INTERIM RECORD OF DECISION

GARVEY ELEVATOR SUPERFUND SITE
OU 1 and OU 2
HASTINGS, NEBRASKA

September 30, 2013

Prepared by:
U.S. Environmental Protection Agency
Region 7
Lenexa, Kansas

INTERIM RECORD OF DECISION
GARVEY ELEVATOR SUPERFUND SITE, OPERABLE UNITS 1 and 2
HASTINGS, NEBRASKA
CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

PART I: DECLARATION

Site Name and Location
Operable Units 1 and 2
Garvey Elevator Superfund Site
Hastings, Adams County, Nebraska
CERCLIS ID# NEN000704351

Statement of Basis and Purpose
This decision document presents the Selected Remedy for Operable Unit (OU) 1 soils and OU 2 groundwater of the Garvey Elevator Superfund Site (Site) in Adams County, Nebraska to address historic releases of hazardous substances. The remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. § 9601 *et. seq.*, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR part 300.

This decision is based on the Administrative Record for this Site. The Administrative Record and copies of key documents are available for review at the following information repositories:

EPA Region 7 Office 11201 Renner Blvd Lenexa, Kansas	Hastings Public Library 517 West 4th Street Hastings, Nebraska

Assessment of the Site
The response action selected in this Interim Record of Decision (Interim ROD) is necessary to protect the public health and welfare and the environment from actual or threatened releases of hazardous substances from the Site into the environment.

Description of the Selected Remedy
The former Garvey Elevators, Inc. (Garvey) grain storage facility is a commercial grain elevator located approximately ½ mile southwest of Hastings, Nebraska, in Adams County. The Garvey Elevator Superfund Site (Site) includes the grain storage facility and off-property areas having groundwater contamination related to the grain storage facility's operations.

This Interim ROD addresses contaminated soils at OU 1 and contaminated groundwater at OU 2 of the Site. OU 1 is designated as the area of soil and groundwater contamination that is generally within the boundaries of the 22-acre parcel on which the grain storage facility formerly owned by Garvey was operated. OU 2 is the associated contaminated groundwater plume that extends east-southeast from OU 1 approximately four miles in the direction of groundwater flow.

Once signed, this will be the second interim ROD issued for the Site. The EPA issued the first interim ROD in June 2010 (2010 Interim ROD), prior to completion of the Site-wide remedial investigation/feasibility study (RI/FS), to take early action to implement control of the source area. The 2010 Interim ROD addressed a portion of the OU 1 soil and the OU 1 groundwater. The objectives of the 2010 Interim ROD were to prevent exposure to the contaminated groundwater, to prevent or minimize further impacts to groundwater from the OU 1 soils, to prevent further migration of contaminated groundwater from the source area and to reduce contamination below the EPA's maximum contaminant levels (MCLs) in the groundwater at OU 1. Since the 2010 Interim ROD was signed, EPA completed the Site-wide RI/FS, as well as the Remedial Design (RD) for the 2010 Interim ROD.

This Interim ROD addresses the contaminated soil in the area designated as OU 1 and the contaminated groundwater plume in the area designated as OU 2. This Interim ROD amends the soil component of the 2010 interim remedy for OU 1 that was selected by the EPA and documented in the 2010 Interim ROD. All other remedial actions identified in the 2010 Interim ROD will continue to be implemented.

With respect to OU 1 groundwater, this Interim ROD does not modify the interim remedy set forth in the 2010 Interim ROD. Further studies of the feasibility of alternatives to address OU 1 groundwater are necessary before selecting a final remedy for the entire Site. This interim action will be consistent with the final remedy. The Record of Decision that will present a final remedy for the entire Site is planned to be completed in 2017.

The EPA's Selected Remedy for OU 1 soils is Alternative S4: excavation, treatment and disposal of contaminated soil and expansion and operation of the existing soil vapor extraction system (SVE). Alternative S4 includes the following components:

- Excavation of contaminated soil in the vicinity of the 2000-gallon above-ground-storage tank and buried transfer pipe, which has been estimated to be approximately 68 bank cubic yards;
- Treatment of the excavated soil by ex-situ SVE to meet cleanup goals;
- Confirmation sampling of walls and floor of excavated volume to determine if perimeter soils meet cleanup goals and possible excavation of any remaining contaminated soils;
- Backfill of the excavated soils with clean fill from an on-site borrow area;
- Disposal of treated soil in the on-site borrow area;
- Installation of SVE wells near the former AST and buried transfer pipe;
- Installation of piping to connect SVE wells to existing SVE system and integration of the into the existing SVE system;
- Operation and maintenance (O&M) of the expanded SVE system;
- Annual sub slab vapor monitoring; and
- Continued monitoring to ensure the effectiveness of the existing Institutional Controls (ICs).

The EPA's Selected Remedy for OU 2 groundwater is Alternative G3: groundwater recovery, treatment and discharge at mid-plume and leading edge of plume. Alternative G3 includes the following components:

- Installation of 12 recovery wells (six each in the mid-plume and leading edge of plume areas);
- Construction of a treatment system and treatment system building;
- Construction of six injection wells to reinjected treated effluent;
- Construction of a network of 30 monitoring wells for performance monitoring of the remedy;
- Quarterly, semiannual, and annual groundwater monitoring;
- System O&M;
- Periodic well maintenance and equipment replacement.
- Implementation, monitoring and enforcement of an IC on the areas within or in close proximity to the contaminated groundwater plume. The ICs will protect human health and the environment by preventing exposures to the contaminated groundwater during remedial actions. At the conclusion of remedial actions the groundwater would be at or below the cleanup levels and available for unrestricted and unlimited use.

The mid-plume recovery wells will target areas of the plume with CCl_4 concentrations greater than 100 μg/l in the intermediate aquifer zone and with CCl_4 concentrations greater than 45 μg/l in the lower aquifer zone. The leading edge recovery wells will extract groundwater at a rate sufficient to capture groundwater contaminated above cleanup levels. Groundwater extracted by the recovery wells will be treated by air stripping. The treated groundwater will be reinjected into the aquifer or made available for beneficial reuse.

Statutory Determinations
This interim action is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principle element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment. Because the combination of this interim remedy and the 2010 interim remedy will not result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure, but it will take more than five years to attain remedial action objectives and cleanup levels, a policy review may be conducted within five years of construction completion for the site to ensure that the remedy is, or will be, protective of human health and the environment. This interim action is acceptable to both the state of Nebraska and the community of Hastings. Further studies of the feasibility of alternatives to address OU 1 groundwater are necessary before selecting a final remedy for the entire Site. The final Site-wide remedy for contaminated soil and groundwater will be determined after these studies have been conducted.

ROD Data Certification Checklist

The following information is included in the Decision Summary (Part II of this Interim ROD). Additional information can be found in the Administrative Record for this Site.

- COPCs and their respective concentrations (see Section 8.1.1 and Table 4).
- Baseline risk represented by the COCs (see Section 8.1.4)
- Potential to leach and impact groundwater (see Section 8.2)
- Current and reasonably expected future use (see Section 6)
- Summary of COCs (Table 9)
- Cleanup levels established for the COCs (see Section 9 and Table 10)
- Source materials (see Section 12)
- Estimated costs (see Section 13.3)
- Key factors that led to selecting the remedy (see Section 11)

Authorizing Signature

Cecilia Tapia, Director
Superfund Division

Date 9/30/13

PART II: DECISION SUMMARY

1. Site Name, Location and Description

Site Name: Garvey Elevator Superfund Site
Site Location: Hastings, Nebraska
CERCLIS ID: NEN000704351
Operable Unit (OU): OU 1 and OU 2

The 106-acre property formerly owned by Garvey Elevators, Inc. (Garvey) is located in the NW 1/4 of Section 23, T7N, R10W, approximately seven miles west of the Adams County/Clay County line and immediately southwest of Hastings, Nebraska (Figures 1 & 2). The 106-acre property, consisting of an 84-acre parcel and a 22-acre parcel, is bounded on the north by U. S. Highway 6 and business and residential properties, on the east by the Burlington Northern and Santa Fe railroad track, on the west by Marion Road, and on the south by farmland. Garvey owned and operated a grain storage facility (facility) on the 22-acre parcel along the eastern boundary of the property. The facility, currently owned and operated by Ag Processing Inc. (AGP), consists of concrete silos, a flat-storage building, steel grain storage bins and associated buildings (maintenance shop, office building and chemical storage shed). The contamination associated with the Garvey Elevator Superfund Site (Site) consists of volatile organic compound (VOC)-contaminated soils and groundwater beneath the 22-acre parcel and an associated contaminated groundwater plume approximately four miles long that extends from the property in an east-southeasterly direction.

The U.S. Environmental Protection Agency (EPA) has organized the Site into two OUs. OU 1 is designated as the area of soil and groundwater contamination that is generally within the boundaries of the 22-acre parcel on which the grain storage facility formerly owned by Garvey was operated. OU 1 is commonly referred to as the source area. OU 2 is the associated contaminated groundwater plume that extends east-southeast from OU 1 approximately four miles in the direction of groundwater flow.

The EPA is the lead agency for the Site and the Nebraska Department of Environmental Quality (NDEQ) is the support agency. The sources of funding for cleanup of this Site will be the Superfund trust fund and state funds received through NDEQ.

This Interim Record of Decision (Interim ROD) addresses the contaminated soil in the area designated as OU 1 and the contaminated groundwater plume in the area designated as OU 2. This Interim ROD amends the soil component of the 2010 interim remedy for OU 1 that was selected by the EPA and documented in the Interim ROD signed on June 30, 2010 (2010 Interim ROD). All other remedial actions identified in the 2010 Interim ROD will continue to be implemented.

With respect to OU 1 groundwater, this Interim ROD does not modify the interim remedy set forth in the 2010 Interim ROD. Further studies of the feasibility of alternatives to address OU 1 groundwater are necessary before selecting a final remedy for the entire Site. This interim action will be consistent with the final remedy.

2. Site History and Enforcement Activities

This section of the Interim ROD provides the history of the Site and a brief discussion of the EPA and the State's removal, remedial, and enforcement activities. The "Proposed Rule" proposing the Site to the

National Priorities List (NPL) was published in the *Federal Register* (FR) on April 27, 2005. The "Final Rule" adding the Site to the NPL was published in the FR on September 14, 2005.

2.1 History of Property Ownership and Operations

The former Garvey property contains an active 8-million bushel capacity grain storage facility currently owned and operated by AGP. Garvey owned the grain storage facility from its construction in 1959 until 2005. Garvey operated the grain storage facility from 1959 until April 1, 1998, at which time the March 28, 1997 Put Through Agreement with AGP became effective. In September 2005, Garvey, AGP, and the EPA entered into an Agreement (CERCLA Docket No. 07-2005-0268) (2005 Agreement) that allowed AGP to purchase the entire 106-acre property with an EPA covenant not to sue, provided AGP satisfactorily performed its obligations under the 2005 Agreement and subject to certain reservations of rights by the EPA (CERCLA Docket No. 07-2005-0268). The effective date of deed transfer to AGP was October 7, 2005.

The property formerly owned by Garvey consisted of a total of 106 acres; but historically, only the 22-acre parcel (Parcel ID – 010003207) was used for grain storage facility operations (Figure 2). The majority of the remaining 84 acres are used to cultivate crops. The grain storage facility at the Garvey terminal consists of a concrete elevator head house and silos, flat-storage building, steel grain storage bins, and associated buildings (maintenance shop, office building and chemical storage shed). The area surrounding the grain storage facility is rural with a sparse distribution of residential properties north, east and west of the site.

Garvey used a liquid mixture of carbon tetrachloride (CCl_4) and carbon disulfide (CS_2) as a grain fumigant from 1959 to 1985. This fumigant mixture is commonly referred to as 80-20 fumigant. Some formulations of the 80-20 fumigant may also have contained a minor amount of ethylene dibromide (EDB), also known as 1,2-dibromoethane. CCl_4, CS_2, and EDB are CERCLA hazardous substances and are categorized as volatile organic compounds (VOCs). In 1960, Garvey installed a 3,000-gallon, above-ground storage tank (AST) north of the silos to store the liquid fumigant (refer to feature labeled "Former CCl_4 AST" in Figure 2). The fumigant was transferred via piping from the AST to the silos' grain application gallery on top of the silos. The section of piping between the AST and the side of the silos was buried (refer to feature labeled "Buried Transfer Pipe" in Figure 2). The piping exited the subsurface at the base of the silos and extended up the north side of the silos to the application gallery on top. In the mid-1970s, a release of carbon tetrachloride at the ground surface was noted in the area where the trucks drove over the underground piping. The buried portion of this delivery pipe was excavated and found to be broken in two places: one near the AST and one near the grain elevator. The piping was completely replaced at the time. Leaks and drips were reported to have occurred during the operation period of the AST and piping. Staining in the area beneath the valve of the AST was also observed. Garvey ceased use of the liquid fumigant in 1985 and the AST and underground piping were removed in 1986.

The grain storage facility located on the 22-acre property is currently owned and operated by AGP. AGP has operated the grain storage facility since April 1998. A ban on the production and import of carbon tetrachloride in developed countries, including the United States, took effect on January 1, 1996.

2.2 State-lead Activities

The former Garvey grain elevator first came to the attention of NDEQ in July 1994, when, in written correspondence, Garvey notified NDEQ of a release of organic solvents and the presence of groundwater contamination at its grain storage facility. The release of CCl_4 and methyl ethyl ketone was reported to have been discovered on June 16, 1994, but the date of occurrence was reported as unknown. Enclosures to the notification letter included results of its self-described Phase I activities of direct push soil sampling and installation and sampling of five monitoring wells. The field activities were conducted in June 1994. The activities appear to have been exploratory and Garvey did not define their purpose, scope or intent in the notification to NDEQ. The results indicated CCl_4 was detected in the soil and groundwater samples. The CCl_4 concentrations in the groundwater exceeded maximum contaminant level (MCL) for CCl_4 of 5 micrograms per liter (μg/l). In October 1994, Garvey reported to NDEQ that according to its sampling results, its monitoring wells, facility water supply well and several nearby private water supply wells were contaminated with CCl_4 at levels that exceeded the MCL and were as high as 300 μg/l. In December 1994, Garvey notified NDEQ that it was beginning site assessment activities in accordance with Nebraska Title 118. Garvey installed an additional 18 monitoring wells.

In April 1995, Garvey met with NDEQ to present preliminary site characterization results and to petition for entry into the Voluntary Cleanup Program (VCP), which is authorized by the Nebraska Remedial Action Plan Monitoring Act (RAPMA). The site characterization results indicated the presence of CCl_4 soil gas contamination in the unsaturated zone across approximately one-third of the 22-acre active portion of the property and a CCl_4 contaminated groundwater plume. The extent of the plume was not totally defined, but it was found to be at least 1 mile long. The highest concentration of CCl_4 observed was 29,943 μg/l in monitoring well (MW)-3B. Garvey also described its efforts to provide alternate water to private water supply well users (reportedly either installing a new well in an uncontaminated portion of the aquifer or connecting the household to the municipal water supply). The potential need to install a soil vapor extraction (SVE) system to address soil contamination in the unsaturated zone was also discussed. In June 1995, NDEQ notified Garvey of its acceptance in the VCP.

In September 1995, Garvey met with NDEQ to present additional site characterization and groundwater modeling results and to propose actions to address the soil and groundwater contamination on its property. Garvey described a groundwater model they developed and applied to evaluate different scenarios for addressing the groundwater at the Site. Garvey summarized its investigations in an October 1995 Site Characterization Report. The report described activities conducted by Garvey in 1994 to characterize the nature and extent of VOC contamination in the soil and groundwater beneath the Site. Soil sampling at the grain storage facility detected only trace quantities of VOCs. Soil gas sampling, conducted primarily from a depth range between 9 and 18 feet below ground surface (bgs), identified potential source areas at numerous locations across the Site. This sampling was supplemented with limited soil gas vertical profiling at three additional locations. The entire area from the north side of the silos to the north side of the shop area, and trending east and west along the entire length of the silos had carbon tetrachloride concentrations in soil gas exceeding 10,000 $\mu g/m^3$. It was estimated that the soil gas contamination was spread across more than 500,000 $feet^2$ at the grain storage facility and that more than 55 million cubic feet of soil was impacted. Of the 36 monitoring wells on the Site, CCl_4 was detected in 15 of the wells at concentrations greater than 1.0 μg/l. The highest measured concentration of CCl_4 (29,943 μg/l) was found on the facility approximately 425 ft north-northeast of the concrete silos. In the nested monitoring well MW-18D, located the furthest from the facility (approximately 5,500 feet) in the direction of groundwater flow, CCl_4 was detected at a concentration of 80 μg/l.

In late 1997, the city of Hastings notified NDEQ that CCl_4 was detected in municipal well #13, located 1,500 feet northeast of the former Garvey property, at 5 μg/l (refer to Figure 3). In November 1997, the City reassigned municipal well #13 for emergency use only. To date, its status remains unchanged.

In January 1999, Garvey completed construction of and began operating a groundwater extraction and treatment (GET) system and an SVE and treatment system (Figure 3). The systems were intended only to treat contaminated soils at the source area and prevent groundwater migration from the source area. The systems were not designed to address that portion of the contaminated groundwater plume that had already migrated east-southeast of the grain storage facility. The GET system consisted of five recovery wells (RW) screened in the shallow aquifer (RW-1 through RW-5) and three wells screened in the intermediate aquifer (RW-6, RW-7 and RW-8). The wells were fitted with variable-frequency pumps designed for a maximum pumping rate of 40 and 100 gpm for the shallow and intermediate wells, respectively. Extracted groundwater was treated by an air stripping tower, after which it was reinjected into the aquifer via two deep injection wells (IW-1 and IW-2) located west of the elevator. The SVE system consisted of five wells screened in the unsaturated zone from approximately 20 to 50 ft bgs (SVE-1, SVE-3, SVE-4, SVE-7, and SVE-8) and three wells screened in the unsaturated zone from about 60 to 110 feet bgs (SVE-9, SVE-10 and SVE-11). The SVE system was constructed with a blower capacity of 200 standard cubic feet per minute (scfm) for the shallow wells, and a 600 scfm blower for the deep wells. Based on pilot study testing, the SVE wells had an expected radius of influence (ROI) of 25 to 30 feet in the shallow unsaturated zone and a ROI of 150 to 180 feet in the deeper unsaturated zone. The extracted soil vapors were treated by a catalytic oxidation unit and scrubber prior to discharge to the atmosphere.

In May 2002, Garvey notified NDEQ that that it would not sign the NDEQ RAPMA Memorandum of Agreement, which would have required the cleanup of not only the source area, but also the contaminated groundwater plume stretching eastward from the former Garvey facility. By this action, Garvey ceased participating in the VCP program. Following this development, in October 2002, NDEQ requested the EPA's assistance in performing a removal site evaluation to identify the full extent of the contaminated groundwater plume. NDEQ had several concerns, including the fact that additional private drinking-water well might be impacted and that Garvey was unwilling to perform the necessary work. The EPA recommended that NDEQ perform a preliminary assessment/site investigation (PA/SI) under its cooperative agreement with the EPA.

In April 2003, NDEQ conducted a PA/SI of the Site and prepared a hazard ranking score report that assessed whether there was a potential threat to human health and the environment and to identify source(s) of groundwater contamination. Thirty-five private and business water supply wells were sampled. The CCl_4 concentrations in these wells ranged from non-detect to greater than 500 μg/L. CCl_4 was the only VOC detected in the samples. The PA/SI report concluded that a release of CCl_4 at the facility had impacted the city of Hastings' municipal well #13 and several nearby private wells at levels exceeding the MCLs.

In correspondence dated December 9, 2003, NDEQ expanded its October 17, 2002 request for EPA assistance. NDEQ requested the EPA's assistance to provide alternate water supplies to impacted private well users, evaluate the effectiveness of and make recommendations for improving the source area control system, characterize the CCl_4 plume downgradient of the facility and evaluate potential remedial alternatives for the CCl_4 plume. In response to these requests, the EPA assumed the role of lead agency and identified Garvey as a potentially responsible party (PRP).

2.3 Federal-lead Activities

On April 27, 2005, the EPA proposed the Site for listing on the EPA's NPL. The Site was listed on the NPL on September 14, 2005.

On October 7, 2005, Garvey entered into an Administrative Order on Consent (AOC) with the EPA (CERCLA Docket No. 07-2005-0215). The AOC identified Garvey as a PRP and required Garvey to perform removal actions and to perform a remedial investigation/feasibility study (RI/FS). The removal and RI/FS activities were to be funded by Garvey through an escrow account that was established from the proceeds of the sale of the former Garvey property to AGP, as documented in the 2005 Agreement between Garvey, AGP and the EPA. The 2005 Agreement also required, among other things, that AGP implement institutional controls (ICs) on the acquired property.

The removal activities described in the AOC included monitoring private residential/business wells and providing alternate water provisions if the wells showed contamination was present above the MCLs. The AOC also required Garvey to perform an evaluation to assess the effectiveness of the SVE and GET systems in containing the OU 1 groundwater. Additionally, the AOC required Garvey to perform an RI/FS to assess the nature and extent of groundwater contamination and to evaluate potential remedial actions to address the contamination.

Between October 2005 and April 2008, Garvey performed a portion of the removal and RI/FS activities. Specifically, Garvey monitored private residential/business wells within and near the known extent of the contaminated groundwater plume and provided alternate water supplies for the impacted private-well users in the form of bottled water and whole-house carbon filtration systems. Garvey also operated the GET and SVE systems; however, Garvey did not demonstrate that it could reliably do so. The systems shut down frequently, repairs were not made in a timely manner and the GET system was nonoperational the majority of the time.

As part of its evaluation of the effectiveness of the SVE and GET systems, Garvey performed a portion of their planned field activities. These included monitoring well installation and soil, soil gas and groundwater sampling. Garvey collected soil and soil gas samples at multiple depths throughout the unsaturated zone. A total of 85 soil samples were collected at 6 locations and 227 soil gas samples were collected at 19 locations. All soil samples were nondetect for CCl_4 and chloroform ($CHCl_3$), a degradation compound of CCl_4, including samples collected between the round grain bin and the flat-storage building. The soil gas sampling indicated CCl_4 contamination of the soil gas throughout the unsaturated zone at a sample location near the former AST as well as at a location between the round grain bin and the flat-storage building. The lateral extent of contamination varied with depth, with the broadest extent being observed at approximately 80 feet bgs.

To characterize the distribution of contaminated groundwater as it migrated from the source area, Garvey collected groundwater samples at seven locations immediately east of and along the Burlington Northern and Santa Fe Railroad tracks. From each location, samples were collected at multiple depths throughout the entire thickness of the upper, medial and lower aquifers. CCl_4 contamination above the MCL was found in the upper and medial aquifers. Generally, the highest levels were found at the base of the upper aquifer, with a maximum detected concentration of 626 µg/l. This investigation was followed by the targeted installation of four multi-level monitoring wells for long-term monitoring. The characterization revealed the source area of groundwater contamination was more than 1,500 feet wide when measured perpendicular to the direction of groundwater flow.
Garvey did not complete characterization of the nature and extent of contamination downgradient of the source area.

On March 27, 2008, Garvey filed a voluntary petition for relief pursuant to Chapter 7 of the United States Bankruptcy Code in the United States Bankruptcy Court for the Northern District of Texas, Fort Worth Division. Following this development, in April 2008, the EPA directed Garvey to halt work at the Site.

The EPA has not required AGP to perform any response actions at the Site except to establish ICs and provide access to the EPA and the state. In October 2010, AGP filed the Declaration of Environmental Protection Easement and Restrictive Covenants with the Adams County Register of Deeds, which restricts the property owner from certain activities including but not limited to the following: (a) use of the groundwater underlying the property for human use or consumption, (b) causing or allowing a disturbance of the surface of the site and (c) using the property for residential purposes.

The EPA initiated Fund-financed removal actions on May 19, 2008, to address the immediate threat to human health posed by the contaminated private wells and to implement source control measures to prevent further impacts to the groundwater at the former Garvey facility. These activities included providing alternate water systems or municipal water connection of impacted and potentially impacted residential/business private-well users. They also included the source control measures of operating and maintaining the existing GET and SVE systems and enhancing these systems as necessary.

On September 26, 2008, the EPA expanded the scope of removal actions to include fabrication of an enclosure for the existing GET system, extension of municipal water supply main lines to impacted private well users and connection of those residences/businesses to the main lines. Between November 2008 and September 2009, the EPA extended municipal water supply main lines 1.44 miles and connected 19 residences whose private wells were impacted. With the exception of one currently unoccupied residence, all potentially impacted or impacted residential/business private well users have been connected to the municipal water supply. The EPA continues to maintain a whole-house carbon filtration system at the single residence still using private well water.

In addition to conducting general operation and maintenance (O&M) of the GET and SVE systems between May 2008 and July 2012, the EPA performed evaluations and made a number of significant repairs and improvements to the GET and SVE systems. The evaluations revealed numerous electrical, mechanical and control systems issues that led the EPA to conclude the GET system had been maintained in an unsatisfactory manner for a number of years and the status reports previously submitted to the EPA by Garvey, as well as contaminant removal estimates from the aquifer, were unreliable. The EPA repairs and improvements greatly enhanced the effectiveness and reliability of both systems. Table 1 summarizes a few of the most significant activities performed under the EPA's removal action authority.

Table 1- EPA Repairs and Upgrades to Garvey-constructed SVE and GET Systems		
Date	**System**	**Activity**
Aug. 2008	SVE/GET	Performed initial assessment of systems
Sept. 2008	GET	Assessed RWs by downhole video logging. Redeveloped 4 RWs (RW-1, RW-3, RW-4, & RW-5). Replaced pumps and/or motors (RW-1, RW-3, and RW-4). Wiring and electrical repairs. Collapsed well screen in RW-5.
Oct. 2008	GET	Installed high-level alarm in air stripper tower and emergency shutoff.
Nov. 2008	GET	Constructed enclosure within Quonset to prevent freezing and installed a/c in equipment control room to prevent overheating of electrical components.
Dec. 2008	SVE	Replaced system 2 blower w/ used unit.
May 2009	SVE	Removed and repaired malfunctioning system 2 blower.
July 2009	GET	Replaced malfunctioning variable frequency drives (VFDs) for all RWs. Replaced outdated programming logic controller (PLC), outdated system server, and obsolete control software.
Aug. 2009	GET	Diagnosed RW-8 flow sensor failure. Diagnosed transducer failure in RW-1 and RW-4. Diagnosed incorrect K-factor programmed into flow transmitter, giving wrong flow rate.
Sept. 2009	GET	Redeveloped RW-6 & RW-7.
Oct. 2009	SVE/GET	Replaced transducers in RW-1, RW-4, & IW-1. Replaced flow sensors for RW-4 and RW-8. Replaced undersized blower for system 2 of the SVE with properly sized unit.
Nov. 2009	GET	Upgraded cooling unit in equipment control room due to cool new VFDs.
Jan. 2010	SVE/GET	PLC suffered water damage from SVE piping failure. Power supply & PLC damaged.
May 2010	GET	Re-drilled RW-5 & installed new properly-size motor/pump. Original was oversized.
June 2010	GET	Replaced power supply and PLC. Installed replacement VFD at RW-5.
Aug. 2010	GET	Re-plumbed manifold piping on RW-1, 3, & 5 in vicinity of flow sensors to increase velocity past sensors to an appropriate range that could be accurately measured by the sensors.
Oct. 2010	GET	Installed repaired transducer in RW-1, RW-2, RW-8,and IW-1
Jan. 2011	GET	Re-plumbed manifold piping on RW-2, RW-4, RW-6, RW-7, & RW-8 in vicinity of flow sensors to increase velocity past sensors to an appropriate range that could be accurately measured by the sensors.
Mar. 2011	GET	Replaced pumps and motors in RW-6, RW-7, and RW-8 during well screen inspection.
Apr. 2011	GET	Replaced flow sensor for total system flow.
Oct 2011	GET	Inspected well screen conditions for RW-1 through RW-5. Replaced pumps and motors in RW-1 through RW-4 with properly sized pumps. Original designed pumps and motors were oversized. Moved well vault from old RW-5 and RW-6 to new RW-5 and RW-6. RW-6 was previously completed using pitless adapter.

Concurrent with Fund-financed removal actions, the EPA conducted Fund-financed RI/FS activities beginning in October 2008. Removal actions are primarily intended to address threats to human health and the environment that can be remedied in a relatively short time frame and for limited cost. Through the RI/FS process, the EPA determined that a remedial action (RA) would be necessary as conditions at the Site posed a threat to human health and the environment by exposures to the large plume of contaminated groundwater which would require long-term, costly and complex cleanup. Remedial actions, in contrast to removal actions, are intended to address threats to human health and the environment that are more complex, more costly, take longer to achieve protectiveness and require long-term management. While the final remedial solution was being developed, the EPA determined an interim RA was necessary to prevent further migration of contaminants from the OU 1 source area.

To establish the basis for taking the Interim Action, in September 2009, the EPA developed an interim data summary to summarize the existing information collected during historic and recent field investigations conducted by Garvey, the State and the EPA. The EPA developed a risk assessment memorandum to assess the potential human health risks based on the data contained in the Interim Data Summary Report. In December 2009, the EPA issued a focused FS, which relied on the data in the Interim Data Summary Report, to evaluate remedial alternatives that would address the OU I source area.

The EPA issued the 2010 Interim ROD for the OU 1 soils and groundwater in June 2010. The interim remedy included the following main components:

- Continued O&M of the GET system,
- Expansion of GET system as necessary to contain OU 1 source area,
- Continued O&M of SVE system, and
- ICs at OU 1 to prevent exposure.

The objectives of the 2010 Interim ROD were to prevent further impacts to groundwater from the OU 1 soils, prevent further migration of contaminated groundwater from the source area and reduce contamination below the MCLs in the groundwater at OU 1.

Between July 2010 and September 2011, the EPA conducted the remedial design (RD) for the interim remedy. Additional characterization of aquifer properties was performed during the RD. The effectiveness of the existing GET system was evaluated by groundwater flow modeling and it was concluded that the GET system, with some electrical, mechanical and control system modifications to improve reliability and if properly operated and maintained, could effectively prevent migration of the contaminated groundwater from the source area.

In August 2012, the EPA initiated activities to implement the interim remedy for OU 1.

While the RD and the RA were being implemented beginning in 2010, the EPA continued work on a full-scale RI/FS to evaluate a range of cleanup alternatives to address the entire Site. In April 2011, the EPA completed the RI which fully characterized the nature and extent of contamination in soil and groundwater at the Site. The RI report did not identify a PRP for the Site other than Garvey. The current owner, AGP, has, up to the current time, met the criteria set forth in CERCLA as a bona fide prospective purchaser, and, therefore, was exempt from liability. AGP did, however, enter into an Agreement with the EPA to implement ICs in accordance with the EPA's directive.

In August 2012, the EPA completed the FS and issued an FS Report that presented the development and full evaluation of RA alternatives to address the entire Site

3. Community Participation

Community-relations activities for the Site were initiated by the EPA in May 2005. Early community-relations activities included meeting with City and State officials to discuss the Site, conducting interviews with local officials and residents, establishing an information repository and preparing a community relations plan. Since 2005, the EPA has conducted periodic meetings with city of Hastings' officials to update them regarding Site work, investigation findings, and to hear the City's concerns about the project. Fact sheets containing information about the Site have been mailed to public officials, businesses and numerous citizens. The availability of an EPA technical assistance grant was announced to the public in May 2005.

The RI/FS and the Proposed Plan for Interim Remedial Action (RA) at OU 1 and OU 2 (Proposed Plan), as well as other supporting documents, were made available to the public in an administrative record (AR) on July 26, 2013. The AR can be found in the information repositories maintained at the EPA Region 7 Records Center in Lenexa, Kansas and the Hastings Public Library in Hastings, Nebraska. The EPA held a public-comment period from July 31 to August 30, 2013, following the release of the Proposed Plan. The Proposed Plan identified the preferred alternative to address the soil contamination at OU 1 and the contaminated groundwater plume at OU 2. On August 8, 2013, the EPA conducted a public meeting to discuss the EPA's preferred alternative for OU 1 and OU 2 and to receive citizens' comments and questions. At this meeting, the EPA's representatives answered questions about OU 1 and OU 2 and the remedial alternatives. The EPA did not receive any comments during the public-comment period. The Responsiveness Summary is included as Part III of this Interim ROD.

4. Scope and Role of the Operable Units and Response Action

The Site covers a large geographical area and encompasses both contaminated soil and groundwater at the source area and an associated contaminated groundwater plume extending to approximately 4 miles east-southeast from the source area. The EPA has organized the Site into two operable units:

OU 1 – The area of soil and groundwater contamination that is generally within the boundaries of the 22-acre property (Adams County parcel ID 010003207) historically used by Garvey in its grain storage facility operations, commonly referred to as the source area.

OU 2 – The area of contaminated groundwater that extends to the east-southeast from OU 1 in the direction of groundwater flow. Because the plume of contaminated groundwater continues to migrate and spread with time, the extent of OU 2 may change. The boundary of OU 2 is defined as near the maximum horizontal extent of contaminated groundwater that exceeds the MCL, regardless of depth in the aquifer (refer to Section 5.3 and Figure 4).

An Interim ROD was previously signed in 2010 (2010 Interim ROD) to address OU 1 groundwater and the risk posed by the contaminated groundwater migrating from OU 1. It was necessary to prevent further contribution of the source area to the downgradient plume area OU 2. The 2010 Interim ROD selected continued operation and upgrade of the existing GET system. The 2010 Interim ROD also addressed a portion of the OU 1 contaminated soils by including the continued operation of the existing SVE system. The EPA completed the RD to implement the 2010 Interim ROD in September 2011. The RD included upgrades to the existing GET system. In 2012, the EPA initiated the interim RA, which is scheduled for completion in 2014.

This Interim ROD addresses the soils at OU 1 and the entirety of OU 2. This Interim ROD is intended to address the risk to human health posed by the contaminated soils at OU 1, to prevent OU 1 soils from further leaching contaminants to the groundwater, to address the risk to human health posed by the contaminated groundwater at OU 2, to prevent further spread of the OU 2 plume and to restore the aquifer to its beneficial use.

With respect to OU 1 groundwater, this Interim ROD does not modify the interim remedy set forth in the 2010 Interim ROD. Further studies of the feasibility of alternatives to address OU 1 groundwater are necessary before selecting a final remedy for the entire Site. This interim action will be consistent with the final remedy.

5. Site Characteristics

This section of the Interim ROD provides a brief overview of the Site, including its physical description, climate setting, topography, hydrology, geology, hydrogeology, the nature and extent of contamination and the conceptual site model (CSM). This summary of the Site characteristics is based on previous investigations and response actions conducted by Garvey, investigations conducted by NDEQ and investigations and removal actions conducted by the EPA. Detailed information about the Site's characteristics can be found in documents in the AR, specifically the Final Remedial Investigation Report (2011) and the Final Remedial Design Field Investigation Report (2011).

5.1 Physical Characteristics

The Site is located within the Loess Plains, a portion of the Great Plains physiographic province. The area is predominately rural, with a sparse distribution of residential properties to the north, east and west of the former Garvey facility, the nearest being approximately 200 feet away. Topography of the area is relatively flat, with a slight slope to the east-southeast. The Site sits on a generally flat area with poor drainage that tends to pond water. Drainage to the east is restricted by the railroad tracks, which divert surface water northward toward Highway 6. Regionally, surface water flow is toward the south-southeast to the Little Blue River approximately 10 miles away. Pawnee Creek, the nearest named perennial surface feature, is as close as 0.5 miles south-southeast of the Site.

5.1.1 Site Geology

The general stratigraphy of Adams County is summarized from test hole drilling, monitoring well drilling, lithologic sampling and downhole geophysical logging conducted across the aerial extent of OU 1 and OU 2. These data show a general sequence of eolian silts and fine sands with occasional interbedded alluvial sediments, overlying coarser sands and gravels. These sediments are Recent to Pleistocene in age, and range in thickness from 180 to 240 feet. These sediments overlie Cretaceous-age bedrock.

The geologic units and their associated geologic characteristics are as follows:

> *Pleistocene Loess* – The Pleistocene Loess is broken down into two units, the Wisconsinan Stage Peoria Loess and the Illinoian Stage Loveland Formation. Locally, the Peoria Loess is brown/yellowish-brown and composed of predominantly silt- and fine silt-sized particles, with some clay and little sand. The Loveland is generally sandier than the Peoria, and shows greater

paleosol development. Loveland sediments are also generally redder than the Peoria. These deposits consist of occasionally sandy silts and clays, and are up to 70 feet thick. Paleosols and thin lenses of coarser-grained alluvial/fluvial sediments are present.

Pleistocene Sand and Gravel – The Pleistocene age sands and gravels occur below the loess units and extend to the bedrock surface at approximately 233 bgs. These are alluvial deposited sands and gravels containing thin layers of clay and silt. Two notable silty clay/clayey silt units are found to underlay the Site; one at approximately 130 feet bgs and the second at approximately 150 feet bgs. The upper and lower silty clay/clayey silt layers vary in thickness from 1 to 7 feet and 0.7 to 3 feet, respectively. Both silty clay/clayey silt layers are somewhat laterally extensive, and appear to slope gently to the east-southeast. They are absent at only a few locations east of OU 1. The thickness of the Pleistocene Sand and Gravel ranges from 130 to 180 feet. Gravel beds within this unit can be as thick as 10 feet. The Pleistocene sands and gravels lie unconformably on the Cretaceous bedrock. Note that the Ogallala Formation is not present beneath the Site; however, it does overlie the bedrock over about one-fifth of Adams County.

Cretaceous Bedrock – The bedrock beneath the Pleistocene Sand and Gravel in Adams County represents an erosional terrain developed on the Cretaceous age Niobrara Formation, and in some areas, remnants of the Cretaceous age Pierre Shale and the Miocene/Pliocene age Ogallala Formation. Beneath the Site, the bedrock is the Niobrara Formation, which consists of yellow and light to dark-gray marine chalky shale and chalk.

5.1.2 Site Hydrogeology

The Pleistocene sands and gravels, and where present, remnants of the Ogallala Formation, are commonly referred to as the northern High Plains aquifer or Pleistocene aquifer. Beneath the Site, the Pleistocene aquifer extends from the water table at about 115 feet bgs to the top of the weathered shale surface of the Niobrara Formation at about 230 feet bgs. The Pleistocene aquifer is typically 100 to 150 feet thick in the Hastings area. The regional groundwater flow direction is toward the east/southeast. The aquifer is highly transmissive, with historical transmissivity estimates ranging from 50,000 gallons per day per foot (gpd/ft), in the northeastern part of Adams County to more than 200,000 gpd/ft in the central part of the county. Groundwater from the Pleistocene aquifer in the Hastings area is utilized for municipal, domestic and agricultural use. Due to the heavy use of the resource, the water table in the aquifer has dropped more than 20 feet since the 1950s to 1992.

Conceptually, the Pleistocene aquifer beneath the Site has been divided into three aquifer zones: upper (A & B zones), intermediate (C zone) and lower (D & E zones). The upper aquifer zone extends from the water table at about 115 feet bgs, to 130 feet bgs, where it is divided from the intermediate (sometimes referred to as "medial") aquifer by the upper, 1- to 7-foot thick, silty clay/clayey silt unit (upper aquitard). Being significantly less permeable to groundwater flow, this unit acts as an aquitard between the upper and intermediate aquifers. It appears to be continuous across OU 1 and the majority of OU 2 and varies in thickness from 1 to 7 feet. The intermediate aquifer zone is semiconfined and extends to about 150 feet bgs, where another, slightly thinner silty clay/clayey silt unit (lower aquitard) separates it from the lower aquifer, which extends to the weathered shale bedrock. The upper aquifer is composed of slightly finer sands. The intermediate and lower aquifers consist of highly permeable sands and gravels.

Groundwater flow in the upper, intermediate and lower aquifer zones is in an east-southeast direction based on water level measurements in the more than 30 monitoring wells distributed across the Site. The following discussion of hydraulic gradients and flow direction excludes groundwater in close proximity to the currently operating OU 1 GET system, which has a strong local influence. The hydraulic gradient ranges from 0.0015 to 0.0020 feet/foot. The groundwater flow direction at the Site is consistent with the regional groundwater flow direction. At the Site, it ranges between approximately 10° to 20° south of east for all three aquifer zones. East of the north-south centerline of the city of Hastings, it does appear that the groundwater flow direction in the lower aquifer zone shifts a few more degrees in the southerly direction. A downward hydraulic gradient across the upper aquitard is consistently observed during the summer growing season due to withdrawals by irrigation wells from the intermediate and lower aquifer zones. Outside of the growing season, the downward hydraulic gradient is less, but generally still present.

Historical assessments on the availability of groundwater have indicated that aquifer transmissivity generally ranges from less than 50,000 gpd/ft in the northeastern corner and southernmost portions of the county to more than 200,000 gpd/ft in the central part of the county.

Hydraulic conductivity at the Site was characterized using geotechnical analysis and hydraulic testing of disturbed lithologic samples and in situ hydraulic tests. More than 100 lithologic samples were collected during the installation of various monitoring wells across the Site – the majority of which were located on OU 1 – and a hydraulic test well in an area upgradient of the contamination at OU 1. The distribution of grain size was calculated based on sieve analysis, and then empirical methods were used to estimate hydraulic conductivity. Additionally, the hydraulic test methods of either constant-head or falling-head permeameter testing were performed on five of the lithologic samples. A program of in situ hydraulic testing was conducted in and upgradient of OU 1 and included two pumping tests and more than 120 dipole flow tests (DFTs). The 48-hour pumping tests (24 hours pumping and 24 hours recovery) were performed in one pumping well screened in the upper aquifer zone (A/B zone) and one pumping well screened in the intermediate aquifer zone (C zone). Drawdowns during the pumping tests were monitored using a network of between 12 and 19 monitoring wells. The program of more than 120 DFTs was performed by the EPA in 2010 along the entire screened section of a specially constructed hydraulic test well located upgradient of the contamination. The well screen fully penetrates the upper, intermediate and lower zones of the Pleistocene aquifer beneath the Site as well as the upper and lower aquitards.

The hydraulic conductivity estimates from the different characterization techniques are summarized in Table 2. In general, the three aquifer zones are highly conductive and the aquitards are composed of material having significantly lower hydraulic conductivity. The average hydraulic conductivity estimates for the upper aquifer zone range from 20 feet/day from the pumping test to 124 feet/day from grain-size analyses. For the intermediate aquifer zone, hydraulic conductivity estimates range from 59 feet/day from the permeameter test to 231 feet/day from the pumping test. For the lower aquifer zone, hydraulic conductivity estimates range from 46 feet/day from the constant-head permeameter test to 137 feet/day from grain-size analysis. The variability of the estimated hydraulic conductivity values is primarily due to the heterogeneous nature of the alluvial soils underlying the Site, the differing sample collection methodology, and differences in the scale of interrogation of the tests.

Table 2 - Hydraulic Conductivity Estimates								
	Grain-size Anlayses		Permeameter Tests Constant-head / Falling-head		Dipole Flow Tests		Pumping Tests Pumping Period / Recovery Period	
Aquifer Zone or Aquitard	K_{ave} (feet/day)[a]	#[b]	K (feet/day)[c]	#[b]	K_{ave} (feet/day)[a]	#[b]	K_{ave} (feet/day)[d]	#[b]
Upper (A/B)	124	10	49	1	46[e]	2	20 / 30	2 / 1
Upper Aquitard	5.6E-02		3.4E-05	1	9	8		
Intermediate (C)	83	16	59	1	87	26	231 / 95	4 / 2
Lower Aquitard	9.4E-03		2.8E-05	1	8	4		
Lower (D/E)	137	66	46	1	80	98		

Notes:
(a) K_{ave} is the average of the hydraulic conductivity estimate for an aquifer zone/aquitard
(b) # is the number of hydraulic conductivity estimates on which K_{ave} is calculated.
(c) K for upper (A/B), intermediate (C), and Lower (D/E) aquifer zones from constant-head permeameter test. K for upper aquitard and lower aquitard from falling-head permeameter test.
(d) K_{ave} are the average of hydraulic conductivity estimates from various test analyses from pumping / recovery periods.
(e) K_{ave} represents the average of only two dipole flow tests performed near the base of the upper aquifer only and not throughout its entire thickness.

Assuming a porosity of 0.30, the linear groundwater flow velocity in the aquifer beneath the site is estimated to range from a low of 0.1 ft/day in the upper aquifer zone, to a high of 1.5 ft/day in the intermediate aquifer zone.

5.2 Known or Suspected Sources of Contamination

At the time the EPA initiated RI scoping activities in 2008 a number of field investigations had previously been performed by Garvey, NDEQ and the EPA. Garvey conducted soil and soil gas investigations to identify the source(s) areas associated with the carbon tetrachloride and other fumigant-related chemicals detected in groundwater at the site. The primary on-site source area for the carbon tetrachloride was identified as the location of the former liquid fumigant AST that held the 80-20 fumigant. The fumigant tank and distribution piping were installed in 1960 and decommissioned and removed from the site in 1986. A leak in the underground carbon tetrachloride distribution piping between the tank and the elevator silos structure was reported to be the principal cause of the soil and groundwater contamination at the Site. The EPA later conducted interviews with previous employees, who indicated that a leak in the distribution piping had occurred, but according to the CERCLA section 104(e) response, Garvey had no knowledge of what year or how much product was lost before the leak was repaired. The tank was formerly located on the north side of the grain silos, with underground piping extending south to the silo and then up the outer wall of the silo. Soil gas sampling conducted by Garvey indicated additional source areas for carbon tetrachloride and the other fumigant chemicals may be present at the Site. Soil gas sampling results for various depths revealed that several Site buildings or features were underlain by areas of carbon tetrachloride contamination of soil gas, including the following:

- Flat-storage building;
- Existing circular grain bin;
- Area to the east and southeast of the flat storage; and
- Area near the MW-3 well cluster, former Garvey water supply well, and eastward toward the rail spur.

Based on past operational practices at the site, the following known and suspected sources of carbon tetrachloride contamination at the Site were identified:

Former AST – Described above.

Grain Elevator Silos – The main silos aligned approximately east to west were constructed in 1959. The silos at the east end of facility and aligned approximately north to south were constructed in 1962. Liquid 80-20 fumigant was used from 1959 to 1985. The liquid 80-20 fumigant was pumped to the gallery that ran over the top of the silos, routed to the application piping, and into the top of the specific silo(s) needing application of the fumigant.

Flat-storage building – Grain augured into the flat-storage building from the elevators grain that had been treated with liquid 80-20 fumigant.

Steel Grain Bins – Three large-capacity, vertical, round, steel grain bins were located at the site. One currently remains at the Site. The date of removal of the other two grain bins is unknown.

Railroad Spur and Construction Debris Disposal Pit – According to the Garvey Elevators 104(e) response, a fumigant was used occasionally to fumigate a railcar loaded with grain that required treatment. This fumigant purportedly did not contain carbon tetrachloride. A dumping area purportedly used for construction debris and cleaning fluids was identified from aerial photos.

Fumigant Applicator Wash Area – The area consisted of a concrete pad at the rear of the office/shop building used as a wash area for fumigant and herbicide applicators and equipment.

In addition to carbon tetrachloride, other pesticides are or were used at the Site. The 2003 PA/SI conducted by NDEQ identified other pesticides formerly used at the Site and locations where they were stored. The following other potential sources of contamination were identified:

- A 500-gallon diesel fuel AST;
- Ground-mounted electrical transformers exhibiting oil stained surfaces and lacking clear labeling regarding the polychlorinated biphenyl (PCB) content of dielectric oil;
- Pesticide storage building; and
- Multiple locations where various containers of roofing materials, paints and petroleum products were stored:
    - Shop Building
    - Machine Room
    - Outdoor Drum Storage

5.3 Nature and Extent of Contamination

RI field activities were conducted at the Site to define the nature and extent of contamination in the sediment, surface soil, subsurface soil, subslab soil gas and groundwater at OU 1 and the groundwater at OU 2. Field investigations at OU 1 focused on those areas where contaminants were known to have been or potentially could have been released. These areas included the known source area of the former AST and buried piping, areas where pesticides or herbicides may have been stored or disposed of, areas where fumigant application equipment was washed and areas where electrical transformers were positioned.

At OU 1, sediment samples were collected from eight locations in the natural drainageways. All samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides, herbicides and PCBs. With the exception of one sampling location between the railroad tracks east of the main silos, contaminants were below screening levels for residential soil. At the sample location between the tracks, the SVOCs benzo(a)pyrene and benzo(b)fluoranthene were both detected at concentration of 230 ug/kg, which exceeds the residential soil screening levels of 15 and 150 µg/kg, respectively. Comparing the observed concentrations to their industrial soil screening levels of 210 and 2100 ug/kg, respectively, benzo(a)pyrene is the only contaminant that is in exceedance. The contaminants at this location are believed to be unrelated to Garvey's activities at the Site. The source of the benzo(a)pyrene and benzo(b)fluoranthene is likely the nearby asphalt pad or the ties supporting the railroad tracks.

Surface soil samples were collected from 19 locations across OU 1 at depths between 0 and 1.5 feet bgs. Depending on their location relative to known or suspected source areas and the type of contaminants potentially released in these areas, the samples were analyzed for VOCs, SVOCs, pesticides, herbicides and/or PCBs. The results indicated there were no contaminants detected above screening levels for residential soil. Aroclor 1248 (a PCB) was detected in one surface soil sample near the transformer pad on the south side of the main elevator, but was below the screening level. The source was likely the oil from the transformer.

Subsurface soil sampling was performed at multiple depths at 31 locations across OU 1. At one location near the former AST, soil sampling was performed approximately every 5 feet to a depth of 81.5 feet bgs. The other locations were sampled to total depths ranging between 10 and 20 feet bgs. Samples were analyzed for one or more of the following groups of contaminants: VOCs, SVOCs, pesticides, herbicides and PCBs. A total of 108 subsurface soil samples from 27 locations across OU 1 were analyzed for VOCs.

CCl_4 and/or $CHCl_3$ were detected above the screening levels for the protection of groundwater at two locations, near the former AST and near the buried piping that transferred the fumigant from the AST to the grain elevator. At the location near the AST, the only CCl_4 exceedance found was at 7 feet bgs. At the location near the buried piping, CCl_4 exceedances were found at all four depths sampled from 4 to 20 feet bgs. There were no detections of herbicides or PCBs in the subsurface soil samples. Naphthalene, an SVOC, was detected above its screening level at one location near the fumigant applicator wash area. Heptachlor epoxide, a pesticide, was detected in one location, but the concentration was below its screening level. Based on these results, it appears that soil contamination is present in the area directly adjacent to or beneath the former liquid fumigant AST and near the buried piping between the AST and the elevator. Subsurface soil samples collected from locations north, south and east of the former AST did not contain CCl_4 or its degradation product $CHCl_3$.

Prior to Fund-financed RI/FS activities, Garvey performed a soil gas survey to define the extent of soil gas contamination. Garvey sampled 19 locations across the Site. At each location, soil gas samples were collected every 10 feet down to a depth of 115 feet bgs. In general, the aerial extent of soil gas contamination expands with increasing depth. At depths approaching the water table, a large portion of OU 1 is found to contain CCl_4 in the soil gas at levels above 500 $\mu g/m^3$. At the 70 foot bgs depth, the maximum CCl_4 concentration observed was 10,000 $\mu g/m^3$ near the railroad spur in the southern part of

OU 1. Between 80 and 115 feet bgs, contamination is widespread across OU 1, with the highest level of 79,900 $\mu g/m^3$ observed just east of the scale house.

Ten subslab soil gas samples were collected within two facility buildings: the office/shop building and the shop area of the maintenance building. These samples were collected to evaluate if vapor concentrations in the soil gas directly beneath the building slab might be considered an indoor worker health and safety issue due to their proximity to the former location of the liquid fumigant AST. Ten indoor air samples were also collected in the two buildings, along with two ambient outside air samples. These samples were collected to evaluate whether subslab contaminants were present in the building, and, if so, whether they exceeded screening levels.

Three subslab soil gas samples from the office/shop building, as well as three samples from the maintenance building, were found to have concentrations that exceeded the screening levels for industrial indoor air for one or more of the following compounds: $CHCl_3$, CCl_4, tetrachloroethene (PCE) and trichloroethene (TCE). However, with the exception of three TCE detections in the maintenance building, none of the compounds were detected above screening levels in the indoor air samples. The compounds 1,2-dichloropropane, benzene, ethylbenzene and methylene chloride were detected above industrial indoor air screening levels in the indoor air samples. Since these compounds were not detected in the subslab soil gas, their presence is attributed to compounds used within the shop. The carbon tetrachloride and its degradation compound chloroform appear to be related to the liquid fumigant. The detections of PCE and TCE may be related to the small-scale use of solvents at the facility for parts washing.

Groundwater contamination at OU 1 was characterized based on 146 samples collected from 40 direct-push technology (DPT) boring locations as well as 416 samples collected from 46 monitoring wells. CCl_4, the primary contaminant of concern (COC) in OU 1 groundwater, was found at its highest concentrations in the upper aquifer immediately downgradient of the location of the former CCl_4 AST shown in Figure 2. The width of the CCl_4 plume, measured perpendicular to the direction of groundwater flow, has been interpreted to be approximately 2,500 feet wide in the vicinity of the railroad tracks at the eastern boundary of the Site. While CCl_4 is more widespread and observed at its highest concentrations in the upper aquifer, it has been detected at significantly lower concentrations in the medial aquifer at the source area. $CHCl_3$, a compound formed as CCl_4 degrades, was detected on a consistent basis in areas where high CCl_4 levels are present. Benzene was not detected in monitoring well samples, but was detected at levels less than its MCL in three DPT sampling locations. TCE was detected in samples from one DPT sampling location at a level that exceeded its MCL. TCE was detected in two MWs at levels that were less than its MCL.

Groundwater contamination at OU 2 was evaluated using a combination of DPT borings and monitoring well sampling (Figure 4). In late 2009, 145 groundwater samples were collected from multiple depths at 19 DPT locations. The DPT locations were positioned along four transects oriented approximately perpendicular to the regional groundwater flow direction. These data were supplemented with the results of 53 groundwater samples collected in early 2008 from six DPT locations during characterization of the West Highway 6 & Highway 281 site located ½ mile northeast of the Site. The optimal locations in which to place additional monitoring wells were identified by interpreting the extent of the CCl_4 plume from DPT groundwater sampling. The wells are distributed within and just outside the perimeter of the groundwater contaminant plume. A total of 269 groundwater samples were collected from the 39 OU 2 MWs during the period October 2008 through March 2013.

The extent of the CCl_4 plume in the groundwater as defined by the highest concentrations observed at each location, regardless of depth, is illustrated in Figure 4. Figure 5 illustrates the CCl_4 plume in a vertical cross-section along the C-C' line shown in Figure 4. Figure 6 illustrates the CCl_4 plume in vertical cross section along the E-E' line. The CCl_4 plume in Figures 4, 5 and 6 were constructed using results from the 2009 DPT sampling event, the June 2010 MW sampling event, as well as the 2008 DPT sampling event at the West Highway 6 & Highway 281 site. There is a slight downward component to groundwater flow and this is reflected in the transport of the CCl_4 as the plume migrates from OU 1. Table 3 summarizes the highest concentrations of the contaminants of potential concern (COPCs) observed since the start of RI activities in October 2008. The only other VOCs detected in OU 2 were $CHCl_3$ and benzene. Benzene was detected in only two DPT locations in OU 2 at levels less than the MCL and does not appear to be attributable to the Garvey OU 1 source area.

Table 3 - Groundwater COPCs

COPC	Maximum Concentration (µg/l) Detected / DPT or MW location		EPA MCL (µg/l)
	OU 1	OU 2	
1,2-DCA	1.2 / MW-51B	ND	5
CCl_4	2200 / MW-51B	770/MW-46D1	5
$CHCl_3$	190 / DPT-20D	140/TS1-01	70 [(1)]
Benzene	4 / SB-37	3.9 TS4-01	5
TCE	6.8 / SB-38	ND	5

1,2-DCA – 1,2-Dichloroethane

[(1)] $CHCl_3$ has an maximum contaminant level goal (MCLG) of 70 µg/l. $CHCl_3$, bromodichloromethane, dibromochloromethane, and bromoform are trihalomethanes (THM). The EPA has established an MCL of 80 µg/l for total THM.

6. Current and Potential Future Site and Resources Uses

The land use at OU 1 is light industrial (I-1). OU 1 is currently the location of an active, 8-million-bushel-capacity, grain storage facility. The grain storage facility is currently owned and operated by AGP. AGP also owns the 84 acres bounding OU 1 on the north, west and south (refer to Figure 2). AGP, as purchaser of the property and under the terms of a 2005 Agreement among the EPA, Garvey and AGP, agreed to execute and record in the Recorder's Office of Adams County, an easement, running with the land (CERCLA Docket No. 07-2005-0268). In October 2010, AGP filed the Declaration of Environmental Protection Easement and Restrictive Covenants with the Adams County Register of Deeds, which restricts the property owner from certain activities including but not limited to the following: a) use of the groundwater underlying the property for human use or consumption, (b) causing or allowing a disturbance of the surface of the site and (c) using the property for residential purposes. The easement grants access for response activities at or near the Site and grants the right to enforce land/water use restrictions that EPA determines necessary to implement, ensure noninterference with or ensure the protectiveness of the response actions to be performed at or near the Site. The land use east of OU 1, and in those areas above the downgradient groundwater plume in OU 2, is a mix of agricultural, residential and commercial. It is anticipated that current land usage at and in the immediate vicinity of OU 1 will remain unchanged for the foreseeable future. The nearest residential developments are approximately 1 mile to the northeast and east. However, isolated residences lie within ⅛ to ¾ of a mile from OU 1.

Groundwater in the area is heavily utilized in areas within and surrounding the Site for domestic, irrigation and commercial uses. Garvey previously utilized a private water well to meet its water supply needs at the grain storage facility. In March 18, 1996, Garvey was connected to the municipal water supply and capped its private water well sometime in 1996. There are currently no water supply wells at OU 1. The majority of land in areas above the OU 2 groundwater plume is outside the city limits of Hastings, and until 2008, a majority of the residential properties in these areas were not served by municipal water from the City. Beginning in 2008, and under authority pursuant to the CERCLA removal program, the EPA extended 1.44 miles of municipal water lines to connect all but one residence/business whose private water wells had been impacted. To address the sole residence not currently connected to the municipal supply, up until recently the EPA was maintaining a whole-house, carbon-filtration system to treat the water from its private well. However, according to recent information the house is unoccupied.

The groundwater in the vicinity of OU 1 has been designated as a Class GA Ground Water Supply by the state of Nebraska. A Class GA Ground Water is a groundwater supply which is currently being used as a public drinking water supply or is proposed to be used as a public drinking water supply. Contamination detected at OU 1 caused the State to designate the Site as a Remedial Action Class 1 (RAC-1), requiring the "most extensive remedial action measures" to clean up the groundwater to drinking water quality suitable for all beneficial uses. The selected remedial action is necessary to ensure that the contaminated groundwater is cleaned up and the aquifer returned to beneficial use within an acceptable time frame.

7. Conceptual Site Model

The illustrated CSM that presents potential human exposure scenarios at OU 1 and OU 2 is shown in Figure 7. The primary source of contamination is the former AST and the buried transfer piping between the AST and the elevator silos. The 3,000-gallon AST was installed in 1960. The AST and buried transfer piping were removed in 1986. Garvey used a liquid mixture of CCl_4 and CS_2 as a grain fumigant from 1959 to 1985. It is unknown for certain whether or not the fumigant mixture contained EDB; however, sampling efforts to date would not suggest it did.

Liquid 80-20 fumigant, and possibly other VOCs, are known or suspected to have been released to the environment through the following mechanisms: breaks or corrosion of the underground piping reported to have once occurred in the mid-1970s, leaks and drips at the valves on the AST over the operational period of the tank, improper application of fumigants to railcars, spills during the transfer of fumigants from the AST to the railcars, and improper use of fumigant in burrows to kill mammalian pests. The volume of 80-20 fumigant released to the subsurface by the above mechanisms is unknown.

The soil at OU 1 was contaminated with VOCs (primarily CCl_4) as a result of these releases. The release mechanism of leaching resulted in transport of dissolved CCl_4 to the water table where it then impacted the groundwater and migrated in the general direction of groundwater flow. The release mechanism of volatilization from the soil may have the potential to impact outdoor and indoor air quality. The release mechanism of surface transport by surface runoff/erosion may have the potential to impact surface water. Fugitive dust may be emitted during construction activities that encounter contaminated soils.

Receptors can potentially be exposed to contaminated media a number of ways: (1) through ingestion, dermal contact, or inhalation of on-property surface soil; (2) through ingestion, dermal contact, or inhalation of on-property subsurface soil; (3) ingestion or dermal contact with surface water; (4) ingestion or dermal contact with sediment; (5) inhalation of ambient air; (6) inhalation of indoor air; and (7) ingestion or dermal contact with groundwater. Note that the exposure media of on-property subsurface soil is considered to be those soils from 6 inches to 10 feet bgs since, in the future, construction activities were assumed to be limited to a depth of 10 feet. Direct exposure to deeper soils was not evaluated.

A range of potential human receptors, both current and future could potentially be exposed. These include the off-property resident, current and future indoor industrial worker, current and future outdoor industrial worker, future construction worker, current and future trespasser and future on-property resident. For purposes of the CSM, future scenarios are hypothetical and assume unlimited and unrestricted use.

The illustrated CSM that presents potential ecological exposure scenarios at OU 1 is shown in Figure 8. Because the groundwater does not discharge to any surface water feature, the groundwater-to-surface water discharge pathway is not a complete migration pathway for this Site. Surface water features are intermittent at OU 1, with surface water only being present after large rain events. Therefore, it is not considered to provide a pathway by which aquatic receptors could be exposed to Site contaminants. Under current Site conditions, terrestrial receptors could be exposed to contaminants in the surface soil outside the current building footprints and sediments in the drainage ditches. In the future, if the buildings and foundations were removed, terrestrial receptors could be exposed to contaminants present in the soil beneath the buildings. Plants, soil invertebrates, mammals and birds could be exposed directly to the contaminants. Indirect exposure to mammals and birds could occur via consumption of food items (plants, invertebrates, small mammals) that may have accumulated soil contaminants within their tissues.

8. Summary of Site Risks

Superfund requires the EPA to seek permanent solutions to protect human health and the environment from hazardous substances. These solutions provide for removal, treatment or containment of hazardous substances, pollutants and contaminants so any remaining contamination does not pose an unacceptable risk to human receptors, ecological receptors or the environment. A baseline human health risk assessment (HHRA), screening level ecological risk assessment (SLERA) and an assessment of the leaching potential of contaminated soils were performed to quantify the risks and/or hazards.

8.1 Summary of Human Health Risk Assessment

An HHRA was conducted for the Site as part of the RI/FS to estimate the risks and hazards to human receptors associated with current and future potential uses. The HHRA is an analysis of the potential adverse human health effects caused by exposure to the hazardous substances in the absence of any actions to control or mitigate the exposures.

A four-step process is used in the HHRA to assess the site-related cancer risks and noncancer health hazards. The four-step process is comprised of identification of COPCs and calculation of exposure point concentrations (EPCs), assessment of potential exposures, assessment of toxicity of COPCs and risk calculation based on exposures, toxicity and concentrations of COPCs. From a human exposure perspective, sediment was treated as soil in the risk assessment. The intermittent nature of surface water features at the Site causes sediment to act as surface soil in the context of exposure because it is not submerged most of the time.

8.1.1 Media and Contaminants of Concern

The HHRA began with identifying COPCs in the various media (i.e., soils, groundwater and sediment) that could potentially cause adverse health effects in exposed populations. In this assessment, EPCs were estimated using the maximum detected concentration of a contaminant. Chronic daily intakes were calculated based on the reasonable maximum exposure (RME), which is the highest reasonably anticipated to occur at the Site. The RME is intended to estimate a conservative exposure scenario that is still within the range of possible exposures. COPCs were then identified through comparison of maximum detected or estimated concentrations to risk-based screening levels. The exposure media in the CSM in Figure 7 are defined as follows: on-property surface soil is represented by samples collected from 0 to 6 inches bgs; on-property subsurface soil are represented by samples collected from 6 inches to 10 feet bgs; sediment is represented by samples collected from areas where intermittent drainages occur on the Site; and indoor air is represented soil gas samples collected beneath the concrete building slabs (commonly referred to as subslab samples). Note that the exposure media of on-property subsurface soil was characterized by samples limited to a depth of 10 feet or less since in the future, construction activities were assumed to be limited to a depth of 10 feet. Direct exposure to deeper soils was not evaluated.

In general, there is little evidence that surface soils are affected by activities at the former grain storage facility on the Garvey property, as indicated by the fact that carbon tetrachloride was not detected in surface soils. Because the surface soil data do not indicate a pattern or trend to chemical distribution, all the surface soil data was used to calculate the EPC. For the subsurface soil, the sample locations selected for consideration in the risk assessments are considered representative of the more contaminated subsurface soil on the Garvey property. These samples were used so that the most conservative estimates are considered when calculating risk from exposure to shallow subsurface soil. Consistent with the surface soil, there is little evidence that sediments are affected by activities at the former grain storage facility. All sediment sampling data were used to calculate the EPC. In an effort to use the most conservative data to characterize the indoor air exposure media, only samples with detections were used when calculating the EPC.

Table 4 lists the COPCs for exposure scenarios in which the EPCs exceeded their respective screening levels. It is important to note that neither the media of on-property surface soils nor the on-property subsurface soils were found to exceed screening levels for direct contact with potential human receptors. At the end of the risk-assessment process, those COPCs found to pose an unacceptable human or ecological risk, called risk drivers, are identified as COCs.

Table 4– Summary of COPCs and Media Specific Exposure Point Concentrations												
Operable Unit	Scenario Timeframe	Media	Exposure Media	Exposure Point	Chemical of Concern	Concentration Detected			Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure[2]
						Min[1]	Max[1]	Units				
OU 1	Current/ Future Non-construction	Sediment	Sediment	Site Sediment	Benzo(a)pyrene	2.3E-01	2.3E-01	mg/kg	1/10	2.3E-01	mg/kg	MAX
					Benzo(b)fluoranthene	2.3E-01	2.3E-01	mg/kg	1/10	2.3E-01	mg/kg	MAX
	Future Construction	Sediment	Sediment	Site Sediment	Benzo(a)pyrene	2.3E-01	2.3E-01	mg/kg	1/10	2.3E-01	mg/kg	MAX
	Future Residential	Groundwater	Groundwater	Groundwater	Benzene	8.6E-01	4.0E+00	ug/L	4/25	4.0E+00	ug/L	MAX
					Carbon Tetrachloride	1.8E+00	1.3E+03	ug/L	25/25	1.3E+03	ug/L	MAX
					Chloroform	1.2E+00	1.8E+01	ug/L	16/25	1.8E+01	ug/L	MAX
					Trichloroethene	3.7E+00	7.3E+00	ug/L	3/25	7.3E+00	ug/L	MAX
	Future Residential	Soil	Soil Gas	Indoor Air	Chloroform	6.3E-01	9.3E+00	ug/m^3	3/6	9.3E+00	ug/m^3	MAX
					Tetrachloroethene	2.3E+00	1.4E+02	ug/m^3	6/6	1.4E+02	ug/m^3	MAX
					Trichloroethene	4.0E+00	4.0E+00	ug/m^3	1/6	4.0E+00	ug/m^3	MAX
	Current Indoor Industrial	Soil	Soil Gas	Ambient Air	Chloroform	6.3E-01	9.3E+00	ug/m^3	3/6	9.3E+00	ug/m^3	MAX
					Tetrachloroethene	2.3E+00	1.4E+02	ug/m^3	6/6	1.4E+02	ug/m^3	MAX
OU 2	Current Residential	Groundwater	Groundwater	Tap Water	Carbon Tetrachloride	6.1E-01	9.6E+02	ug/L	114/114	9.6E+02	ug/L	MAX
					Chloroform	2.6E-01	1.4E+02	ug/L	42/107	1.4E+02	ug/L	MAX
					1,2-Dichloroethane	3.0E+00	3.0E+00	ug/L	1/102	3.0E+00	ug/L	MAX
Notes:	(1) Minimum/Maximum detected concentrations (2) The statistical measure of detections that is used for screening.											

8.1.2 Exposure Assessment

The purpose of the exposure assessment is to estimate the way a receptor could be exposed to chemicals at the Site; quantify potential receptor characteristics such as location, the presence of sensitive sub-populations, and the activity patterns of current and future receptors; and the duration of the exposure. These are then used to quantify the exposure. The intensity of the exposure is dependent on the receptor characteristics of the receptor and the concentrations of the chemicals. The CSM identified potential receptors based on a simple particle tracking process linking contaminant sources to potential receptors though environmental transport and fate mechanisms (Figure 7). The CSM serves to identify the types of potential receptors and potential routes of exposure under current and plausible future conditions. Exposure assessment involves projecting concentrations along potential pathways between sources and receptors. The projection is accomplished using Site-specific data, and, when necessary, modeling.

Pathways that are potentially complete are identified on the CSM (Figure 7). In addition to an adult receptor, which was assumed for all pathways, an adolescent, age-adjusted and/or child receptor were also considered for certain pathways.

Potentially contaminated media associated with the Site include sediment, groundwater and air. Because permanent surface water features are not present on the property, surface water was not considered a complete exposure pathway. From a human-exposure perspective, sediment was treated as soil in the risk assessment. The intermittent nature of surface water features at the Site causes sediment to act as surface soil in the context of exposure because it is not submerged most of the time. The Site is currently an industrial setting.

The land use scenarios included the following potential exposure pathways and populations:

- Current and Future Indoor Industrial Workers: ingestion of surface soil, inhalation of volatiles from surface soil, inhalation of fugitive dust and inhalation of vapors from soil gas via vapor intrusion in.

- Current and Future Outdoor Industrial Workers: ingestion and dermal adsorption of sediment and inhalation of volatile and fugitive dust emissions.

- Future Construction Workers: ingestion and dermal adsorption of sediment and inhalation of volatile and fugitive dust emissions.

- Current and Future Trespassers: ingestion and dermal adsorption of sediment and inhalation of volatile and fugitive dust.

- Current Off-property Residents: ingestion, dermal adsorption and inhalation of VOCs from domestic use of groundwater, and ingestion and dermal adsorption of VOCs from groundwater used for irrigation.

- Future On-property Residents: ingestion and dermal adsorption of sediment; inhalation of volatile and fugitive dust emissions from sediment; inhalation of volatiles from vapor intrusion; ingestion, inhalation and dermal adsorption of volatiles from domestic use of groundwater; and ingestion and dermal adsorption of volatiles from groundwater used for irrigation. For cancer risk, the most conservative approach is to use the age-adjusted resident. This approach assumes that the resident lives 30 years at the Site—6 years as a child and 24 years as an adult.

8.1.3 Toxicity Assessment

Toxicity assessment identifies the types of potential adverse health effects associated with exposure to a contaminant and how the appearance of these adverse health effects is related to the exposure level. Human health risk assessments typically characterize potential noncancer health and cancer health effects separately. They are evaluated separately because for noncancer health effects it is assumed there is a level, or threshold, which will not result in adverse health effects, while for cancer effects it is typically assumed that exposure to any level will increase the risk or probability of developing cancer (i.e., no threshold exists).

There are five standard descriptors used to describe a chemical carcinogenic hazard potential based on a weight of evidence analysis. They are as follows: "Carcinogenic to Humans," "Likely to be Carcinogenic to Humans," "Suggestive Evidence of Carcinogenic Potential," "Inadequate Information to Assess Carcinogenic Potential," and "Not Likely to be Carcinogenic to Humans." Both carbon tetrachloride and chloroform are classified as "Likely to be Carcinogenic to Humans."

Toxicity values were obtained from the following hierarchy of sources in accordance with the EPA's Office of Superfund Remediation and Technology Innovation:

- Tier 1 – Integrated Risk Information System
- Tier 2 – Provisional Peer-Reviewed Toxicity Values
- Tier 3 – Other peer-reviewed values including: Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels; Califo rnia Environmental Protection Agency (Cal/EPA); and the EPA Health Effects Assessment Summary Tables values (HEAST).

Carcinogenic toxicity information which is relevant to the COCs, is provided in Table 5. Table 6 provides noncancer toxicity data for COCs. As was the case for the carcinogenic data, dermal reference doses (RfDs) were extrapolated from the oral RfDs after applying an appropriate adjustment factor.

Table 5 – Cancer Toxicity Data Summary

Pathways: Ingestion and Dermal

COPC	Oral Cancer Slope Factor		Adjusted Dermal Slope Factor[1]		Weight of Evidence / Cancer Guideline Description	Oral CSF	
	Value	Units	Value	Units		Source	Date[2]
1,2-Dichloroethane	9.1E-02	$(mg/kg\text{-}day)^{-1}$	9.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	May 2010
Benzene	5.5E-02	$(mg/kg\text{-}day)^{-1}$	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	May 2010
Carbon Tetrachloride	7.0E-02	$(mg/kg\text{-}day)^{-1}$	7.0E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	May 2010
Chloroform	3.1E-02	$(mg/kg\text{-}day)^{-1}$	3.1E-02	$(mg/kg\text{-}day)^{-1}$	N/A	CalEPA	May 2010
Trichloroethene	5.9E-03	$(mg/kg\text{-}day)^{-1}$	5.9E-03	$(mg/kg\text{-}day)^{-1}$	N/A	CalEpA	May 2010
Benzo(a)pyrene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	May 2010
Benzo(b)flouoranthene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	7.3E-01	$(mg/kg\text{-}day)^{-1}$	N/A	RSL	May 2010

Pathway: Inhalation

COPC	Unit Risk		Weight of Evidence/Cancer Guideline Description	Unit Risk Inhalation CSF	
	Value	Units		Source	Date[2]
1,2-Dichloroethane	2.6E-05	$(\mu g/m^3)^{-1}$	B2	IRIS	May 2010
Benzene	7.8E-06	$(\mu g/m^3)^{-1}$	A	IRIS	May 2010
Carbon Tetrachloride	6.0E-06	$(\mu g/m^3)^{-1}$	B2	IRIS	May 2010
Chloroform	2.3E-05	$(\mu g/m^3)^{-1}$	B2	IRIS	May 2010
Tetrachloroethene	5.9E-06	$(\mu g/m^3)^{-1}$	N/A	CalEPA	May 2010
Trichloroethene	2.0E-06	$(\mu g/m^3)^{-1}$	N/A	CalEPA	May 2010
Benzo(a)pyrene	1.1E-03	$(\mu g/m^3)^{-1}$	N/A	CalEPA	May 2010
Benzo(b)flouoranthene	1.1E-04	$(\mu g/m^3)^{-1}$	N/A	CalEPA	May 2010

Notes:
IRIS – Integrated Risk Information System
Cal/EPA – California EPA
RSL – Oak Ridge National Laboratory Regional Screening Level Table
CSF – Cancer Slope Factor
mg/kg-day – milligrams per kilogram per day
$\mu g/m^3$ – micrograms per cubic meter

Weight of Evidence: A – Human carcinogen; B2 – Probable human carcinogen (indicates sufficient evidence in animals and inadequate or no evidence in humans; N/A – Not available.

[1] (Oral CSF)/(Oral to Dermal Adjustment Factor) = Adjusted Dermal CSF. Oral to Dermal Adjustment Factor =1. Source: RAGS Vol 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA, 2004.
[2] For IRIS values, date that IRIS was searched. For RSL values, date table was downloaded. For PPRTV values, date the file was downloaded from the database.

Table 6 – Noncancer Toxicity Data Summary

Pathways: Ingestion and Dermal

Chemical of Potential Concern	Chronic / Subchronic	Oral RfD		Dermal RfD		Primary Target Organ	Combined Uncertainty / Modifying Factors	Source of RfD: Primary Target Organ Source(s)	Date of RfD: Primary Target Organ Source
		Value	Units	Value	Units				
1,2-Dichloroethane	Chronic	2.0E-02	mg/kg-day	2.0E-02	mg/kg-day	N/A	N/A	PPRTV	May 2010
Benzene	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Lymphocytes	300/1	IRIS	May 2010
Carbon Tetrachloride[1]	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Liver	1000/1	IRIS	May 2010
Chloroform	Chronic	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	Liver	100/1	IRIS	May 2010
Trichloroethene	-	NV	mg/kg-day	NV	mg/kg-day	N/A			
Benzo(a)pyrene	-	NV	mg/kg-day	NV	mg/kg-day	N/A			
Benzo(b)fluoranthene	-	NV	mg/kg-day	NV	mg/kg-day	N/A			

Pathway: Inhalation

Chemical of Potential Concern	Chronic / Subchronic	Inhalation RfC[2]		Primary Target Organ	Combined Uncertainty / Modifying Factors	Source of RfD: Primary Target Organ Source(s)	Date of RfD: Primary Target Organ Source
		Value	Units				
1,2-Dichloroethane	Chronic	2.4E+00	mg/m^3	N/A	N/A	ATSDR	May 2010
Benzene	Chronic	3.0E-02	mg/m^3	Lymphocytes	300/1	IRIS	May 2010
Carbon Tetrachloride[1]	Chronic	1.0E-01	mg/m^3	Liver	100/1	IRIS	May 2010
Chloroform	Chronic	9.8E-02	mg/m^3	N/A	N/A	ATSDR	May 2010
Tetrachloroethene	Chronic	2.7E-01	mg/m^3	N/A	N/A	ATSDR	May 2010
Trichloroethene	-	NV	mg/m^3	N/A	-	-	-
Benzo(a)pyrene	-	NV	mg/m^3	N/A	-	-	-
Benzo(b)fluoranthene	-	NV	mg/m^3	N/A	-	-	-

Notes:
ATSDR – Agency for Toxic Substances and Disease Registry
IRIS – Integrated Risk Information System
mg/m^3 – milligrams per cubic meter
mg/kg-day – milligrams per kilogram per day
RfC – Reference Concentration
RfD – Reference Dose

(1) Carbon tetrachloride toxicity values are based on IRIS values published in 1987. An IRIS reassessment of carbon tetrachloride was published on March 31, 2010.
(2) Refer to RAGS, Part A and text for an explanation. Adjusted Inhalation RfD (mg/kg/day) = Inhalation RfC (mg/m^3) x 20 (m^3/day)/70 kg.

8.1.4 *Risk Characterization*

This section summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of Site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for noncancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, an incremental lifetime cancer risk (ILCR) of 1.0E-04 (or 10^{-4}) means a "one in 10,000 excess cancer risk," or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the exposure assessment. ILCR is calculated from the following equation:

$$ILCR = CDI \times CSF$$

where:

ILCR	=	a unitless probability (e.g., 2E-05[5]) of an individual's developing cancer
CDI	=	Chronic daily intake averaged over 70 years (mg/kg-day)
CSF	=	Cancer slope factor $(mg/kg\text{-}day)^{-1}$

Current Superfund regulations for acceptable exposures specify an upper value of excess cancer risk as between 10E-04 to 10E-06. The goal of protection is less than 10E-06 for cancer risk.

For noncarcinogens, the potential for a receptor to develop an adverse health effect is estimated by comparing the predicted level of exposure for a particular chemical (e.g., chronic daily intake) with the highest level of exposure that is considered protective (i.e., its RfD). The ratio of chronic daily intake (i.e., exposure) to RfD (i.e., toxicity) is termed the hazard quotient (HQ) and is calculated as follows:

$$HQ = CDI/RfD$$

where:

RfD	=	Reference dose (mg/kg-day)
CDI	=	Chronic daily intake (mg/kg-day)

CDI and RfD represent the same exposure period (i.e., chronic, subchronic or short term).

The Hazard Index (HI) is generated by adding the HQs for all COCs that affect the same organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposures may present a risk to human health.

The calculated carcinogenic risk and noncarcinogenic risk for each exposure scenario are presented in Tables 7 and 8, respectively. The calculated risks are compared to the EPA's target cancer range of 10E-06 to 10E-04 for carcinogenic effects and an HI of 1 on a target organ basis for noncarcinogenic effects. Chemicals which are estimated to cause a cancer risk greater than 10E-04 or an HI of 1 are typically those that will require remedial action at the site and are referred to as COCs.

Current and Future Industrial Worker (Indoor and Outdoor) – The current and future indoor industrial worker scenario was evaluated for the exposure to COPCs in sediment via incidental ingestion and inhalation as well as from subslab vapor intrusion into indoor air. The total ILCR for all pathways is 8.4E-05, which is less than the EPA's threshold of 10E-04. The total HI is 0.1, which is less than the threshold of 1. The current and future outdoor industrial worker was evaluated for the exposure to COPCs in sediment via ingestion, dermal absorption and inhalation. Because the two COPCs do not have noncancer toxicity values, the total HI is zero. The total ILCR for all pathways is 1.1E-06, which is less than the EPA's threshold of 10E-04. Based on this evaluation, the COPCs in sediment do not present a significant risk to a current or future indoor or outdoor industrial worker under the assumed exposure conditions.

Future Construction Worker – The future construction worker was evaluated for exposure to COPCs in sediment via ingestion, dermal absorption and inhalation. Because the COPC does not have a noncancer toxicity value, the total HI is zero. The total ILCR for all pathways is 1.1E-07, which falls below the EPA's threshold of 1.0E-04. Based on this evaluation, the COPCs in sediment do not present a significant risk to a future construction worker under the assumed exposure conditions.

Current and Future Trespasser – The current and future adolescent trespasser was evaluated for the exposure to COPCs in sediment via ingestion, dermal absorption, and inhalation. Because the two COPCs do not have noncancer toxicity values, the total HI is zero. The total ILCR for all pathways is 2E-07, which falls below the EPA's threshold of 1.0E-04. Based on this evaluation, the COPCs in sediment do not present a significant risk to a current or future trespasser under the assumed exposure conditions.

Current and Future Off-property Resident – The current and future off-property resident was evaluated for exposure to COPCs in groundwater. The noncancer hazard for the current/future off-property child resident is 24.3, which is greater than EPA's threshold of 1. Therefore, the risk assessment quantified the HI on a target organ basis. The organ-specific HI value for the liver exceeded 1 (HI = 24). Carbon tetrachloride is the chemical responsible for the elevated liver toxicity. The total HI for the current/future off-property adult resident is 11.7, which is greater than the target value of 1. Therefore, the risk assessment quantified the HI on a target organ basis. The organ-specific HI value for the liver exceeded 1 (HI = 11). The primary component of the noncancer hazard is carbon tetrachloride in tap water. The ILCR of 1.4E-03 exceeds the EPA's threshold of 1.0E-04. The primary chemical contributor to cancer risk is carbon tetrachloride (ingestion and dermal contact). Based on this evaluation, the COPCs in off-property groundwater may present a significant risk to a current resident under the assumed exposure conditions.

Future On-property Resident – The future resident was evaluated for exposure to COPCs in sediment, subslab soil gas, and on-property groundwater. The total HI for the future child resident is 34, which is greater than EPA's threshold of 1. Therefore, the risk assessment quantified the HI on a target organ basis. The HI for the liver exceeded 1 (HI = 31). The primary components of the noncancer hazard is carbon tetrachloride (ingestion, inhalation and dermal) and TCE (ingestion) in groundwater. The total HI for the future adult resident is 16. Therefore, the risk assessment quantified the HI on a target organ basis. The HI for the liver exceeded 1 (HI = 14). The primary component of the noncancer hazard is carbon tetrachloride (ingestion, inhalation and dermal) in groundwater. The total ILCR of 2E-03 exceeds the EPA threshold of 1.0E-04. The cancer risk exceeds the EPA's target risk range for vapor intrusion (ILCR = 4E-04) and groundwater as tap water (2E-03). The primary chemical component of the cancer risk is inhalation of PCE via subslab soil gas vapor intrusion and ingestion of and dermal contact with carbon tetrachloride in groundwater. Based on this evaluation, the COPCs in on-property subslab soil gas and groundwater may present a significant risk to a future resident under the assumed exposure conditions.

8.1.5 Uncertainty

The main uncertainties in the HHRA are associated with data quality, exposure estimation and toxicological data. Considering the potential routes for exposure to groundwater in the CSM, data quality control, and the high COC concentrations in groundwater at both OU 1 and OU 2, these uncertainties are low for the HHRA. The uncertainty for the of the HHRA are discussed in detail in the RI/FS.

The indoor air data were not used to evaluate potential risks to the current industrial worker because comparison of the indoor air results to the subslab soil gas data indicated that the Site contaminants currently are not migrating across the foundation. The indoor air data suggest that the current indoor worker may be potentially exposed to volatile chemicals associated with ongoing building operations. The HHRA did not consider the exposure of current indoor workers to their occupational hazards.

The apparent lack of migration from subslab soil gas to indoor air is likely due to operation of the SVE system. It is expected that continued operation of the SVE system will decrease VOC concentrations in the subsurface soil and the soil gas, thereby decreasing the potential for exposure via the vapor intrusion pathway. Based on this expectation, use of the current subslab soil gas data to estimate future exposure is conservative. To estimate the concentration of vapors that could accumulate inside the building if the SVE system was not operating, an attenuation factor of 0.1 was applied to the soil gas concentrations. Depending on the cracks in the building foundation and operation of the ventilation system, this attenuation factor could under estimate or over estimate potential migration of vapors across the foundation and accumulation in the building. The attenuation factor of 0.1 was also applied to the soil gas concentrations when assessing the future residential receptor and the same caveats apply.

Table 7 – Risk Characterization Summary – Carcinogens

Scenario Timeframe: Current and Future
Receptor Population: Indoor Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk Ingestion	Carcinogenic Risk Inhalation	Carcinogenic Risk Dermal	Carcinogenic Risk Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	2.9E-07	--	--	3.0E-07
			Benzo(b)fluoranthene	2.9E-08	--	--	3.0E-08
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	--	1.5E-11	--	1.5E-11
			Benzo(b)fluoranthene	--	1.5E-12	--	1.5E-12
						Sediment Risk Total =	3.3E-07
Soil	Soil Gas	Vapor Intrusion	Chloroform	--	1.7E-05	--	1.7E-05
			Tetrachloroethene	--	6.7E-05	--	6.7E-05
						Soil Gas Risk Total =	8.4E-05
						Receptor Population Risk =	**8.4E-05**

Scenario Timeframe: Current and Future
Receptor Population: Outdoor Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk Ingestion	Carcinogenic Risk Inhalation	Carcinogenic Risk Dermal	Carcinogenic Risk Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	5.0E-07	--	5.0E-07	1.0E-06
			Benzo(b)fluoranthene	5.0E-08	--	5.0E-08	1.0E-07
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	--	1.4E-11	--	1.4E-11
			Benzo(b)fluoranthene	--	1.4E-12	--	1.4E-12
						Sediment Risk Total	1.1E-06
						Receptor Population Risk	**1.1E-06**

Table 7 – Risk Characterization Summary –Carcinogens (cont.)

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	8.0E-08	--	3.0E-08	1.1E-07
	Air	Volatile and Fugitive Emissions	Benzo(a)pyrene	--	1.1E-09	--	1.1E-09
						Sediment Risk Total	1.1E-07
						Receptor Population Risk	**1.1E-07**

Scenario Timeframe: Current and Future
Receptor Population: Site Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	1.0E-07	--	8.7E-08	1.9E-07
			Benzo(b)fluoranthene	1.0E-08	--	8.7E-09	1.9E-08
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	--	4.3E-13	--	4.3E-13
			Benzo(b)fluoranthene	--	4.3E-14	--	4.3E-14
						Soil Risk Total	2.0E-07
						Receptor Population Risk	**2.0E-07**

Scenario Timeframe: Current
Receptor Population: Off-property Resident
Receptor Age: Age-adjusted Adult/Child Combined

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Total
Groundwater	Groundwater	Tap and Shower	1,2-Dichloroethane	4.1E-06	1.2E-08	2.0E-07	4.3E-06
			Carbon Tetrachloride	1.0E-03	9.0E-07	2.9E-04	1.3E-03
			Chloroform	6.5E-05	5.1E-07	5.9E-06	7.1E-05
		Irrigation	1,2-Dichloroethane	3.0E-08	--	5.6E-10	3.1E-08
			Carbon Tetrachloride	7.7E-06	--	7.7E-07	8.5E-06
			Chloroform	4.7E-07	--	1.7E-08	4.9E-07
						Groundwater Risk Total	1.4E-03
						Receptor Population Risk	**1.4E-03**

Table 7 – Risk Characterization Summary – Carcinogens (cont.)

Scenario Timeframe: Future
Receptor Population: On-property Resident
Receptor Age: Age-adjusted Resident

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	1.0E-05	--	4.0E-06	2.0E-05
			Benzo(b)fluoranthene	1.0E-06	--	4.0E-07	2.0E-06
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	--	2.0E-10	--	2.0E-10
			Benzo(b)fluoranthene	--	2.0E-11	--	2.0E-11
						Sediment Risk Total	2.0E-05
Soil	Soil Gas	Vapor Intrusion	Chloroform	--	8.8E-05	--	8.8E-05
			Tetrachloroethene	--	3.4E-04	--	3.4E-04
			Trichloroethene	--	3.3E-06	--	3.3E-06
						Soil Gas Risk Total	4.3E-04
Groundwater	Groundwater	Tap and Shower	Benzene	3.2E-06	4.8E-09	5.0E-07	3.7E-06
			Carbon Tetrachloride	1.3E-03	1.2E-06	4.0E-04	1.7E-03
			Chloroform	8.4E-06	6.4E-08	7.4E-07	9.2E-06
			Trichloroethene	6.5E-07	2.2E-09	1.1E-07	7.6E-07
		Irrigation	Benzene	2.4E-08	--	1.4E-09	2.5E-08
			Carbon Tetrachloride	9.8E-06	--	1.1E-06	9.9E-06
			Chloroform	6.2E-08	--	2.1E-09	6.4E-08
			Trichloroethene	4.7E-09	--	3.1E-10	5.1E-09
						Groundwater Risk Total	1.7E-03
						Receptor Population Risk	**2.1E-03**

Notes:
- - - Exposure route incomplete.
NV - Toxicity criteria are not available to quantitatively address this route of exposure.
N/A : Route of exposure is not applicable to this medium.

Table 8 – Risk Characterization Summary – Non-carcinogens

Scenario Timeframe: Current and Future
Receptor Population: Indoor Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Non-carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	N/A	NV	--	--	NV
			Benzo(b)fluoranthene	N/A	NV	--	--	NV
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	N/A	--	NV	--	NV
			Benzo(b)fluoranthene	N/A	--	NV	--	NV
							Sediment Hazard Index Total =	NV
Soil	Soil Gas	Vapor Intrusion	Chloroform	N/A	--	0.02	--	0.02
			Tetrachloroethene	N/A	--	0.1	--	0.1
							Soil Gas Hazard Index Total =	0.1
							Receptor Population Hazard Index =	**0.1**

Scenario Timeframe: Current and Future
Receptor Population: Outdoor Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Non-carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	N/A	NV	--	NV	NV
			Benzo(b)fluoranthene	N/A	NV	--	NV	NV
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	N/A	--	NV	--	NV
			Benzo(b)fluoranthene	N/A	--	NV	--	NV
							Sediment Hazard Index Total =	NV
							Receptor Population Hazard Index =	**NV**

Table 8 – Risk Characterization Summary – Non-carcinogens (cont.)

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Non-carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	N/A	NV	--	NV	NV
	Air	Volatile and Fugitive Emissions	Benzo(a)pyrene	N/A	--	NV	--	NV
							Sediment Hazard Index Total =	NV
							Receptor Population Hazard Index =	NV

Scenario Timeframe: Current and Future
Receptor Population: Site Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Non-carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	N/A	NV	--	NV	NV
			Benzo(b)fluoranthene	N/A	NV	--	NV	NV
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	N/A	--	NV	--	NV
			Benzo(b)fluoranthene	N/A	--	NV	--	NV
							Soil Hazard Index Total =	NV
							Receptor Population Hazard Index =	NV

Table 8 – Risk Characterization Summary – Non-carcinogens (cont.)

Scenario Timeframe: Current
Receptor Population: Off-property Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Non-carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Total
Ground-water	Ground-water	Tap	1,2-Dichloroethane	N/A	0	0	0	0
			Carbon Tetrachloride	Liver	15.3	3.5	4	22.8
			Chloroform	Liver	0.9	0.5	0.1	1.5
	Groundwater Hazard Index Total =							24.3
Receptor Population Hazard Index =								24.3

Scenario Timeframe: Current
Receptor Population: Off-property Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Non-carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Total
Ground-water	Ground-water	Tap	1,2-Dichloroethane	N/A	0	0	0	0
			Carbon Tetrachloride	Liver	5.5	3.5	1.9	10.9
			Chloroform	Liver	0.3	0.5	0	0.8
		Irrigation	1,2-Dichloroethane	N/A	0	--	0	
			Carbon Tetrachloride	Liver	0	--	0	
			Chloroform	Liver	0	--	0	
	Groundwater Hazard Index Total =							11.7
Receptor Population Hazard Index =								11.7

Table 8 – Risk Characterization Summary – Non-carcinogens (cont.)									
Scenario Timeframe:	Future								
Receptor Population:	On-property Resident								
Receptor Age:	Child								
				Non-carcinogenic Hazard Quotient					
Medium	Exposure Medium	Exposure Point	Chemical	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Total	
Sediment	Sediment	Sediment	Benzo(a)pyrene	N/A	NV	--	NV	NV	
			Benzo(b)fluoranthene	N/A	NV	--	NV	NV	
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	N/A	NV	NV	--	NV	
			Benzo(b)fluoranthene	N/A	NV	NV	--	NV	
							Sediment Hazard Index Total =	NV	
Soil	Soil Gas	Vapor Intrusion	Chloroform	N/A	--	0.1	--	0.1	
			Tetrachloroethene	N/A	--	0.5	--	0.5	
			Trichloroethene	N/A	--	NV	--	NV	
							Soil Gas Hazard Index Total =	0.6	
Ground-water	Ground-water	Potable Water Well, Inhalation While Showering	Benzene	Lympho-cytes	0.06	0.05	0.01	0.12	
			Carbon Tetrachloride	Liver	21	5	5	31	
			Chloroform	Liver	0.1	0.07	0.01	0.2	
			Trichloroethene	N/A	2	N/A	0.3	2	
							Groundwater Hazard Index Total =	33	
							Receptor Population Hazard Index =	**34**	

Table 8 – Risk Characterization Summary – Non-carcinogens (cont.)

Scenario Timeframe: Future
Receptor Population: On-property Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Non-carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Total
Sediment	Sediment	Sediment	Benzo(a)pyrene	N/A	NV	--	NV	NV
			Benzo(b)fluoranthene	N/A	NV	--	NV	NV
	Air	Volatile and Fugitive Dust Emissions	Benzo(a)pyrene	N/A	--	NV	--	NV
			Benzo(b)fluoranthene	N/A	--	NV	--	NV
							Soil Hazard Index Total =	NV
Soil	Soil Gas	Vapor Intrusion	Chloroform	N/A	--	0.09	--	0.09
			Tetrachloroethene	N/A	--	0.5	--	0.5
			Trichloroethene	N/A	--	NV	—	NV
							Soil Gas Risk Total =	0.6
Ground-water	Ground-water	Potable Water Well, Inhalation While Showering	Benzene	Lymphocytes	0.02	0.05	0.005	0.08
			Carbon Tetrachloride	Liver	7	5	3	15
			Chloroform	Liver	0.04	0.07	0.005	0.12
			Trichloroethene	N/A	0.5	N/A	0.1	0.6
		Irrigation	Benzene	Liver	0.0001	--	0.000006	0.0001
			Carbon Tetrachloride	Liver	0.04	--	0.004	0.04
			Chloroform	Kidneys	0.0002	--	0.000007	0.0002
			Trichloroethene	N/A	0.003	--	0.0002	0.003
							Groundwater Risk Total =	16
							Receptor Population Hazard Index =	**17**

Notes:
--- - Exposure route incomplete.
NV - Toxicity criteria are not available to quantitatively address this route of exposure.
N/A : Route of exposure is not applicable to this medium.

8.2 Assessment of Leaching Potential of Contaminated Soils

The primary contaminant released to OU 1 soils from former facility operations was CCl_4. $CHCl_3$, a degradation product of CCl_4, has been found in the soils as well. Other contaminants that could have been used in small quantities include TCE and PCE. During the RI/FS, the EPA developed Site-specific screening levels for the OU 1 soils. The Site-specific screening levels are the soil concentrations above which contaminants will migrate (i.e., leach) from the unsaturated zone to the water table at a sufficient rate to cause and exceedance of the MCL in the groundwater. To assess the potential for contaminated soils at OU 1 to leach to the groundwater and cause an exceedance of the MCL in the groundwater, the measured concentrations of contaminants in soil were compared to these Site-specific screening levels. CCl_4 was the only contaminant detected in the soils at concentrations that exceeded the Site-specific screening levels. CCl_4 was detected in samples from 4 to 5 feet and 16.5 to 17 feet bgs in the area between the former AST and the main elevator where the buried piping was located.

8.3 Summary of Screening-level Ecological Risk Assessment

A SLERA was conducted to analyze the potential effects of Site contaminants on plants, soil invertebrates, mammals and birds. Detected concentrations were compared to benchmark values and were used to estimate daily doses via the food web. The initial, conservative screening indicated that PAHs and various other organic compounds required a more thorough evaluation with respect to exposure via the food web. To address the uncertainty generated through the conservatism associated with the initial screening, a refined exposure assessment was completed. This latter evaluation considered the mean normalized food ingestion and mean soil ingestion rates. Based on this refined assessment, current Site conditions do not pose a threat to ecological receptors.

8.4 Summary of Risks/Basis of Action

The interim remedy selected in this Interim ROD for OU 1 and OU 2 of the Site is warranted to protect public health and welfare from actual or threatened releases of hazardous substances to the groundwater that may present an imminent and substantial endangerment to public health or welfare. The HHRA prepared by the EPA in April 2011 determined the following:

<u>OU 1</u>

- Unacceptable carcinogenic risk to future residents from vapor intrusion. PCE was the major contributor to the risk, and chloroform and trichloroethene were minor contributors.

- Unacceptable carcinogenic risk to future residents from exposure to groundwater used for domestic purposes. CCl_4 was the major contributor. Chloroform was a minor contributor.

- Unacceptable noncarcinogenic risk to future residents from exposure to groundwater used for domestic purposes. Carbon tetrachloride and trichloroethene were major contributors.

<u>OU 2</u>

- Unacceptable carcinogenic risk to current residents from exposure to groundwater used for domestic purposes. CCl_4 was the major contributor.

- Unacceptable noncarcinogenic risk to future residents from exposure to groundwater used for domestic purposes. CCl_4 and chloroform were the major contributors.

Based on the results of the HHRA, the SLERA and the assessment of the leaching potential of contaminated soil, the COCs in the different media at the Site are summarized in Table 9.

Table 9 - Summary of COCs			
		OU 1	OU 2
HHRA			
	Sediment	None	N/A
	Surface/Subsurface Soils	None	N/A
	Subsurface Soil Gas	PCE	N/A
	Groundwater	CCl_4, $CHCl_3$, TCE	CCl_4, $CHCl_3$
SLERA			
	All Media	None	N/A
Soil Potential to Leach			
	Surface/Subsurface Soils	CCl_4	N/A
	Subsurface Soil Gas	CCl_4	N/A

9. Remedial Action Objectives

Remedial Action Objectives (RAOs) have been developed for the Site for the protection of public health and the environment based on findings of the RI/FS. The RAOs are organized by media and specify the exposure pathway and cleanup level for each COC. The cleanup levels are based on chemical-specific applicable or relevant and appropriate requirements (ARARs) where available and to-be-considered (TBC) criteria. The ARARs identify standards, criteria and guidances (SCGs) used to establish soil and groundwater cleanup levels that eliminate or mitigate the significant threat to public health and environment.

The Site-specific RAOs listed below address the soils at OU 1 and the groundwater in the OU 2 area. They do not address groundwater at the OU 1 source area. The RAOs set forth in the 2010 Interim ROD addressed OU 1 soils and OU 1 groundwater. With respect to the OU 1 soils, the RAOs presented below supersede the RAOs in the 2010 Interim ROD. The RAOs set forth in the 2010 Interim ROD for OU 1 groundwater remain unchanged.

The RAOs for this interim RA for the Site are:

- To prevent or minimize the release of contaminants from the unsaturated soils to groundwater by reducing concentrations in the soil and soil gas to the cleanup levels. The soil cleanup level has been set at the soil concentration above which leaching to groundwater is predicted to cause an exceedance of the MCL in the groundwater. The soil gas cleanup level has been set based on equilibrium partitioning.

- To prevent exposure of future residents to concentrations of soil gas, via the vapor intrusion pathway, at or above the cleanup levels in the soil gas at OU 1.

- To prevent further migration of contaminated groundwater in excess of the cleanup levels from the OU 2 area.

- To prevent exposure of current and future residents to concentrations of contaminants at or above the cleanup levels in the groundwater beneath the OU 2 area from its domestic use.

- To provide an interim remedy that would not interfere with the future effectiveness of other long-term remedial action alternatives that might warrant detailed evaluation in a supplemental FS such as in situ treatment technologies for groundwater restoration at the OU 1 source area.

The long-term objectives for this remedial action are to reduce concentrations of contaminants in:

- Soil and soil gas at the OU 1 source area to concentrations less than or equal to the cleanup levels within a reasonable time frame;

- Groundwater beneath the OU 1 source area to concentrations less than or equal to the cleanup levels within a reasonable time frame so that the aquifer is restored to its beneficial use; and

- Groundwater in the OU 2 area to concentrations less than or equal to their respective cleanup levels so that the aquifer is restored to its beneficial use.

A summary of the cleanup levels for soil, soil gas and groundwater for each COC is provided in Table 10 below.

The cleanup levels for CCl_4, $CHCl_3$ and PCE in the soil gas are 4, 1, and 90 $\mu g/m^3$, respectively. In accordance with the EPA guidance, this soil gas cleanup level is calculated as 10 times the calculated Site-specific, risk-based level for residential indoor air (i.e., 10 percent or less of indoor air originates from the subsurface). These cleanup levels apply to the shallow subsurface soils, defined as the upper 10 feet of the subsurface soil. These cleanup levels also apply to any excavated soil to be disposed of on-Site.

The cleanup level for CCl_4 in the fine-grained soil that generally extends from the ground surface to 65 feet bgs is 45 ug/kg. The basis of the preliminary soil cleanup level is the concentration above which the soils have the potential to leach to the groundwater and cause an exceedance of the groundwater cleanup level. This cleanup level will be applied to the soils in the vicinity of the former AST and buried transfer piping.

The cleanup levels for CCl_4 in the soil gas are 95,000 ug/m^3 and 130,000 ug/m^3 for the fine-and coarse-grained soils, respectively. The basis of the soil gas cleanup levels is the equilibrium partitioning between the gaseous, dissolved and adsorbed phases of CCl_4, and the potential for CCl_4 to leach to the groundwater and cause an exceedance of the groundwater cleanup level. These cleanup levels will be applied to the soils in all areas of OU 1.

The cleanup level for CCl_4 in OU 2 groundwater is 5 μg/l, which is the MCL. The cleanup level for $CHCl_3$ in OU 2 groundwater is 70 μg/l. $CHCl_3$ is the only THM that has been observed at levels of concern. The EPA does not have an MCL for $CHCl_3$, but has established an maximum contaminant level goal (MCLG) of 70 μg/l. This remedy is termed an interim RA under CERCLA because it does not select the final remedy for the groundwater at OU 1. The Selected Remedy in this document is expected to achieve the RAOs in the OU 1 soils and the OU 2 groundwater.

Table 10 - Cleanup Levels for COCs

OPERABLE UNIT 1

Current Use: Industrial (Light)
Anticipated Use: Industrial (Light)
Available Use[a]**:** Unrestricted
Controls to Ensure Restricted Use[b]**:** Institutional controls

Media: Soil
Site Area: Fine-grained subsurface soils[c]

Chemical of Concern	Cleanup Level (μg/kg)	Basis for Cleanup Level
Carbon Tetrachloride	45	Migration to groundwater

Media: Soil Gas
Site Area: Shallow fine-grained subsurface soils[d]

Chemical of Concern	Cleanup Level (μg/m^3)	Basis for Cleanup Level
Carbon Tetrachloride	4	Vapor intrusion[b]
Chloroform	1	Vapor intrusion[b]
Tetrachloroethene	90	Vapor intrusion[b]

Media: Soil Gas
Site Area: Fine-grained subsurface soils[c]

Chemical of Concern	Cleanup Level (μg/m^3)	Basis for Cleanup Level
Carbon Tetrachloride	95,000	Migration to groundwater[f]

Media: Soil Gas
Site Area: Coarse-grained subsurface soils[e]

Chemical of Concern	Cleanup Level (μg/m^3)	Basis for Cleanup Level
Carbon Tetrachloride	130,000	Migration to groundwater[f]

OPERABLE UNIT 2

Current Use: Mixed
Anticipated Use: Mixed
Available Use[a]**:** Unrestricted
Controls to Ensure Restricted Use[b]**:** Institutional controls

Chemical of Concern	Cleanup Level (μg/l)	Basis for Cleanup Level
Carbon Tetrachloride	5	Compliance with Federal and State ARARs
Chloroform	70[g]	Compliance with Federal and State ARARs

Notes:
(a) Anticipated available use at the conclusion of remedial activities upon achieving cleanup levels.
(b) Controls to ensure use is restricted during the conduct of remedial activities.
(c) Fine-grained material defined as the upper 65 ft of loess and interbedded unsaturated soils beneath OU 1.
(d) Shallow fine-grained material defined as the upper 10 ft of loess and interbedded unsaturated soils beneath OU 1.
(e) Coarse-grained material defined as the unsaturated soil beneath the upper fine-grained material at OU 1.
(f) Cleanup level derived based on the soil concentration above which leaching to groundwater causes an exceedance of MCLs.
(g) MCL for total trihalomethanes (bromodichloromethane, bromoform, chloroform and dibromochloromethane). The National Primary Drinking Water Regulations for disinfection byproducts assigns an MCLG for chloroform of 70 μg/l.

10. Description of Remedial Alternatives

The development of alternatives to meet the RAOs followed the requirements identified in CERCLA and is not inconsistent with the NCP. The development of remedial alternatives was guided by prior EPA experience at VOC-contaminated sites. Reflecting the scope and purpose of these remedial actions, four remedial alternatives were developed to address each of the following areas: contaminated soil and soil gas within OU 1, contaminated groundwater at OU 1, and contaminated groundwater in OU 2. The remedial alternatives are presented below. For each of the areas, the common elements of the remedial actions are described. For each of the remedial alternatives presented, certain distinguishing features are discussed.

10.1 Remedial Alternatives to Address OU 1 Contaminated Soil

The remedial alternatives for OU 1 contaminated soils are presented below. The four alternatives share two common elements. The first is the continued monitoring and enforcement of the existing IC on the former Garvey property. The IC restricts land and water uses to protect human health and the environment by preventing exposures to the contaminated soil and groundwater. The second common element is five-year reviews, which will be performed every five years, to ensure protection of human health and the environment, until contaminants are reduced to levels that allow for unlimited use and unrestricted exposure, as required by CERCLA

10.1.1 Alternative S1: No Action

Estimated Time frame: 30 years
Estimated Capital Cost: $53,000
Estimated O&M Cost: $156,000
Estimated Periodic Cost: $372,000
Estimated Total Present Value: $298,000

The NCP requires that the EPA consider a "no action" alternative against which other remedial alternatives can be compared. Under this alternative, the EPA would discontinue operation of the SVE system and take no action to address the OU 1 soils through engineering controls. No change in the soil contaminant concentrations would occur since treatment or removal of contaminated soil is not included in this alternative. The OU 1 soils would continue to leach contaminants and cause impacts to the groundwater quality. Periodic subslab vapor monitoring and reporting would be conducted every five years, and five-year reviews would be performed as required by CERCLA. The purpose of the five-year reviews is to evaluate the implementation and performance of a remedy to determine if a remedy is or will be protective of human health and the environment. For cost estimating purposes, a 30-year time frame is assumed. As described previously, this "no action" alternative includes the monitoring and enforcement of the existing IC. Typically ICs are excluded from "no action" alternatives and instead are included in a "limited action" alternative. However, it is considered appropriate to include them in this "no action" alternative because they have already been implemented.

10.1.2 Alternative S2: Excavation, Treatment, and Disposal of Contaminated Soil and Operation of Existing SVE System

Estimated Time frame: 30 years
Estimated Capital Cost: $345,000
Estimated Five-year O&M Cost: $498,000

Estimated Periodic Cost: $372,000
Estimated Present Value: $929,000

Alternative S2 would involve excavating and treating the contaminated soils in the vicinity of the former AST and buried transfer pipe, as well as operating the existing SVE system. The expected volume of contaminated soil to be excavated and treated is approximately 89 cubic yards, which consists of an area 40 feet by 10 feet to a depth of approximately 6 feet. The depth of excavation is limited by the proximity to the grain elevator. The excavation is not expected to address the deeper contaminated soils in this area. Clean fill from an on-site borrow area would be used to backfill the excavated area to match the surrounding grade. Excavated soil would be treated with an ex situ SVE process to reduce concentrations below the cleanup levels. The treated soil would be placed into the on-Site borrow area, compacted and seeded. Since the treated soil would be placed on-Site, the most stringent of the soil/soil gas cleanup levels outlined in Table 10 would be applicable. This alternative includes operating the existing SVE system, with no expansions or upgrades. It is assumed the existing SVE system would continue to operate for five years. One subslab vapor monitoring and reporting event per year would be conducted through the fifth year. It is assumed that cleanup levels for the OU 1 shallow soils would be achieved by this remedy in the area of excavated soils and beneath the building slab. However, since deeper soils in the vicinity of the transfer pipe, that exceed the cleanup levels, would not be addressed, a five-year review for these OU 1 soils would be necessary and performed every five years as required by CERCLA. For costing purposes a 30-year time frame is assumed.

10.1.3 Alternative S3: Expansion and Operation of Existing SVE System

Estimated Time frame: 10 years
Estimated Capital Cost: $336,000
Estimated 10-year O&M Cost: $946,000
Estimated Periodic Cost: $186,000
Estimated Present Value: $1,168,000

Alternative S3 would expand the treatment area of the existing SVE system by installing one shallow and one deep SVE well in the area of contaminated soils near the former AST and buried transfer pipe. Soil vapors extracted by the existing SVE system do not currently require treatment because the total emission rate is below the NDEQ threshold of five tons per year for any single hazardous air pollutant. A catalytic oxidation unit and scrubber are located on-site, but are not currently used. This equipment could be reactivated if treatment prior to discharge is needed to comply with State air regulations after expanding the existing SVE system. It is estimated that cleanup levels would be achieved in all of the OU 1 soils at the conclusion of the 10-year period. One subslab vapor monitoring and reporting event per year would be conducted through the 10th year. Two five-year reviews would be necessary, to be performed every five years as required by CERCLA.

10.1.4 Alternative S4: Excavation, Treatment and Disposal of Contaminated Soil and Expansion and Operation of Existing SVE System

Estimated Time frame: 5 years
Estimated Capital Cost: $407,000
Estimated Five-year O&M Cost: $516,000
Estimated Periodic Cost: $62,000
Estimated Present Value: $883,000

Alternative S4 combines Alternatives S2 and S3 to minimize the time frame that the SVE system would be required to operate by removing a portion of the contaminated soils from the source area. This alternative protects the environment through excavation and ex situ treatment of contaminated soil in the area of the former AST and buried transfer pipe, described in detail in Alternative S2 as well as expansion and operation of the existing SVE system as described in Alternative S3. For costing purposes, it is assumed the SVE system would continue to operate for five years. One subslab vapor monitoring and reporting event per year would be conducted through the fifth year of the remedial action. Only one five-year review would be necessary under CERCLA and is included in this cost estimate.

10.2 Remedial Alternatives to Address OU 2 Contaminated Groundwater

The four remedial alternatives for OU 2 contaminated groundwater are presented below. The alternatives share two elements. The first is the implementation, monitoring and enforcement of an IC on the areas within or in close proximity to the contaminated groundwater plume. The IC will protect human health and the environment by preventing exposures to the contaminated groundwater. The ICs would remain in place throughout the remedial action on OU 2 contaminated groundwater until RAOs are achieved. The second common element is five-year reviews, which will be performed every five years to ensure protection of human health and the environment until contaminants are reduced to levels that allow for unlimited use and unrestricted exposure, as required by CERCLA.

10.2.1 Alternative G1: No Action

Estimated Time frame: 30 years
Estimated Capital Cost: $312,000
Estimated O&M Cost: $924,000
Estimated Periodic Cost: $462,000
Estimated Present Value: $852,000

Contaminated groundwater throughout OU2 would not be remediated under the "no action" alternative. The contaminated groundwater would continue to migrate and spread in the direction of groundwater flow and to impact previously uncontaminated areas. This alternative would include the conduct of groundwater monitoring every five years to characterize water quality for the five-year reviews. As described previously, this "no action" alternative includes the implementation, monitoring and enforcement of the existing IC. Typically, ICs are excluded from "no action" alternatives and instead included in a "limited action" alternative. However, it is considered appropriate to include them in this "no action" alternative because the Site is located adjacent to two other Superfund sites, one of which is classified as a mega site. An IC is already in place on the mega site and its restrictions are also appropriate for this Site. Implementing the IC would only involve expanding its boundaries through modification of the city ordinance.

The "no action" alternative is carried through the FS process to provide a baseline for comparisons of Site remedial alternatives as required by the NCP. For cost estimating purposes, a 30-year time frame is assumed.

10.2.2 Alternative G2: Groundwater Recovery, Treatment, and Discharge at Leading Edge of Plume

Estimated Time frame: 100 years
Estimated Capital Cost: $4,715,000
Estimated O&M Cost: $30,052,000

Estimated Periodic Cost: $4,539,000
Estimated Present Value: $11,485,000

Under Alternative G2, a groundwater extraction, treatment, and reinjection system would be constructed at the leading (eastern-most) edge of the contaminated groundwater plume. The system would extract the contaminated groundwater as it migrates eastward and treat the extracted groundwater to remove contaminants and reduce concentrations to or below the cleanup levels. The treated groundwater would either be beneficially reused and/or reinjected into the aquifer. This alternative would include the construction of six recovery wells, system piping, a treatment building equipped with air stripping system, and three injection wells. Over the duration of the remedial action, this alternative would also include system O&M, periodic groundwater monitoring, and assessment of system performance, as well as five-year reviews, as required by the NCP.

Implementation of this alternative would require land acquisitions or easements for the wells, piping, and treatment building. The estimated time to reach cleanup levels in the OU 2 groundwater for this alternative is 100 years. The process of air stripping transfers the dissolved phase VOCs to the atmosphere. Emissions of VOCs to the atmosphere are projected to be well below acceptable federal and state requirements, so it is assumed that control technology for air emissions would not be necessary.

During remedial actions, this alternative would provide protection of human health through ICs to restrict access to VOC-contaminated groundwater. At the conclusion of remedial actions the groundwater would be at or below the cleanup levels and available for unrestricted and unlimited use.

10.2.3 Alternative G3: Groundwater Recovery, Treatment and Discharge at Mid-plume and Leading Edge of Plume

Estimated Time frame: 75 years
Estimated Capital Cost: $7,199,000
Estimated O&M Cost: $29,552,000
Estimated Periodic Cost: $3,541,000
Estimated Present Value: $15,550,000

Under Alternative G3, a groundwater extraction, treatment and reinjection system would be installed on the leading (eastern-most) edge of the contaminated groundwater plume, similar to Alternative G2. In addition, to reduce the cleanup time frame, groundwater extraction wells would be installed in two areas within the plume where some of the highest contaminant concentrations were observed. The groundwater extracted from these wells would be piped to the treatment system at the leading edge of the plume for treatment by air stripping and reinjection. The first area within the plume for the additional groundwater extraction wells is generally in the vicinity of South Elm Avenue., in the medial (C-zone) aquifer. These extraction wells would target the groundwater with carbon tetrachloride concentrations greater than 100 μg/l. The second area is generally in the vicinity of Showboat Boulevard, in the lower (D/E-zone) aquifer. These extraction wells would target the groundwater with carbon tetrachloride concentrations greater than 45 μg/l. Over the duration of the remedial action, this alternative would also include system O&M, periodic groundwater monitoring and assessment of system performance, as well as five year reviews, as required by the NCP.

As with Alternative G2, implementation of this alternative would require land acquisitions or easements, not only for the wells, piping, and treatment building at the leading edge of the plume, but also in the mid-plume areas. The estimated time to reach cleanup levels in the OU 2 groundwater for this alternative is 75 years. The process of air stripping transfers the dissolved phase VOCs to the atmosphere. Emissions of VOCs to the atmosphere are projected to be well below acceptable federal and state requirements, so it is assumed that control technology for air emissions would not be necessary.

During remedial actions, this alternative would provide protection of human health through ICs to restrict access to VOC-contaminated groundwater. At the conclusion of remedial actions the groundwater would be at or below the cleanup levels and available for unrestricted and unlimited use.

10.2.4 Alternative G4: In Situ Treatment at Core of Plume and Groundwater Recovery, Treatment, and Discharge at Leading Edge of Plume

Estimated Time frame: 75 years
Estimated Capital Cost: $7,525,000
Estimated O&M Cost: $27,607,000
Estimated Periodic Cost: $27,063,000
Estimated Present Value: $36,651,000

Alternative G4 combines Alternative G2 with in situ treatment through groundwater amendments in the core of the OU 2 groundwater contaminant plume to reduce the time frame for aquifer restoration. Refer to the description of Alternative G2 for details of its components. Similar to Alternative SG3, the groundwater amendments would consist of injecting a compound, either organic substrate, chemical oxidant or reducing agent, or a variety of compounds through a series of 78 injection points. One or more types of compound will be selected for full-scale injection based on pilot-scale studies. Due to the depths involved, the injection points would be permanent well installations. A series of five injections would be conducted annually for the first five years. Over the duration of the remedial action, this alternative would also include system O&M, periodic groundwater monitoring, and assessment of system performance, as well as five year reviews, as required by the NCP.

As with Alternative G2, implementation of this alternative would require land acquisitions or easements, for the wells, piping and treatment building at the leading edge of the plume. Groundwater modeling results provided an estimated time to reach cleanup levels in the OU 2 groundwater for this alternative of 75 years. The process of air stripping transfers the dissolved phase VOCs to the atmosphere. Emissions of VOCs to the atmosphere are projected to be well below acceptable federal and state requirements, so it is assumed that control technology for air emissions would not be necessary.

During remedial actions, this alternative would provide protection of human health through ICs to restrict access to VOC-contaminated groundwater. At the conclusion of remedial actions the groundwater would be at or below the cleanup levels and available for unrestricted and unlimited use.

11. Comparative Analysis of Alternatives

Section 300.430(e)(9) of the NCP requires that the EPA evaluate and compare the remedial cleanup alternatives based on the nine criteria listed below. The first two criteria, overall protection of human health and the environment, and compliance with ARARs, are threshold criteria that must be met for the Selected Remedy. The Selected Remedy must then represent the best balance of the following five primary balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility or volume of contaminants through treatment; short-term effectiveness; implementability and cost. The final two criteria, state and community acceptance, are referred to as modifying criteria. Presented below is the comparative analysis according to each of the threshold, primary balancing and modifying criteria. This analysis recognizes the interim nature of the remedy. Refer to Tables 11 and 12 below for additional details on the evaluation of alternatives for OU 1 soils and OU 2 groundwater, respectively. Table 13 provides a breakdown of capital, O&M, and period cost for the alternatives. Table 14 presents a summary of the comparative analysis using a qualitative ratings system to assess the degree to which each alternative satisfies the threshold and balancing criteria.

11.1 Overall Protection of Human Health and the Environment

This threshold criterion evaluates whether an alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced or controlled through institutional controls, engineering controls and/or treatment.

Alternative S1 would provide adequate protection of human health, through existing ICs, but would not provide adequate protection of the environment because contaminants would continue to leach and impact the groundwater. Alternatives S2, S3 and S4 would meet this criterion through the combination of institutional and engineering controls. Alternatives G1-G4 protect human health through the implementation and monitoring of ICs. Alternatives G2-G4 are protective of the environment because they prevent further migration of the OU 2 contaminant plume. Alternative G1 fails to meet the protection of the environment criterion because it allows continued migration of the OU 2 contaminant plume. Alternative G1 was eliminated from consideration under the remaining eight criteria.

Alternatives S1 and G1 are "no action" alternatives that do not meet this threshold criteria, but are carried through for the full detailed analysis to establish a baseline.

11.2 Compliance with Applicable or Relevant and Appropriate Requirements

This criterion addresses whether the alternative will comply with federal and state environmental statutes, regulations and other requirements that pertain to the site or whether a waiver is justified. Section 121(d) of CERCLA and NCP § 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria and limitations (collectively referred to as ARARs) unless such ARARs are waived under CERCLA section 121(d)(4). "Applicable requirements" are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. "Relevant and appropriate requirements" are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

In accordance with the NCP 40 CFR 300.430(f)(1)(ii)(C)(1), because this is an interim action remedy, there is not a requirement to meet ARARs. However, the ARARs pertinent to the Site are outlined in Appendix A. This interim RA will become part of the Site-wide remedial action, which will attain ARARs. There are no location-specific ARARs to evaluate for Alternatives S1-S4. There are no chemical- or action-specific ARARs for the "no action" Alternative S1 to meet. The action- and chemical-specific ARARs related to the on-site treatment and disposal of excavated soils and the air emissions from the SVE system in Alternatives S2 and S4 would be met.

There are no location-specific ARARs to evaluate for Alternatives G1-G4. Alternative G1 does not meet federal and state chemical-specific ARARs in groundwater that is a current source of drinking water. Alternatives G2-G4 would meet chemical-specific ARARs including the Nebraska Title 118 groundwater quality standards. Alternatives G2-G4 would meet action-specific ARARs including Nebraska Title 122 underground injection control.

11.3 Long-term Effectiveness and Permanence

This criterion evaluates expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

A common element of Alternatives S1-S4 is the ICs that are already in place. This adequately addresses the risk to a hypothetical future on-site resident through vapor intrusion. In the absence of the IC, the residual risk to a future resident, as well as the risk of contaminant leaching to groundwater, would not be reduced by Alternative S1. Alternative S4 reduces the risk to a future on-site resident to an acceptable level and eliminates the risk of contaminants leaching to groundwater at levels causing an exceedance of the MCL. Alternative S3 is as effective as Alternative S4 in reducing risk to the future on-site resident, but is not as effective at removing contaminants from the unsaturated zone, so some contaminant leaching could continue. Alternative S2 is not as effective as either Alternatives S3 or S4 because the actions would only reduce risk in both areas, but not necessarily reduce it to acceptable levels.

Alternatives G2, G3 and G4 are similar in that residual contamination at the Site would be at levels less than the MCLs and the magnitude of residual risk at the conclusion of remedial activities would be reduced to acceptable levels. Unrestricted groundwater use would be restored. The "no action" Alternative G1 does not include remedial actions to address groundwater contamination, and, therefore, this criterion would not be met.

11.4 Reduction of Toxicity, Mobility and Volume

This criterion evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants; the degree of expected reduction in toxicity, mobility or volume; the type and quantity of treatment residuals; the degree to which the treatment will be irreversible; and the amount of residuals. Alternatives S3 and S4 satisfy all the requirements of this criterion by irreversibly treating the entire volume of contaminated soils, and by not leaving treatment residuals above cleanup levels. Alternative S2 uses irreversible treatment, but may leave residual contamination in the deep soils in the vicinity of the former AST. The "no-action" Alternative S1 does not satisfy this criterion, since it involves no engineering controls.

Alternatives G2, G3 and G4 satisfy all the requirements of this criterion equally well. All apply treatment technologies. Each alternative removes approximately the same contaminant mass, employs irreversible treatment and leaves residuals below levels of concern. Alternative G1 does not satisfy any of the requirements of this criterion, as no treatment technology is applied.

11.5 Short-term Effectiveness

This criterion evaluates the short-term risks that might be posed to the community, to workers and to the environment during construction and operation of the alternative as well as the time until protection is achieved.

The "no action" Alternative S1 does not employ engineering controls, and, therefore, is not expected to achieve RAOs. Alternatives S2 and S4 are expected to achieve RAOs within five years and Alternative S3 is expected to take 10 years. It is recognized that any construction activity poses a risk to workers. Alternatives S2 and S4 have a greater increased short-term risk than does Alternative S3 due to their excavation component. Safety measures can reduce but not eliminate this risk. The construction of the two additional SVE wells poses increased short-term risk, but less than that posed by the excavation. Alternatives S2-S4 each poses only a minimal risk to the community and grain elevator workers.

The "no-action" Alternative G1 does not employ engineering controls, and, therefore, is not expected to achieve RAOs. Alternative G2 is expected to achieve RAOs in 100 years and Alternatives G3 and G4 are expected to achieve RAOs in 75 years. Although the quantity of the different constructed elements for Alternatives G2-G4 may differ, there is some risk to workers due to the construction of monitoring, extraction, and injection wells, buried piping runs, and the treatment building. There is additional risk for Alternative G4 since chemical oxidants used in injections pose significant potential hazards during handling as they are highly corrosive and reactive. There is a risk of accidental exposure that could cause burns as well as potential explosive hazard. There is not a significant risk to the community as the area of construction is rural. The transport of the chemical oxidants for Alternative G4 slightly increases this risk.

11.6 Implementability

This criterion evaluates the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility and coordination with other governmental entities are also considered.

Alternative S1 is highly implementable as it involves no engineering controls. Alternatives S2-S4 are technically feasible; however, they require additional considerations due to the excavation in an area near the main grain elevator. The installation of the two additional SVE wells is highly implementable. Administrative feasibility of Alternatives S2-S4 is high since regulatory approvals for the soils excavation are implementable and approvals for SVE operation are already in place for the existing SVE system.

Alternative G1 is highly implementable because it involves no engineering controls. Alternatives G2-G4 are technically feasible, but Alternative G4 would require additional bench- and pilot-scale studies to optimize full-scale implementation of the chemical oxidant injections. Administratively, the implementation of Alternatives G2-G4 involves entering into easement agreements with property owners to locate buildings, piping and wells. Alternatives G3 and G4 involve greater effort than G2 due to the greater number of locations where equipment would be installed.

11.7 Cost

This criterion evaluates the estimated capital costs, O&M costs and present-value costs of each alternative. Present Value is the total cost of an alternative over time in terms of today's dollar value.

Cost estimates are expected to be accurate within a range of +50 to -30 percent. A summary of estimated costs is provided in Table 13. The table includes the cleanup time frame, capital cost, total O&M cost incurred over the cleanup time frame, periodic costs (e.g., pump replacement, well rehabilitation, etc) and present value. The FS contains the detailed breakdown of the costs for each alternative presented as well as the assumptions used to develop cost figures. The cost for conducting the five-year reviews is included in the O&M category for each of the alternatives presented.

Table 11 – Comparative Analysis of Remedial Alternatives for OU 1 Soil

Criteria	S1	S2	S3	S4
OVERALL EFFECTIVENESS				
Human Health Protection				
Vapor Intrusion	No reduction in potential future risk. Current ICs prevent unacceptable risk by preventing future on-site residential development.	Excavation, treatment, and disposal of contaminated soil expected to reduce risk to less than 1 x 10^{-6} in all areas.	SVE would reduce risk to less than 1 x 10^{-6} in all areas.	SVE and removal of contaminated soil would reduce risk to less than 1 x 10^{-6}.
Environmental Protection				
Leaching to cause groundwater to exceed MCLs.	No reduction in risk.	Risk of leaching would be reduced below acceptable levels in all OU 1 soils except soils deeper than excavation depth beneath buried transfer pipe. Slight possibility these soils would still impact groundwater.	Risk of leaching from OU 1 soil areas would be reduced below acceptable levels by removal of contaminants by expanded SVE.	Risk of leaching from OU 1 soils would be reduced below acceptable levels by removal of contaminated soil and removal of contaminants by expanded SVE..
COMPLIANCE WITH ARARs				
Chemical-Specific ARARs	No chemical-specific ARARs.	Ex situ treatment and disposition of excavated soil would meet federal and state chemical-specific requirements. SVE emissions would meet 40 CFR and NDEQ Title 129 standards.	The disposal of drill cuttings during SVE well construction and SVE emissions would meet chemical-specific federal and state air quality ARARs.	Comments for Alternatives S2 and S3 apply.
Location-Specific ARARs	No location-specific ARARs.	No location-specific ARARs.	No location-specific ARARs.	No location-specific ARARs.
Action-Specific ARARs	N/A(1)	Ex situ treatment and disposition of excavated soil would meet federal RCRA and NDEQ Title 128/132 requirements and SVE emissions would meet 40 CFR 264 and NDEQ Title 129 standards.	The disposal of drill cuttings during SVE well construction and SVE emissions would meet action-specific federal and state air quality ARARs.	Comments for Alternatives S2 and S3 apply.
LONG-TERM EFFECTIVENESS AND PERMANENCE				
Magnitude of Residual Risk	N/A(1)	Risk to future resident of exposure to vapor intrusion and risk of contaminant leaching to groundwater significantly reduced, but may still be above acceptable levels in vicinity of former AST and buried transfer	Risk to future on-site resident of exposure to VOCs by vapor intrusion reduced below 1 x 10^{-6} and risk of contaminant leaching and causing impact to groundwater above MCLs is reduced and possibly eliminated.	Risk to future on-site resident of exposure to VOCs by vapor intrusion reduced below 1 x 10^{-6} and risk of leaching and causing impact to groundwater above MCLs is eliminated.

Table 11 – Comparative Analysis of Remedial Alternatives for OU 1 Soil

Criteria	S1	S2	S3	S4
		pipe.		
Adequacy and Reliability of Controls	N/A(1)	Small possibility of residual risk to be controlled by continuing ICs.	Small possibility of residual risk that would be controlled by continuing ICs at OU 1 and OU 1 groundwater containment.	No residual risk.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT				
Treatment Process Used	N/A(1)	In situ and ex situ SVE are treatment technologies that transfer VOCs from the soil to the atmosphere. Existing cat ox unit, which destroys contaminants, not expected to be necessary. This alternative would satisfy the statutory preference for treatment of the soils, which are a principle threat to human health and the environment.	Expanded in situ SVE is a treatment technology that transfers VOCs from soil to the atmosphere. Existing cat ox unit, which destroys contaminants, not expected to be necessary. This alternative would satisfy the statutory preference for treatment of the soils, which are a principle threat to human health and the environment.	In situ and ex situ SVE are treatment technologies that transfer VOCs from the soil to the atmosphere. Existing cat ox unit, which destroys contaminants, not expected to be necessary. This alternative would satisfy the statutory preference for treatment of the soils, which are a principle threat to human health and the environment.
Amount Destroyed or Treated	N/A(1)	Entire volume of contaminated soils at site, except the deeper soils beneath former AST & buried pipe.	Entire volume of contaminated soils at site.	Entire volume of contaminated soils at site.
Reduction of Toxicity, Mobility, or Volume	N/A(1)	In situ SVE has been demonstrated to be an effective technology for removal of contaminants from the soil. Ex situ SVE to reduce toxicity below cleanup levels prior to on-site placement.	In situ SVE has been demonstrated to be an effective technology for removal of contaminants from the soil. SVE expected to remove contaminants from entire contaminated soil volume.	In situ SVE has been demonstrated to be an effective technology for removal of contaminants from the soil. Ex situ SVE to reduce toxicity below cleanup levels prior to on-site placement.
Irreversible Treatment	N/A(1)	Yes	Yes	Yes
Type and Quantity of Residuals Remaining after Treatment	N/A(1)	Residual soil contamination may remain below excavation depth near the former AST & buried pipe.	None above cleanup levels.	None above cleanup levels.
SHORT-TERM EFFECTIVENESS				
Protection of the Community During Remedial Actions	N/A(1)	Short-term risk to community and on-site grain elevator workers when excavating adjacent to grain storage silos. Safety measures such as exclusion zones, dust	Short-term risk would be mitigated with safety measures, including establishing work zones and dust suppression. Installation of SVE wells would be performed by licensed contractor. Contaminated drill cutting would be	Short-term risk to grain elevator workers when excavating adjacent to grain storage silos. Safety measures such as exclusion zones, dust suppression, and temporary shoring, would be implemented to reduce short-term

Table 11 – Comparative Analysis of Remedial Alternatives for OU 1 Soil

Criteria	S1	S2	S3	S4
		suppression, and temporary shoring, would be implemented to reduce short-term exposure risk. Security measures would be implemented to prevent potential trespassers.	disposed of at a proper disposal facility.	exposure risk. Installation of SVE wells would be performed by licensed contractor. Contaminated drill cutting would be disposed of at a proper disposal facility.
Protection of Workers during Remedial Actions	N/A(1)	This alternative involves excavation and transport of contaminated soil, which could pose short-term risk. Safety measures such as dust suppression, use of protective personal equipment (PPE) and establishment of work zones would be implemented during construction to reduce short-term exposure risk. Other hazards include electrical and mechanical hazards and the hazard of working in close proximity to an active grain storage facility.	This alternative involves SVE well drilling, which could pose short-term risk. Safety measures such as use of protective personal equipment (PPE) and establishment of work zones would be implemented during construction to reduce short-term exposure risk. Other hazards include electrical and mechanical hazards, the hazard of working in close proximity to an active grain storage facility, and hazards of drilling activities.	This alternative involves excavation and transport of contaminated soil and SVE well drilling, which could pose short-term risk. Safety measures such as dust suppression, use of protective personal equipment (PPE) and establishment of work zones would be implemented during construction to reduce short-term exposure risk. Other hazards include electrical and mechanical hazards, the hazard of working in close proximity to an active grain storage facility, and hazards of drilling activities.
Environmental Impacts	N/A(1)	The application of emissions reduction strategies and fuel conservation methods for removal and transportation equipment can reduce short term impacts to the environment. Short-term environmental impacts could occur if dust controls during construction are ineffective.	Standard procedures for transport and handling of contaminated soil cuttings would mitigate risks to the environment.	The application of emissions reduction strategies and fuel conservation methods for removal and transportation equipment can reduce short term impacts to the environment. Standard procedures for transport and handling of contaminated soil cuttings would mitigate risks to the environment. Short-term environmental impacts could occur if dust controls during construction are ineffective.
Time Until Remedial Action Objectives are Achieved	RAOs not estimated to be achieved.	RAOs estimated to be achieved in five years in all areas except deep soils beneath the area of the former AST and buried pipe.	RAOs estimated to be achieved in ten years.	RAOs estimated to be achieved in five years.
IMPLEMENTABILITY				
Technical Feasibility	N/A(1)	Excavation adjacent to grain elevator may require temporary shoring or protection. Removal, on-site treatment, and disposal of contaminated soil easily implemented. Seasonal	SVE is a reliable technology and a presumptive remedy for treating VOCs in contaminated soil. SVE system already operational on-site and would only need to be expanded by installing additional wells.	Excavation adjacent to grain elevator may require temporary shoring or protection. Removal, on-site treatment, and disposal of contaminated soil easily implemented. Seasonal conditions could affect the ability to remove soil

Table 11 – Comparative Analysis of Remedial Alternatives for OU 1 Soil				
Criteria	**S1**	**S2**	**S3**	**S4**
		conditions could affect the ability to remove soil and could impact construction progress.		and could impact construction progress. SVE is a reliable technology and a presumptive remedy for treating VOCs in contaminated soil.
Administrative Feasibility	N/A[(1)]	Regulatory approval for SVE is already in place. Necessary regulatory approval for excavation, treatment, and disposal should be obtainable.	Regulatory approval for SVE is already in place. No modification necessary for expansion.	Regulatory approval for SVE is already in place. Necessary regulatory approval for excavation, treatment, and disposal should be obtainable.
Availability of Services and Materials	N/A[(1)]	Labor, equipment, and materials for contaminated soil removal, on-site treatment, and disposal are readily available. The ex situ SVE system is easily constructed.	Equipment and materials for SVE well installation are readily available. Licensed drilling contractor would be used to install SVE wells. Labor, equipment, and materials readily available for SVE well effluent piping to treatment building.	Labor, equipment, and materials for contaminated soil removal, on-site treatment, and disposal are readily available. The ex situ SVE system is easily constructed. Equipment and materials for SVE well installation are readily available. Licensed drilling contractor would be used to install SVE wells. Labor, equipment, and materials readily available for SVE well effluent piping to treatment building.

Table 12 – Comparative Analysis of Remedial Alternatives for OU 2 Groundwater

Criteria	G1	G2	G3	G4
OVERALL EFFECTIVENESS				
Human Health Protection				
Ingestion, inhalation, and dermal exposure	IC addresses risk by preventing exposure pathway of potable water well use. Monitoring ICs prevents future exposures. No reduction in potential future risk.	IC addresses risk by preventing exposure pathway of potable water well use. Monitoring ICs prevents future exposures. Long-term risk eliminated after cleanup levels achieved.	IC addresses risk by preventing exposure pathway of potable water well use. Monitoring ICs prevents future exposures. Long-term risk eliminated after cleanup levels achieved.	IC addresses risk by preventing exposure pathway of potable water well use. Monitoring ICs prevents future exposures. Long-term risk eliminated after cleanup levels achieved.
Environmental Protection				
Groundwater migration	Does not prevent migration	OU 2 GET system would contain groundwater at the leading edge of the plume and prevent aquifer degradation to downgradient areas. Performance monitoring during remedial action would ensure continued containment and be used to assess process to achieving cleanup levels in the OU 2 plume.	OU 2 GET system would contain groundwater at the leading edge of the plume and prevent aquifer degradation to downgradient areas. Mid-plume system would accelerate aquifer restoration. Performance monitoring during remedial action would ensure continued containment and be used to assess process to achieving cleanup levels in the OU 2 plume.	OU 2 GET system would contain groundwater at the leading edge of the plume and prevent aquifer degradation to downgradient areas. Performance monitoring during remedial action would ensure continued containment and be used to assess process to achieving cleanup levels in the OU 2 plume. Chemical injectants would be used within areas of high concentration to accelerate restoration.
COMPLIANCE WITH ARARs				
Chemical-Specific ARARs	Does not address federal and state requirements regarding groundwater that is a current source of drinking water.	Addresses federal SDWA and state Title 118 by achieving ARARs at the conclusion of remedial action and preventing further aquifer degradation.	Addresses federal SDWA and state Title 118 by achieving ARARs at the conclusion of remedial action.	Addresses federal SDWA and state NDEQ Title 118 by achieving ARARs at the conclusion of remedial action.
Location-Specific ARARs	No location-specific ARARs.	No location-specific ARARs.	No location-specific ARARs.	No location-specific ARARs.
Action-Specific ARARs	No remedial action would occur; therefore, there are no action-specific ARARs to meet.	OU 2 GET system would treat extracted groundwater via air stripping. It is estimated the air stripper would meet federal and state air emission requirements. Treated effluent would be monitored to ensure the state's Title 122 requirements for underground injection are met.	OU 2 GET system would treat extracted groundwater via air stripping. It is estimated the air stripper would meet federal and state air emission requirements. Treated effluent would be monitored to ensure the state's Title 122 requirements for underground injection are met.	Description from G2 applies here. Also injections of groundwater amendments would meet the requirements of the state's Title 122 rules for underground injections.
LONG-TERM EFFECTIVENESS AND PERMANENCE				
Magnitude of Residual Risk	N/A(1)	At the conclusion of the RA, groundwater would achieve groundwater cleanup levels.	At the conclusion of the RA, groundwater would achieve groundwater cleanup levels.	At the conclusion of the RA, groundwater would achieve groundwater cleanup levels.

Table 12 – Comparative Analysis of Remedial Alternatives for OU 2 Groundwater

Criteria	G1	G2	G3	G4
Adequacy and Reliability of Controls	N/A[(1)]	Controls would not be necessary to manage, because untreated residuals, if any, would not cause contamination above groundwater cleanup levels.	Controls would not be necessary to manage, because untreated residuals, if any, would not cause contamination above groundwater cleanup levels.	Controls would not be necessary to manage, because untreated residuals, if any, would not cause contamination above groundwater cleanup levels.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT				
Treatment Process Used	N/A[(1)]	Air stripping is a proven and reliable transfer technology, removing VOCs in water and transferring them to the atmosphere. This alternative satisfies the statutory preference for treatment.	Air stripping is a proven and reliable transfer technology, removing VOCs in water and transferring them to the atmosphere. This alternative satisfies the statutory preference for treatment.	Combination of in situ treatment to destroy contaminants and air stripping of VOCs from groundwater not addressed by in situ treatment. This alternative satisfies the statutory preference for treatment.
Amount Destroyed or Treated	N/A[(1)]	Estimate of contaminant mass not available, but Alternatives G2, G3, and G4 destroy approximately the same quantity.	Estimate of contaminant mass not available, but Alternatives G2, G3, and G4 destroy approximately the same quantity.	Estimate of contaminant mass not available, but Alternatives G2, G3, and G4 destroy approximately the same quantity.
Reduction of Toxicity, Mobility, or Volume	N/A[(1)]	Contaminated groundwater hydraulically contained and prevented from migrating downgradient of capture zone at leading edge of OU 2 plume. Treatment of captured and extracted groundwater removes contaminants through SVE treatment. Throughout OU 2, the volume of groundwater that exceeds MCLs would be eliminated.	Contaminated groundwater hydraulically contained and prevented from migrating downgradient of capture zone of extraction wells at leading edge of OU 2 plume. Treatment of captured and extracted groundwater removes contaminants through SVE treatment. Throughout OU 2, the volume of groundwater that exceeds MCLs would be eliminated.	In situ treatment would result in complete degradation/destruction of contaminants in those areas where contaminated groundwater comes in contact with the chemical oxidants/reducing agents/active bioremediation zone. Contaminated groundwater also hydraulically contained and prevented from migrating downgradient of capture zone of extraction wells at leading edge of OU 2 plume. In OU 2, volume of groundwater that exceeds MCLs would be eliminated.
Irreversible Treatment	N/A[(1)]	Yes	Yes	Yes
Type and Quantity of Residuals Remaining after Treatment	N/A[(1)]	Any remaining adsorbed residual contamination in the aquifer would not impact groundwater above MCLs.	Any remaining adsorbed residual contamination in the aquifer would not impact groundwater above MCLs.	Any remaining adsorbed residual contamination in the aquifer would not impact groundwater above MCLs.
SHORT-TERM EFFECTIVENESS				
Protection of the Community During	N/A[(1)]	As with any construction activity, it may pose short-term risk to the community. Safety	As with any construction activity, it may pose short-term risk to the community. Safety measures such as establishment	As with any construction activity, it may pose short-term risk to the community. Safety measures such as establishment

Table 12 – Comparative Analysis of Remedial Alternatives for OU 2 Groundwater

Criteria	G1	G2	G3	G4
Remedial Actions		measures such as establishment of work zones would be implemented to reduce risk. All workers would be OSHA trained and would wear appropriate PPE. Installation of wells would be performed by a licensed contractor.	of work zones would be implemented to reduce risk. All workers would be OSHA trained and would wear appropriate PPE. Installation of wells would be performed by a licensed contractor.	of work zones would be implemented to reduce risk. All workers would be OSHA trained and would wear appropriate PPE. Installation of wells, including injection wells, would be performed by a licensed contractor. GET system is already constructed.
Protection of Workers during Remedial Actions	N/A[(1)]	All workers OSHA trained and required to wear appropriate PPE. Some risk to workers during construction of monitoring, extraction, and injection wells, buried piping runs, and the treatment building.	All workers OSHA trained and required to wear appropriate PPE. Some risk to workers during construction of monitoring, extraction, and injection wells, buried piping runs, and the treatment building.	Some risk to workers due to the construction of monitoring, extraction, and injection wells, buried piping runs, and the treatment building. Chemical oxidants pose significant potential hazards during handling, as they are highly corrosive and reactive. Risk of accidental exposure that could cause burns as well as potential explosive hazard. All workers OSHA trained and to wear appropriate PPE, however, proper training and PPE cannot eliminate all risk.
Environmental Impacts	N/A[(1)]	Emissions from air stripper would be below state regulatory requirements. No other potential environmental impacts are expected.	Emissions from air stripper would be below state regulatory requirements. No other potential environmental impacts are expected.	Emissions from air stripper would be below state regulatory requirements. No other potential environmental impacts are expected. A potential adverse impact may result from a spill of chemicals. The potential for a spill would be mitigated through safe work practices and using compatible materials and injectant.
Time Until Remedial Action Objectives are Achieved	RAOs not estimated to be achieved.	RAOs estimated to be achieved in 100 years.	RAOs estimated to be achieved in 75 years.	RAOs estimated to be achieved in 75 years.
IMPLEMENTABILITY				
Technical Feasibility	N/A[(1)]	Implementation involves installation of monitoring wells, extraction wells, and injection wells, and construction of pipelines, treatment building, and treatment system. Standard equipment and installation and construction techniques would be used. Inspection, maintenance, and replacement	Same description as G2, but with twice the number of extraction and injection wells and 1.5 times the length of the G2 pipeline.	Same description as G2. In addition, bench- and pilot-scale studies would be conducted to optimize full scale implementation of injection of groundwater treatment amendments. Injections conducted using approximately 78 permanent monitoring wells.

Table 12 – Comparative Analysis of Remedial Alternatives for OU 2 Groundwater				
Criteria	**G1**	**G2**	**G3**	**G4**
		of engineering controls are easily implementable. Pump and treat is a presumptive remedy and operation is straightforward.		
Administrative Feasibility	N/A(1)	Requires locating wells, pipelines, and treatment system in existing right-of-way or entering easement agreements with property owners.	Same description as G2, greater number of easement agreements required.	Same description as G2. In addition, a great number of easements will be necessary to locate the 78 permanent injection wells. May be difficult to obtain in this agricultural setting. Injections would require meeting requirements of the state's UIC program.
Availability of Services and Materials	N/A(1)	No off-site treatment or storage required. No specialized drilling equipment required. Treatment system building easily constructed by a licensed contractor. Tray air strippers available from a variety of vendors. Materials, equipment, and labor resources for all work are readily available.	No off-site treatment or storage required. No specialized drilling equipment required. Treatment system building easily constructed by a licensed contractor. Tray air strippers available from a variety of vendors. Materials, equipment, and labor resources for all work are readily available.	No off-site treatment or storage required. No specialized drilling equipment required. Treatment system building easily constructed by a licensed contractor. Tray air strippers available from a variety of vendors. Materials, equipment, and labor resources for all work are readily available. Numerous contractors with capability to perform injections are available. Numerous in situ treatment chemicals available to treat contaminants.

Notes: (1) Not applicable to the no-action alternative.

Table 13 –Summary of Estimated Costs for Remedial Alternatives Garvey Elevator Superfund Site					
Alternative	Estimated Time Frame (years)	Capital Construction Cost ($1,000's)	Total Annual O&M Cost ($1,000's)	Periodic Cost ($1,000's)	Total Present Value ($1,000's)
OU 1 Soils					
S1 – No Action	30	53	156	372	298
S2 – Excavation, Treatment, and Disposal of Contaminated Soil and Operation of Existing SVE System	30	345	498	372	929
S3 – Expansion and Operation of Existing SVE System	10	336	946	186	1,168
S4 – Expansion and Operation of SVE System and Excavation, Treatment, and Disposal of Contaminated Soil	5	407	516	62	883
OU 2 Groundwater					
G1 – No Action	30	312	924	462	852
G2 – Groundwater Recovery, Treatment, and Discharge at Leading Edge of Plume	100	4,715	30,052	4,539	11,485
G3 – Groundwater Recovery, Treatment, and Discharge at Mid-plume and Leading Edge of Plume	75	7,199	29,552	3,541	15,550
G4 – In Situ Treatment at Core of Plume and Groundwater Recovery, Treatment, and Discharge at Leading Edge of Plume	75	7,525	27,607	27,063	36,651
Notes: 5 percent discount rate. Costs are rounded to the nearest $1,000. Capital costs for deconstruction and decommissioning of systems are included with capital construction costs.					

11.8 State Acceptance

This criterion considers whether the state, based on its review of the information, concurs with, opposes or has no comment on the EPA's preferred alternative. The state of Nebraska's authority regarding acceptance has been delegated to NDEQ.

In the letter received June 9, 2013, NDEQ expressed support for the EPA's selection of Alternatives S4 and G3 to address the OU 1 soil and OU 2 groundwater, respectively.

11.9 Community Acceptance

This criterion considers whether the local community agrees with the EPA's analyses and preferred alternative. Comments received on the proposed plan are important indicators of community acceptance.

The public-comment period on the Proposed Plan for interim action remedy for OU 1 and OU 2 was July 31 through August 30, 2013. A public meeting was conducted on August 8, 2013, to explain the Proposed Plan and all of the alternatives presented in the FS. General questions about the contamination at the Site were received and responded to during the public meeting. During the public meeting, no disagreement of the preferred alternatives was expressed by individual members of the local community. The full text of the transcript of the public meeting is included in the Administrative Record.

Table 14 – Summary of Detailed Analysis of Alternatives
Garvey Elevator Superfund Site

Alternative	Threshold Criteria		Balancing Criteria							
	Overall Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Mobility or Volume through Treatment	Short-Term Effectiveness	Implement-ability	Cost ($1,000s)			
							Capital	Annual O&M	Periodic	Present Value
OU 1 Soil										
S1	-	+	N/A[1]	N/A[1]	N/A[1]	N/A[1]	$53	$156	$372	$298
S2	+	+	3	3	3	3	$345	$498	$372	$929
S3	+	+	4	4	3	4	$336	$946	$186	$1,168
S4	+	+	5	4	3	3	$407	$516	$62	$883
OU 2 Groundwater										
G1	-	-	N/A[1]	N/A[1]	N/A[1]	N/A[1]	$312	$924	$462	$852
G2	+	+	4	4	3	4	$4,715	$30,052	$4,539	$11,485
G3	+	+	4	4	4	3	$7,199	$29,552	$3,541	$15,550
G4	+	+	4	4	3	2	$7,525	$27,607	$27,063	$36,651

Legend for Qualitative Ratings System:
0 – None
1 – Low
2 – Low to moderate
3 – Moderate
4 – Moderate to high
5 – High

Notes: [1] Not applicable to this "no-action" alternative. The "no-action" alternatives do not meet threshold criteria, but are carried through to provide a baseline.

12. Principal Threat Wastes

The NCP establishes an expectation that the EPA will use treatment to address the "principal threats" posed by a site whenever practicable [NCP § 300.430(a)(1)(iii)(A)]. The "principal threat" concept is applied to the characterization of source materials at this Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, nonaqueous phase liquids (NAPLs) in groundwater may be viewed as source materials. Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile, which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment, should exposure occur. Conversely, nonprincipal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

Wastes that generally constitute principal threats include but are not limited to the following:

> Liquid source material – waste contained in drums, lagoons or tanks, free product in the subsurface (i.e., NAPLs) groundwater containing contaminants of concern.
>
> Mobile source material – surface soil or subsurface soil containing high concentrations of COCs that are or potentially are mobile due to wind entrainment, volatilization (e.g., VOCs), surface runoff or subsurface transport.
>
> Highly toxic source material – buried drummed nonliquid wastes, buried tanks containing nonliquid wastes or soils containing significant concentrations of highly toxic materials.

Wastes that generally will not constitute principal threats include but are not limited to the following:

> Nonmobile contaminated source material of low to moderate toxicity – surface soil containing COCs that generally are relatively immobile in or near groundwater (i.e., nonliquid, low-volatility, low-leachability contaminants such as high molecular weight compounds) in the specific environmental setting.
>
> Low-toxicity source material – soil and subsurface soil concentrations not greatly above reference dose levels or that present an excess cancer risk near the acceptable risk range were exposure to occur.

The contaminated soils in the OU 1 source area are considered to be principal threat wastes because the COCs are considered to be mobile source materials. The subsurface soil contains high vapor phase concentrations of COCs that can easily move through the sandy soils in the unsaturated zone above the water table. Through chemical and physical process, the COCs can contaminate infiltrating water and impact groundwater. Although the contaminated groundwater in OU 1 and OU 2 themselves also pose risks, they are not considered principle threats as defined by the EPA guidance. Alternative S2 includes remedial actions to address only a portion of the contaminated soils at OU 1 by excavation and treatment. Alternative S3 and S4 include remedial actions to address the entirety of the contaminated soils at OU 1. An interim RA is currently being conducted in accordance with the 2010 Interim ROD to address a portion of these unsaturated subsurface soils at the source area by SVE. Alternatives S3 and S4 include continued operation of the existing SVE, with two additional SVE wells, to address the residual source materials. Alternative S4, a combination of Alternatives S2 and S3, will address contaminated soils at OU 1 on a shortened time frame.

13. Selected Remedy

Based upon consideration of CERCLA requirements, the detailed analysis of alternatives and comments from the state of Nebraska and the public, the EPA has selected Alternative S4 to address OU 1 soils and Alternative G3 to address OU 2 groundwater. These selections are consistent with the EPA's preferred alternatives presented in the Proposed Plan. The rationale, description, cost and expected outcomes of the Selected Remedy are discussed herein.

13.1 Summary of the Rationale for the Selected Remedy

Based on the information currently available, the EPA believes that the Selected Remedy meets the two threshold criteria and provides the best balance of trade-offs among the other alternatives with respect to the balancing and modifying criteria.

The EPA's Selected Remedy for the OU 1 soils is excavation, treatment and disposal of an estimated 68 cubic yards of contaminated soil and expansion and operation of the existing SVE system by installing an additional two SVE wells. The primary considerations that affected the selection of the remedy over the other alternatives were as follows:

- The remedy will achieve greater reductions in the risk to human health and the environment than the other alternatives. The Selected Remedy will reduce risk of vapor intrusion from contaminated soil gas, as well as reduce risk of leaching of contaminants to the groundwater from contaminated soils.

- The Selected Remedy provides permanent and significant reduction in the toxicity, mobility and volume of COCs at OU 1 by transferring contaminant mass from the soil and soil gas to the atmosphere through treatment.

- The Selected Remedy has a cleanup time frame equal to or shorter than the other alternatives.

- The remedy has a lower estimated present value than the other alternatives. The lower cost is attributable to the remedy's predicted shorter cleanup time frame than the other alternatives.

The EPA's Selected Remedy for the OU 2 groundwater is groundwater extraction, treatment and reinjection, with groundwater extraction from wells installed near the leading edge of the groundwater contaminant plume and in the mid-plume areas. The primary considerations that affected the selection of the remedy over the other alternatives were as follows:

- The remedy will achieve greater reductions in the risk to human health and the environment than Alternative G2 by more quickly reducing contaminant concentrations within the groundwater contaminant plume. The remedy will, to the same degree or better than the other alternatives, prevent the continued spreading of contaminants in the aquifer and the resulting aquifer degradation.

- The Selected Remedy provides permanent and significant reduction in the toxicity, mobility and volume of COCs at OU 1 by transferring contaminant mass from the soil and soil gas to the atmosphere through treatment.

- The Selected Remedy utilizes a proven technology that is more technically and administratively feasible to implement than Alternative G4.

- The remedy has a cleanup time frame equal to or shorter than the other alternatives.

- The remedy has a significantly lower estimated present value than Alternative G4. The higher cost of Alternative G4 is due to the much higher periodic costs, which involve the performance of multiple chemical treatment injections to the aquifer.

The EPA expects the Selected Remedy to satisfy the following statutory requirements of CERCLA section 121(b): (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost effective, (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and (5) satisfy the preference for treatment as a principal element. Unacceptable short-term or cross-media impacts are not expected to occur.

13.2 Description of the Selected Remedy

The EPA's Selected Remedy for the soils at OU 1 is excavation, treatment and disposal of contaminated soil and expansion and operation of the existing SVE system. The area of excavation is a 40-foot-by-10-foot area near the former AST and buried transfer pipe. The area will be excavated to a depth of 6 feet. Confirmation sampling will be performed to determine if contaminated soils are present on the sides or bottom of the excavated pit. Additional excavation may be performed if confirmation sampling indicates contaminated soils remain. The excavated soils are to be arranged in a soil pile(s) in a manner to allow for air stripping. Clean fill soil from an on-site borrow area will be used to backfill the excavated soils. Once the excavated contaminated soils have achieved cleanup goals, they will be placed in the borrow area. The area of excavation and tentative treatment and borrow/disposal areas are shown on Figure 9. The existing SVE system will be expanded by an estimated two additional SVE wells in the vicinity of the former AST and buried piping: one in the shallow unsaturated soils and one in the deep unsaturated soils (refer to Figure 10). To reach cleanup goals, it is estimated the expanded SVE system will need to be operated for an additional five years subsequent to the soil excavation activities.

The principal components of the remedy for the OU 1 soils are as follows:

- Excavation of contaminated soil in the vicinity of the 2,000-gallon AST and buried transfer pipe, which has been estimated to be approximately 68 bank cubic yards.

- Treatment of the excavated soil by ex situ SVE to meet cleanup goals;

- Confirmation sampling of walls and floor of excavated volume to determine if perimeter soils meet cleanup goals and possible excavation of any remaining contaminated soils;

- Backfill of the excavated soils with clean fill from an on-site borrow area;

- Disposal of treated soil in the on-site borrow area;

- Installation of SVE wells near the former AST and buried transfer pipe;
- Installation of buried piping from SVE wells to existing SVE system;
- Integration of the new SVE wells into the existing SVE system;
- Operation of the expanded SVE system;
- Annual subslab vapor monitoring.

The EPA's Selected Remedy for OU 2 is implementation of an IC and a groundwater recovery and treatment system with an estimated 12 extraction wells distributed at the leading edge and mid-plume areas. The mid-plume recovery wells will target areas of the plume with CCl_4 concentrations greater than 100 μg/l in the intermediate aquifer zone (C zone), and with CCl_4 concentrations greater than 45 μg/l in the lower aquifer zone (D/E zone). The leading-edge recovery wells will extract groundwater at a rate sufficient to capture groundwater contaminated above cleanup levels. Groundwater extracted by the recovery wells will be treated by air stripping. The treated groundwater will be reinjected into the aquifer or made available for beneficial reuse. The number of recovery wells, their approximate locations and groundwater extraction rates, have been estimated based on a groundwater flow and transport model and are illustrated on Figure 11.

The principal components of the interim remedy for the OU 2 groundwater are as follows:

- Installation of 12 recovery wells;
- Construction of a treatment system and treatment system building;
- Construction of six injection wells to reinjected treated effluent;
- Construction of a network of 30 monitoring wells for performance monitoring of the remedy;
- Quarterly, semiannual and annual groundwater monitoring;
- System operation and monitoring;
- Periodic well maintenance and equipment replacement.
- Implementation, monitoring and enforcement of an IC on the areas within or in close proximity to the contaminated groundwater plume. The ICs will protect human health and the environment by preventing exposures to the contaminated groundwater during remedial actions. At the conclusion of remedial actions, the groundwater would be at or below the cleanup levels and available for unrestricted and unlimited use.
- The ICs would remain in place throughout the remedial action on OU 2 contaminated groundwater until RAOs are achieved.

The descriptions of the Selected Remedy are based on information currently available. Details such as the exact position of SVE or recovery wells, rates of groundwater extraction from recovery wells and layout of piping from wells to the treatment system, as well as other details, will be determined during the remedial design based on achieving the RAOs. The Selected Remedy will require land acquisitions or easements, not only for the wells, piping, and treatment building at the leading edge of the plume, but also in the mid-plume areas. The estimated time to reach cleanup levels in the OU 2 groundwater for this alternative is 75 years. The process of air stripping transfers the dissolved phase VOCs to the atmosphere. Emissions of VOCs to the atmosphere have been are projected to be well below acceptable federal and state requirements, so it is assumed that control technology for air emissions would not be necessary.

The RAOs and cleanup levels for this interim RA were previously outlined in section 9. Performance objectives that will be used to monitor progress towards achieving the RAOs and cleanup levels will be established during the RD.

13.3 Cost Estimate for the Selected Remedy

<u>OU 1 Soils</u>
Estimated Time frame: 5 years
Estimated Capital Cost: $407,000
Estimated 5-year O&M Cost: $516,000
Estimated Periodic Cost: $62,000
Estimated Present Value: $883,000

<u>OU 2</u>
Estimated Time frame: 75 years
Estimated Capital Cost: $7,199,000
Estimated O&M Cost: $29,552,000
Estimated Periodic Cost: $3,541,000
Estimated Present Value: $15,550,000

Summaries of the estimated capital, O&M, and periodic costs of the major components of the Selected Remedy for OU 1 and OU 2 are included in Tables 15 and 16, respectively. Table17 and 18 provide summaries of the present value analysis for OU 1 and OU 2. The present value analysis provides an annualized breakdown of capital, annual and periodic costs. More details on the development of the cost estimates can be found in Appendix F of the FS. The information in these cost-estimate summary tables and present value analyses are based on the best available information regarding the anticipated scope of the remedial alternatives. These are order-of-magnitude engineering cost estimates that are expected to be within +50 to -30 percent of the actual project cost. In addition, changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternatives. Major changes, if any, may be documented in the form of a memorandum in the Administrative Record, an explanation of significant difference or a ROD amendment.

13.4 Estimated Outcomes of the Selected Remedy

This interim remedy for the Site will capture contaminated groundwater from OU 2 and prevent its downgradient migration and reduce concentrations of contaminants in OU 2 groundwater below the MCLs, thereby reducing the risk to human health and the environment. This interim remedy also will remove contaminants from the soils and soil gas at the source area OU 1 to reduce risk to human health and the environment.

The cleanup levels were provided in Table 10 of section 9 of this Interim ROD. The cleanup levels for OU 1 soil were established on the basis of the potential for contaminants to migrate from the soil to the groundwater and cause an exceedance of the MCL. The cleanup levels for OU 1 soil gas were established on the basis of the potential for adverse health effects to a future resident from vapor intrusion of soil gas into a hypothetical residence on OU 1, as well as on the potential for contaminants to migrate from the soil gas to the groundwater and cause an exceedance of the MCL. The cleanup levels for OU 2 groundwater were established on the basis of federal and state ARARs.

For OU 1, upon achievement of the cleanup levels in the soil gas, the unacceptable risk to a future resident from vapor intrusion of soil gas into a hypothetical residence on OU 1, should be eliminated. Additionally, the risk that contaminants in the soil gas will migrate to the groundwater and cause an exceedance of the MCL should be eliminated.

For OU 1, upon achievement of the cleanup levels in soil, the risk that contaminants in the soil will migrate to the groundwater and cause and exceedance of the MCL should be eliminated.

For OU 2, upon achievement of the cleanup levels, the unacceptable risk to current resident from exposure to contaminated groundwater should be eliminated.

Table 15 – Cost Estimate Summary for the Selected Remedy, OU 1 Alternative S4 – Expansion and Operation of SVE System and Excavation, Treatment, and Disposal of Contaminated Soil				
CAPITAL COSTS				
Description	**Quantity**	**Units**	**Unit Cost**	**Total Line Item Cost**
Incurred During Year 0				
Mobilization/Demobilization	1	LS	$5,428	$5,428
Institutional Controls	1	LS	$30,400	$30,400
Earthwork				
Excavation of Contaminated Soils	297	BCY	$20	$5,884
Treatment of Contaminated Soils	357	LCY	$72	$25,566
Disposal of Treated Soils at Borrow Area	357	LCY	$4	$1,154
Restoration of Excavated Areas	400	SF	$14	$5,557
Confirmation Sampling	1	LS	$3,849	$3,849
Miscellaneous Requirements for Sampling	1	LS	$53,300	$53,300
SVE Well Installation	2	EA	$17,121	$34,241
Pipe Installation	310	LF	$16	$4,732
			Subtotal	$166,096
Contingency (Scope and Bid) (20%)				$33,219
			Subtotal	$199,315
Remedial Design (15%)				$29,897
Project Management (8%)				$15,945
Construction Management (10%)				$19,932
Total Capital Cost Incurred During Year 0 [(a)]				**$265,000**
Incurred During Year 5				
SVE Well Abandonment	11	EA	$2,856	$31,410
Decommissioning Treatment System	1	LS	$50,000	$50,000
			Subtotal	$81,410
Contingency (Scope and Bid) (20%)				$16,282
			Subtotal	$97,692
Project Management (10%)				$9,769
Remedial Design (20%)				$19,538
Construction Management (15%)				$14,654
Total Capital Costs Incurred During Year 20 [(b)]				**$142,000**
TOTAL CAPITAL COSTS *(Incurred in Years 0 and 5)*				**$407,000**

Table 15 – Cost Estimate Summary for the Selected Remedy, OU 1 (cont.) Alternative S4 – Expansion and Operation of SVE System and Excavation, Treatment, and Disposal of Contaminated Soil				
OTHER COSTS				
Description	**Quantity**	**Units**	**Unit Cost**	**Total Line Item Cost**
Annual SVE O&M Costs (Incurred during years 0 through 5)				
O&M of SVE Treatment System	1	EA	$40,141	$40,141
			Subtotal	$40,141
Contingency (Scope and Bid) (20%)				$8,028
			Subtotal	$48,169
Project Management (10%)				$4,817
Technical Support (15%)				$7,225
			Total Annual SVE O&M Costs [b]	**$60,000**
Annual Monitoring Costs (Incurred During Years 0 through 5)				
Vapor Monitoring Sampling and Reporting	1	EA	$17,223	$17,223
			Subtotal	$17,223
Contingency (Scope and Bid) (20%)				$3,445
			Subtotal	$3,445
Project Management (10%)				$2,067
Technical Support (15%)				$3,100
			Total Annual Monitoring Cost [b]	**$26,000**
Five-Year Site Review Periodic Costs (Year 5)				
Five-Year Site Review	1	EA	$46,722	$46,722
			Subtotal	$46,722
Contingency (Scope and Bid) (20%)				$9,344
			Subtotal	$56,066
Project Management (10%)				$5,607
			Total Five-Year Site Review Periodic Cost [b]	**$62,000**

Notes: [a] Rounded to nearest $1,000
[b] Not adjusted to present value

Table 16 – Cost Estimate Summary for the Selected Remedy, OU 2 Alternative G3 – Groundwater Recovery, Treatment, and Discharge at Mid-plume and Leading Edge of Plume				
CAPITAL COSTS				
Description	**Quantity**	**Units**	**Unit Cost**	**Total Line Item Cost**
Incurred During Year 0				
Land Acquisition/Easement Requirements	1	LS	$14,464	$14,464
Institutional Controls	1	LS	$30,400	$26,385
Miscellaneous Requirements for Sampling	1	LS	$53,300	$53,300
Monitoring Well Installation	30	EA	$10,969	$329,045
Recovery Well Installation	12	EA	$106.439	$1,277,257
Re-injection Well Installation	6	EA	$101,355	$608,129
Well Vault Installation	18	EA	$48,941	$880,931
Pipe Installation	18,250	LF	$58	$1,047,130
Treatment System Building	1	EA	$98,469	$98,469
Treatment System	1	EA	$231,425	$231,425
Treatment System Startup Testing	1	EA	$13,947	$13,947
			Subtotal	$4,580,482
Contingency (Scope and Bid) (20%)				$916,096
			Subtotal	$5,496,578
Remedial Design (8%)				$439,726
Project Management (5%)				$274,829
Construction Management (6%)				$329,795
Total Capital Cost Incurred During Year 0 [(a)]				$6,541,000
Incurred During Year 75				
Monitoring Well Abandonment	57	EA	$3,634	$207,088
Recovery Well Abandonment	12	EA	$8,233	$98,793
Re-injection Well Abandonment	6	EA	$9,433	$56,597
Decommissioning Treatment System	1	LS	$50,000	$50,000
			Subtotal	$412,478
Contingency (Scope and Bid) (20%)				$82,496
			Subtotal	$494,974
Remedial Design (15%)				$74,246
Project Management (8%)				$39,598
Construction Management (10%)				$49,497
Total Future Capital Cost Incurred in Year 75 [(b)]				$658,000
TOTAL CAPITAL COSTS *(Incurred in Years 0 and 75)*[(b)]				$1,312,000

Table 16 – Cost Estimate Summary for the Selected Remedy, OU 2 (cont.)

Alternative G3 – Groundwater Recovery, Treatment, and Discharge at Mid-plume and Leading Edge of Plume

OTHER COSTS				
Description	**Quantity**	**Units**	**Unit Cost**	**Total Line Item Cost**
Quarterly Monitoring Annual Costs (Incurred during year 1)				
Groundwater Sampling Event	4	EA	$43,720	$174,880
Groundwater Monitoring Event Report	4	EA	$29,788	$119,152
			Subtotal	$294,032
Contingency (Scope and Bid) (20%)				$58,806
			Subtotal	$352,838
Project Management (8%)				$28,227
Technical Support (15%)				$52,926
Total Annual Quarterly Monitoring Costs (b)				**$434,000**
Semiannual Monitoring Costs (Incurred During Years 2 through 5)				
Groundwater Sampling Event	2	EA	$43,720	$87,440
Groundwater Monitoring Event Report	2	EA	$29,788	$59,576
			Subtotal	$147,016
Contingency (Scope and Bid) (20%)				$29,403
			Subtotal	$176,419
Project Management (8%)				$14,114
Technical Support (15%)				$26,463
Total Annual Semiannual Monitoring Costs (b)				**$217,000**
Annual Monitoring Costs (Incurred During Years62 through 75)				
Groundwater Sampling Event	1	EA	$43,720	$43,720
Groundwater Monitoring Event Report	1	EA	$29,788	$29,788
			Subtotal	$73,508
Contingency (Scope and Bid) (20%)				$14,702
			Subtotal	$88,210
Project Management (10%)				$8,821
Technical Support (15%)				$13,232
Total Annual Monitoring Costs (b)				**$110,000**

Table 16 – Cost Estimate Summary for the Selected Remedy, OU 2 (cont.) Alternative G3 – Groundwater Recovery, Treatment, and Discharge at Mid-plume and Leading Edge of Plume				
OTHER COSTS				
Description	**Quantity**	**Units**	**Unit Cost**	**Total Line Item Cost**
Annual GET O&M Costs (Incurred during years 0 through 75)				
O&M of GET System	1	EA	$172,891	$172,891
			Subtotal	$172,891
Contingency (Scope and Bid) (20%)				$34,578
			Subtotal	$207,469
Project Management (8%)				$16,598
Technical Support (15%)				$31,120
			Total Annual O&M Costs [(b)]	**$255,000**
Annual Institutional Control Costs (Incurred During Years 0 through 75)				
Monitoring and Enforcement of ICs	1	EA	$12,552	$12,552
			Subtotal	$12,552
Contingency (Scope and Bid) (20%)				$2,510
			Subtotal	$15,062
Project Management (10%)				$1,506
Technical Support (15%)				$2,259
			Total Annual IC Cost [(b)]	**$19,000**

Table 16 – Cost Estimate Summary for the Selected Remedy, OU 2 (cont.) Alternative G3 – Groundwater Recovery, Treatment, and Discharge at Mid-plume and Leading Edge of Plume				
OTHER COSTS				
Description	**Quantity**	**Units**	**Unit Cost**	**Total Line Item Cost**
Equipment Replacement Periodic Costs (Every 5 years)				
Equipment Replacement Allowance	1	EA	$75,000	$75,000
			Subtotal	$75,000
Contingency (Scope and Bid) (20%)				$15,000
			Subtotal	$90,000
Project Management (10%)				$9,000
Technical Support (15%)				$13,500
			Total Well Maintenance Periodic Costs [(b)]	**$113,000**
Well Maintenance Periodic Costs (Every 10 years)				
Monitoring Well Maintenance	1	EA	$55,496	$55,496
Recovery Well Maintenance	1	EA	25,743	$25,473
Re-injection Well Maintenance	1	EA	17,005	$17,005
			Subtotal	$98,244
Contingency (Scope and Bid) (20%)				$19,649
			Subtotal	$117,893
Project Management (10%)				$5,607
			Total Five-Year Site Review Periodic Cost [(b)]	**$62,000**
Notes: [(a)] Rounded to nearest $1,000 [(b)] Not adjusted to present value				

Table 17 - Summary of Present Value Analysis for the Selected Remedy, OU 1

Alternative S4 - Expansion and Operation of SVE System and Excavation, Treatment, and Disposal of Contaminated Soil

Garvey Elevator Site, OU 1

Year[1]	Capital Costs	Annual Costs[2]	Periodic Costs[3]	Total Annual Expenditure[4]	Discount Factor[5]	Present Value[6,7]
0	$265,000	$86,000	$0	$351,000	1.0000	$351,000
1	$0	$86,000	$0	$86,000	0.9524	$81,906
2	$0	$86,000	$0	$86,000	0.9070	$78,002
3	$0	$86,000	$0	$86,000	0.8638	$74,287
4	$0	$86,000	$0	$86,000	0.8227	$70,752
5	$142,000	$86,000	$62,000	$290,000	0.7835	$227,215
TOTALS:	**$407,000**	**$516,000**	**$62,000**	**$985,000**		$883,162
			TOTAL PRESENT VALUE			**$883,000**

Notes:

1 - Duration is estimated for present value analysis. Estimated remedial timeframes are discussed within the FS report.

2 - Annual cost includes O&M cost and monitoring cost for the respective year.

3 - Periodic cost includes well maintenance, equipment replacement cost and five-year review cost for the respective year.

4 - Total annual expenditure is the total cost per year with no discounting.

5 - Based on discount rate of 5%.

6 - Present value is the total cost per year including a discount factor for that year.

7 - Total present value is rounded to the nearest $1,000. Depreciation is excluded from the present value cost.

Table 18 - Summary of Present Value Analysis for the Selected Remedy, OU 2

Alternative G3 – Groundwater Recovery, Treatment, and Discharge at Mid-plume and Leading Edge of Plume

Garvey Elevator Superfund Site, OU 2

Year[1]	Capital Cost	Annual Cost[2]	Periodic Cost[3]	Total Annual Expenditure[4]	Discount Factor[5]	Present Value[6,7]
0	$6,541,000	$0	$0	$6,541,000	1.0000	$6,541,000
1	$0	$708,000	$0	$708,000	0.9524	$674,299
2	$0	$491,000	$0	$491,000	0.9070	$445,337
3	$0	$491,000	$0	$491,000	0.8638	$424,126
4	$0	$491,000	$0	$491,000	0.8227	$403,946
5	$0	$491,000	$175,000	$666,000	0.7835	$521,811
6	$0	$384,000	$0	$384,000	0.7462	$286,541
7	$0	$384,000	$0	$384,000	0.7107	$272,909
8	$0	$384,000	$0	$384,000	0.6768	$259,891
9	$0	$384,000	$0	$384,000	0.6446	$247,526
10	$0	$384,000	$322,000	$706,000	0.6139	$433,413
11	$0	$384,000	$0	$384,000	0.5847	$224,525
12	$0	$384,000	$0	$384,000	0.5568	$213,811
13	$0	$384,000	$0	$384,000	0.5303	$203,635
14	$0	$384,000	$0	$384,000	0.5051	$193,958
15	$0	$384,000	$175,000	$559,000	0.4810	$268,879
16	$0	$384,000	$0	$384,000	0.4581	$175,910
17	$0	$384,000	$0	$384,000	0.4363	$167,539
18	$0	$384,000	$0	$384,000	0.4155	$159,552
19	$0	$384,000	$0	$384,000	0.3957	$151,949
20	$0	$384,000	$322,000	$706,000	0.3769	$266,091
21	$0	$384,000	$0	$384,000	0.3589	$137,818
22	$0	$384,000	$0	$384,000	0.3418	$131,251
23	$0	$384,000	$0	$384,000	0.3256	$125,030
24	$0	$384,000	$0	$384,000	0.3101	$119,078
25	$0	$384,000	$175,000	$559,000	0.2953	$165,073
26	$0	$384,000	$0	$384,000	0.2812	$107,981
27	$0	$384,000	$0	$384,000	0.2678	$102,835
28	$0	$384,000	$0	$384,000	0.2551	$97,958
29	$0	$384,000	$0	$384,000	0.2429	$93,274

Table 18 - Summary of Present Value Analysis for the Selected Remedy, OU 2 (cont.)

Alternative G3 – Groundwater Recovery, Treatment, and Discharge at Mid-plume and Leading Edge of Plume

Garvey Elevator Superfund Site, OU 2

Year[1]	Capital Cost	Annual Cost	Periodic Cost	Total Annual Expenditure[2]	Discount Factor[3]	Present Value[4,5]
30	$0	$384,000	$322,000	$706,000	0.2314	$163,368
31	$0	$384,000	$0	$384,000	0.2204	$84,634
32	$0	$384,000	$0	$384,000	0.2099	$80,602
33	$0	$384,000	$0	$384,000	0.1999	$76,762
34	$0	$384,000	$0	$384,000	0.1904	$73,114
35	$0	$384,000	$175,000	$559,000	0.1813	$101,347
36	$0	$384,000	$0	$384,000	0.1727	$66,317
37	$0	$384,000	$0	$384,000	0.1644	$63,130
38	$0	$384,000	$0	$384,000	0.1566	$60,134
39	$0	$384,000	$0	$384,000	0.1491	$57,254
40	$0	$384,000	$322,000	$706,000	0.1420	$100,252
41	$0	$384,000	$0	$384,000	0.1353	$51,955
42	$0	$384,000	$0	$384,000	0.1288	$49,459
43	$0	$384,000	$0	$384,000	0.1227	$47,117
44	$0	$384,000	$0	$384,000	0.1169	$44,890
45	$0	$384,000	$175,000	$559,000	0.1113	$62,217
46	$0	$384,000	$0	$384,000	0.1060	$40,704
47	$0	$384,000	$0	$384,000	0.1009	$38,746
48	$0	$384,000	$0	$384,000	0.0961	$36,902
49	$0	$384,000	$0	$384,000	0.0916	$35,174
50	$0	$384,000	$322,000	$706,000	0.0872	$61,563
51	$0	$384,000	$0	$384,000	0.0831	$31,910
52	$0	$384,000	$0	$384,000	0.0791	$30,374
53	$0	$384,000	$0	$384,000	0.0753	$28,915
54	$0	$384,000	$0	$384,000	0.0717	$27,533
55	$0	$384,000	$175,000	$559,000	0.0683	$38,180
56	$0	$384,000	$0	$384,000	0.0651	$24,998
57	$0	$384,000	$0	$384,000	0.0620	$23,808
58	$0	$384,000	$0	$384,000	0.0590	$22,656
59	$0	$384,000	$0	$384,000	0.0562	$21,581

Table 18 - Summary of Present Value Analysis for the Selected Remedy, OU 2 (cont.)

Alternative G3 – Groundwater Recovery, Treatment, and Discharge at Mid-plume and Leading Edge of Plume

Garvey Elevator Superfund Site, OU 2

Year[1]	Capital Cost	Annual Cost	Periodic Cost	Total Annual Expenditure[2]	Discount Factor[3]	Present Value[4,5]
60	$0	$384,000	$322,000	$706,000	0.0535	$37,771
61	$0	$384,000	$0	$384,000	0.0510	$19,584
62	$0	$384,000	$0	$384,000	0.0486	$18,662
63	$0	$384,000	$0	$384,000	0.0462	$17,741
64	$0	$384,000	$0	$384,000	0.0440	$16,896
65	$0	$384,000	$175,000	$559,000	0.0419	$23,422
66	$0	$384,000	$0	$384,000	0.0399	$15,322
67	$0	$384,000	$0	$384,000	0.0380	$14,592
68	$0	$384,000	$0	$384,000	0.0362	$13,901
69	$0	$384,000	$0	$384,000	0.0345	$13,248
70	$0	$384,000	$322,000	$706,000	0.0329	$23,227
71	$0	$384,000	$0	$384,000	0.0313	$12,019
72	$0	$384,000	$0	$384,000	0.0298	$11,443
73	$0	$384,000	$0	$384,000	0.0284	$10,906
74	$0	$384,000	$0	$384,000	0.0270	$10,368
75	$658,000	$384,000	$62,000	$1,104,000	0.0258	$28,483
TOTALS:	**$7,199,000**	$29,552,000	$3,541,000	**$40,292,000**		$15,550,127
			TOTAL PRESENT VALUE			**$15,550,000**

Notes:

1 - Duration is estimated for present value analysis. Estimated remedial timeframes are discussed within the FS report.

2 - Annual cost includes O&M cost and monitoring cost for the respective year.

3 - Periodic cost includes well maintenance, equipment replacement cost and five-year review cost for the respective year.

4 - Total annual expenditure is the total cost per year with no discounting.

5 - Based on discount rate of 5%.

6 - Present value is the total cost per year including a discount factor for that year.

7 - Total present value is rounded to the nearest $1,000. Depreciation is excluded from the present value cost.

14. Statutory Determinations

Under CERCLA section 121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume toxicity or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. This preference is addressed in the Selected Remedy. The following sections discuss how the Selected Remedy meets these statutory requirements.

14.1 Protection of human health and the environment

The Selected Remedy, the combination of Alternatives S4 and G3, will protect human health and the environment at OU 1 through treatment of CCl_4- and PCE-contaminated soil by SVE and excavation, treatment and on-site disposal of treated soil. The Selected Remedy will protect human health and the environment at OU 2 through establishment of an institutional control at OU 2 and by pumping and treating contaminated groundwater to remove CCl_4 and $CHCl_3$ contamination to Federal drinking water standards.

The existing IC on OU 1 will eliminate the threat of exposure of a hypothetical future resident in the OU 1 area to the PCE-contaminated soil via vapor intrusion, as well as to the CCl_4- and TCE-contaminated groundwater via domestic use of private well water. The excavation, treatment and on-site disposal and the SVE will also minimize the potential for leachate generation and recontamination of OU 1 groundwater. Once established, the IC on OU 2 will prevent the threat of exposure of current/future residents to the CCl_4- and $CHCl_3$ contaminated groundwater via domestic use of private well water. The current carcinogenic cancer risk associated with these pathways exceeds 1.0E-04 and/or the noncarcinogenic risk exceeds 1.0. The Selected Remedy will reduce the carcinogenic risk from exposure to less than or equal to 1.0E-06 and reduce the noncarcinogenic risk from exposure to less than 1.0. There are no short-term threats associated with the Selected Remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the Selected Remedy.

14.2 Compliance with ARARs

Section 121(d)(2) of CERCLA; 42 U.S.C. 9621(d)(2); NCP, 40 CFR part 300; and guidance and policy issued by EPA require that remedial actions conducted under CERCLA achieve a degree or level of cleanup which, at a minimum, attains any standard, requirement, criteria or limitation under any federal environmental law...or any promulgated standard, requirement, criteria or limitation under a state environmental or facility siting law that is more stringent than any federal standard ". . .[which] is legally applicable to the hazardous substance or pollutant or contaminant concerned or is relevant and appropriate under the circumstances of the release or threatened release of such hazardous substance or pollutant or contaminant..." The identified standards, requirements, criteria or limitations thus adopted from other environmental laws, which govern on-site cleanup activities at this Site, are referred to as applicable or relevant and appropriate requirements or ARARs.

For on-site cleanup activities under section 121(e)(1) of CERCLA, EPA is not required to obtain any federal, state, or local permits. For actions conducted on-site, the Selected Remedy will comply with the substantive (nonadministrative) requirements of the identified federal and state laws. However, for cleanup activities that will occur off-Site, both the substantive as well as the administrative requirements of such laws will apply to cleanup activities. This section identifies the ARARs which will apply to the on-site cleanup activities.

CERCLA section 121(d)(4) authorizes that any ARAR may be waived under one of six conditions. One of these conditions is when the remedial action selected is only part of a total remedial action, and the total remedial action will attain such level or standard of control when completed. This Interim ROD describes the interim RA that will address soils at OU 1 and groundwater at OU 2. With respect to OU 1 groundwater, this Interim ROD does not modify the interim remedy set forth in the 2010 Interim ROD. Further studies of the feasibility of alternatives to address OU 1 groundwater are necessary before selecting a final remedy for the entire Site. This Interim Action will be consistent with the final remedy.

Appendix A presents a summary of federal and state ARARs. The Selected Remedy for OU 1 soils and OU 2 groundwater will comply with the ARARs in Appendix A. Several of the more significant ARARs for the Selected Remedy are as follows:

- ***Safe Drinking Water Act, 42 U.S.C. 300(f), et seq., National Primary and Secondary Drinking Water Regulations, 40 CFR parts 141 and 142:*** Primary Drinking Water Standards are established in 40 CFR part 141. SDWA MCLs are health-based standards for chemicals in public water supplies. The NCP requires consideration of MCLs, where they exist, as relevant and appropriate requirements for groundwater cleanups when the aquifer is a current or potential source of drinking water. MCLs for the COCs are relevant and appropriate for establishing cleanup standards for remedial actions.

- ***Nebraska Ground Water Quality Standards and Use Classification, Title 118:*** The substantive requirements of NDEQ's Title 118 are relevant and appropriate to the groundwater at the Site. Under Title 118, a Remedial Action Classification of RAC-1 is assigned to the aquifer at the Site. Preliminary cleanup levels in RAC-1 areas are typically MCLs. If an MCL has not been established for a particular contaminant, NDEQ can consider EPA's Ambient Water Quality Criteria, Health Advisories, and other documents in setting the preliminary cleanup levels, or, if there is no established MCL, a level equivalent to the 1×10^{-6} risk level. The time frame for any required corrective action is established—subject to appeal with adequate justification—as the period of potential exposure in the absence of any remedial action or 20 years, whichever time frame is less. Title 113, Chapter 3, provides that any groundwater whose existing quality is better than the MCLs must be maintained at the higher quality; however, the state may choose, after public notice and public hearing and based upon necessary economic social development, to allow degradation that does not interfere with existing uses.

- ***State of Nebraska Solid Waste Requirements, Titles 128 and 132:*** These regulations set forth standards that apply to a person involved in any aspect of the management of solid or hazardous waste. If a solid waste is generated during implementation of the remedial action (e.g., spent carbon) a hazardous waste determination must be made pursuant to Title 128, Chapter 4, 002. If material is a hazardous waste, it must be handled and disposed of in accordance with the hazardous waste management requirements in Chapters 8 – 11. If the material is not a hazardous waste, it may be a special waste as defined in Title 132, Chapter 1, and the generator must follow the requirements of NDEQ Title 132, Chapter 13, and may only be disposed of at a permitted landfill which is operated and maintained in compliance with NDEQ regulations, unless an alternate location and management method is approved.

- ***State of Nebraska Groundwater Well and Monitoring Requirements:*** Pursuant to Title 456, groundwater monitoring wells must be registered with the Nebraska Department of Natural Resources. Water Well Standards and Contractor's Licensing regulations are found at Neb. Rev. Stat. 46-1201 to 46-1241 and accompanying regulations at Title 178. Well Spacing requirements are found at Neb. Rev. Stat. 46-651 to 46-655.

- ***State of Nebraska Rules and Regulations for Underground Injection and Mineral Production Wells, Title 122:*** The selected interim RA includes the reinjection of treated groundwater to the aquifer.

14.3 Cost Effectiveness

The EPA has determined that the Selected Remedy is cost effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." [NCP § 300.430 (f)(1)(ii)(D)]. This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost effectiveness.

The Selected Remedy meets the criteria and provides for overall effectiveness in proportion to its costs. The estimated present value of the Selected Remedy is $16,433,000, $883,000 of which is for the OU 1 soil component and $15,550,000 of which is for the OU 2 groundwater component. Changes in the cost elements are likely to occur as a result of new information and data collected during the implementation of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record, an explanation of significant differences, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project costs.

14.4 Utilization of Permanent Solutions and Innovative Treatment Technologies to the Maximum Extent Practicable

The EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at OU 1. Of those alternatives that are protective of human health and the environment and comply with ARARs, the EPA has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria given the scope of this action while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering state and community acceptance.

The Selected Remedy treats the source materials constituting principal threats at the Site, achieving significant reductions in CCl_4 concentrations in the soil. The Selected Remedy satisfies the criteria for long-term effectiveness by removing CCl_4 contamination from soil. The Selected Remedy does not present short-term risks different from other treatment alternatives. There are no special implementability issues that set the Selected Remedy apart from the other alternatives evaluated.

14.5 Preference for Treatment which Reduces Toxicity, Mobility, or Volume

The preference for treatment is addressed in this interim remedy for OU 1 and OU 2. The treatment component includes excavation and treatment of VOC-contaminated soil by air stripping, as well as soil vapor extraction to remove COCs from the soil and to reduce the volume of COC-contaminated soil. The treatment component also includes air stripping to remove COCs from the extracted groundwater.

14.6 Five-year Review Requirement

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a statutory review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment. This statutory review will be conducted within five years after the initiation of the remedial actions.

15. Documentation of Significant Changes

The Proposed Plan for the Site was released for public comment July 26, 2013. The Proposed Plan identified the following as the Preferred Alternatives: Alternative S4 – Excavation, Treatment and Disposal of Contaminated Soil and Expansion and Operation of the Existing SVE System and Alternative G3 – Groundwater Recovery, Treatment and Discharge at Mid-plume and Leading Edge of Plume. The EPA did not receive written or verbal comments during the public comment period.

The EPA determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate. However, the EPA did identify two necessary changes to the scope of this Interim Action. Firstly, the list of RAOs, presented in the Proposed Plan, has been amended to include the following RAO in this Interim Action: To prevent exposure of future residents to concentrations of soil gas, via the vapor intrusion pathway, at or above the cleanup levels in the soil gas at OU 1. This RAO is necessary to prevent unacceptable risk to a future resident at OU 1. Secondly, the list of preliminary cleanup levels for soil gas, which, as presented in the Proposed Plan only included PCE, has been revised to include the contaminants CCl_4 and $CHCl_3$ and to clarify the cleanup levels are applicable from the surface to 10 feet bgs. This revision was necessary to address the unacceptable risk to a future resident via vapor intrusion.

PART III: RESPONSIVENESS SUMMARY

This responsiveness summary has been prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This document provides the response from the U.S. Environmental Protection Agency (EPA) to all significant comments received regarding the Proposed Plan from the public during the public-comment period.

On July 26, 2013, the EPA released the Proposed Plan and the Administrative Record File which contains the documents considered or relied upon by the EPA with regard to response actions at Operable Unit 1 (OU 1) and OU 2 of the Garvey Elevator Superfund Site (Site). The Proposed Plan discussed EPA's proposed actions to mitigate further impacts to the groundwater from the contaminated source area soils, prevent human exposures to contaminated groundwater in and near the OU 2 contaminated groundwater plume, prevent further migration of the OU 2 plume, and restore the aquifer to its beneficial use. The public-comment period on the Proposed Plan for OU 1 was held from July 26 to August 30, 2013. On August 8, 2013, the EPA held a public meeting to present the Proposed Plan for OU 1 and OU 2, to apprise the public of the comment period and to record the concerns of the community expressed during the meeting. A copy of the transcript from the public meeting is included in the Administrative Record File. No written comments were received in response to the EPA's Proposed Plan.

In general, individual members of the local community and the current property owners of the former Garvey Elevator facility were concerned and had general questions about the Site but did not express an opinion regarding the EPA's preferred alternatives. During the public meeting, no disagreement of the preferred alternatives was expressed by individual members of the local community. There were no local officials in attendance at the public meeting.

ABBREVIATIONS

AGP	Ag Processing, Inc.
AOC	Administrative Order on Consent
AR	administrative record
ARAR	applicable or relevant and appropriate requirements
AST	above ground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
CCl_4	carbon tetrachloride
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
$CHCl_3$	chloroform
COC	contaminant of concern
COPC	contaminant of potential concern
CS_2	carbon disulfide
CSF	cancer slope factor
CSM	conceptual site model
DFT	dipole flow test
DNAPL	dense non-aqueous phase liquid
DPT	direct-push technology
EDB	ethylene dibromide
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
°F	degrees Farenheit
FS	feasibility study
FFS	focused feasibility study
FR	Federal Register
Garvey	Garvey Elevators, Inc.
GET	groundwater extraction and treatment
gpd/ft	gallons per day per foot
HEAST	EPA health effects summary tables
HHRA	baseline human health risk assessment
HI	hazard index
HQ	hazard quotient
IC	institutional control
ICA	institutional control area
ILCR	incremental lifetime cancer risk
IW	injection well
Interim ROD	Interim Record of Decision
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MW	monitoring well
N/A	not applicable
NAPL	nonaqueous phase liquid
NCP	National Oil and Hazardous Substances Contingency Plan
NDEQ	Nebraska Department of Environmental Quality
NPL	National Priorities List

O&M	operation and maintenance
OU	operable unit
PA/SI	preliminary assessment / site investigation
PCE	tetrachloroethene
PCB	polychlorinated biphenyl
PLC	programming logic controller
PRP	potentially responsible party
RA	remedial action
RAC	remedial action classification
RAO	remedial action objective
RAPMA	Remedial Action Plan Monitoring Act
RD	remedial design
RfD	dermal reference dose
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
ROI	radius of influence
RP	responsible party
RW	recovery well
SARA	Superfund Amendments and Reauthorization Act
scfm	standard cubic feet per minute
SCGs	standards, criteria and guidances
SDWA	Safe Drinking Water Act
Site	Garvey Elevator Superfund Site
SLERA	screening level ecological risk assessment
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TBC	to-be-considered
TCE	trichloroethene
THM	trihalomethanes
UCL	upper confidence limit
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
VCP	voluntary cleanup program
VFD	variable frequency drive
VOC	volatile organic compound

GLOSSARY OF TERMS

This glossary defines many of the technical terms used in relation to the site in this Interim Action ROD for the interim RA. The terms and abbreviations contained in this glossary are often defined in the context of hazardous waste management and apply specifically to work performed under the Superfund program. Therefore, these terms may have other meanings when used in a different context.

Administrative Record: The body of documents the EPA uses to form the basis for selection of a response.

Applicable or Relevant and Appropriate Requirements: Federal and state requirements for cleanup, control, and environmental protection that a Selected Remedy for a site will meet.

Aquifer: A formation, or group of formations, that yields water to a well of sufficient quality and quantity for drinking and/or other purposes.

Aquitard: A layer within an aquifer that is composed of material less permeable than the aquifer located above and below it.

Capital Costs: Expenses related to the labor, equipment, and material costs of construction.

Carcinogenic Risk: Carcinogenic risks are probabilities usually expressed in scientific E notation (e.g., 1E-06). An excess carcinogenic risk of 1E-06 indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of a site-related exposure.

Cleanup Levels: Medium- and contaminant-specific goals set to achieve as a result of the RAOs (e.g., treatment of contaminated groundwater to MCLs).

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. The acts created a special tax that went into a trust fund, commonly known as Superfund, to investigate and cleanup abandoned or uncontrolled hazardous waste sites. Under the program, the EPA can either: (1) pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or (2) take legal action to force parties responsible for site contamination to clean up the site or pay back the federal government the cost of the cleanup.

Contaminant of Concern: The chemical substances found at the site at concentrations that pose an unacceptable risk to human health and the environment.

Contaminant Plume or Plume: A three-dimensional volume of contaminated groundwater. The contaminant plume's size and shape are influenced by such factors as groundwater flow direction and rate, the type of contaminant, the properties of the aquifer, and rate of aquifer recharge from infiltration, among other factors.

Downgradient: Locations along the general path of groundwater flow in a direction away from the observer or reference point. It is analogous to the term downstream when referring to locations on a stream relative to an observer.

Feasibility Study: The report that presents the identification and evaluation of the most appropriate technical approaches to address contamination problems at a Superfund site.

Fund-financed: Activities financed by the Trust Fund. Refer to Comprehensive Environmental Response, Compensation, and Liability Act.

Fund-lead Removal Action: The EPA-lead cleanup activities, generally time sensitivity in nature, taken to abate, prevent minimize, stabilize, mitigate, or eliminate the threat to human health and the environment.

Groundwater Extraction and Treatment: A groundwater remediation technology that utilizes a combination of extraction wells and a treatment system(s) that treats the discharge from the extraction wells (commonly referred to as pump-and-treat).

Hazard Ranking Score: The principal mechanism the EPA uses to place uncontrolled waste sites on the NPL.

Interim Remedial Action: A remedy that is performed before the RI/FS for the site or operable unit has been completed and is performed to mitigate immediate threats.

Maximum Contaminant Level: Established by the Safe Drinking Water Act as the maximum permissible contaminant level in water that is delivered to any user of a public water system.

Maximum Contaminant Level Goal: The highest level of a contaminant in drinking water below which there are no known or expected risk to human health.

Mega Site – A site where the combined extramural, actual and planned, removal and remedial action costs incurred by Superfund or by PRPs are greater than $50 million.

National Priorities List: The EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response.

Operable Unit: A distinct portion of a Superfund site or a distinct action at a Superfund site. An operable unit may be established based on a particular type of contamination, contaminated media (e.g., soil, water), source of contamination, and/or some physical boundary or restraint.

Operation and Maintenance: Activities conducted at a site after a remedy has been constructed, to ensure that the cleanup or containment system continues to operate as designed.

Operation and Maintenance Costs: The cost and time frame of operating labor, maintenance, materials, energy, disposal, and administrative components of the remedy.
Preferred Alternative: Of all the alternatives considered, the preferred alternative is the alternative that is proposed by the EPA to address the site.

Preliminary Assessment/Site Investigation: A Preliminary Assessment (PA) assesses readily available information to determine whether a site poses a threat and whether further investigation is necessary. A Site Investigation (SI) collects samples to determine whether hazardous substances have been released and assess whether they have reached nearby targets. The PA and SI are typically performed simultaneously. They provide the data needed for Hazard Ranking System scoring and documentation.

Present Value: The amount of money, which is invested in the current year, would be sufficient to cover all the costs over time associated with a remedial action. It is calculated using a predetermined discount rate and interest rate.

Presumptive Remedies: Preferred technologies for common categories of sites, based on historical patterns of remedy selection and the EPA's scientific and engineering evaluation of performance data on technology implementation.

Proposed Plan: A document requesting public input on a proposed remedial alternative.

Record of Decision: A document which is a consolidated source of information about the site, the remedy selection process, and the Selected Remedy for a cleanup under CERCLA.

Remedial Action: Action taken to clean up contamination at a site to acceptable standards.

Remedial Action Objectives: General descriptions of what the cleanup will accomplish (e.g., restoration of contaminated groundwater to drinking water levels).

Remedial Investigation (RI): A detailed study of a site to characterize the nature and distribution of contaminants at the site. The RI includes a baseline human health risk assessment (HHRA) that assesses the potential impact of site-related contamination on human health. The RI typically also includes an assessment of the potential risk to the environment.. The RI may include an investigation of air, soil, surface water, and groundwater to determine the source(s), types of contaminants, and extent of contamination at a site.

Screening Levels: Risk-based levels calculated using the latest toxicity values, default exposure assumption and physical and chemical properties. They are used to evaluate whether a chemical warrants further assessment. The EPA publishes these and updates them on a regular basis. http://www.epa.gov/region9/superfund/prg/

Soil Vapor Extraction: Typically used to remove VOCs from soil. A vacuum is applied to subsurface soil inducing an air stream through the soil, thereby transferring the VOC contaminants from the soil to the air. The contaminant-laden air, or soil vapor, is extracted from the subsurface with a vacuum blower and discharged to the atmosphere. Prior to discharge to the atmosphere the soil vapor may be treated to reduce contaminant levels.

Toxicity: A measure of the degree to which a substance is harmful to humans and the environment (plants, animals, etc.)

Volatile Organic Compound: An organic compound which evaporates readily to the atmosphere.

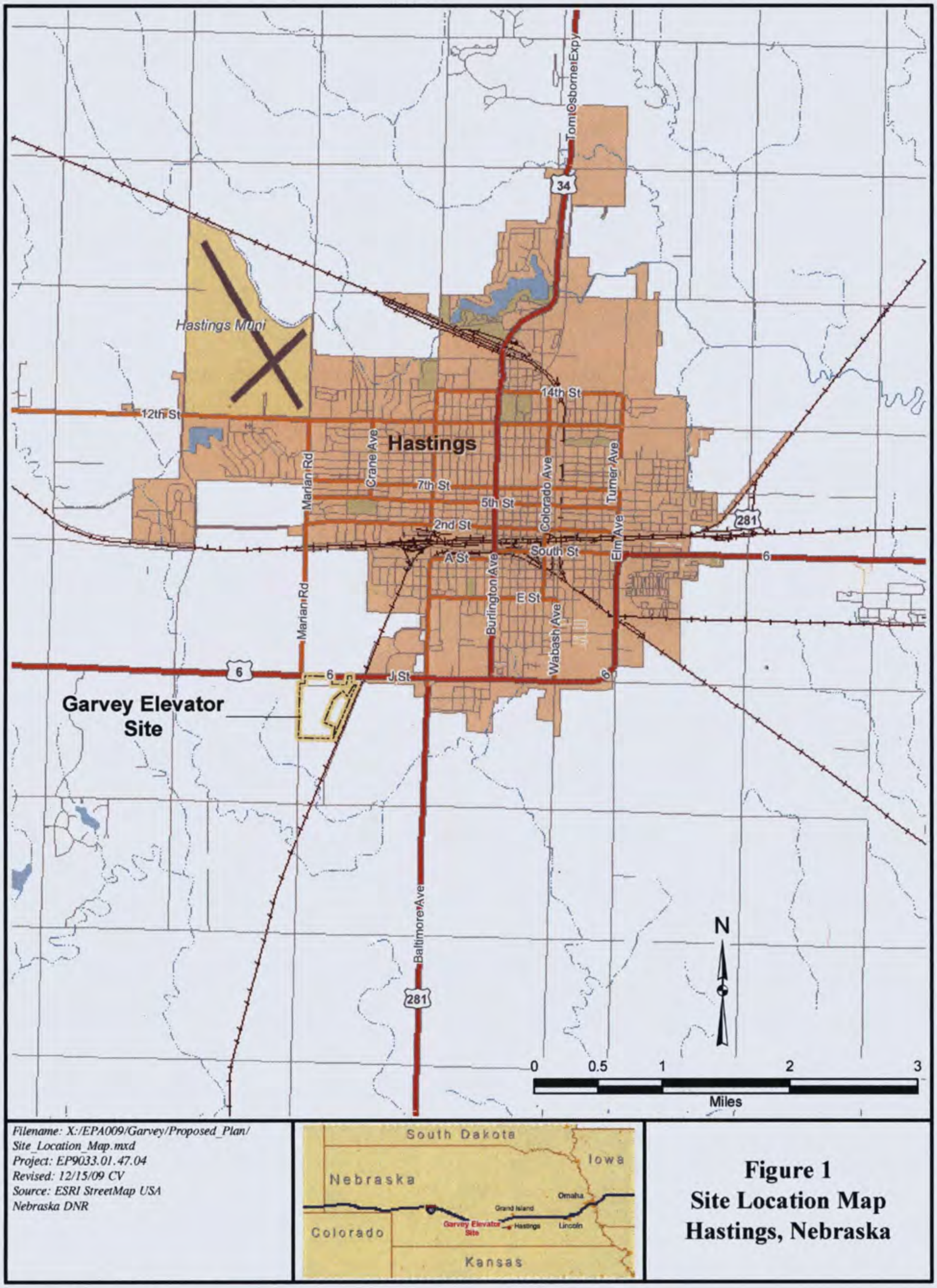

Figure 1 – Site location map

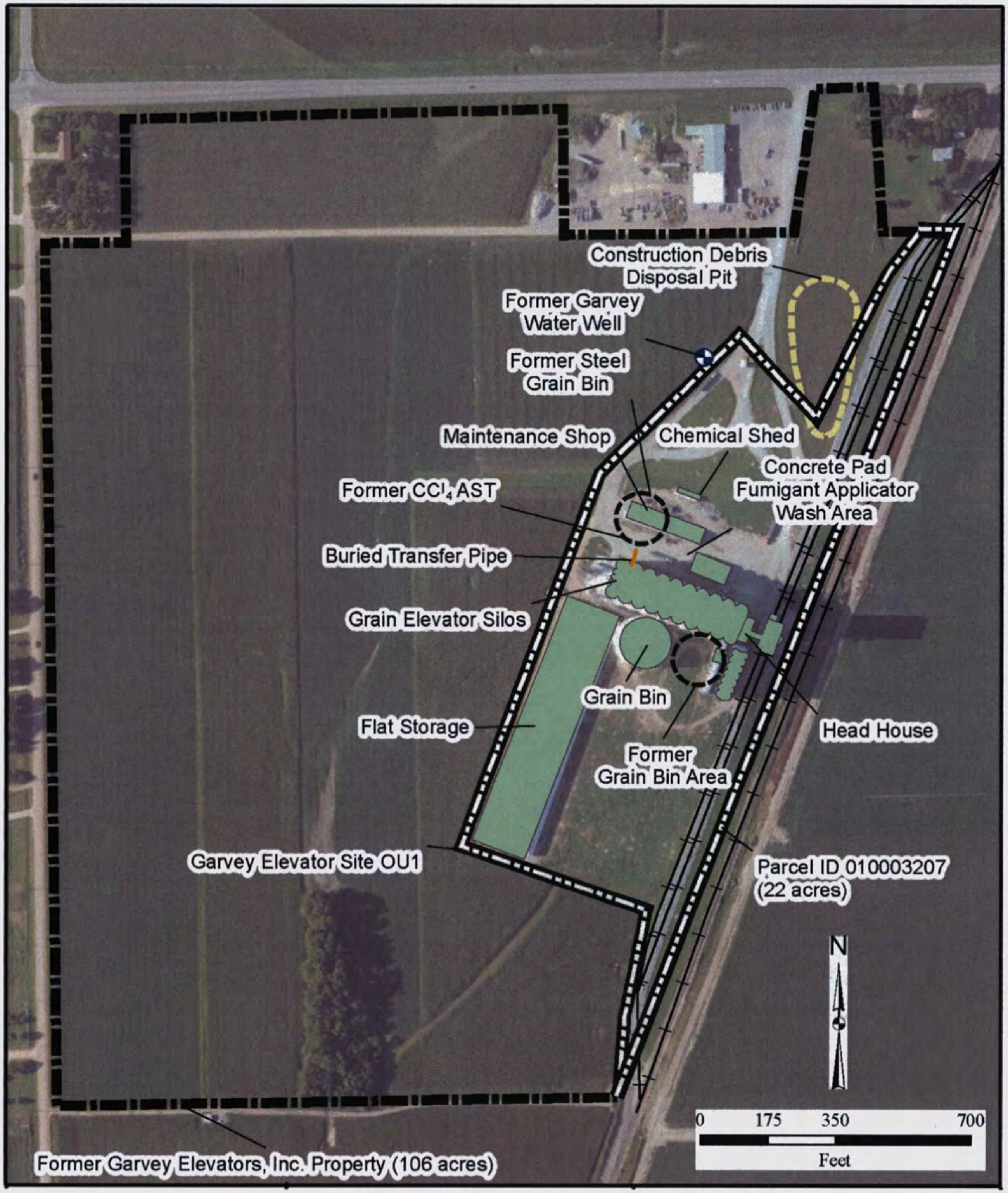

Figure 2 – OU 1 site map.

Figure 3 – Existing GET and SVE systems.

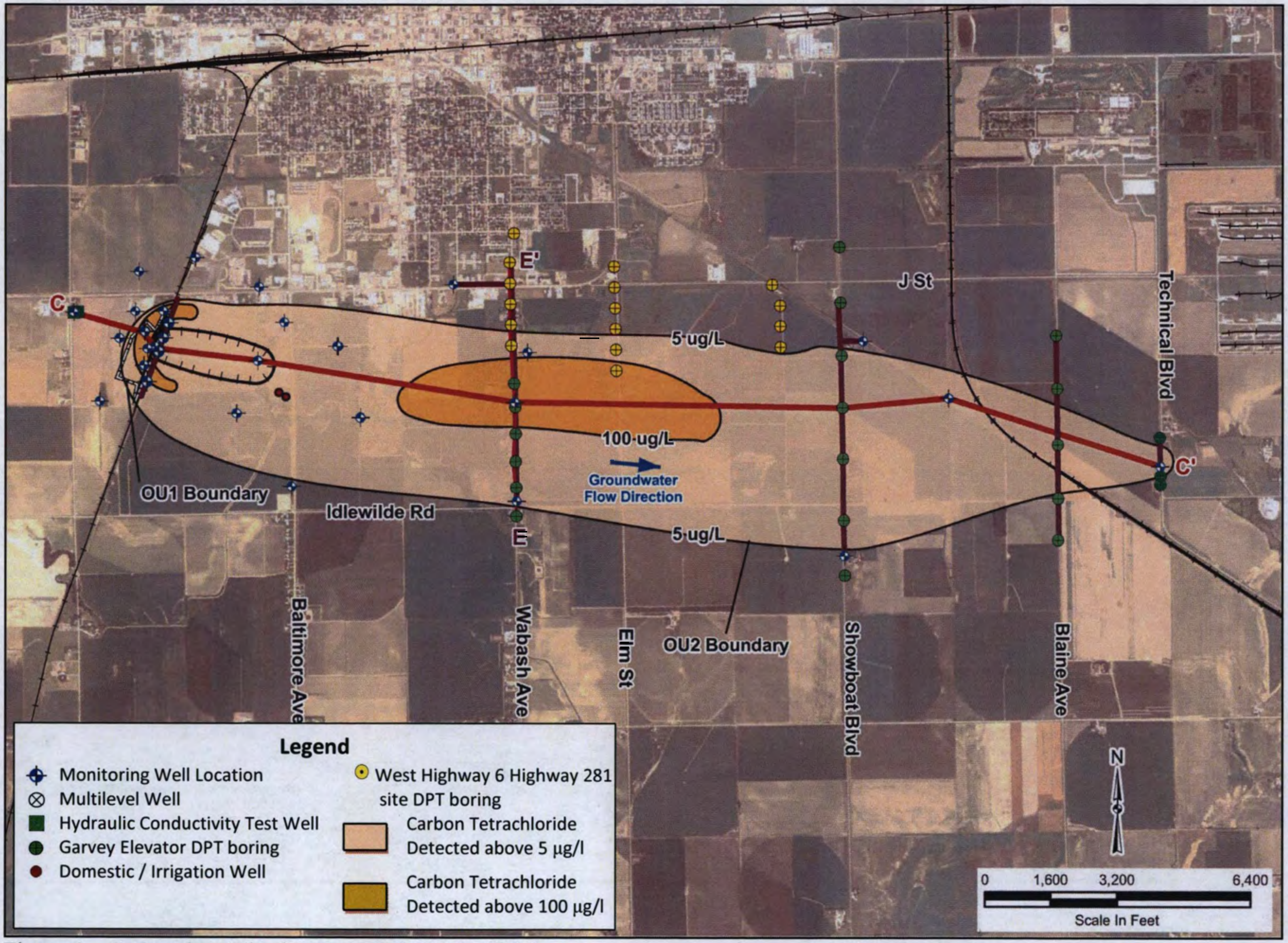

Figure 4 – Composite CCl_4 plume extent in OU 2 (2009).

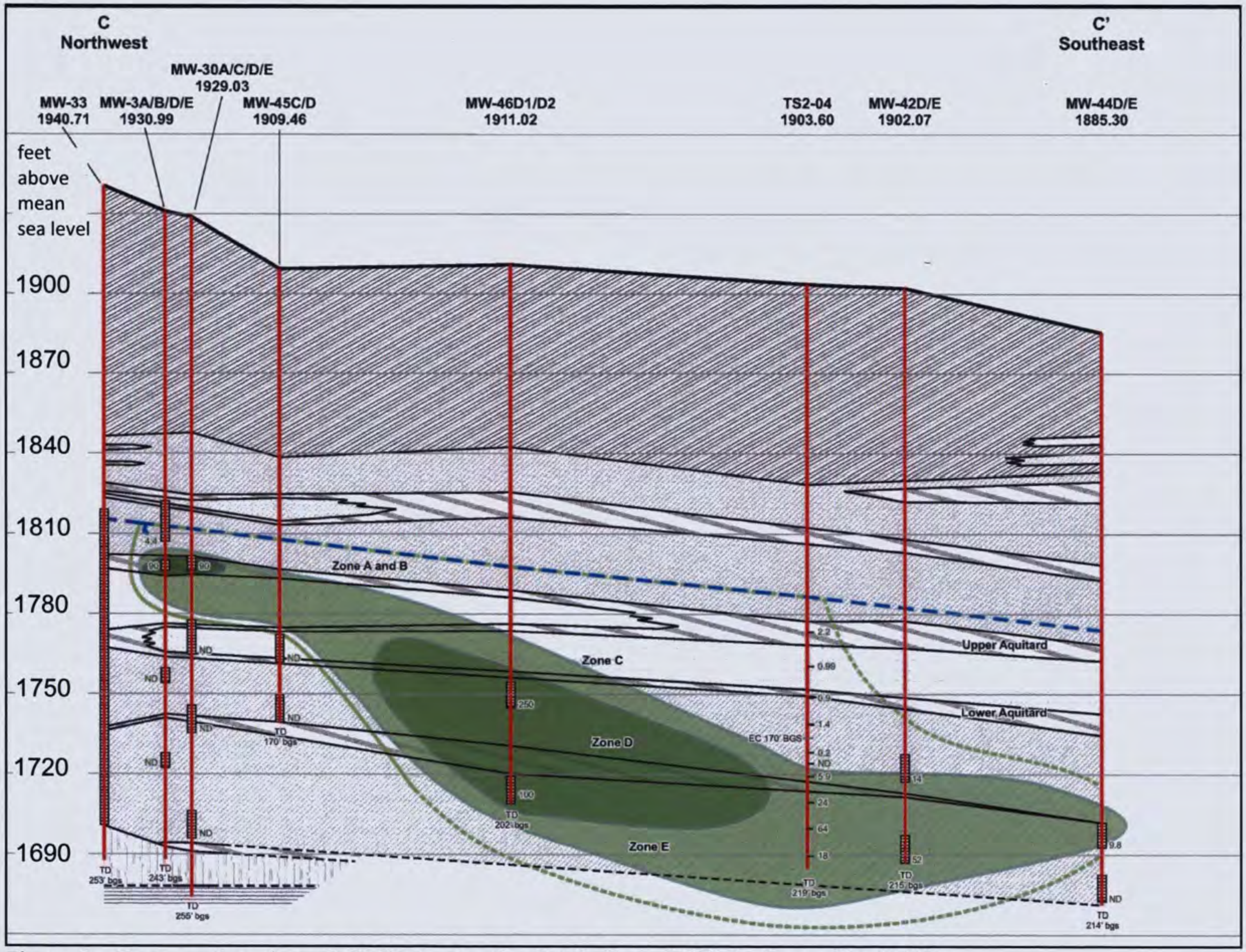

Figure 5 – Cross-section along C-C' illustrating the distribution of CCl_4 in the aquifer (2009).

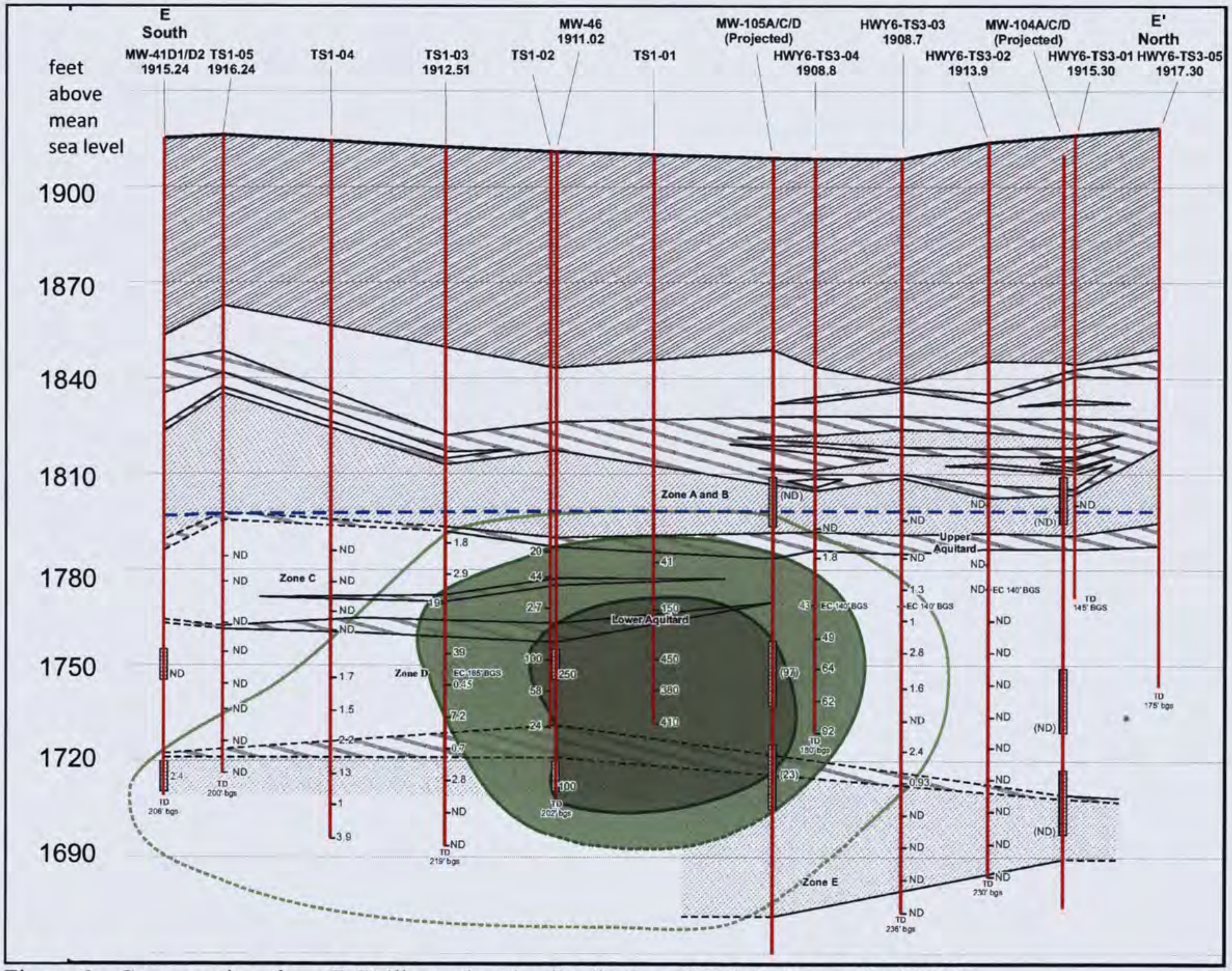

Figure 6 – Cross-section along E-E' illustrating the distribution of CCl_4 in the aquifer (2009).

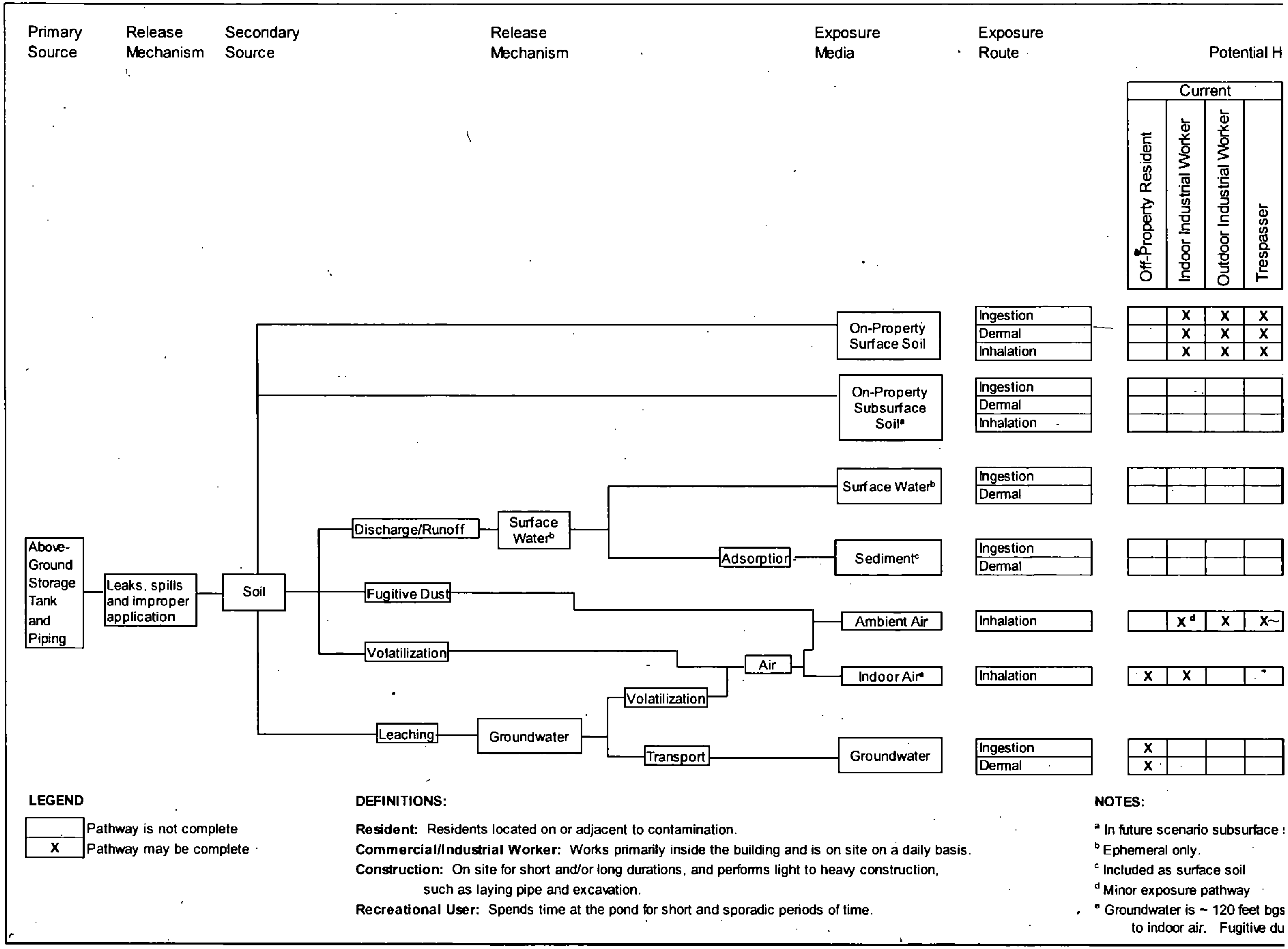

Figure 7 – Conceptual site model for human exposure.

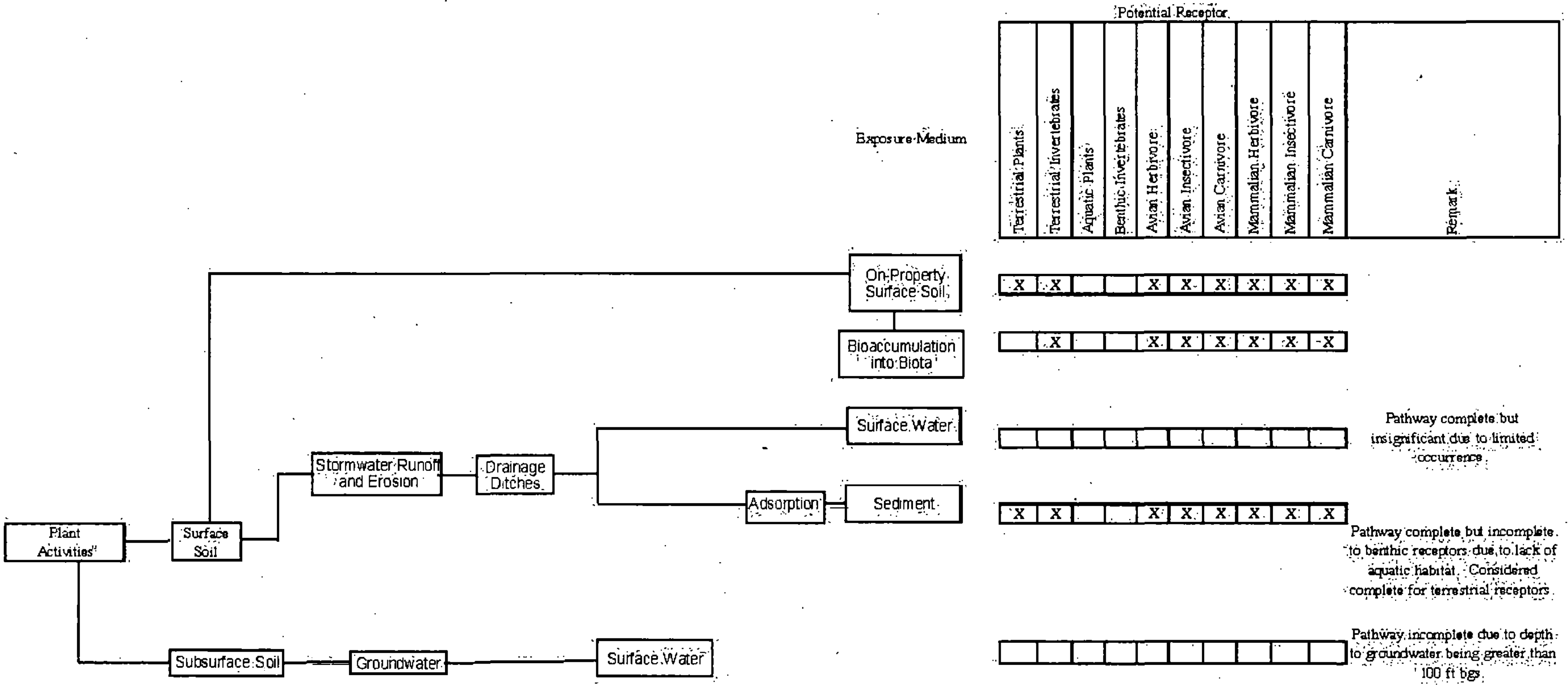

Figure 8 – Conceptual site model for ecological exposure.

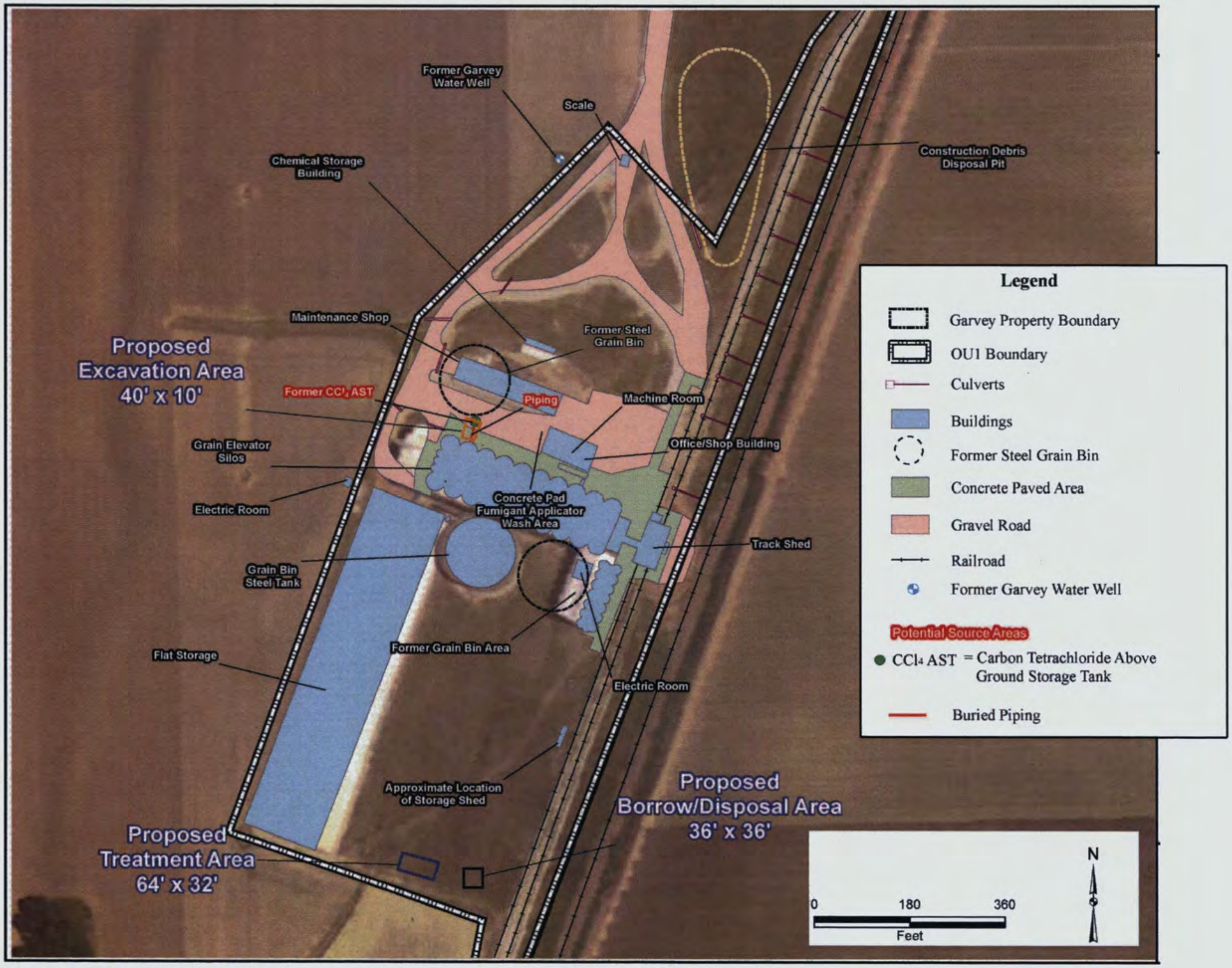

Figure 9 – Excavation area of OU 1 soils component of the Selected Remedy.

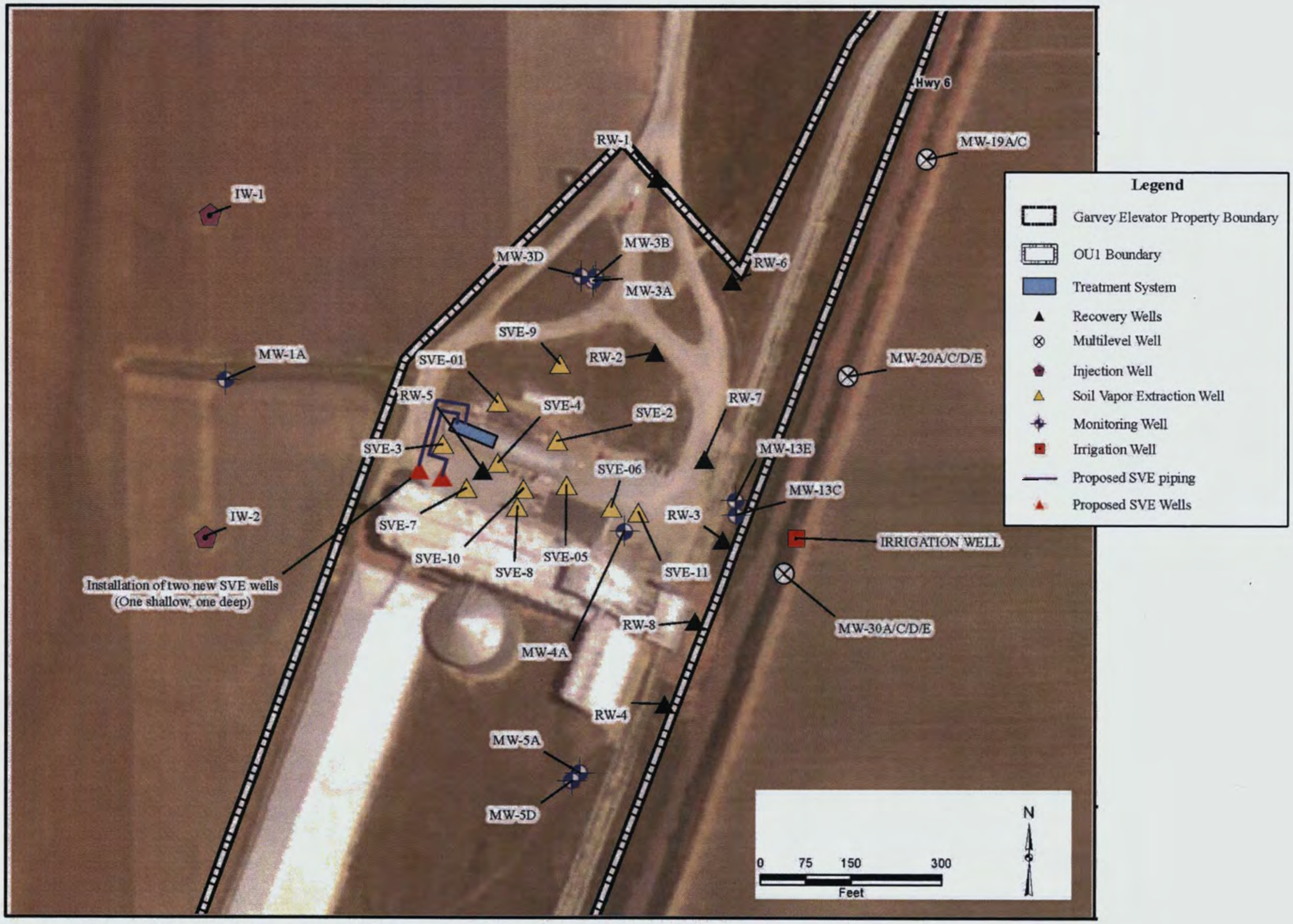

Figure 10 – Additional SVE wells of OU 1 soils component of Selected Remedy.

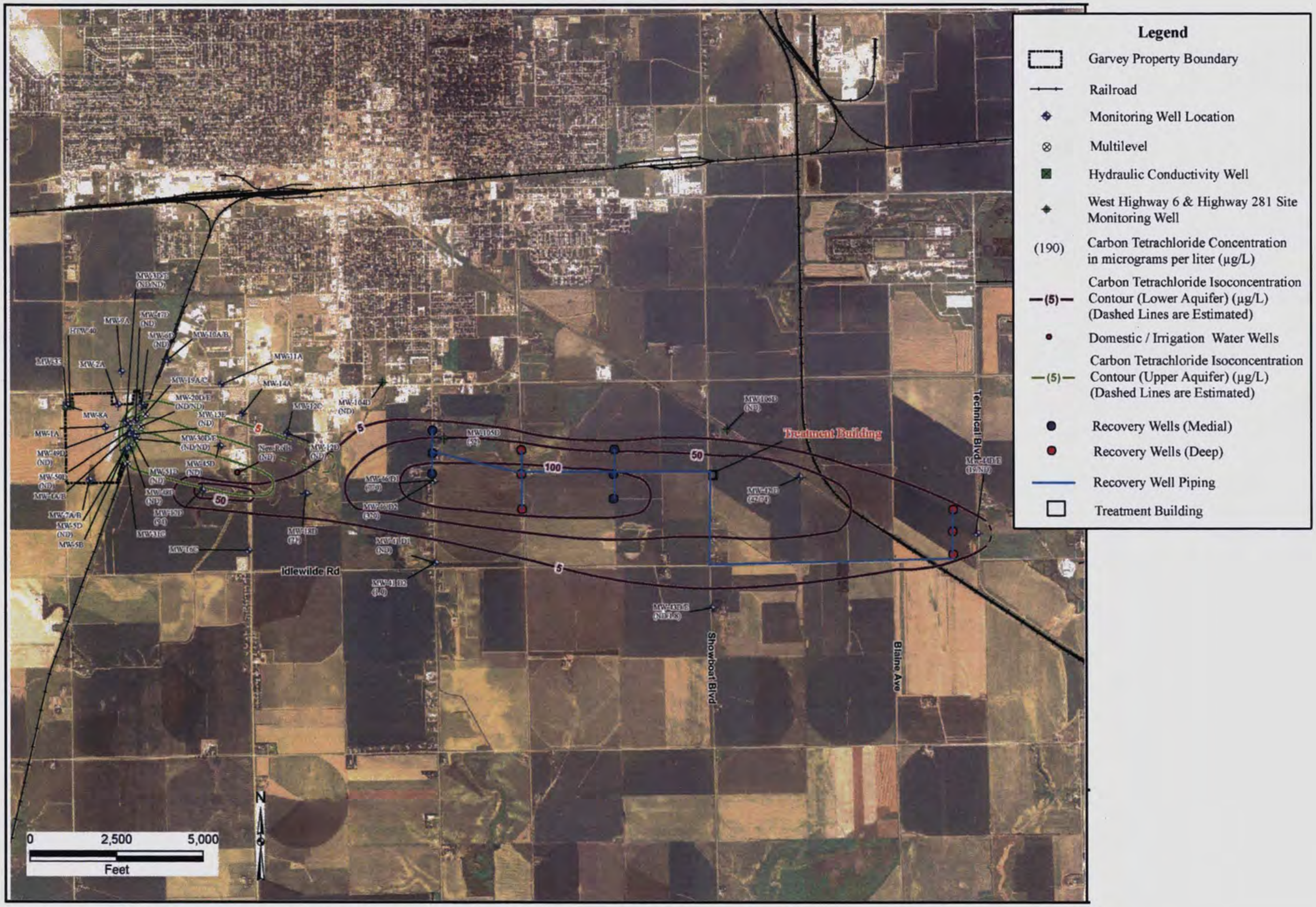

Figure 11 – Groundwater recovery wells and treatment building of OU 2 groundwater component of Selected Remedy.

Appendix A

Summary of Chemical-, Location-, and Action-Specific Applicable or Relevant and Appropriate Requirements

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
FEDERAL ARARs								
Safe Drinking Water Act, 42 U.S.C § 300f, et seq., National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141 and 142	Relevant and Appropriate	The National Primary and Secondary Drinking Water Regulations (40 CFR Parts 141 and 142) establish MCLs for chemicals in drinking water distributed in public water systems. These are enforceable in Nebraska under Nebraska Revised Statutes (NRS) § 81-1505(1)(2), et seq., § 71–5301 to 71-5313 (Safe Drinking Water Act [SDWA]), NDHHS Title 179, and NDEQ Title 118, Chapter 4.	The Preamble to the NCP clearly states that MCLs are relevant and appropriate for groundwater that is a current source of drinking water. See 55 Federal Register 8750, March 8, 1990, and 40 CFR § 300.430(e)(2)(I)(B). MCLs developed under the SDWA generally are ARARs for current or potential drinking water sources. See EPA Guidance on Remedial Action for Contaminated Groundwater at Superfund Sites, OSWER Directive Number 9283.1-2, December 1988.		✓	✓		
Federal Surface Water Quality Requirements, Clean Water Act, 33 U.S.C. § 1251, et seq.	Applicable	As provided under Section 303 of the Clean Water Act, 33 U.S.C. § 1313, the State of Nebraska has promulgated water quality standards.	No Comments		✓	✓		
Air Emission Standards for Process Vents, 40 CFR 264, Subpart AA	Relevant and Appropriate	This provision establishes standards for air emissions of VOCs during air stripping operations.	No Comments	✓	✓	✓		
Air Emission Standards for Equipment Leaks, 40 CFR 264, Subpart BB	Relevant and Appropriate	This provision establishes standards for air emissions for equipment leaks.	No Comments	✓	✓	✓		
RCRA and regulations, 40 CFR § 264.18 (a) and (b)	Relevant and Appropriate	Regulations promulgated under NRS § 81-1505(13), et seq., specify requirements that apply to the location of any solid waste management facility.	No Comments	✓	✓		✓	

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
RCRA deed notice for hazardous wastes remaining on-site after closure - 40 CFR 264.119 and 265.119	Relevant and Appropriate	Deed restrictions.	No Comments	✓	✓		✓	
Clean Water Act Point Source Discharges Requirements, 33 U.S.C. § 1342	Applicable	Section 402 of the Clean Water Act, 33 U.S.C. § 1342, et seq., authorizes the issuance of permits for the "discharge" of any "pollutant." This includes stormwater discharges associated with "industrial activity." See 40 CFR § 122.1 (b)(2)(iv). "Industrial activity" includes inactive mining operations that discharge stormwater contaminated by contact with, or that has come into contact with any overburden with, any over burden, raw material, intermediate products, finished products, byproducts, or waste products located on the site of such operations, see 40 CFR § 122.26 (b)(14)(iii); landfills, land application sites, and open dumps that receive or have received any industrial wastes including those subject to regulation under RCRA Subtitle D, see 40 CFR § 122.26(b)(14)(x)	Because the State of Nebraska has been delegated the authority to implement the Clean Water Act, these requirements are enforced in Nebraska through the Nebraska Pollutant Discharge Elimination (NPDES). The NPDES requirements are set forth below. EPA is not required to obtain permits from federal, state, or local entities but must still meet the substantive requirements of the permits.		✓			✓
Groundwater Monitoring 40 CFR part 264 and part 265 Subpart F and part 270.14 (c)	Applicable	Sets forth requirements for groundwater monitoring.	The groundwater monitoring requirements found at 40 CFR part 264 and part 265 subpart F and part 270.14 (c) are incorporated in Nebraska Title 128 (hazardous waste regulations).		✓			✓
On-Site Groundwater Treatment 40 CFR part 264 and	Applicable	Sets forth requirements for on-site treatment of hazardous waste.	The treatment requirements found at 40 CFR part 264 and part 265 subparts I and J are incorporated in		✓			✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
part 265 subparts I and J			Nebraska Title 128 (hazardous waste regulations).					
Closure and Post-Closure/Disposal of Soils 40 CFR part 264 and part 265 subpart G	Applicable	Sets forth requirements for closure and post-closure care (including disposal of soils) for hazardous waste treatment facilities.	The closure and post-closure requirements found at 40 CFR part 264 and Part 265 Subparts I and J are incorporated in Nebraska Title 128 (hazardous waste regulations).	✓	✓			✓
Occupational Safety and Health Act regulations 29 CFR part 1910, Occupational Safety and Health Administration (OSHA) Standards	Relevant and Appropriate	Contains health and safety requirements that must be met during implementation of any remedial action. These standards are intended to protect construction and utility workers at the site. Contains health and safety training requirements for on-site workers and permissible exposure limits for conducting work at a site.	No Comments	✓	✓			✓
Financial Assurance Requirements 40 CFR part 264 and part 265	Applicable	Regulations promulgated under Title 123 and Title 132, Chapter 8 also specify requirements that apply to financial assurance for owners and operators of hazardous waste treatment, storage and disposal facilities.	The financial assurance requirements found in 40 CFR part 264 and part 265 are incorporated by reference in Title 128, Chapters 21 and 22.	✓				✓
STATE OF NEBRASKA ARARs								
Regulations Governing Water Well Contraction, Pump Installation and Water Well Abandonment Neb. Rev. Stat. §46–602, Title 178, Chapter 10, and Title 456, Chapter 12	Applicable	Groundwater wells must be registered with the Department of Water Resources within the Department of Natural Resources.	If the well is to be located in a groundwater management area, a permit is required from the local Natural Resources District prior to construction if it pumps more than 50 gpm. However, EPA is only required to meet the substantive requirements of said permit. Hastings Ordinance No. 3754 contains certain restrictions and		✓			✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
			requirements on well installations within the HICA or within a tow-mile extraterritorial jurisdictional area (Hastings City Code Section 32-616)					
Regulations Governing Water Well Contraction, Pump Installation and Water Well Abandonment Standards Neb. Rev. Stat. §46–602 and Title 178, Chapter 10	Applicable	Relates to the licensure of water well contractors and pump installation contractors and to the certification of water well drilling supervisors, pump installation supervisors, natural resources groundwater technicians and water well monitoring technicians.	No comments.		✓			✓
Water Well Standards and Contractor's Practice Act, Neb. Rev. Stat. §46-1201 to §46-1241, Title 178, Chapter 10, and Title 456, Chapter 9	Applicable	The purposes of the Water Well Standards and Contractors' Practice Act are to: (1) Provide for the protection of groundwater through the licensing and regulation of water well contractors, pump installation contractors, water well drilling supervisors, pump installation supervisors, water well monitoring technicians, and natural resources groundwater technicians in the State of Nebraska; (2) protect the health and general welfare of the citizens of the state; (3) protect groundwater resources from potential pollution by providing for proper siting and construction of water wells and proper decommissioning of water wells; and (4) provide data on potential water supplies through well logs which will promote the economic and efficient utilization and management of the water resources of the state.	No Comments.		✓			✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
Well Spacing Requirements Neb. Rev. Stat. §46–651 to §46-655	Relevant and Appropriate	Well spacing requirements.	No Comments.		✓		✓	✓
The Industrial Ground Water Regulatory Act Neb. Rev. Stat. §46–675 through 46-690 and Title 456, Chapters 4 and 7	Relevant and Appropriate	Requires a permit for the withdrawal and transfer of groundwater for other than domestic or agricultural use. The permit must be obtained prior construction of the extraction well(s). The permit program is administered by the NDNR.	EPA is only required to meet the substantive requirements of the groundwater use permit.		✓			✓
Municipal and Rural Domestic Ground water Transfers Permit Act Neb. Rev. Stat. §46-638 to §46-650	Relevant and Appropriate	Relates to protective permitting for public water supplies.	EPA is only required to meet the substantive requirements of protective permitting for public water supplies.		✓		✓	✓
Restrictive covenants Title 128, Chapter 21 and 22	Applicable	Institutional controls are generally land use restrictions designed to restrict access, future use, and interference with a Selected Remedy for a contaminated area. They are typically methods to manage risk during the implementation of a remedy and do not eliminate risk entirely. An institutional control enacted as a remedy should be compliant with the Uniform Environmental Covenants Act pursuant to The Nebraska Uniform Covenants Act, March 2005, Neb. Rev. Stat. §76-2601 to 76-2613. For groundwater, the goal of an institutional control would be to prevent situations from occurring in which humans or animals might inadvertently consume or otherwise be exposed to contaminated groundwater.	Groundwater in Nebraska is considered to be publicly owned. Property owners only have the right to use the groundwater underlying their property. There is no ability under Nebraska State law to restrict the use of groundwater by prohibiting access. Public entities with zoning authority may be able to restrict access to groundwater from certain surface areas within the zoning jurisdiction of the entity, but groundwater use cannot be prohibited, and existing wells could still probably continue as non-conforming uses. Condemnation	✓	✓		✓	✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
			might be a possibility to remove these existing wells from use. Some limitations on use may be established by a local Natural Resource District to protect the quantity, and in certain circumstances preserve water quality, but only if a Groundwater Management Area has been established pursuant to Neb. Rev. Stat. §46-656 et seq. This authority, however, cannot be used to restrict the use of contaminated groundwater. Long-term effectiveness and enforcement concerns make this component much less reliable that other methods of active remediation.					
Air Quality Regulations Title 129 Chapter 17, Section 001	Applicable	Depending on the size of the unit and the potential to emit criteria pollutants and/or toxic or hazardous pollutants, a pre-construction review and permit may be required under Title 129 (Air Quality Regulations) specifically, Chapter 17, Section 001. Potential to emit is defined in Title 129, Chapter 1, as the maximum capacity of a stationary source to emit a pollutant under its physical and operational design	A risk analysis may be required on a case-by-case basis. Depending on the potential to emit, a Class I or Class II operating permit may be required. See specifically Title 129, Chapter 5 for determining applicability. If applicable, EPA would only be required to meet the substantive requirements of an operating permit. Best Available Control Technology (BACT) is required if the emissions unit has a potential to emit equal to or more than 2 1/2 tons/year of any	✓	✓	✓		✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
			hazardous air pollutant or an aggregate of 10 tons/year of hazardous air pollutants. See Title 129, Chapter 27, 002. It must be utilized continuously while the emissions unit is operating. If the emissions unit meets the threshold limits for construction/operating permits, annual emissions must be reported if requested by the Department. See Title 129, Chapter 6.					
Disposal of Wastewater Treatment Residuals Title 128, Chapter 2	Relevant and Appropriate	The sludge generated from flocculation and sedimentation, reverse osmosis, enhanced oxidation, and precipitation are wastewater treatment processes would be a solid waste under Title 128, Chapter 2. For other requirements applicable to the sludge, see B. 2 through 8 above.	No Comments.		✓	✓		✓
Disposal of Activated Carbon Used as Air Emission Control Title 128, Chapter 2	Relevant and Appropriate	If activated carbon is used as an air emission control, the spent carbon may be required to be handled as a hazardous waste in accordance with Title 128 requirements	The spent carbon, ion-exchange resin, and granular media meet the definition of solid waste in Title 128, Chapter 2. Air permits may also be required for carbon regeneration or reactivation depending on potential to emit (construction and/or operating permits - see Title 129). However, EPA would only be required to meet the substantive requirements of the construction and/or operating	✓	✓	✓		✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
			permit.					
Integrated Solid Waste Management Regulations Title 132, Chapter 13	Relevant and Appropriate	If aerobic or anaerobic biological treatment is used for groundwater treatment, waste from the treatment process may be required to be handled and disposed of as special waste in accordance with Title 132 requirements.	No Comments.	✓	✓	✓		✓
Excavation of Contaminated Soil Title 128, Chapter 4	Relevant and Appropriate	Soil excavated and removed with the intent of disposal meets the definition of solid waste in Title 128, Chapter 4.	No Comments.	✓				✓
Disposal of Hazardous Waste Title 128, Chapter 4	Relevant and Appropriate	A hazardous waste determination must be made in accordance with Title 128, Chapter 4, 002. If material is a hazardous waste, it must be handled in accordance with all hazardous waste management requirements in Title 128, Chapters 8, 9, and 10.If material is hazardous waste, it must be disposed of in a permitted TSD facility as required under Title 128, Chapters 8, 9, and 10. However, generators subject to the requirements of Chapter 8 (conditionally exempt small quantity generator) have disposal options. The transporter must comply with the requirements of Title 128, Chapter 11.	If the material which caused the contamination was a hazardous waste then the closure and post-closure requirements of 40 CFR part 264 or part 265, subpart G, as incorporated by reference in Title 128, Chapters 21 and 22 are applicable. If the generator intends to store the hazardous waste for more than 90 days (more than 180 days for small quantity generators; or more than 270 days if a small quantity generator must transport the waste, or offer the waste for transportation over a distance of 200 miles or more) or intends to treat said waste on-site, the requirements of Title 128, Chapters 12 through 15, 21, and 22 apply. If the generator is also acting as the	✓	✓	✓	✓	✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
			transporter, then it must follow the transporter requirements found in Title 128, Chapter 11.					
Land Disposal Requirements (LDRs) Title 128, Chapter 20	Relevant and Appropriate	On-site treatment of those wastes that are determined to be hazardous would have to be conducted in a tank or container meeting requirements of 40 CFR part 264, subparts I and J.	No Comments.	✓				✓
Disposal of Nonhazardous Waste Title 132, Chapter 1	Relevant and Appropriate	Nonhazardous waste may be a special waste as defined in Title 132, Chapter 1 and the generator must follow the requirements of Title 132, Chapter 12, and may only be disposed at a licensed landfill which is operated and maintained in compliance with NDEQ regulations and that is approved to accept special waste. Department and landfill approval required.	No Comments.	✓				✓
Disposal of Surface Water During Excavation	Relevant and Appropriate	If sumps are necessary during excavation to dewater, the water to be discharged either to the surface of the ground or a stream, then a permit and/or discharge limits must be obtained from the Department in accordance with Title 119 (NPDES regulations), Title 121 (NPDES effluent guidelines and standards), and Title 117 (Surface Water Quality Standards) or Title 127 (POTW pretreatment rules and regulations). If the water is to be reinjected, it must be done in accordance with Title 122 (UIC regulations).	No Comments.	✓		✓		
Rules and Regulations for Design, O&M of Wastewater Treatment	Relevant and Appropriate	Flocculation and sedimentation, reverse osmosis, enhanced oxidation, and precipitation are wastewater treatment processes for which	No Comments.		✓			✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
Works Title 123		submission and review of plans and specifications and a construction permit are required.						
Nebraska Pollutant Discharge Elimination System	Relevant and Appropriate	Any surface discharge of contaminated or treated water is subject to the requirements of Title 119 - Rules and Regulations Pertaining to the Issuance of Discharge Elimination System Permits, Title 121 - Effluent Guidelines and Standards, Title 117 – Nebraska Surface Water Quality Standards. Any reinjection of contaminated water or treated water is subject to the requirements of Title 122 - Rules and Regulations for Underground Injections and Mineral Production Wells and Title 118 - Ground Water Quality and Use Classification (Department of Environmental Quality).	If applicable, EPA would only be required to meet the substantive requirements of the NPDES permit.		✓	✓		
Nebraska Surface Water Quality Standards Title 117	Applicable	Establishes the water quality standards applicable to surface waters in the State of Nebraska, including wetlands.	No Comments.		✓	✓		
Groundwater Quality Standards Title 118	Relevant and Appropriate	Establishes narrative and numerical standards for contaminants introduced to groundwater either directly or indirectly by human activity. Provides that any groundwater whose existing quality is better than the MCLs must be maintained at the higher quality; however the State may choose, after public notice and public hearing and based upon necessary economic or social development, to allow degradation that does not interfere with existing uses.	The narrative and numerical requirements of Title 118 are relevant and appropriate to the groundwater at the Garvey Elevator Superfund Site. It is likely that any discharge limits would be based on groundwater quality standards because of the conjunctive relationship of groundwater and surface water. Under Title 118, a Remedial Action		✓	✓		✓

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
		Establishes a procedure for determining the needed action for groundwater pollution occurrences. This Protocol includes assessment of the degree and extent of the contamination, setting preliminary cleanup levels, and developing remedial actions.	Classification (RAC) of "1" is assigned automatically any time a public or private drinking water supply has been contaminated. Minimum requirements imposed upon the responsible party in a RAC-1 area include the cleanup of readily removable contaminants. Mitigation may also be required. If additional cleanup is not required, the remaining contaminated groundwater will be managed and monitored to prevent any further damage. Preliminary cleanup levels in RAC-1 areas are typically MCLs. If an MCL has not been established for a particular contaminant, the Department can consider EPA's Ambient Water Quality Criteria, Health Advisories, and other documents in setting the preliminary cleanup level. The level will be set at the concentration which is estimated to result in a 1×10^6 excess cancer risk or the laboratory detection limit, if higher and within an acceptable range. The time frame for any required corrective action is established, subject to appeal with adequate justification, as the period of potential exposure in the absence of any remedial action or 20 years, whichever time frame is less.					

Statute and Regulatory Citation	ARAR Determination	Description	Comment	Media of Concern		Type of ARAR		
				Soil	GW	Chemical	Location	Action
Rules and Regulations for Underground Injection and Mineral Production Wells Title 122	Relevant and Appropriate	The Underground Injection Control (UIC) Program issues and reviews permits, conducts inspections, and performs compliance reviews for wells used to inject fluids into the subsurface.	Infiltration and/or reinjection of groundwater and injection of substances or nutrients would require a UIC permit or review under Title 122 or review of plans and specifications under Title 123. Underground injection may also require an NPDES permit under Titles 119 and 121 based on the potential impact to groundwater. However, EPA would only be required to meet the substantive requirements of the UIC and NPDES permits.	✓	✓			✓
Flood Plain Management	Relevant and Appropriate	The Flood Plain Management Act, Neb. Rev. Stat. §31-1001 to §31-1031, and Title 258 – Rules Governing Flood Plain Management, govern certain activities occurring in flood plains.	No Comments.	✓	✓		✓	✓
Endangered and Threatened Species	Relevant and Appropriate	The Nebraska Nongame and Endangered Species Act, Neb. Rev. Stat. §37-801 to §37-811 (recodified in 1998), and Title 163, Chapter 4, 012, require consultation with the Nebraska Game and Parks Commission regarding actions which may affect threatened or endangered species and their critical habitat (Nebraska Game and Parks Commission).	No Comments.	✓	✓		✓	✓