 versus the limits as of the October 2007 monitoring event.

As pumping rates have been varied or select wells shut off due to reduced chromium concentrations or low regional groundwater level conditions, some rebound in concentrations has been experienced. When this occurs, adjustments are made to select extraction wells to ensure capture of the target plume.

Wells showing persistent concentrations above the action level are located nearest the source area. However, these wells are also showing a consistent downward trend over time.

An investigation is planned on the Ace Service property to determine if potential soil source materials remain that may still be contributing to groundwater contamination. This investigation will help determine if any additional actions are necessary to expedite and optimize the completion of the remedy.

6.0 Five-Year Review Process

6.1 Administrative Components

The five-year review process was conducted by Rob Weber, EPA Region 7 remedial project manager (RPM) for the Site and supported by Jeremy Johnson, EPA Region 7 Toxicologist and Human Health Risk Assessor; Venessa Madden, EPA Region 7 Ecological Risk Assessor; Paul Speckin, U.S. Army Corps of Engineers (USACE) Civil Engineer; and Chuck Williams, USACE Hydrogeologist. The Five-Year Review began on September 11, 2007, with a review of the Site file.

6.2 Community Involvement

A fact sheet announcing the start of the first five-year review for the Ace Services Superfund Site in Colby, Kansas, was (1) faxed on November 30, 2007, to Senator Sam Brownback, Senator Pat Roberts, and Representative Jerry Moran, (2) placed on the Region 7 Website on November 30, 2007, and (3) mailed to the updated mailing list of 105 addresses on November 30, 2007.

A newspaper display advertisement announcing the start of the Five-Year Review was published in the *Colby, Kansas Free Press* on December 3, 2007.

6.3 Document Review

Documents reviewed as part of the Five-Year Review included the following:

- Baseline Risk Assessment, Groundwater, Soil, Dust, and Air (BVSPC, October 1998)
- Remedial Investigation Report (BVSPC, October 1998)
- Feasibility Study, (BVSPC, November 1998)
- Record of Decision (USEPA Region 7, May 1999)
- Pump Test Results Memorandum (BVSPC, November 2000)
- Final Remedial Action Report: Buildings (BVSPC, November 2000)
- Groundwater Model Technical Memorandum (BVSPC, December 2000)
- Groundwater Model Technical Memorandum Amendment (BVSPC, July 2001)
- Amended Record of Decision (USEPA Region 7, September 2001)
- Long-Term Response Action, Field Sampling Plan (BVSPC, August 2003)
- Long-Term Response Action, Quality Assurance Project Plan (BVSPC, August 2003)
- Remedial Action Report, Demolition Summary (BVSPC, September 2003)

- Interim Remedial Action Report (BVSPC, September 2003)
- Preliminary Close Out Report (USEPA Region 7, September 2003)
- Remedial Action Report, (BVSPC, October 2003)
- Long-Term Response Action, Semi-Annual Cleanup Status Report (BVSPC, January 2004)
- Long-Term Response Action, Annual Cleanup Status Report (BVSPC, June 2004)
- Final Construction Report - As Installed, Metzler Private Well Site (BE&K/TerraNext, June 2004)
- Long-Term Response Action, Audit Reports No. 1 (BVSPC, November 2003) through No. 15 (BVSPC, November 2007)
- Long-Term Response Action, Cleanup Status Report No. 3 (December 2004) through No. 9 (November 2007)
- Quarterly Operation/Maintenance and Monitoring Report, Hi-Plains Coop and Granular Activated Carbon System (MILCO Environmental Services, Inc., March 2007)
- Quarterly Operation/Maintenance and Monitoring Report, Hi-Plains Coop and Granular Activated Carbon System (MILCO Environmental Services, Inc., December 2007)
- April 2008 Data Evaluation, (BVSPC, June 4, 2008)
- Long-Term Response Action, Audit Report No. 16 (BVSPC, June 3, 2008)

6.4 Data Review

Treatment Plant Effluent

All daily effluent data sampling results were reviewed as part of the Five-Year Review. Effluent discharge, whether to the tributary to Prairie Dog Creek or to the City drinking water system, is sampled on a daily basis and tested using Hach test kits and a Hanna monitoring probe. These tests are accurate enough to provide an early indication of a possible problem with the system, but cannot be relied on to give the true concentration of effluent discharge. Samples collected on Wednesday of each week are split with one split sent to an off-site laboratory for analysis. Laboratory effluent sample results have all been nondetect for Cr(VI) with detection levels at 10 µg/L. Total chromium is not sampled in the discharge since most, if not all, of the chromium at the Site is in the Cr(VI) form. The discharge limits for the Site are 17 µg/L Cr(VI) and 100 µg/L total chromium.

Groundwater Monitoring Data

All groundwater monitoring data, from the beginning of the project in the 1980s through April 2008, was reviewed. However, the groundwater monitoring system did not reach its current configuration until 2003.

Data summary tables and trend plots for monitoring data collected from April 2003 through April 2008 are included in Attachment A.

Since the start up of the extraction system in August 2003, there has been a significant reduction in the areal extent of the plume exceeding the 100 µg/L total chromium action level. In each of the three aquifer zones, the area of the plume exceeding 100 µg/L has been reduced by over 90 percent. There have been occasional concentration fluctuations and spikes experienced in some monitoring and extraction wells, but in general, the chromium concentrations at all of the monitoring points has shown a significant downward trend. The results from the sampling events in April 2007, October 2007, and April 2008 show that the vast majority of monitoring results are at nondetect.

Performance of the system is periodically evaluated and adjustments to pumping rates are made to optimize capture of the plume. Below are three examples of how adjustments have been made to the system based on periodic evaluation of the sampling results.

After the start of the groundwater extraction system in August 2003, analytical data for the ACE Recovery Well (ARW) ARW-S and ARW-I wells showed a steady increase in chromium concentrations through the April 2005, sampling event. This well is located immediately downgradient of the former plating facility. The concentration increase was attributed to possible leaching from residual source material that remains in the subsurface of the former plating facility. To ensure capture of this plume, in April 2005 pumping rates were increased in extraction well EX-1I and EX-1D. Since that time there has been a significant decrease in the chromium concentrations in ARW-S and ARW-I, with the October 2007 results at nondetect. Increases in the ARW wells have been observed in the April 2008 sampling results, but none of the results were above the maximum contaminant level (MCL). Other downgradient wells in close proximity to the former plating facility, extraction well EX-1I and monitoring well MW-2I, have consistently been above the action level but have shown a consistent downward trend over time. In April 2007, there was a significant spike (553 µg/L) in concentration at monitoring well

MW-2S which is located near extraction well EX-1; however, this concentration was significantly reduced in the October 2007 sampling results (30 µg/L), and was nondetect in the April 2008 results.

Chromium concentrations in extraction wells EX-4S and EX-5S displayed a rebound in the October 2007 sampling event, after these extraction wells had been shut off for over two years. The pumping rate in extraction well EX-5I/D was increased from 100 gpm to 125 gpm to effect capture of the plume.

Based on the results of the April 2008 Data Evaluation (BVSPC, 2008) and the overall reduced chromium concentrations throughout the Site groundwater, extraction wells EX-2-I, EX-3-I, EX-4-I/D have been taken offline and the pumping rate for extraction wells EX-5-I/D was decreased to the original planned pumping rate of 100 gpm. Total system flow of 295 gpm is being alternated every two weeks between treatment trains and will be reevaluated based on the sample results from the next semi-annual sampling event.

6.5 Site Inspection

A Site inspection was performed on November 29, 2007. The Site inspection checklist is included in Attachment B and photos taken during the Site inspection are included in Attachment C. The purpose of the Site inspection is to make an assessment of Site conditions and determine if the remedy is functioning as intended by the design documents.

The following individuals participated in the Site inspection: Rob Weber, EPA Region 7 RPM for the Site; Ashley Allen, KDHE project manager; Paul Speckin, USACE; Chuck Williams, USACE; and Jim Helus, treatment plant operator for the City.

The inspection consisted of a general question/answer session with the Five-Year Review team and Mr. Helus. Mr. Helus then provided a comprehensive tour of the treatment plant, including an overview of treatment system operations, procedures for resin change out, the daily and weekly sampling protocol, and personal computer based system controls. The O&M manual, as-

built drawings, sampling records, and maintenance records were all readily available at the Site. Access to the treatment plant is restricted by a door that remains locked when the facility is not occupied as well as an intrusion alarm system. The facility has not experienced any significant vandalism problems.

The plant, office, storage, and lab areas were clean and very well organized. Overall, the treatment plant was in very good condition, with no significant issues noted during the inspection. There was some minor rust on the treatment plant piping, apparently the result of persistent condensation during the hot summer months. This was identified in audit report No. 15 dated November 30, 2007, with a recommendation to prep and paint the piping during the winter when condensation was not an issue.

After the plant inspection, the team inspected each of the extraction well locations and nearby monitoring wells. Each extraction well, along with associated electrical components and valving, is housed within a locked shed. Each well and components was inspected and all appear to be in good condition. No signs of vandalism were apparent at any of the well locations. Access to extraction wells EX-3, EX-4, and EX-5 is via an unimproved road. There was significant rutting at a few locations along the road and it appeared it could become difficult to traverse during bad weather conditions. Project personnel indicated they had never experienced problems during their maintenance or monitoring activities. If conditions worsen, it may be necessary to fill the ruts with gravel or have a road grader even out the road.

In addition to the above Site inspection, Rob Weber, the EPA Region 7 RPM for the Site, conducted a Site visit on April 22 and 23, 2008, during semi-annual sampling activities to confirm that Site waste documentation was in place with respect to spent resin transportation and disposal. A general review of the Site and vicinity was conducted and no significant changes were observed as compared to the November 29, 2007, Site inspection.

6.6 Interviews

Interviews were conducted on November 29, 2007, during the Site inspection. City personnel interviewed included the City manager, the groundwater treatment plant operator, the public utilities director, and the Site information technology manager. A general consensus from those interviewed at the City indicated that the system was operating well and no major concerns were expressed by the public or others. The reuse of the treated water as a potable water supply was mentioned by City personnel as beneficial to the City and its citizens. The water provided by the Site treatment system supplied approximately 50 percent of the demand for the City's potable water supply. Day-to-day operational issues were addressed with EPA and EPA's contractor, BVSPC..

7.0 Technical Assessment

The Five-Year Review must determine whether the remedy at a Site is protective of human health and the environment. EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy. These questions are assessed for the Site in the following paragraphs. At the end of the section is a summary of the technical assessment.

7.1 *Question A*: Is the remedy functioning as intended by the decision documents?

Yes.

7.1.1 Remedial Action Performance

The groundwater extraction system is effectively capturing the chromium plume and has significantly reduced the size of the plume exceeding the 100 µg/L total chromium cleanup level. In comparison to the initial baseline total chromium isoconcentration in April 2003, the estimated limits of the plume exceeding 100 µg/L in April 2008 for each of the aquifer zones is as follows:

Zone	April 2003 Approximate Plume Area	April 2008 Approximate Plume Area
Surface	60.4 acres	3.7 acres
Intermediate	70.5 acres	4.2 acres
Deep	88.9 acres	0 acres

There has been a greater than 90 percent reduction in the plume size for each of the aquifer zones. A graphical representation of the change in plume size is shown on Figures 2, 3, and 4 for the shallow, intermediate, and deep aquifer zones respectively. The solid isoconcentrations lines represent the extent of the plume as of April 2008. The dashed isoconcentration lines represent the extent of the plume in April 2003. Figure 5 presents the vertical groundwater flow lines at the Site.

Groundwater monitoring is performed on a semi-annual basis and the data is evaluated for system performance and effectiveness. The sampling and evaluation is performed by BVSPC

under contract to EPA Region 7. Based on the results of the monitoring, pumping rates for the extraction wells are adjusted as necessary in response to observed plume concentrations aquifer conditions and available well yield to capture the target plume.

A total of approximately 1.488 billion gallons of groundwater have been treated by the Site groundwater treatment system since inception. A total of 1,231.56 kilograms of chromium have been removed during treatment. The City has beneficially reused approximately 0.994 billion gallons of the treated groundwater in its potable water supply system.

Continuing with the current operational procedures should maintain the effectiveness of the remedy, with the only question being when to shut down the system. The system is quickly approaching the point when influent concentrations will be below the total chromium action level. When the decision is made to discontinue operation of the system, ongoing confirmatory periodic sampling of the monitoring/extraction wells should continue to ensure no rebound of concentration that would necessitate re-starting the system.

7.1.2 System Operations and Maintenance

The groundwater extraction and treatment systems are operated and maintained by the City. BVSPC provides periodic oversight of both systems to evaluate and optimize the effectiveness of the groundwater extraction and to monitor key plant operations to ensure operator's conformance to specified requirements for system operation. Findings from this oversight are documented in a Long-Term Response Action Audit Report. These reports were generated on a quarterly basis up to the fourteenth Audit Report dated May 10, 2007. After the fourteenth report, frequency was reduced to semi-annual. The latest report reviewed as part of this Five-Year Review was dated June 3, 2008.

The audit reports provide a thorough evaluation of O&M of both the extraction well system and groundwater treatment system. These reports vary from the Cleanup Status Reports that evaluate the effectiveness in remediating the groundwater plume. The audits review system operation, maintenance records, monitoring records, and evaluate ways to optimize operations. Problems

and anomalies regarding operation of the well field and treatment system are identified in each audit report along with recommendations to correct the problems. Plant personal have a good track record of following up and correcting problems in a timely manner.

The overall impression of the Five-Year Review team was that the system was well run and well maintained. Housekeeping was excellent and all required documents–O&M manual, as-built drawings, plant operation records, historical monitoring results, and maintenance logs–were all readily available at the Site.

One item noted was that effluent discharge results for water discharged to the Prairie Dog Creek and the City drinking water system, were not addressed in the audit reports. All effluent results between August 2003 (the startup of the treatment plant) through June 2008 were reviewed as part of this Five-Year Review. The results demonstrate the treatment plant has been effectively removing chromium to below the discharge standards. There have been no detected discharges to Prairie Dog Creek or the City drinking water system that have exceeded the discharge standards (17 µg/L hexavalent chromium and 100 ug/L total chromium). However, the primary purpose of the treatment plant is to remove the chromium contamination to levels that can be safely discharged. Therefore, it seems reasonable that achievement of this goal should be one of the items documented in the audit reports. It is recommended that discharge results be addressed in future audit reports.

7.1.3 Opportunities for Optimization

System optimization has been an ongoing process, with continual adjustment of pumping locations and rates to most efficiently reach remedial goals. Optimization of the treatment process has also been a continual fine-tuning exercise. Sampling frequency has been decreased where appropriate. A Remedial System Evaluation (RSE) was performed in April 2007 with a final report completed in September 2007. The RSE report made several recommendations to optimize operations and reduce costs. These recommendations were evaluated and implemented as appropriate. There were no additional opportunities for optimization identified as part of this Five-Year Review.

7.1.4 Early Indicators of Potential Issues

Although equipment breakdowns have occasionally occurred, the problems are repaired in a timely manner. There have been no repair or maintenance issues that appear to have had a significant negative impact on the performance of the remedy.

During the RSE, the RSE team noted that there was an initial increase then a decrease in chromium concentrations at the ARW sampling locations. It was determined that this was the results of one of two causes: it either (1) represents the redistribution of existing groundwater contamination under a new pumping regime or (2) represents contaminant mass that leached from the soil to the groundwater and then migrated to the ARW location. There was no specific event that could be directly tied to this slug of contamination; however, demolition of the building and removal of source material below the building occurred approximately two years prior to this increase in concentrations. If a heavy rain event occurred during that time, it could have mobilized contaminants remaining in the soil below the building. The RSE report noted the estimated travel time from the source to the ARW sample location is two years, which may correlate with the time frame between demolition/soil removal and the increase in concentration.

It should also be noted that Ecology and Environment, Inc. (E&E) developed a report for a 1994 removal action consisting of general cleanup of Site plating shop and associated debris, cleanup of the former wastewater treatment building, stabilization and cleanup of the trough area in plating shop, and cleanup of lagoon area soils. During excavation of trough C, a thin layer with elevated Cr(VI) concentrations was discovered. The thin layer had Cr(VI) concentrations of 19,000 mg/kg and total chromium concentrations of 27,000 mg/kg. Excavation in trough C extended to a depth of 20 feet. The report also identified the need to pump rainwater that had accumulated in trough C. The water was sampled and had chromium concentrations up to 6.0 mg/L.

In 2003, a Remedial Action Report - Demolition Summary (generated by Black & Veatch Special Projects Corporation for EPA) documented the demolition of the plating shop building, machine shop, and former gas station and excavation of Site soils in preparation for the installation of the new groundwater treatment plant building. The excavation activities occurred beneath the former Site plating shop building and in a former wastewater lagoon area near the plating shop building. Upon completion of the excavation in the area of the new planned groundwater treatment building, soils with up to 7,000 ± 940 parts per million of chromium based on x-ray fluorescence (XRF) readings were allowed to remain in place at a depth of 12 feet below original ground surface or 15 feet below current ground surface. Chromium at the base of the excavation exceeded its action level for toxicity characteristics leaching procedure (TCLP). The decision was made by EPA to allow the contamination to remain in place given that the depth of contamination was not accessible to excavation equipment and that the new treatment building and attending paved areas would effectively serve as a cap to the contamination. In the lagoon area, excavation occurred to a depth of approximately two feet below ground surface. Results indicate that chromium exceeded the action level in two locations and lead exceeded the action level in one location. Both chromium and lead samples from this area did not exceed their respective action levels for TCLP. Excavation of the lagoon area was stopped by EPA to allow for more excavation and disposal in the new treatment plant building area.

Based on these reports, it is likely that contamination remains in soil below the location of the former facilities. Whether or not it is acting as an ongoing source of groundwater contamination is unknown. EPA Region 7 is currently in the process of procuring a contract to perform additional investigation in these areas to determine if significant source material remains that may be contributing to groundwater contamination.

7.1.5 Implementation of Institutional Controls and Other Measures

Institutional controls have been implemented for the Site through public education and warnings about use of the groundwater in the plume area. The City also has in place a permit system which limits new wells in the City. The Site property is zoned as light industrial. Future use of the Site is expected to remain commercial or industrial, and future use of the Site facility will be to house the treatment plant at least for the duration of the remedial action.

The ROD calls for placement of deed restrictions to prevent future use of the Site for anything other than commercial or industrial. This deed restriction had not been implemented to date due to historical ownership concerns related to multiple trusts. This does not present a current protectiveness issue due to the operation of the groundwater treatment plant on-site.

7.2 *Question B*: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Yes.

7.2.1 Changes in Exposure Pathways

- Has land use or expected land use on or near the Site changed (e.g., industrial to residential, commercial to residential)?

Land use has not changed at or near the Site and any potential future land use changes have not been observed.

- Have any human health or ecological routes of exposure or receptors changed or been newly identified (e.g., dermal contact where none previously existed, new populations or species identified on-site or near the Site) that could affect the protectiveness of the remedy?

No new exposure pathways have been identified that would affect the protectiveness of the remedy. Also, as noted previously, exposure scenarios involving contact with residual contamination in the plating buildings are no longer valid as the buildings have been removed. KDHE made public water available to residents with private wells located within or in proximity to the chromium plume. A majority of the residents with private wells chose to switch to public water thereby eliminating this potential exposure pathway. Although the residential wells have

been discontinued for potable use, monitoring of these wells continues. Monitoring data indicates that all of the monitored residential wells have been below detectable levels of chromium since October 2006. There have been no exceedances of the MCLs in the residential wells in the last five years. No other changes to previously identified receptors and routes of exposure have been identified that would affect the protectiveness of the remedy.

- Are there newly identified contaminants or contaminant sources?

The available data do not demonstrate new contaminants or contaminant sources. The EPA is conducting a source area investigation to determine if residual source materials remain that may contribute to groundwater contamination.

- Are there unanticipated toxic byproducts of the remedy not previously addressed by the decision documents (e.g., byproducts not evaluated at the time of remedy selection)?

No unanticipated toxic byproducts of the remedy have been identified.

- Have physical Site conditions (e.g., changes in anticipated direction or rate of groundwater flow) or the understanding of these conditions (e.g., changes in anticipated direction or rate of groundwater flow) changed in a way that could affect the protectiveness of the remedy?

In October 2003, it was discovered that extraction wells EX-1I, EX-2I, and PWS-8 were contaminated with VOCs from a petroleum plume originating at the High Plains COOP, located upgradient of the Site. It was necessary to shut down extraction wells EX-1, EX-2, and PWS-8 until a GAC system was put in place to pre-treat the VOC contaminated groundwater prior to entering the Site treatment plant. Extraction wells EX-1, EX-2, and PWS-8 returned to service in August 2004. This delayed full implementation of the remedy but has not had a long-term impact affecting the protectiveness of the remedy. No other physical site conditions have changed affecting the protectiveness of the remedy.

7.2.2 Changes in Standards, Newly Promulgated Standards, To Be Considereds

- Have there been changes to risk-based cleanup levels or standards identified as Applicable or Relevant and Appropriate Requirements (ARARs) in the ROD that call into question the protectiveness of the remedy?

No, the cleanup levels are still valid or are no longer relevant because of the removal and remedial actions taken. The Cr VI groundwater cleanup level of 100 µg/L, which was based on the federal MCL, is still valid. Also, the exterior soil cleanup level of 1,500 mg/kg for total chromium is below a hazard index of 1 and within EPA's target cancer risk range of 10^{-6} to 10^{-4}. The lead cleanup standard is less than the industrial worker screening level of 750 milligrams per kilogram (mg/kg). The cleanup levels for indoor air and interior dust/concrete are no longer valid as the plating buildings containing residual contamination (for which the standards were developed) have been removed. Therefore, there is no need to evaluate indoor air or interior dust/concrete cleanup levels.

Despite the above findings, it is worth noting that a chromium VI groundwater preliminary remediation goal (PRG) based on current risk assessment practices (see table 3) would be approximately 40 µg/L at a HI of 1. This value represents the upper end of the range (i.e., more conservative) of potential chromium VI PRGs. Other potential sources of PRGs, such as the Region 6 Medium-Specific Screening Levels, provide a tap water PRG of 110 µg/L. Note that the differences between these PRGs are a result of the exposure duration and the receptor being evaluated.

7.2.3 Changes in Toxicity and Other Contaminant Characteristics

- Have toxicity factors for contaminants of concern at the Site changed in a way that could affect the protectiveness of the remedy?

Chromium VI was the only contaminant evaluated quantitatively in the 1998 Baseline Risk Assessment (BRA). All other compounds (lead, arsenic, etc.) were evaluated qualitatively. The chromium VI oral and dermal reference doses (RIDs) used in the 1998 BRA are no longer valid. For a comparison, see the Table 3. Also, the recommended gastrointestinal absorption factor used to derive the dermal RID has changed per *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (USEPA, 2004). Despite these changes in toxicity values, they are not expected to affect the protectiveness of the remedy as the cleanup level for groundwater is based on the MCL.

Table 3. Evaluation of Toxicity Values		
Toxicity Values	**1998 Baseline Risk Assessment**	**Current Guidance and Policy**
Chromium VI Oral RfD:	5E-03 mg/kg-day	3E-03 mg/kg-day
Gastrointestinal Absorbtion Efficiency:	0.5	0.025
Chromium VI Dermal RfD:	2.5E mg/kg-day	7.5E-05 mg/kg-day

- Have other contaminant characteristics changed in a way that could affect the protectiveness of the remedy?

There have been no changes in contaminant characteristics that could affect the protectiveness of the remedy.

7.2.4 Changes in Risk Assessment Methods

- *Have standardized risk assessment methodologies changed in a way that could affect the protectiveness of the remedy?*

Standardized risk assessment methodologies have changed since the 1998 BRA and ROD, but they have not changed in a way that could affect the protectiveness of the remedy. Table 4 illustrates the changes in risk assessment methodologies with the most significant change involving the exposure receptor and exposure duration. As a result of these changes in exposure factors, as well as toxicity values, the hazard indices in the 1998 BRA were underestimated approximately four-fold. However, previously estimated hazard indices (i.e., future groundwater pathway) already exceeded acceptable levels requiring remedial action.

Table 4. Evaluation of Exposure Factors and Impacts on Risk Estimates

Exposure Factors	1998 Baseline Risk Assessment	Current Guidance and Policy
Surface Area Adult	18,200 cm^2	18,000 cm^2
Surface Area Child	7,200 cm^2	6,600 cm^2
Exposure Time Adult	0.2 hour/day	0.58 hour/day
Exposure Time Child	0.2 hour/day	1 hour/day
Exposure Duration/Receptor	30 years, time-weighted average (6 years as child and 24 years as an adult)	6 years, child

7.3 *Question C*: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

7.3.1 Ecological Risks

An ecological risk assessment was completed. No complete exposure pathways were determined to exist and therefore ecological risk was not considered in developing clean-up levels for the Site. Results of sediment sampling conducted by KDHE in 1989 in the unnamed tributary to Prairie Dog Creek do not exceed the current chromium ecological screening level for toxicity to macroinvertebrates (43.4 mg/kg) as taken from the "Development and Analysis of Sediment Quality Guidelines for Freshwater Ecosystems" by D. MacDonald, C. G. Ingersoll, and T.A. Berger and published in 2000.

The ecological risk assessment did not consider the pathway associated with treated groundwater discharged to Prairie Dog Creek. If flow from this discharge created a continuous flow, then chronic criteria would be appropriate. If discharge created an intermittent flow, then acute criteria would be appropriate. The current discharge standards for hexavalent chromium (17 µg/L) do meet the chronic or acute levels of the National Ambient Water Quality (NAWQC) for protection of aquatic life. The chronic NAWQC standard for hexavalent chromium is 11 µg/L and the acute standard is 16 µg/L.

After reviewing discharge records it was found that the flow to the tributary is not continuous and discharge levels have all been below detectable levels with a detection limit below both the chronic and acute NAWQC standards for hexavalent chromium. Therefore, as currently operated, the remedy is ecologically protective.

7.3.2 Natural Disaster Impacts

No known natural disasters have occurred that would affect the protectiveness of the remedy.

7.3.3 Any Other Information That Could Call Into Question the Protectiveness of the Remedy

There is no other information found in this Five-Year Review that would call into question the protectiveness of the remedy.

7.4 Technical Assessment Summary

There has been significant progress made at attaining the remediation goals at the Site. All parties involved with the Site are actively engaged in the remedial action to maximize effectiveness and efficiency. Site conditions are evaluated on a regular basis and adjustments are made to the extraction and treatment systems when necessary. This active approach to the remediation has resulted in reduction in the plume size by over 90 percent. The equipment and facilities associated with the extraction and treatment systems are well maintained to ensure near continuous operations. There have been no significant shutdowns that have had a negative impact on the protectiveness of the remedy. A total of approximately 1.488 billion gallons of groundwater have been treated by the Site groundwater treatment system since inception. A total of 1,231.56 kilograms of chromium have been removed during treatment. The City has beneficially reused approximately 0.994 billion gallons of the treated groundwater in their potable water supply system.

The remedy at the Site currently protects human health and the environment because exposure pathways to groundwater have been cut off through hook up of private wells to the City water system, the plume has been reduced to greater than 90 percent of its original extent, an institutional control exists in the form of a permit requirement for installation of new wells, and the site property is zoned as light industrial.

8.0 Issues

TABLE 5: Issues

Issue No.	Issue	Affects Protectiveness (Y/N)	
		Current	Future
1	Treatment plant Audit Reports do not address results of effluent discharge to the tributary to Prairie Dog Creek and City Drinking Water System	No	No
2	Source area soils may have a potential to continue contributing to the groundwater contaminant plume.	No	No
3	The ROD calls for placement of deed restrictions to prevent future use of contaminated groundwater, to prevent residential use of the Site and buildings, and to prevent removal of floors and soils beneath the building. These deed restrictions have not been implemented to date due to historical ownership concerns related to multiple trusts.	No	No

9.0 Recommendations and Follow-Up Actions

Below is a list of recommended actions to address the issues identified in section 8.0.

TABLE 6: Recommendations and Follow-Up Actions

Issue No.*	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
1	Add section to Audit Report addressing results of discharges to tributary Prairie Dog Creek and City Drinking Water System.	EPA	EPA	October 2008 Audit Report
2	Based on recommendations from an Remediation Systems Evaluation, a source area investigation will be conducted to determine the nature of contamination in source area soils and if the potential exists for the contaminants in these soils to leach to groundwater. Remediation system enhancements may be considered based on the results of the soil investigation.	EPA/KDHE	EPA	September 30, 2010
3	The absence of a deed restriction does not present a current protectiveness issue due to the operation of the groundwater treatment plant on-site. Institutional controls have been implemented for the Site through public education and warnings about use of the groundwater in the plume area. The City also has implemented a permit system which limits new wells in the City. The City has zoned the Site as light industrial. Future use of the Site is expected to remain commercial or industrial, and future use of the Site facility will be to house the treatment plant at least for the duration of the remedial action. An investigation is planned to determine if there are still residual source materials on the Site property contributing to the groundwater contamination. A future determination during the next Five-Year Review will be made to assess whether or not a deed restriction can be implemented without disruption of the treatment system.	EPA	EPA/KDHE	September 19, 2013

10.0 Protectiveness Statements

Operable Unit 1

The remedy at OU1 is protective of human health and the environment. The metal and plating shop buildings and associated foundations remedy included scarification of the floor surfaces in the plating and machine shop buildings as well as debris removal from inside and outside the buildings. OU1 actions were conducted in accordance with Site decision documents. The exposure pathways and the Site buildings for this OU no longer exist and were removed as part of the OU2 activities.

Operable Unit 2

The remedy at OU2 currently protects human health and the environment. The metal and plating shop buildings and foundations were removed. Soils beneath these structures were excavated to a depth of 15 feet below grade. A new groundwater treatment building constructed above the residual soils will serve as a cap and will remain for at least the duration of the remedial action. The lagoon area surface soils were excavated and clean fill was placed on the surface of the Site. The groundwater contaminant plume has been reduced to greater than 90 percent of its original extent. Downgradient private well receptors have been provided an alternate water supply and the remaining private wells are periodically monitored.

However, in order for the remedy to be protective in the long-term, the following actions will need to be taken to ensure long-term protectiveness. An investigation is planned to determine if there are residual source materials on the Site property that are contributing to the groundwater contamination. The results of the investigation may lead to additional investigations and/or Site remediation system enhancements. An evaluation during the next Five-Year Review period will be made to assess whether or not a deed restriction can be implemented without disruption of the treatment system. The absence of a deed restriction does not present a current protectiveness issue due to the operation of the groundwater treatment plant on-site. Institutional controls have been implemented for the Site through public education and warnings about use of the

groundwater in the plume area. The City also has implemented a permit system which limits new wells in the City. The City has zoned the Site as light industrial. Future use of the Site is expected to remain commercial or industrial, and future use of the Site facility will be to house the treatment plant at least for the duration of the remedial action.

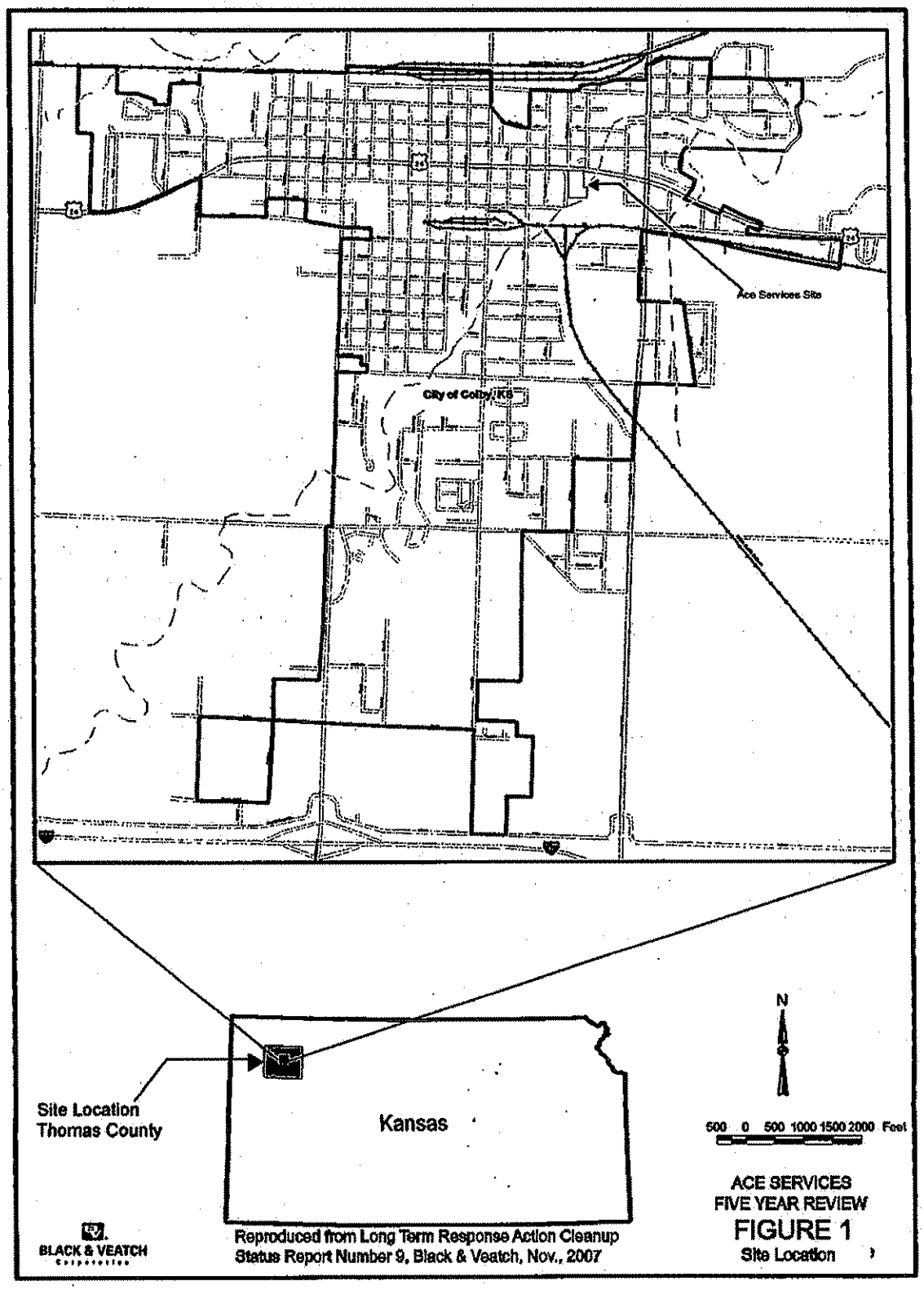
Site Wide

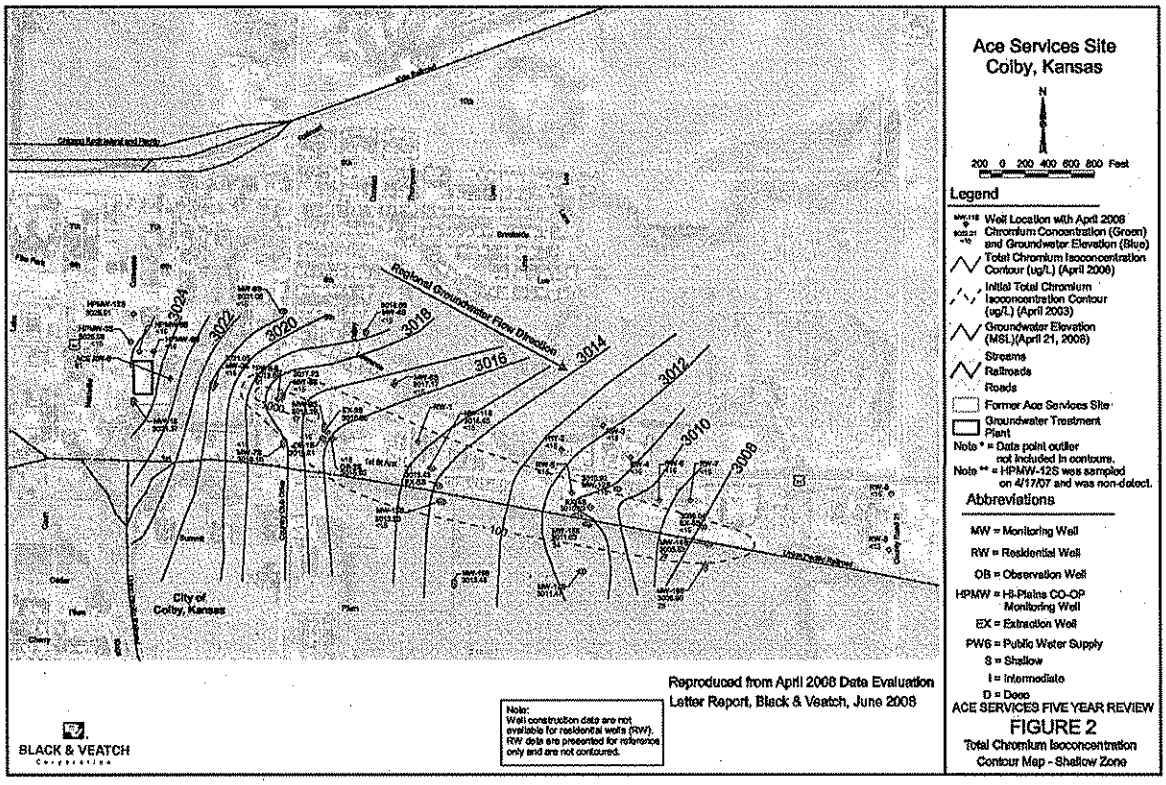
Because the remedial actions at all OUs are protective, the Site is protective of human health and the environment.

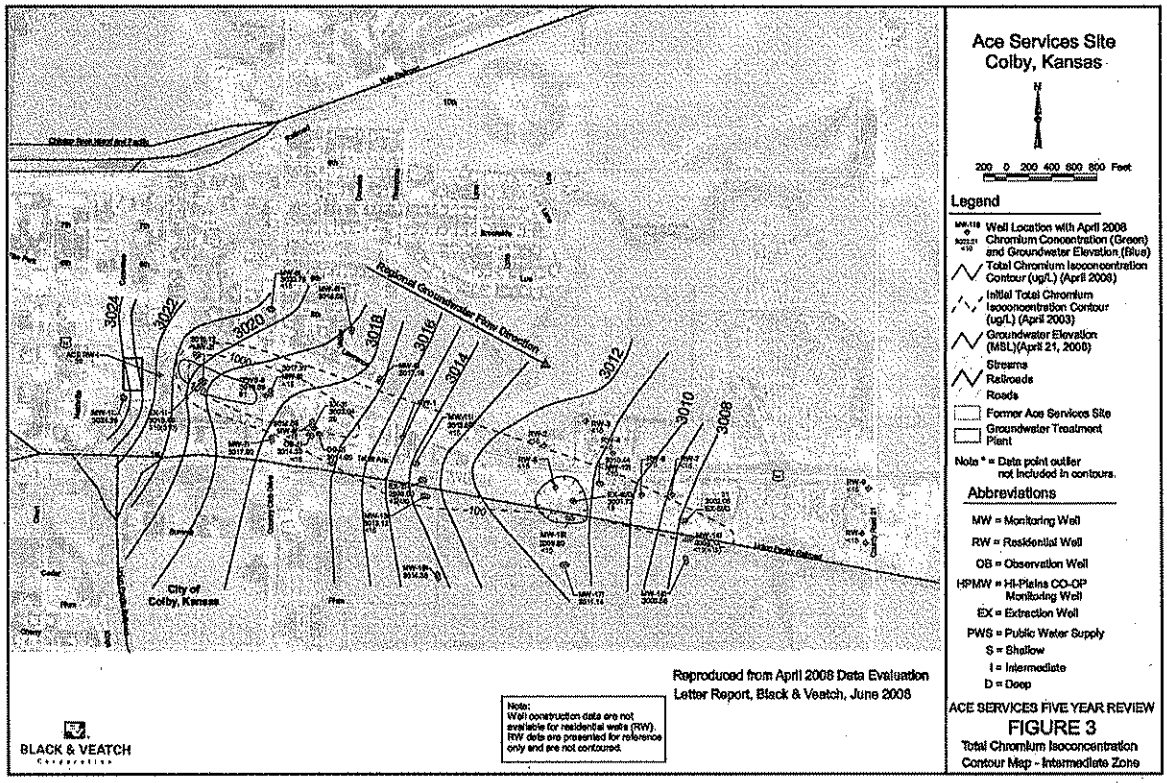
11. Next Review

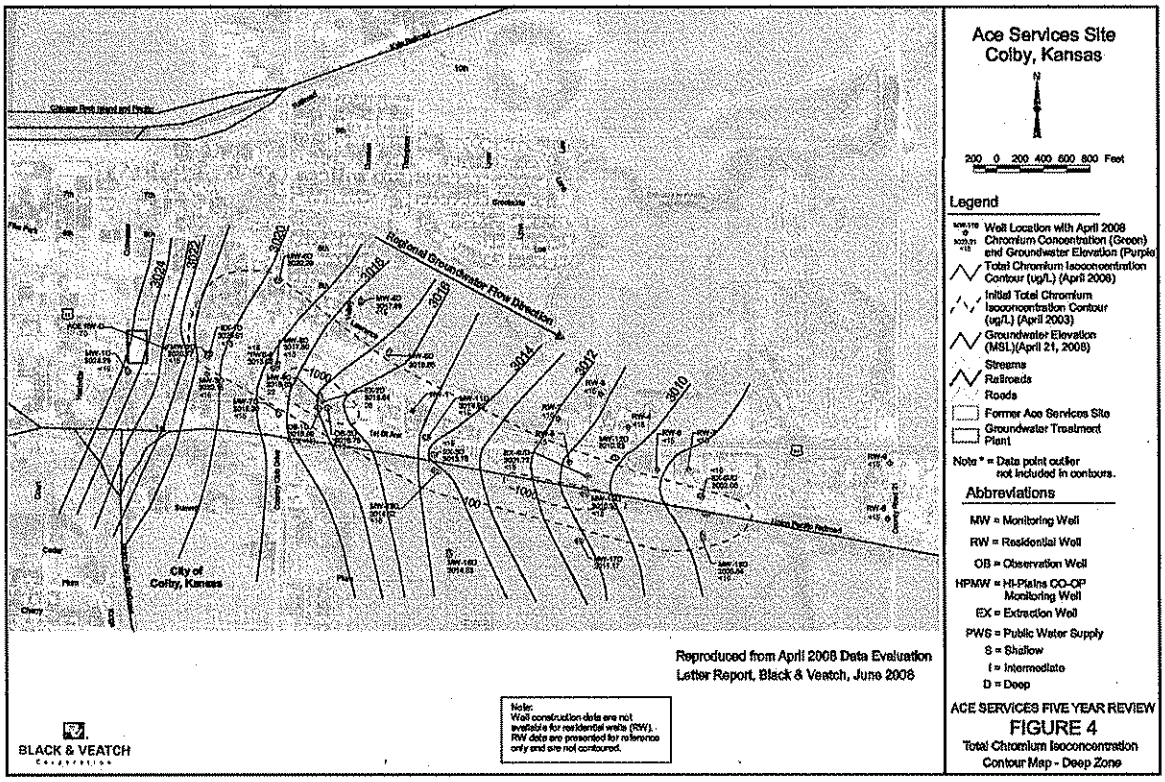
The next Five-Year Review for the Ace Service Site is required five-years from the signature date of this review.

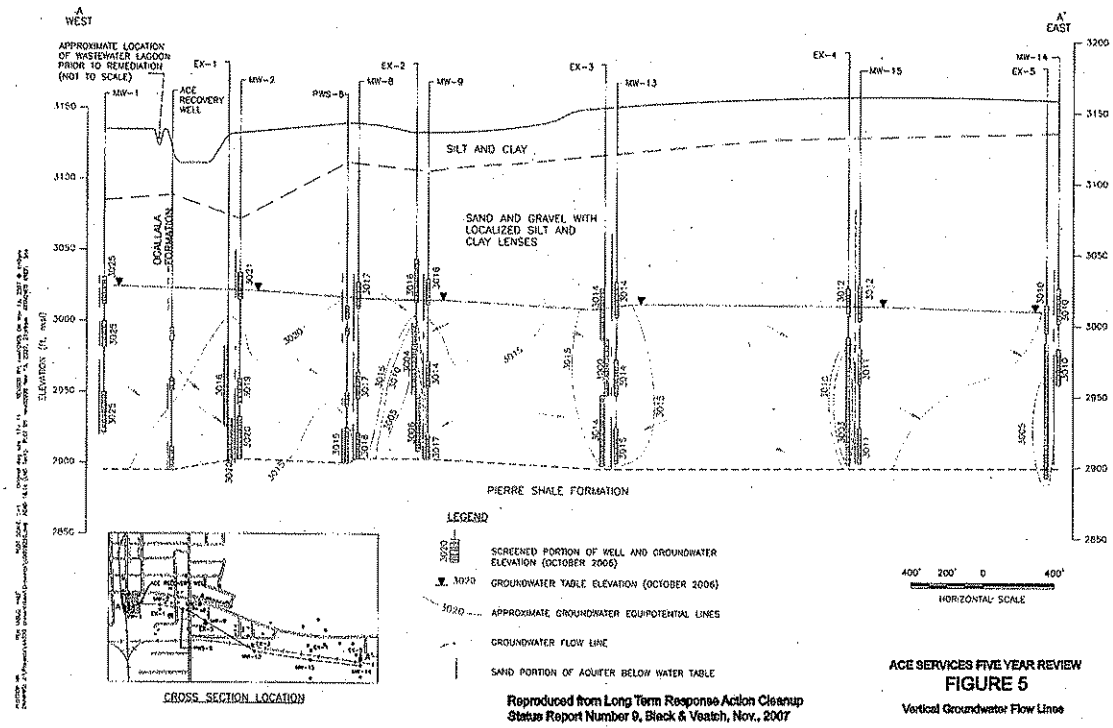
FIGURES


Ace Services Site
City of Colby, KS
Site Location
Thomas County
Kansas
N
500 0 500 1000 1500 2000 Feet
BLACK & VEATCH
Corporation
Reproduced from Long Term Response Action Cleanup
Status Report Number 9, Black & Veatch, Nov., 2007
ACE SERVICES
FIVE YEAR REVIEW
FIGURE 1
Site Location


Ace Services Site
Colby, Kansas
N
200 0 200 400 600 800 Feet
Legend
Well Location with April 2008 Chromium Concentration (Green) and Groundwater Elevation (Blue)
Total Chromium Isoconcentration Contour (ug/L) (April 2008)
Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
Groundwater Elevation (MSL)(April 21, 2008)
Streams
Railroads
Roads
Former Ace Services Site
Groundwater Treatment Plant
Note * = Data point outlier not included in contours.
Note ** = HPMW-12S was sampled on 4/17/07 and was non-detect.
Abbreviations
MW = Monitoring Well
RW = Residential Well
OB = Observation Well
HPMW = Hi-Plains CO-OP Monitoring Well
EX = Extraction Well
PWS = Public Water Supply
S = Shallow
I = Intermediate
D = Deep
Rixford Groundwater Flow Direction
3024
3022
3020
3018
3016
3014
3012
3010
3008
City of Colby, Kansas
Reproduced from April 2008 Data Evaluation Letter Report, Black & Veatch, June 2008
Note:
Well construction data are not available for residential wells (RW). RW data are presented for reference only and are not contoured.
BLACK & VEATCH
ACE SERVICES FIVE YEAR REVIEW
FIGURE 2
Total Chromium Isoconcentration Contour Map - Shallow Zone


Ace Services Site
Colby, Kansas
N
200 0 200 400 600 800 Feet
Legend
Well Location with April 2008 Chromium Concentration (Green) and Groundwater Elevation (Blue)
Total Chromium Isoconcentration Contour (ug/L) (April 2008)
Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
Groundwater Elevation (MSL)(April 21, 2008)
Streams
Railroads
Roads
Former Ace Services Site
Groundwater Treatment Plant
Note * = Data point outlier not included in contours.
Abbreviations
MW = Monitoring Well
RW = Residential Well
OB = Observation Well
HPMW = Hi-Plains CO-OP Monitoring Well
EX = Extraction Well
PWS = Public Water Supply
S = Shallow
I = Intermediate
D = Deep
ACE SERVICES FIVE YEAR REVIEW
FIGURE 3
Total Chromium Isoconcentration Contour Map - Intermediate Zone
Regional Groundwater Flow Direction
3024
3022
3020
3018
3016
3014
3012
3010
3008
City of Colby, Kansas
Reproduced from April 2008 Data Evaluation Letter Report, Black & Veatch, June 2008
Note:
Well construction data are not available for residential wells (RW). RW data are presented for reference only and are not contoured.
BLACK & VEATCH
Corporation


Ace Services Site
Colby, Kansas
200 0 200 400 600 800 Feet
Legend
Well Location with April 2008 Chromium Concentration (Green) and Groundwater Elevation (Purple)
Total Chromium Isoconcentration Contour (ug/L) (April 2008)
Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
Groundwater Elevation (MSL)(April 21, 2008)
Streams
Railroads
Roads
Former Ace Services Site
Groundwater Treatment Plant
Note * = Data point outlier not included in contours.
Abbreviations
MW = Monitoring Well
RW = Residential Well
OB = Observation Well
HPMW = HI-Plains CO-OP Monitoring Well
EX = Extraction Well
PWS = Public Water Supply
S = Shallow
I = Intermediate
D = Deep
Regional Groundwater Flow Direction
City of Colby, Kansas
Union Pacific Railroad
Reproduced from April 2008 Data Evaluation Letter Report, Black & Veatch, June 2008
Note:
Well construction data are not available for residential wells (RW). RW data are presented for reference only and are not contoured.
BLACK & VEATCH
Corporation
ACE SERVICES FIVE YEAR REVIEW
FIGURE 4
Total Chromium Isoconcentration Contour Map - Deep Zone



Reproduced from Long Term Response Action Cleanup Status Report Number 9, Black & Veatch, Nov., 2007

ACE SERVICES FIVE YEAR REVIEW

FIGURE 5

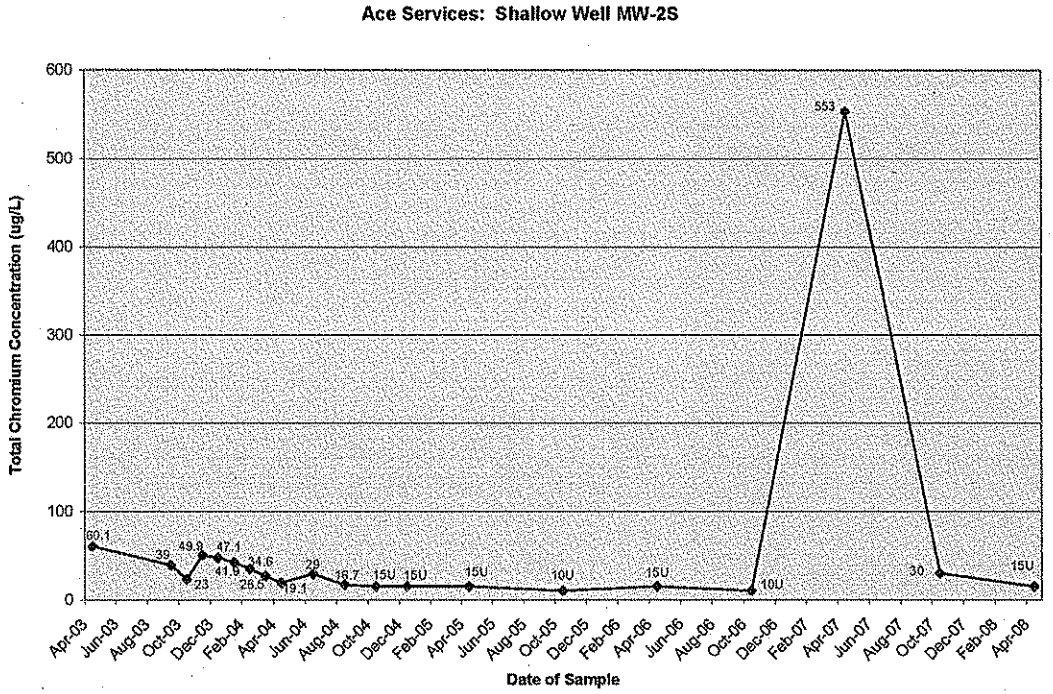
Vertical Groundwater Flow Lines

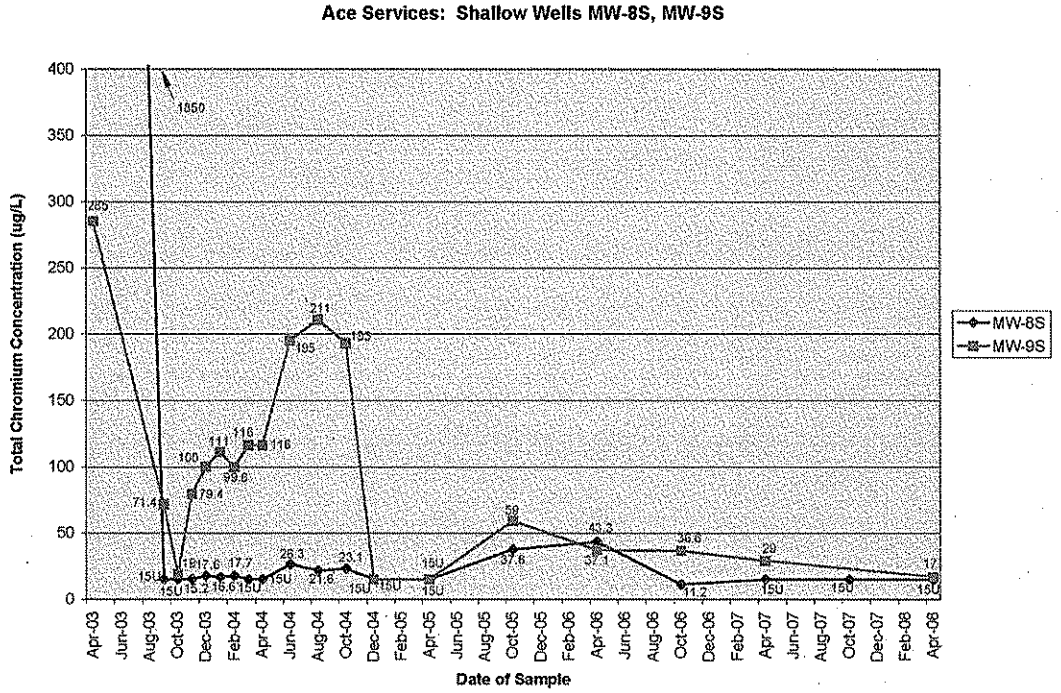
Attachment A

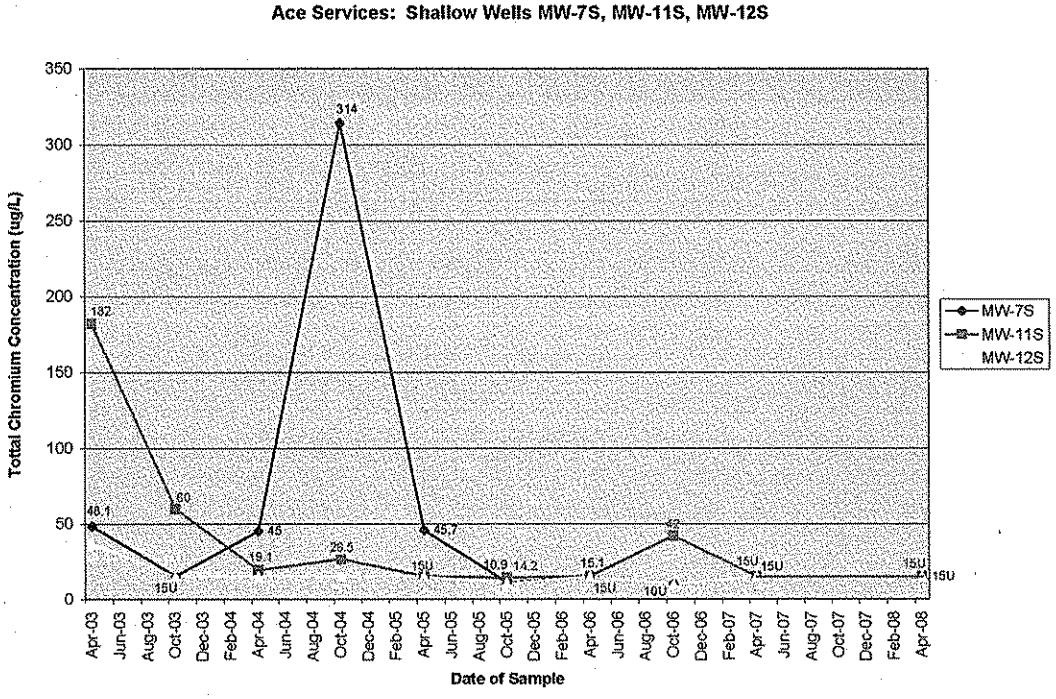
Monitoring Data Summary Tables

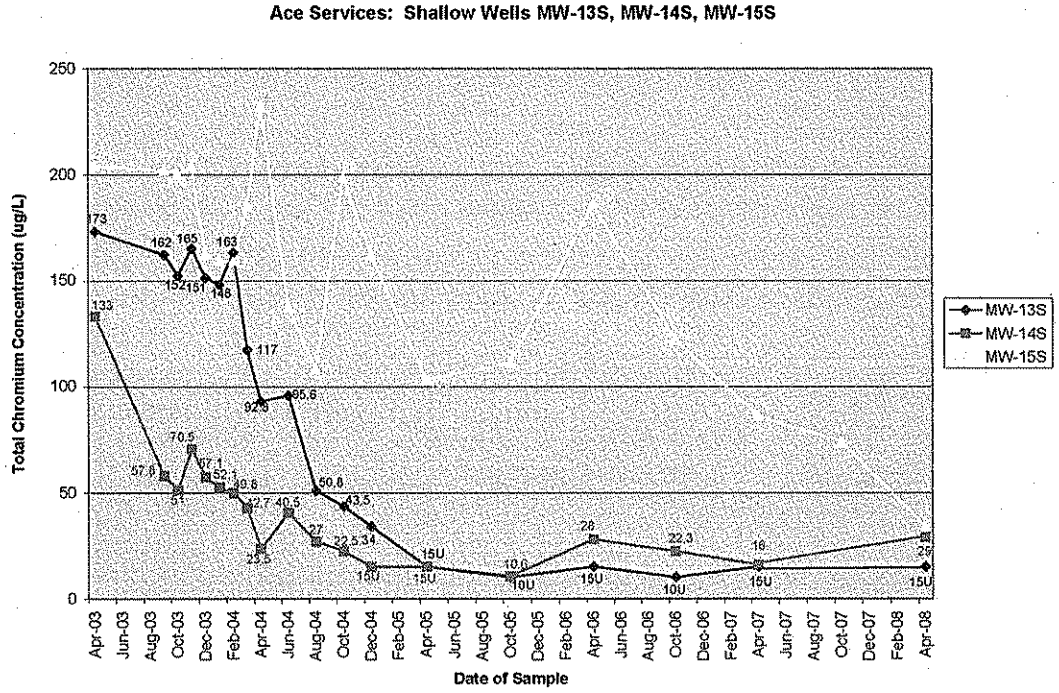
and

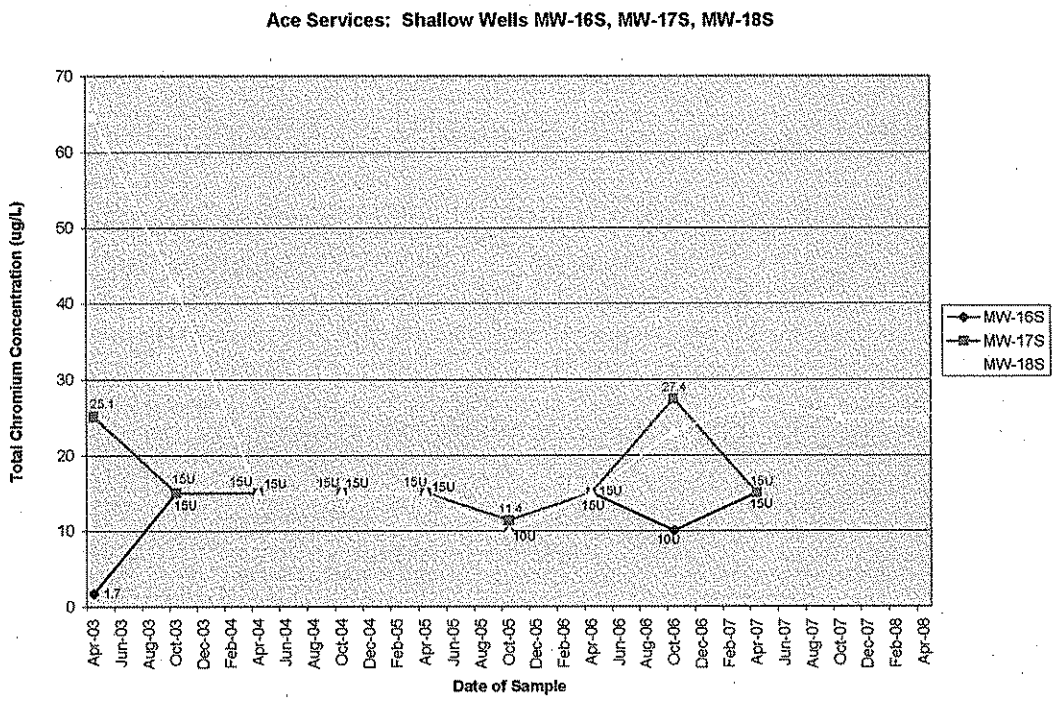
Trend Plots

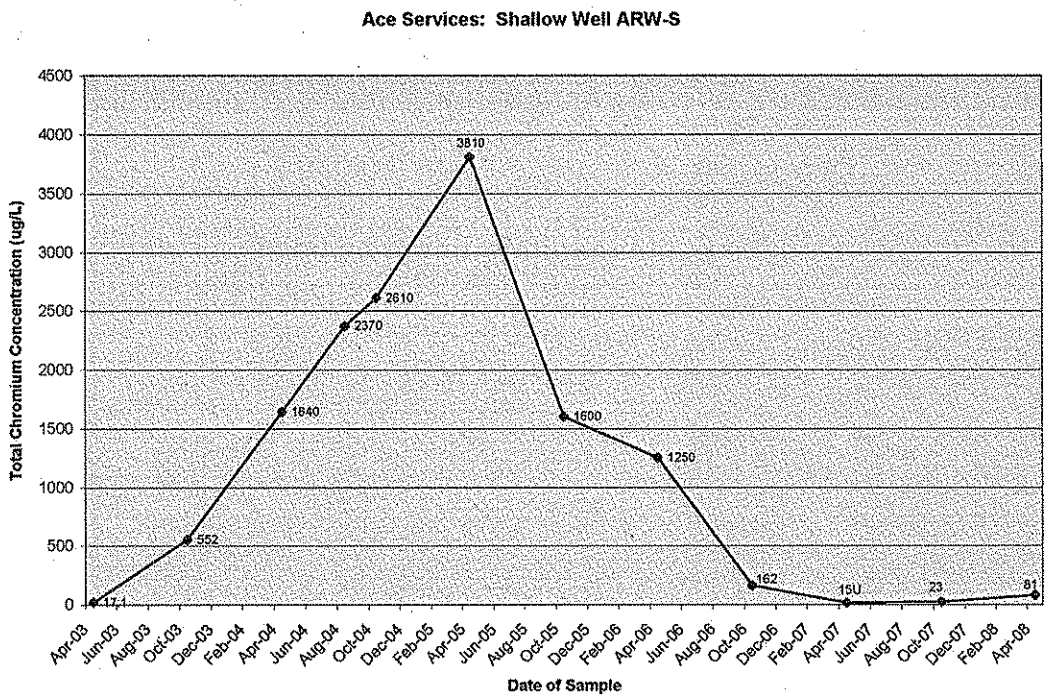

Ace Services: Shallow Well MW-2S
Total Chromium Concentration (ug/L)
600
500
400
300
200
100
0
60.1
39
23
49.9
47.1
41.9
34.6
26.5
19.1
29
16.7
15U
15U
15U
10U
15U
10U
553
30
15U
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample

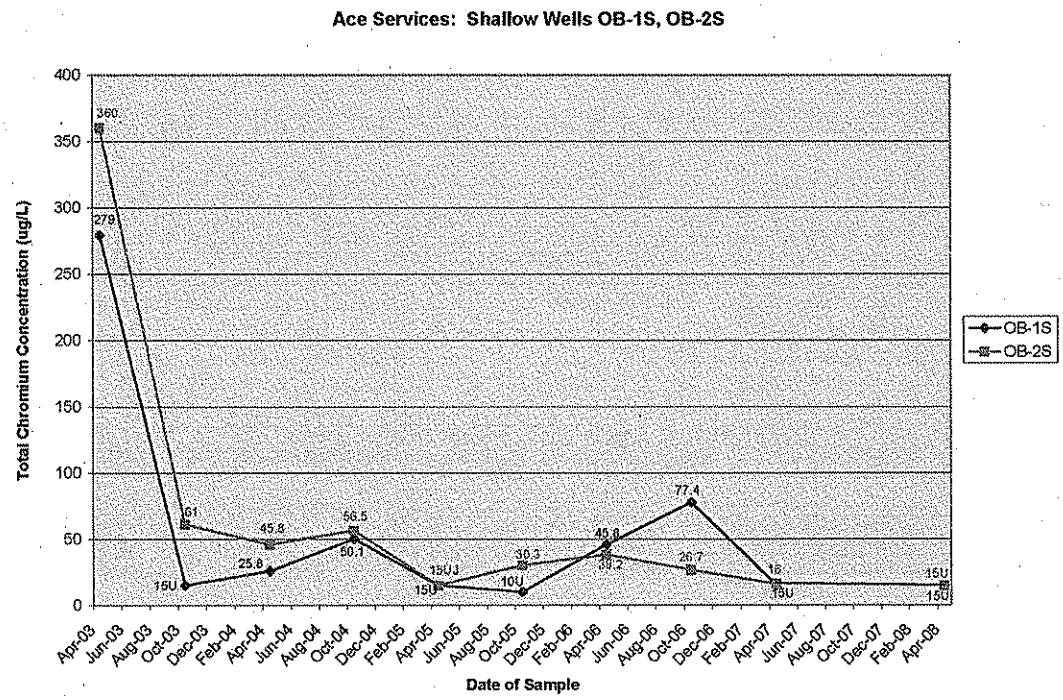

Ace Services: Shallow Wells MW-8S, MW-9S
Total Chromium Concentration (ug/L)
Date of Sample
MW-8S
MW-9S
400
350
300
250
200
150
100
50
0
1850
285
71.4
15U
15U
15U
15.2
16.6
15U
17.7
15U
25.3
21.8
23.1
15U
15U
15U
15U
37.6
59
37.1
43.3
11.2
36.6
15U
29
15U
17
15U
79.4
100
111
99.6
116
116
195
211
193
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08


Ace Services: Shallow Wells MW-7S, MW-11S, MW-12S
Tottal Chromium Concentration (ug/L)
350
300
250
200
150
100
50
0
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample
MW-7S
MW-11S
MW-12S
48.1
15U
45
314
45.7
10.9
14.2
15.1
15U
10U
15U
15U
15U
15U
182
60
19.1
26.5
15U

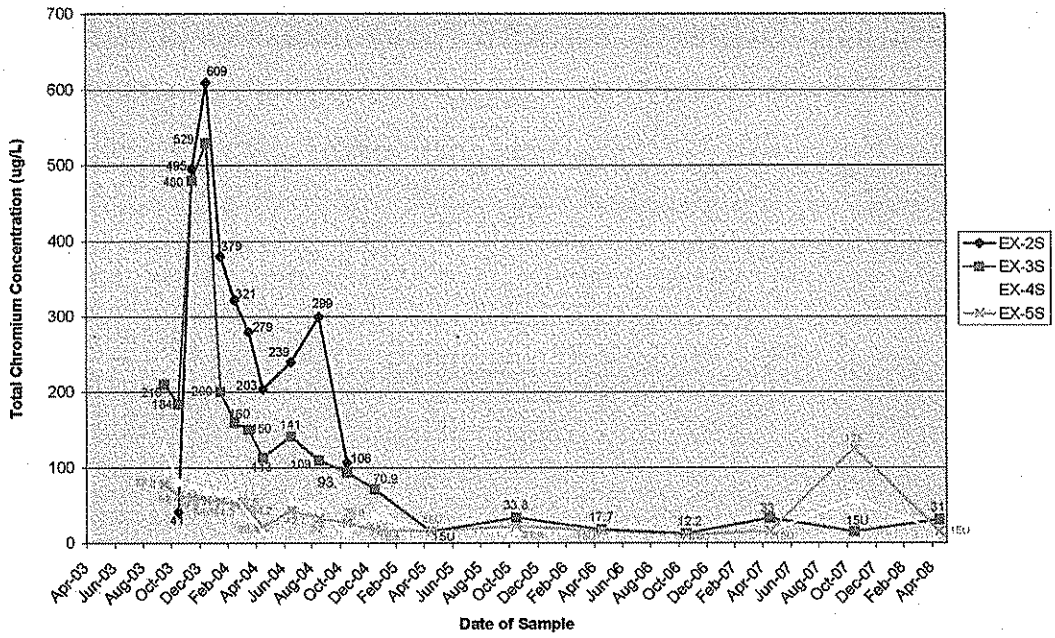

Ace Services: Shallow Wells MW-13S, MW-14S, MW-15S
Total Chromium Concentration (ug/L)
Date of Sample
MW-13S
MW-14S
MW-15S
250
200
150
100
50
0
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08

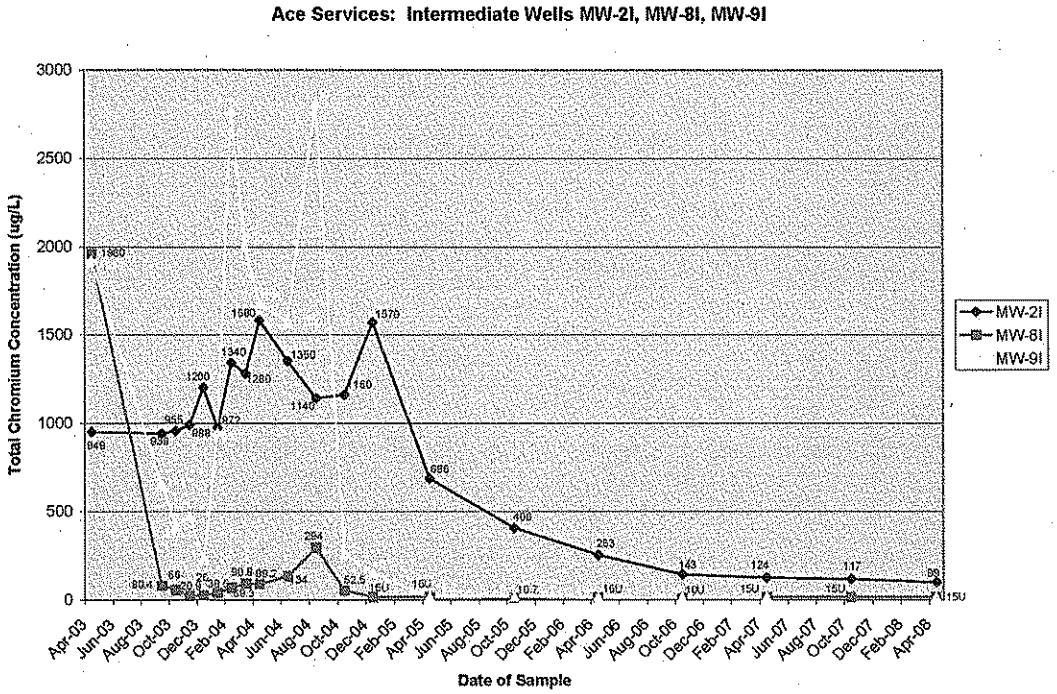

Ace Services: Shallow Wells MW-16S, MW-17S, MW-18S
Total Chromium Concentration (ug/L)
70
60
50
40
30
20
10
0
25.1
1.7
15U
11.4
10U
27.4
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample
MW-16S
MW-17S
MW-18S

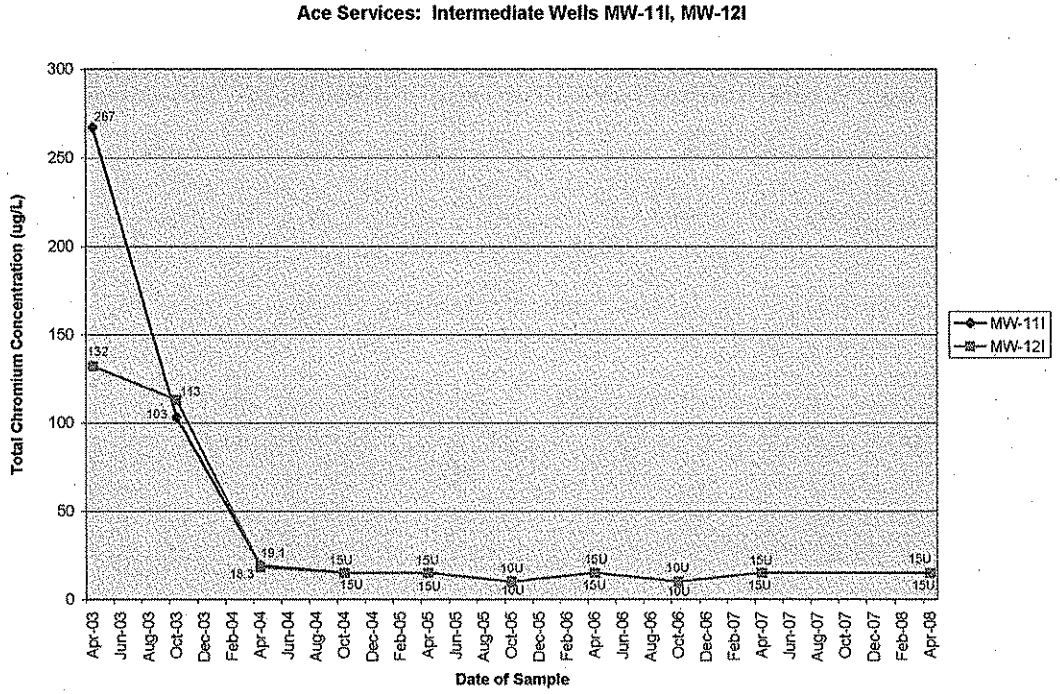

Ace Services: Shallow Well ARW-S
Total Chromium Concentration (ug/L)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
17.1
552
1640
2370
2610
3810
1600
1250
162
15U
23
81
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample


Ace Services: Shallow Wells OB-1S, OB-2S
Total Chromium Concentration (ug/L)
400
350
300
250
200
150
100
50
0
360
279
61
15U
25.8
45.8
56.5
50.1
15UJ
15U
10U
30.3
39.2
45.8
77.4
26.7
18
15U
15U
OB-1S
OB-2S
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample

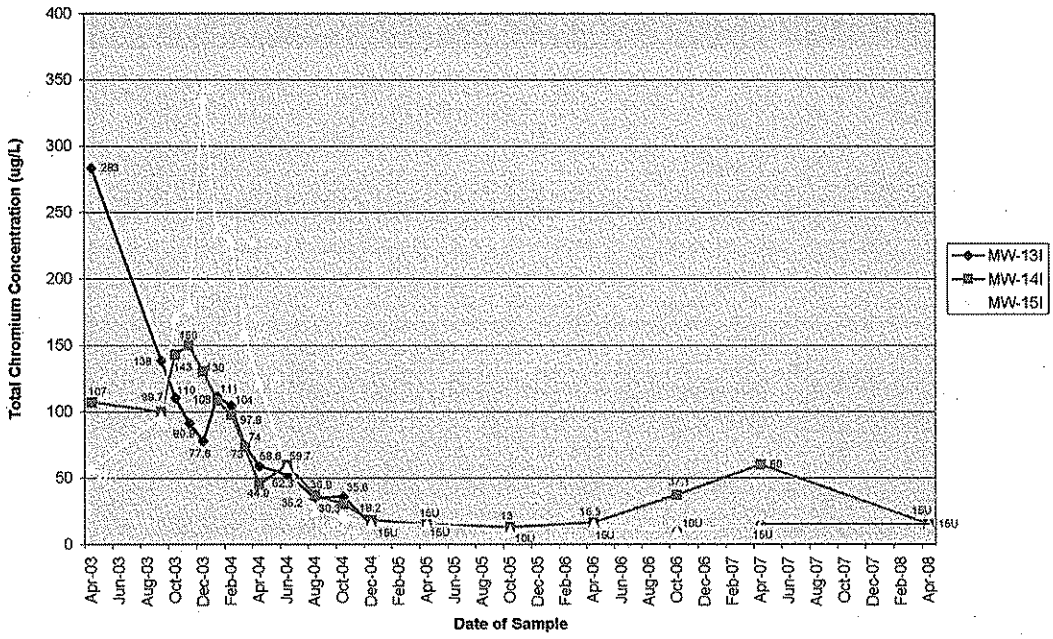
Ace Services: Shallow Extraction Wells EX-2S, EX-3S, EX-4S, EX-5S

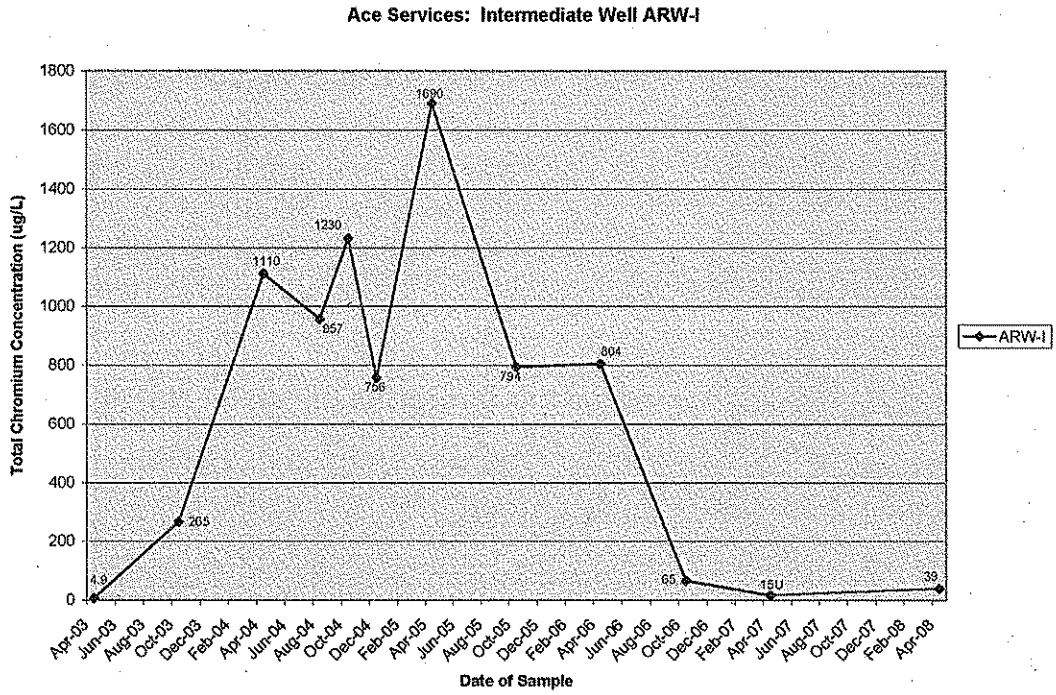


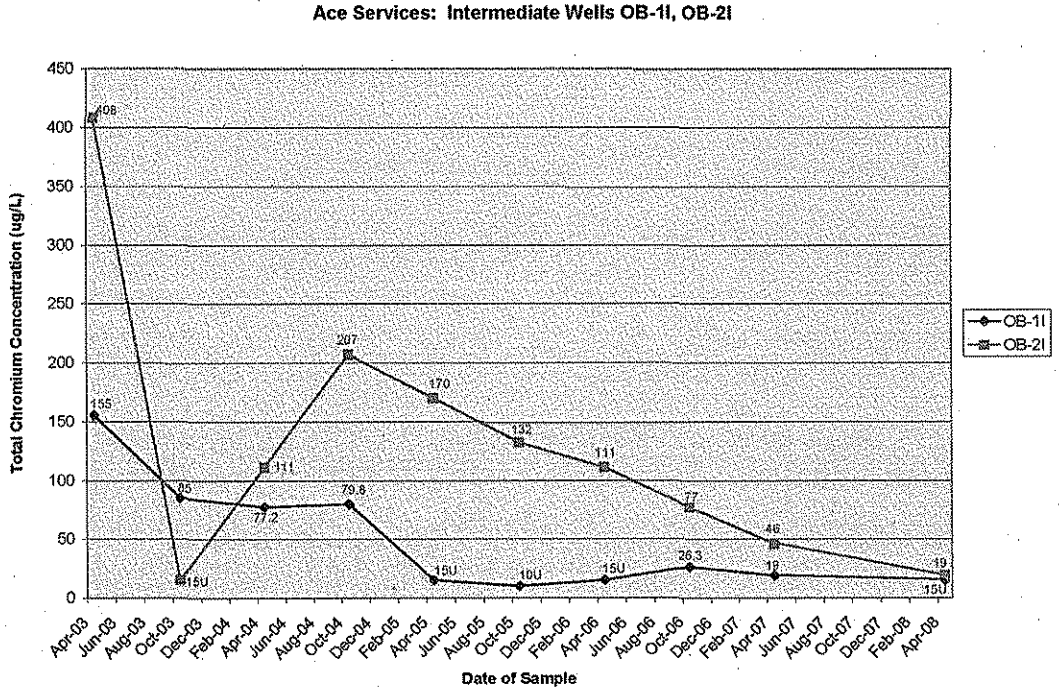

Ace Services: Intermediate Wells MW-2I, MW-8I, MW-9I
Total Chromium Concentration (ug/L)
3000
2500
2000
1500
1000
500
0
Date of Sample
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
MW-2I
MW-8I
MW-9I

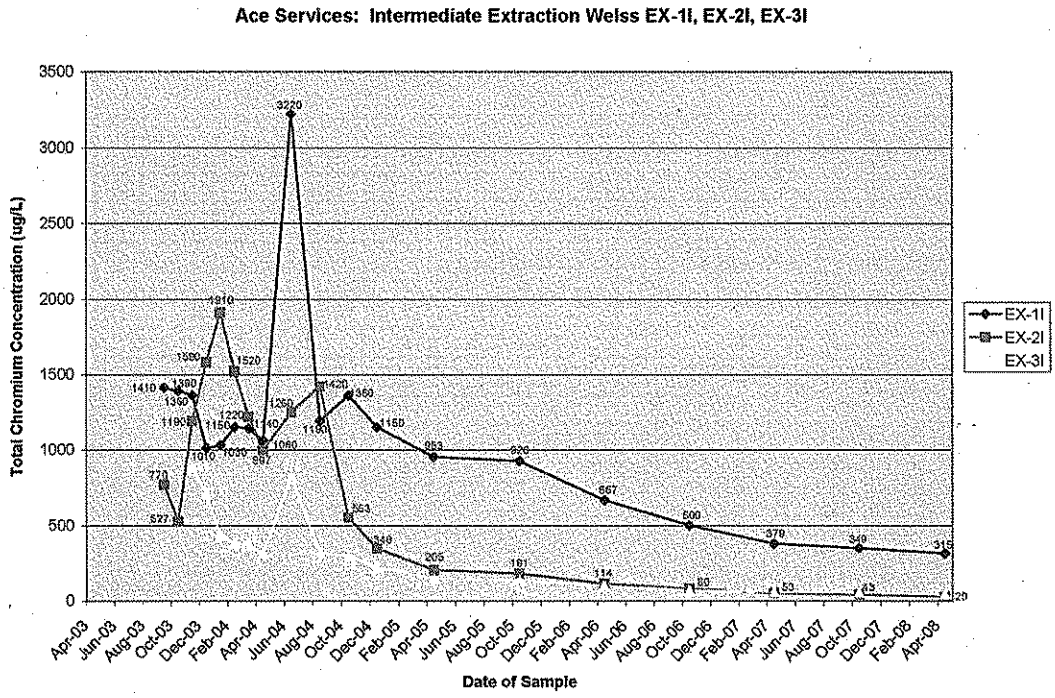

Ace Services: Intermediate Wells MW-11I, MW-12I
Total Chromium Concentration (ug/L)
300
250
200
150
100
50
0
267
132
103
113
18.3
19.1
15U
10U
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample
MW-11I
MW-12I

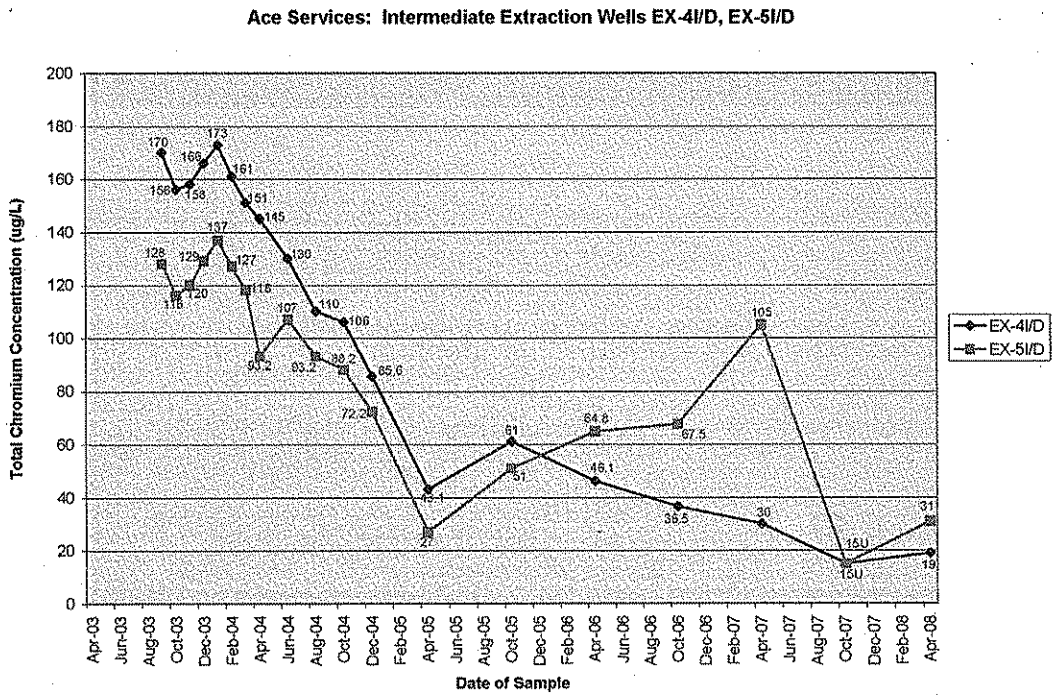
Ace Services: Intermediate Wells MW-13I, MW-14I, MW-15I

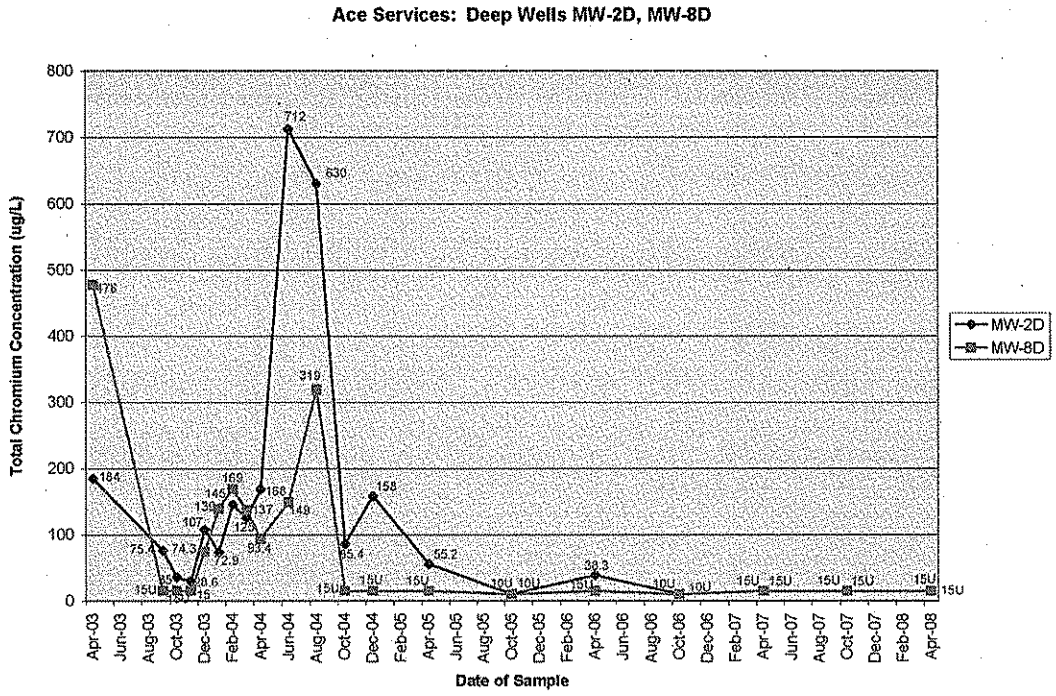


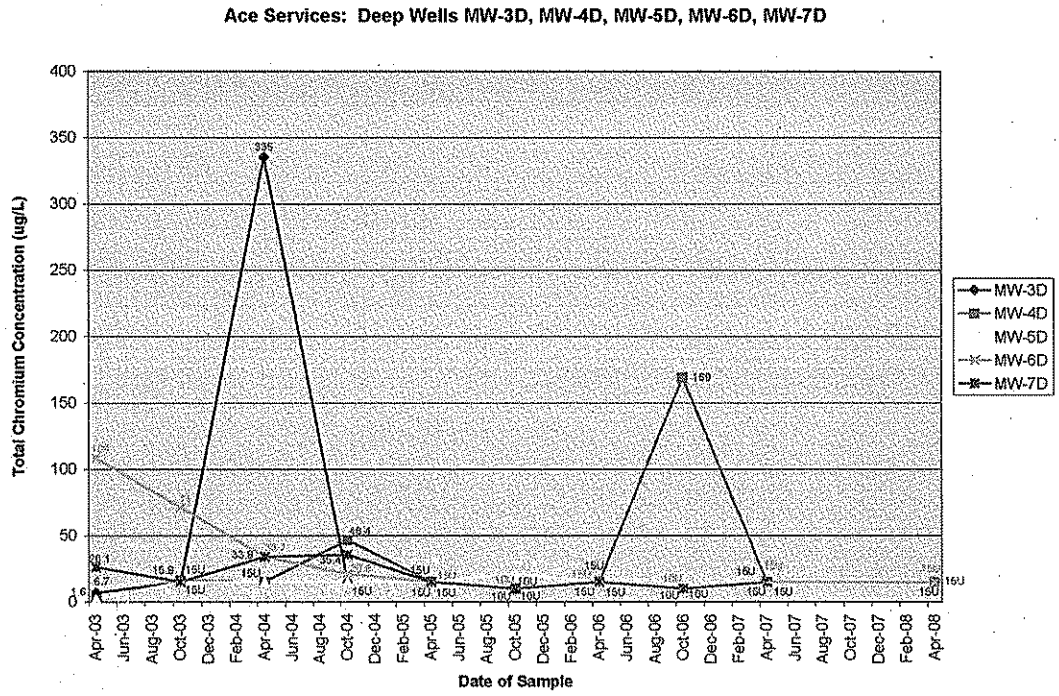

Ace Services: Intermediate Well ARW-I
Total Chromium Concentration (ug/L)
1800
1600
1400
1200
1000
800
600
400
200
0
4.9
265
1110
957
1230
756
1690
794
804
65
15U
39
ARW-I
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample

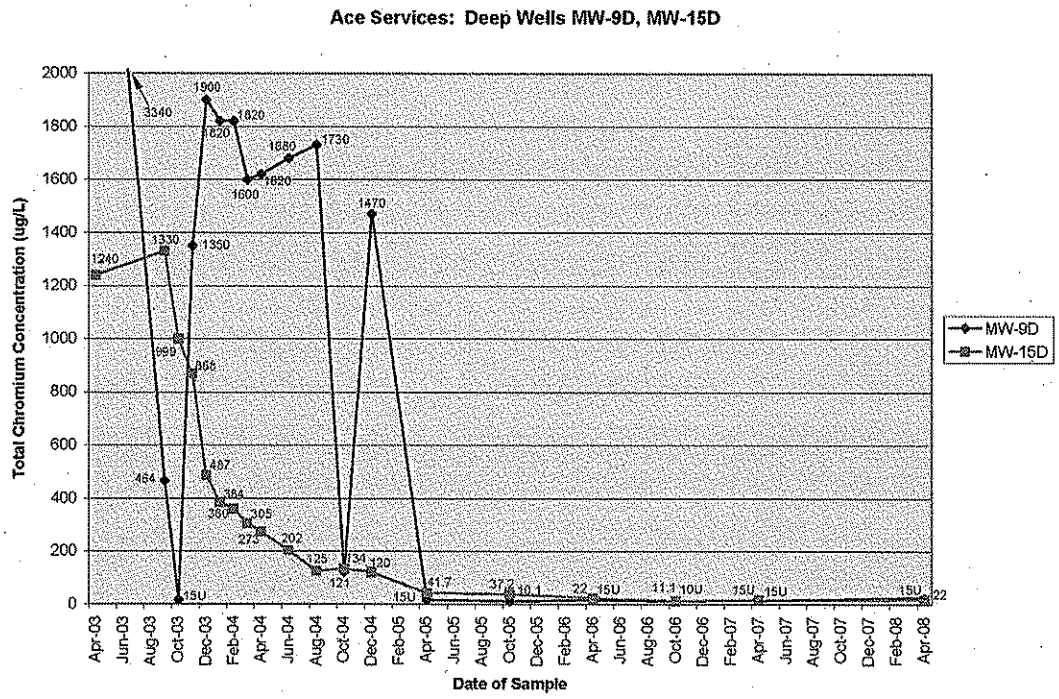

Ace Services: Intermediate Wells OB-1I, OB-2I
Total Chromium Concentration (ug/L)
Date of Sample
OB-1I
OB-2I
450
400
350
300
250
200
150
100
50
0
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
155
85
15U
77.2
79.8
15U
10U
15U
26.3
19
15U
408
111
207
170
132
111
77
46
19

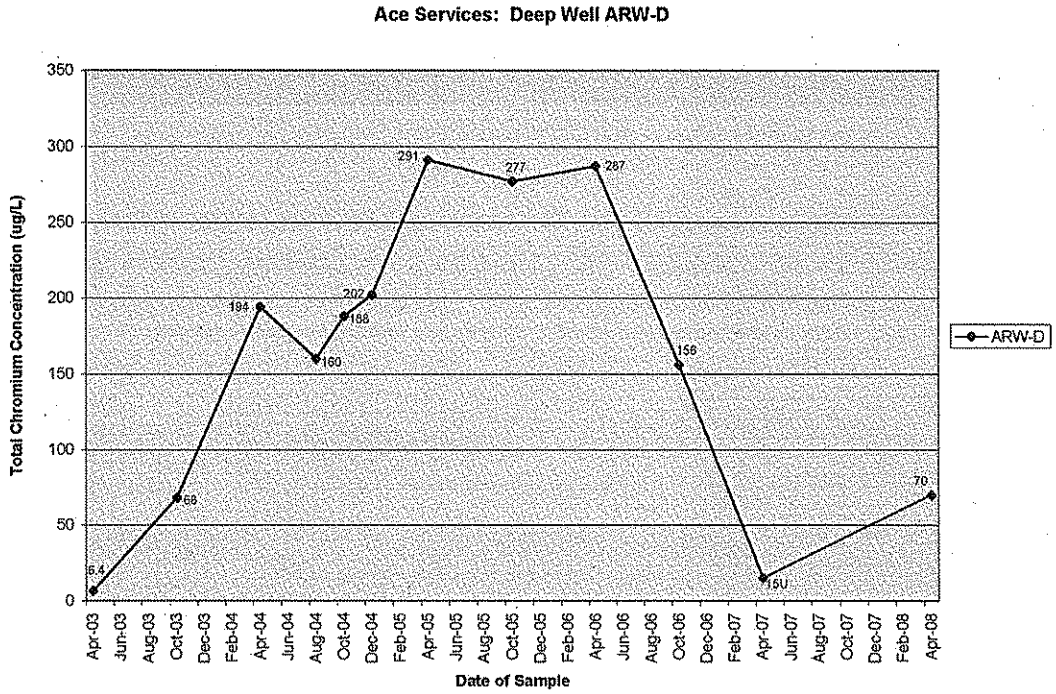

Ace Services: Intermediate Extraction Weiss EX-1I, EX-2I, EX-3I
Total Chromium Concentration (ug/L)
Date of Sample
EX-1I
EX-2I
EX-3I
3500
3000
2500
2000
1500
1000
500
0
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08

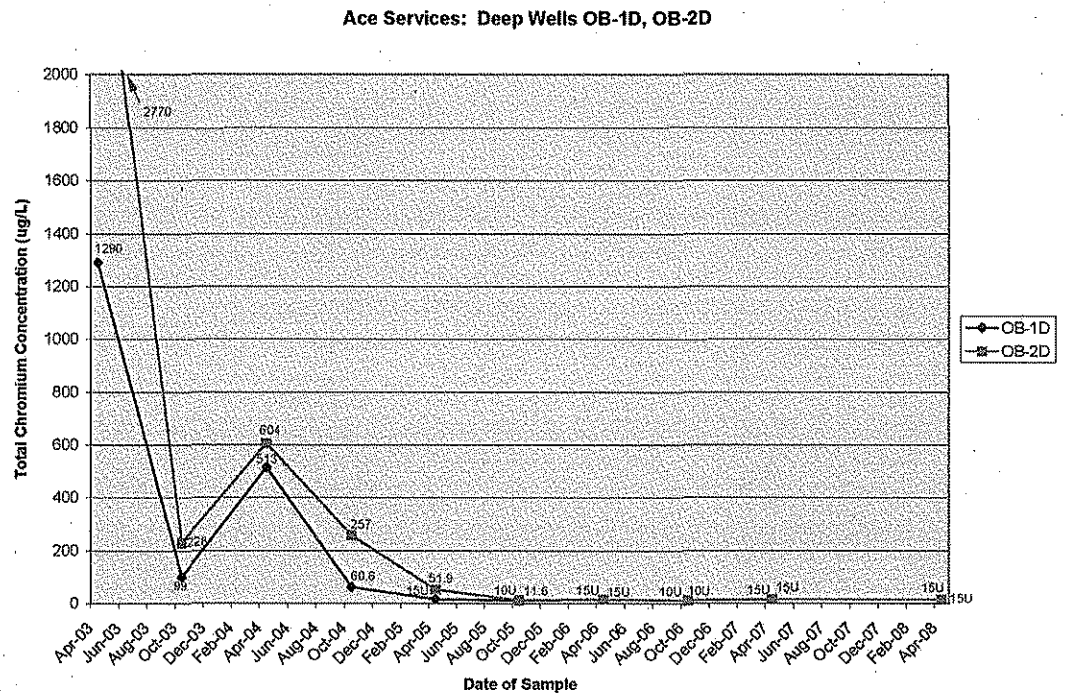

Ace Services: Intermediate Extraction Wells EX-4I/D, EX-5I/D
Total Chromium Concentration (ug/L)
Date of Sample
EX-4I/D
EX-5I/D
0
20
40
60
80
100
120
140
160
180
200
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
170
156
168
158
173
161
151
145
128
116
129
120
137
127
118
90.2
107
93.2
110
106
88.2
85.6
72.2
43.1
27
61
51
64.8
67.5
46.1
36.5
105
30
15U
15U
31
19

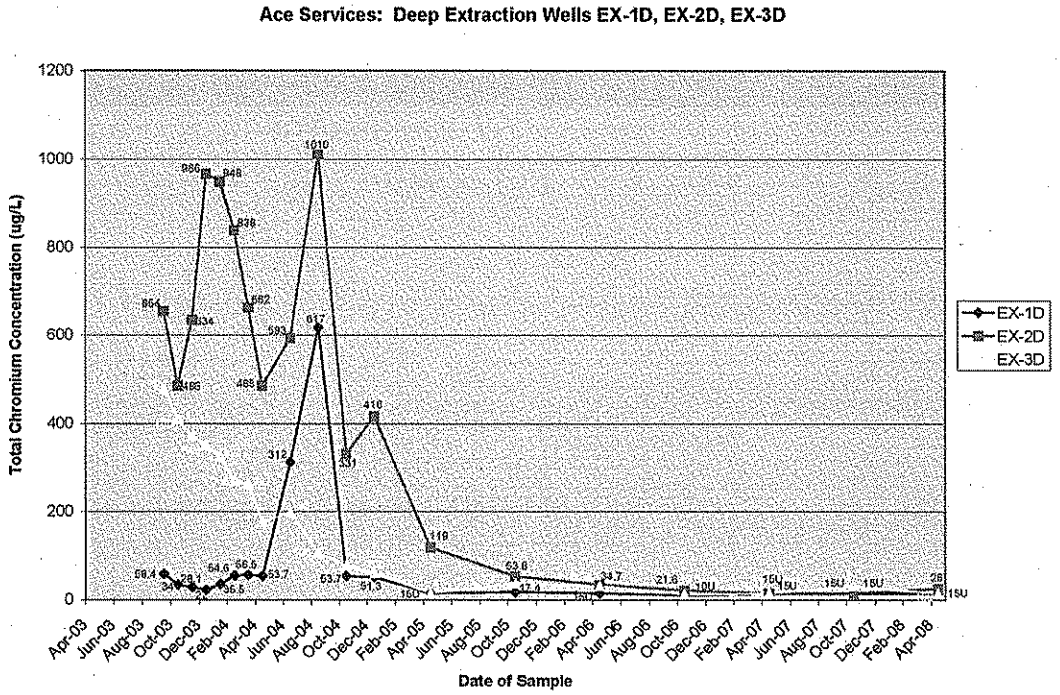

Ace Services: Deep Wells MW-2D, MW-8D
Total Chromium Concentration (ug/L)
800
700
600
500
400
300
200
100
0
MW-2D
MW-8D
Date of Sample
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08

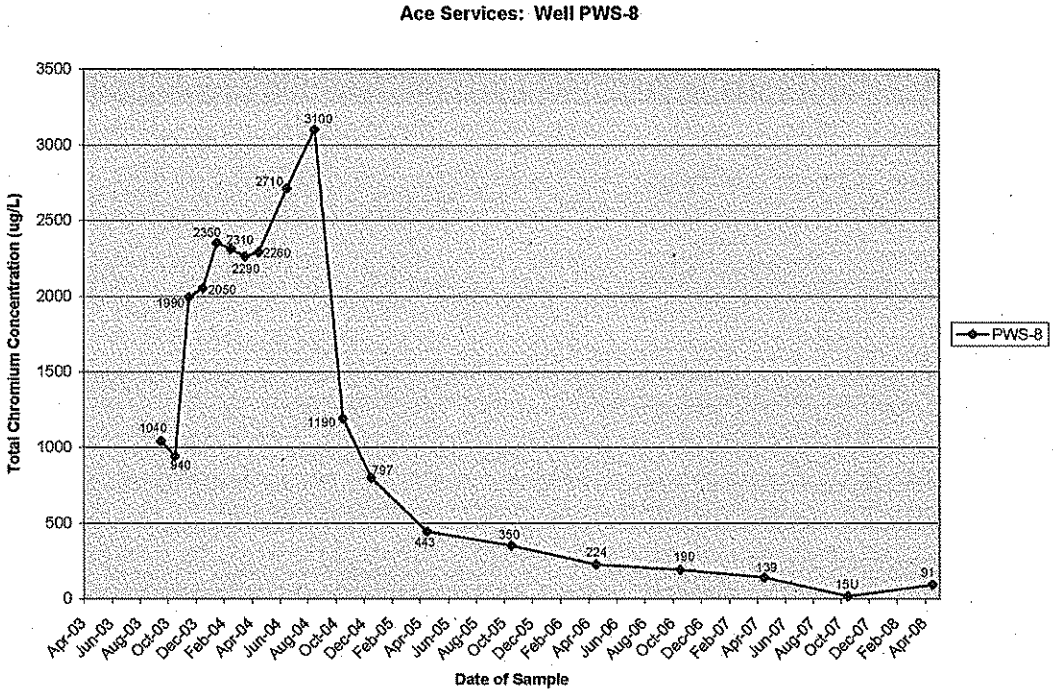

Ace Services: Deep Wells MW-3D, MW-4D, MW-5D, MW-6D, MW-7D
Total Chromium Concentration (ug/L)
400
350
300
250
200
150
100
50
0
336
169
MW-3D
MW-4D
MW-5D
MW-6D
MW-7D
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample

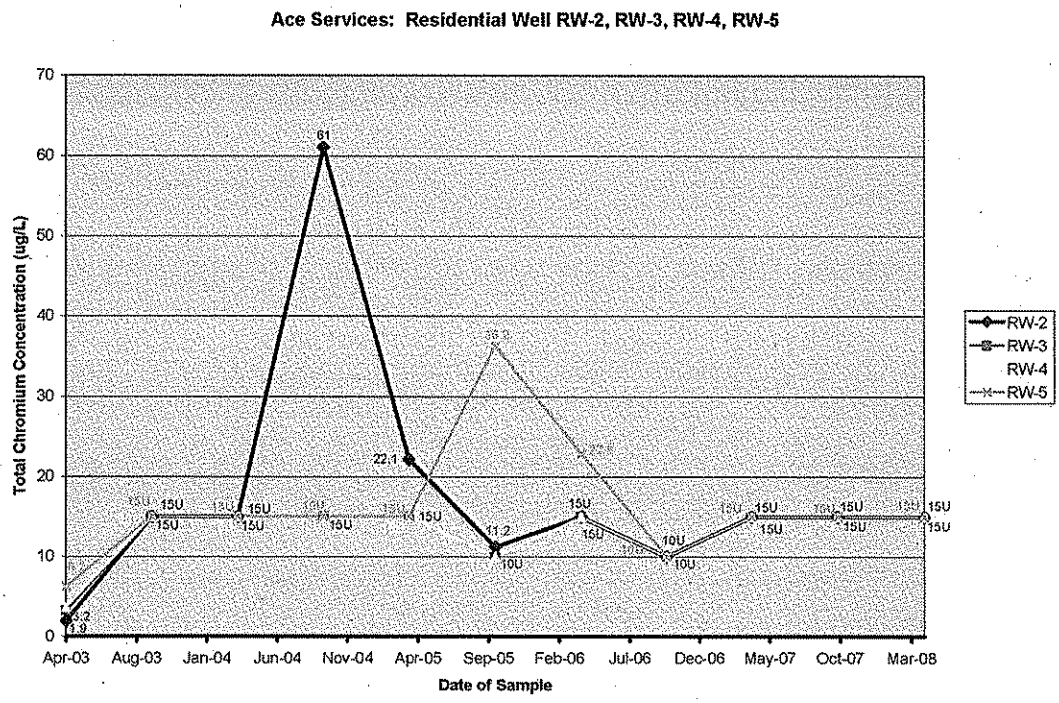

Ace Services: Deep Wells MW-9D, MW-15D
Total Chromium Concentration (ug/L)
Date of Sample
MW-9D
MW-15D
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
3340
1900
1820
1620
1680
1730
1600
1820
1470
1240
1330
1350
999
866
464
487
384
360
305
275
202
125
121
134
120
15U
41.7
37.3
10.1
22
15U
11.1
10U
15U
15U
15U
22


Ace Services: Deep Well ARW-D
Total Chromium Concentration (ug/L)
350
300
250
200
150
100
50
0
6.4
68
194
160
188
202
291
277
287
156
15U
70
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample
ARW-D

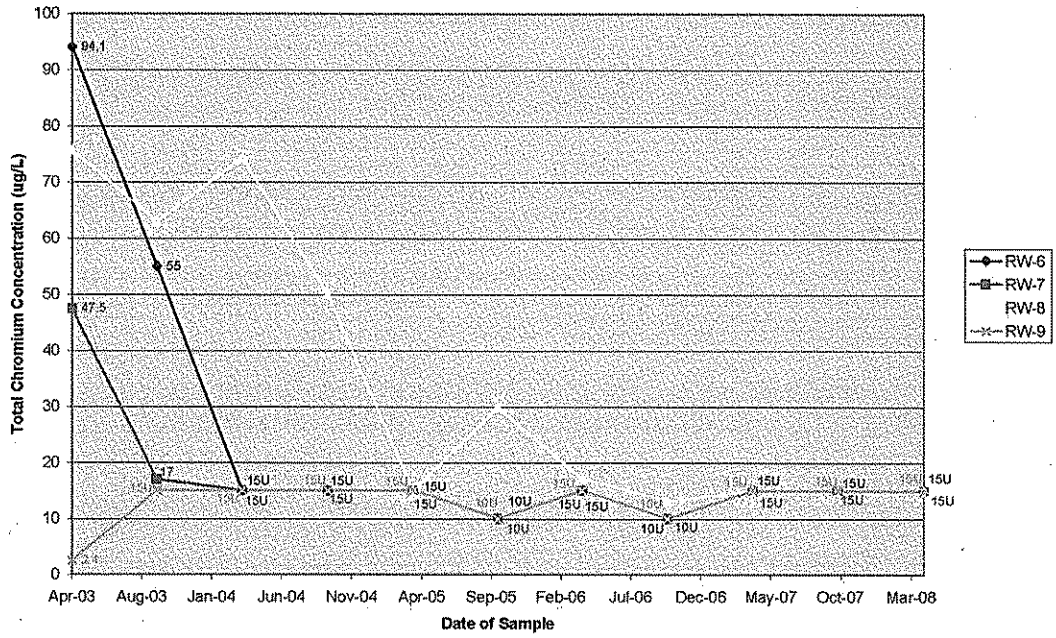

Ace Services: Deep Wells OB-1D, OB-2D
Total Chromium Concentration (ug/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1290
2770
99
226
604
515
257
60.6
51.9
15U
10U
11.6
15U
15U
10U
10U
15U
15U
15U
15U
OB-1D
OB-2D
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample


Ace Services: Deep Extraction Wells EX-1D, EX-2D, EX-3D
Total Chromium Concentration (ug/L)
1200
1000
800
600
400
200
0
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample
EX-1D
EX-2D
EX-3D


Ace Services: Well PWS-8
Total Chromium Concentration (ug/L)
3500
3000
2500
2000
1500
1000
500
0
1040
940
1990
2050
2350
2310
2290
2260
2710
3100
1190
797
443
360
224
190
139
150
91
PWS-8
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Feb-05
Apr-05
Jun-05
Aug-05
Oct-05
Dec-05
Feb-06
Apr-06
Jun-06
Aug-06
Oct-06
Dec-06
Feb-07
Apr-07
Jun-07
Aug-07
Oct-07
Dec-07
Feb-08
Apr-08
Date of Sample


Ace Services: Residential Well RW-2, RW-3, RW-4, RW-5
Total Chromium Concentration (ug/L)
70
60
50
40
30
20
10
0
Apr-03
Aug-03
Jan-04
Jun-04
Nov-04
Apr-05
Sep-05
Feb-06
Jul-06
Dec-06
May-07
Oct-07
Mar-08
Date of Sample
RW-2
RW-3
RW-4
RW-5
61
22.1
11.2
15U
10U

Ace Services: Residential Wells RW-6, RW-7, RW-8, RW-9



Attachment B

Site Inspection Checklist

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Ace Services Site	**Date of inspection:** 11/29/07
Location and Region: Colby, KS	**EPA ID:** KSD046746731
Agency, office, or company leading the five-year review: EPA Region 7	**Weather/temperature:** Sunny/ 20 – 30°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other:
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Jim Helus (Name) City of Colby Public Works (Title) 11/29/07 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☒ Report attached _____

2. **O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☒ O&M manual — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ As-built drawings — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ Maintenance logs — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks

2. **Site-Specific Health and Safety Plan** — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ Contingency plan/emergency response plan — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☒ Effluent discharge — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Other permits ____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks Effluent discharges to public water supply or drainage surface water. Discharge standards are 100 ug/L total chromium for drinking water discharge and 17 ug/L hexavalent chrome and 100 ug/L total chrome for surface water discharge. However, there are no discharge permits for this site.

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks

7. **Groundwater Monitoring Records** — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☒ Water (effluent) — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☒ N/A

    Remarks No daily access security logs

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☐ Contractor for PRP
   - ☒ Federal Facility in-house
   - ☒ Contractor for Federal Facility
   - ☒ Other City of Colby is the plant operator. Black and Veatch provide technical support

2. **O&M Cost Records**
   - ☒ Readily available ☐ Up to date
   - ☐ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: ___No

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A
   Remarks

B. Other Access Restrictions

1. **Signs and other security measures** ☒ Location shown on site map ☐ N/A
   Remarks There is a sign on the front door of the treatment building

C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached
Residents in downgradient area of plume are monitored. There is a city ordnance in place preventing installation of residential supply wells.

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks _____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks Minimal in past. No signs of vandalism currently present.

2. **Land use changes on site** ☐ N/A
Remarks None

3. **Land use changes off site** ☐ N/A
Remarks None

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks Unimproved road to some of the downgradient extraction wells. May require four-wheel-drive during wet conditions but no problems navigating with standard passenger vehicle during site inspection.

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent _____ Depth _____
   Remarks _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths _____ Widths _____ Depths _____
   Remarks _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent _____ Depth _____
   Remarks _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent _____ Depth _____
   Remarks _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ▪ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent _____ Height _____
   Remarks _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
■ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

E. Gas Collection and Treatment	☐ Applicable	☐ N/A
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks_____	
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks_____	
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks_____	
F. Cover Drainage Layer	☐ Applicable	☐ N/A
1.	**Outlet Pipes Inspected** ☐ Functioning ☐ N/A Remarks_____	
2.	**Outlet Rock Inspected** ☐ Functioning ☐ N/A Remarks_____	
G. Detention/Sedimentation Ponds	☐ Applicable	☐ N/A
1.	**Siltation** Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks_____	
2.	**Erosion** Areal extent_____ Depth_____ ☐ Erosion not evident Remarks_____	
3.	**Outlet Works** ☐ Functioning ☐ N/A Remarks_____	
4.	**Dam** ☐ Functioning ☐ N/A Remarks_____	

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☒ Good condition ☐ Needs Maintenance
   Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   ☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   - ☒ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☒ Carbon adsorbers
   - ☒ Filters__Bag, Resin Trap Filter, Resin, Carbon Adsorbers associated with High Plains_____
   - ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   - ☐ Others_____
   - ☒ Good condition ☐ Needs Maintenance
   - ☒ Sampling ports properly marked and functional
   - ☒ Sampling/maintenance log displayed and up to date
   - ☒ Equipment properly identified
   - ☒ Quantity of groundwater treated annually 365,000,000 gallons
   - ☐ Quantity of surface water treated annually_____
   - Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   - ☐ N/A ☒ Good condition ☐ Needs Maintenance
   - Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   - ☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   - Remarks_____

4. **Discharge Structure and Appurtenances**
   - ☐ N/A ☒ Good condition ☐ Needs Maintenance
   - Remarks_____

5. **Treatment Building(s)**
   - ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐ Chemicals and equipment properly stored
   - Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☒ Good condition
   - ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   - Remarks Not all wells inspected but ones inspected during site visit were in good condition

D. Monitoring Data

1. Monitoring Data
   - ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
   - ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

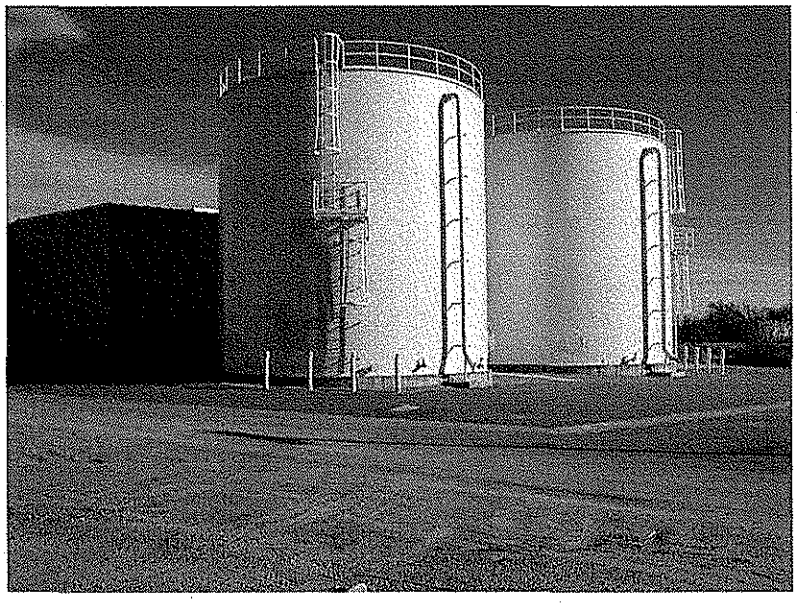
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

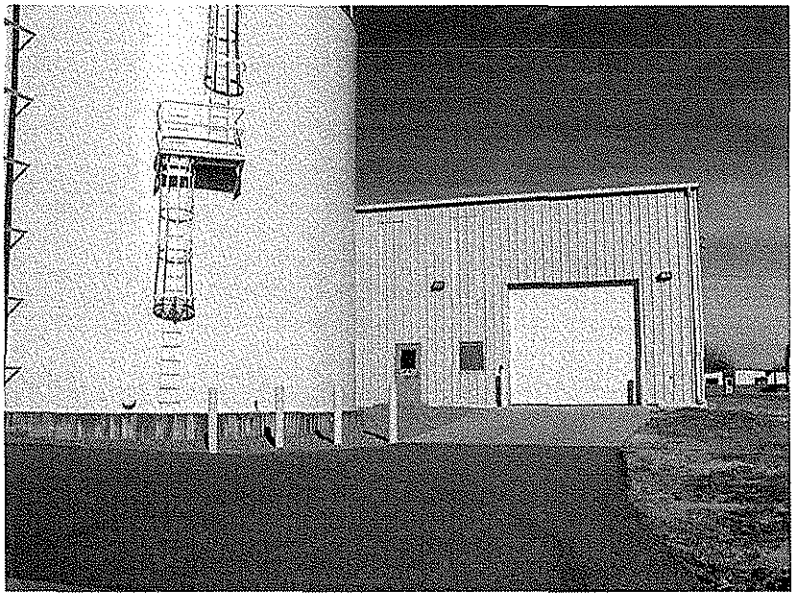
Attachment C

Site Inspection Photographs

North Side of Treatment Building

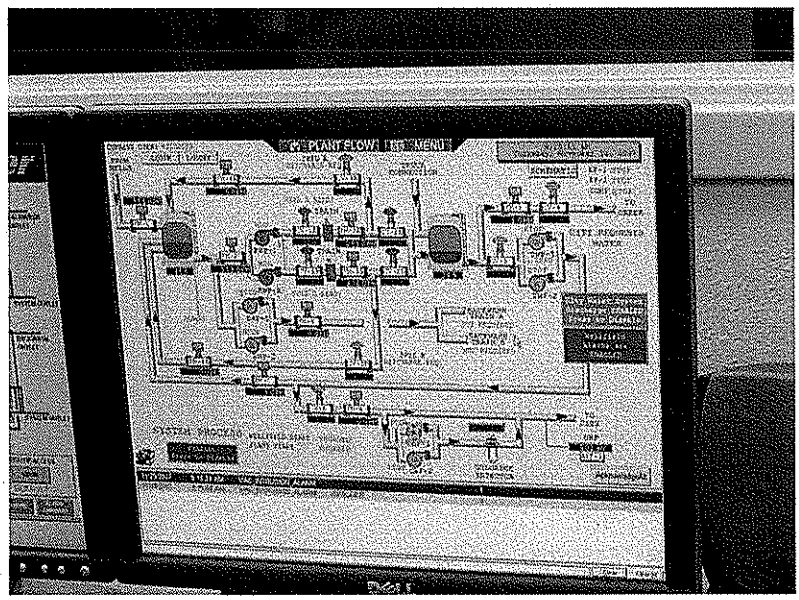


Influent and Effluent Tanks – South Side of Treatment Building

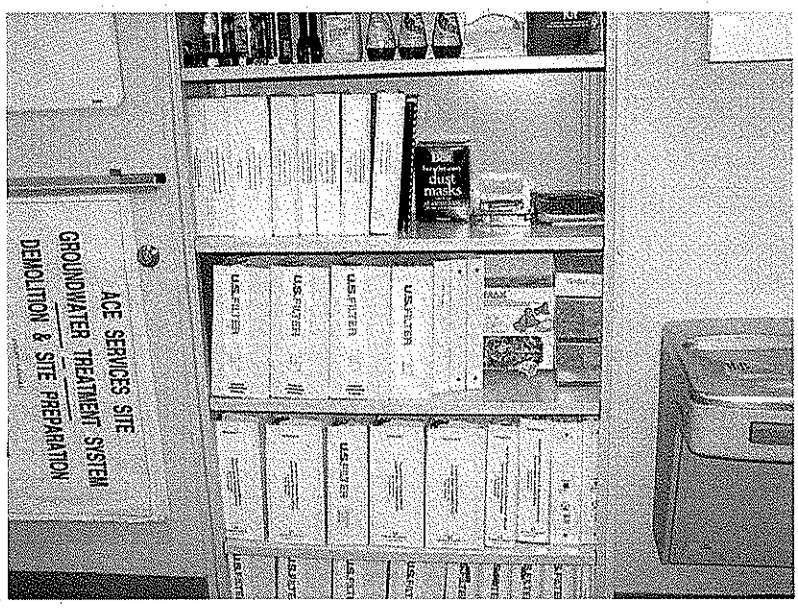


Truck Access Door – South Side of Treatment Building

Effluent Discharge Pipe to Tributary to Prairie Dog Creek



Treatment Plant Control Panel

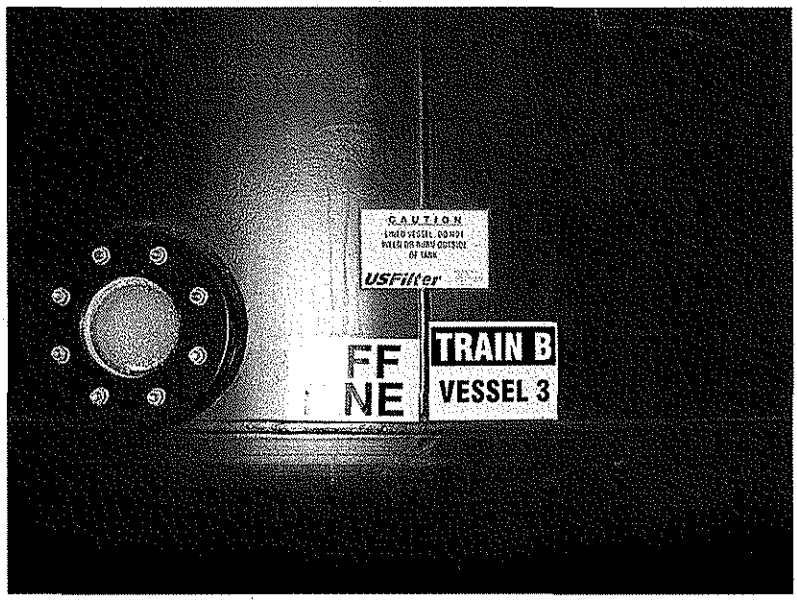


O&M Manuals and As-built Drawings

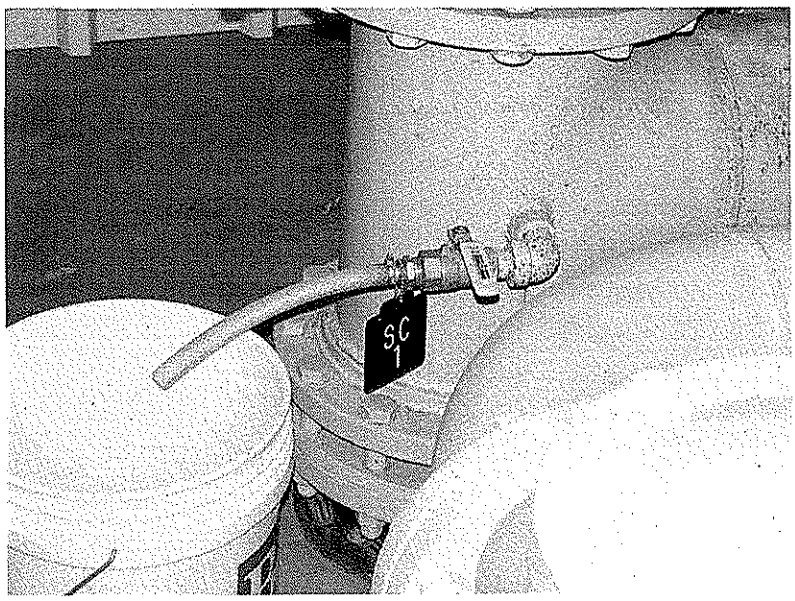
Resin Tanks - Treatment Train B

Ion Exchange Lead Vessel – Treatment Train B

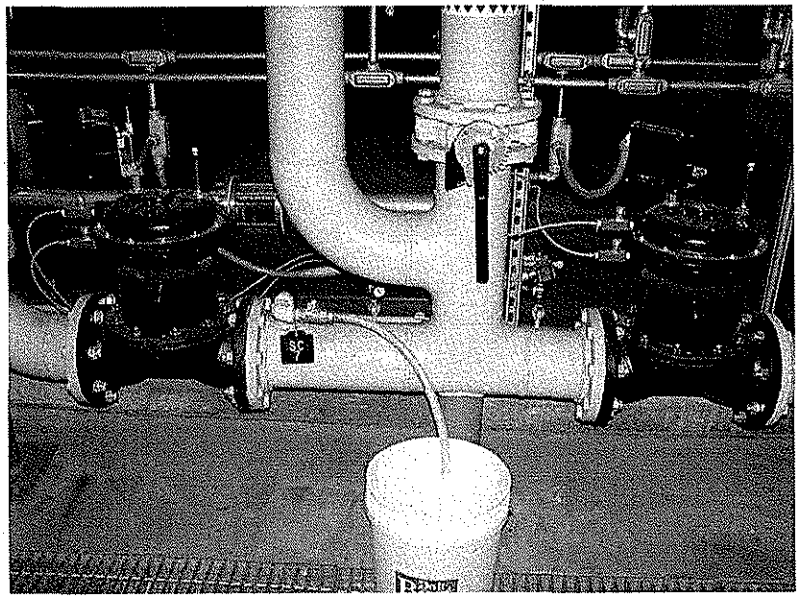
Ion Exchange Lag Vessel – Treatment Train B



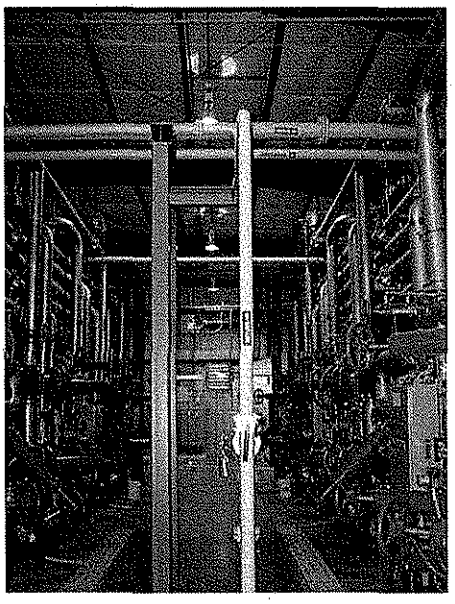
Ion Exchange Offline Vessel – Treatment Train B



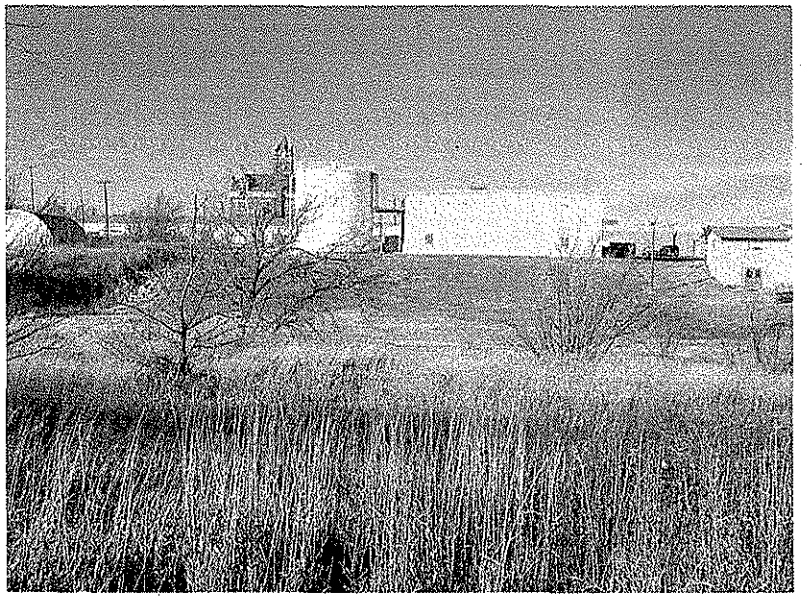
Influent Sample Port – Note Minor Rust on Piping



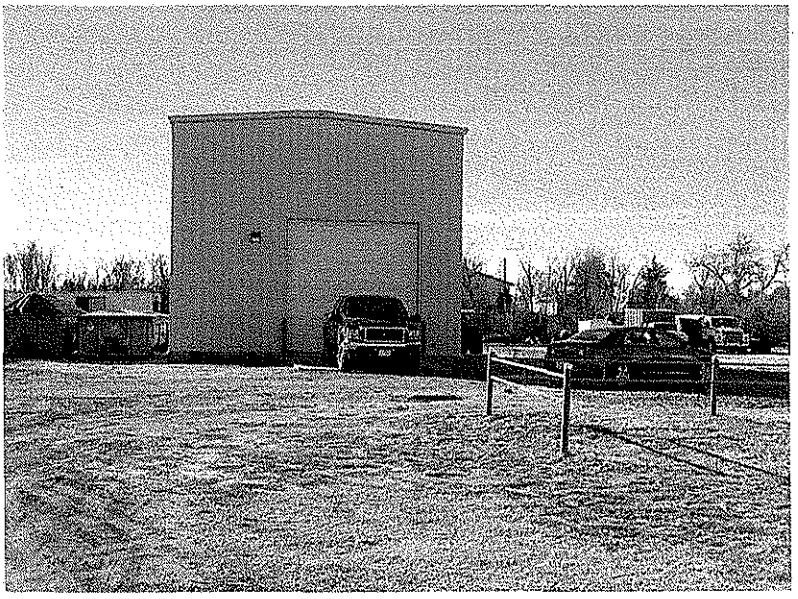
Sample Port SC-7: Train B Effluent Sample Location



View Between Treatment Trains



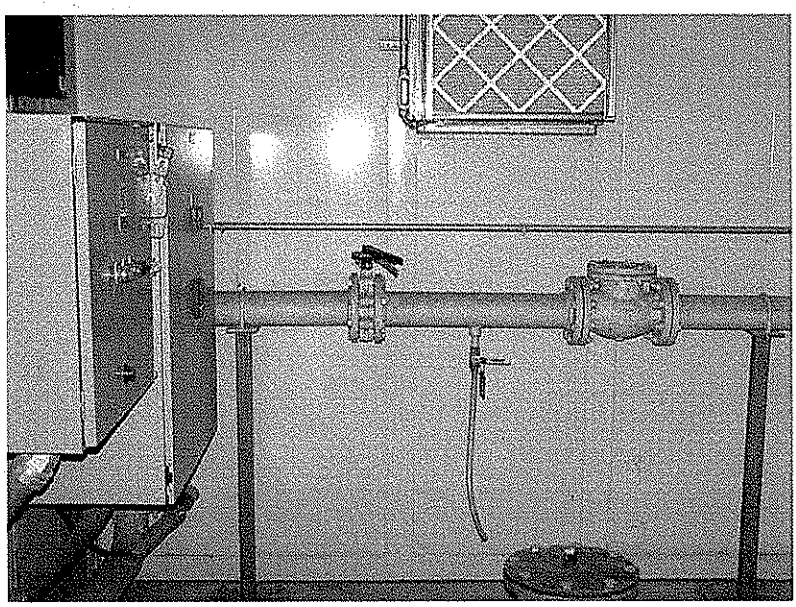
Overview of Treatment Facility – Looking West



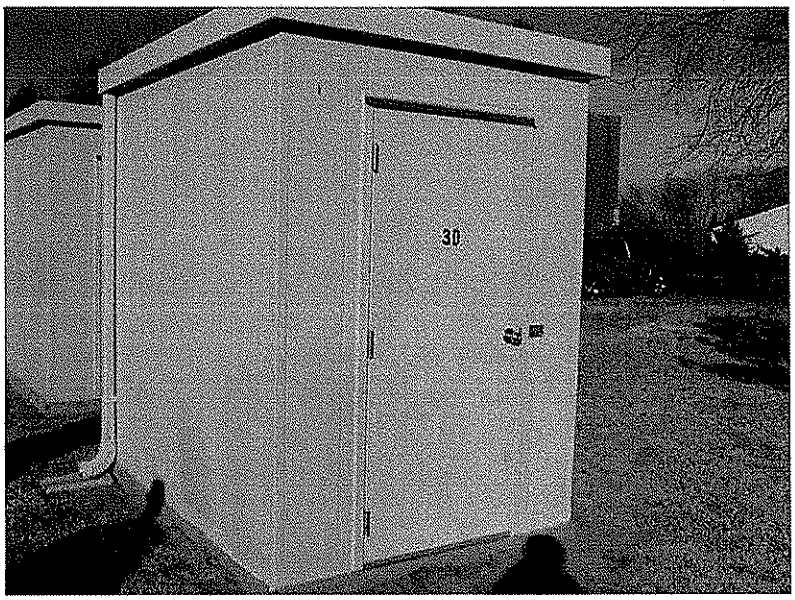
Building Housing GAC High Plain COOP GAC Unit

Monitoring Wells Associated with High Plains COOP VOC Plume

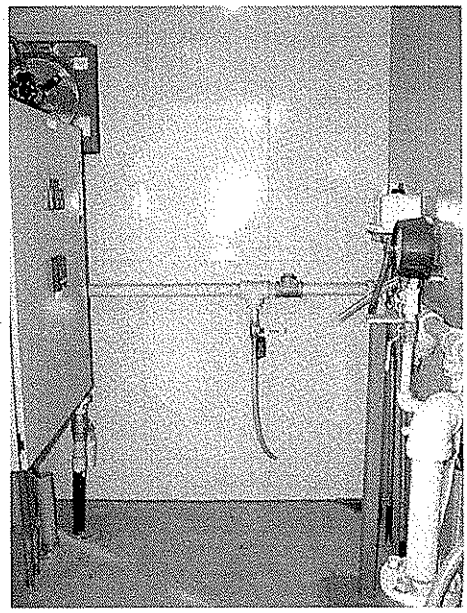
Protective Building - Former City Production Well PWS-8



Inside PWS-8 Building



EX-3D Protective Building – Typical for All Extraction Wells



Interior of Building Housing EX-4S – Typical for All Extraction Wells

Ace Recovery Well