Corrective Action Decision

Kansas Department of Health and Environment
Environmental Remediation

Agra USDA Site
Agra, Kansas

April 2021
KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
FINAL CORRECTIVE ACTION DECISION
Agra USDA SITE
Agra, Kansas

DECLARATION OF REMEDIAL ACTION SELECTION

SITE NAME AND LOCATION
Agra USDA Site
Agra, Phillips County, Kansas

STATEMENT OF BASIS AND PURPOSE

This Final Corrective Action Decision (CAD) document presents the remedy selected to address contamination at the Agra USDA Site (Site) in Agra, Kansas. The Site is located on the north edge of Agra in Section 27, Township 3 South, Range 16 West, approximately 64 miles north of Hays, Kansas. Land in this area is designated as agricultural, while adjacent properties are currently zoned as agricultural, commercial, industrial, vacant, and residential.

Since 1986, several investigations have identified carbon tetrachloride (CT) and chloroform contamination in soil and groundwater at concentrations above the corresponding KDHE Tier 2 Levels or federal Maximum Contaminant Levels on and near the former Commodity Credit Corporation/United States Department of Agriculture (CCC/USDA) facility and existing Pro-Ag Agra facility. Both CCC/USDA and Pro-Ag are responsible for the CT contamination at the site, and Pro-Ag is responsible for the nitrate contamination.

The Corrective Action Study (CAS) focused on the evaluation of various remedial alternatives to address groundwater contamination at the Site. The remedial action selected for the Site was based on the documents and information contained in the Administrative Record File for the Site.

DESCRIPTION OF THE SELECTED REMEDY

KDHE has determined that the selected remedy, described in the final CAD, satisfies or meets the criteria established for selection and will be protective of human health and the environment. The selected remedy includes Groundwater Extraction, Treatment with a Tray Aerator, Discharge (NPDES or beneficial reuse); Groundwater Monitoring; and Five-Year Reviews. In the event the preferred remedy does not remain protective to human health or the environment, KDHE may require the development and implementation of contingency measures. The main components of the selected remedy are summarized below:
• Groundwater Extraction, Treatment with a Tray Aerator, Discharge (NPDES or beneficial reuse) – installation of three extraction wells to remove groundwater contaminated by CT, and use of a tray aerator to treat recovered groundwater. The treated effluent water will be discharged at Turner Creek under a NPDES permit, and/or to a holding tank for beneficial reuse.

• Groundwater Monitoring – groundwater monitoring for an estimated period of eight years, or until the CT concentrations fall below the MCL.

• Five-Year Reviews – Five-Year Reviews will be prepared by CCC/USDA with the first review to take place five years after implementation of the remedy.

DECLARATION:

The selected remedy will be protective of human health and the environment and attain State, Federal and local requirements that are applicable or relevant and appropriate. The selected remedy also actively reduces the toxicity, mobility and volume of contamination identified at the Site. In selecting and declaring this remedy, KDHE believes implementation of this remedy will have a beneficial effect by reducing the toxicity, mobility, and volume of contaminants.

4-26-2021

Date

Lee A. Norman, M.D.
Secretary of Kansas Department of Health and Environment
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ACRONYMS AND ABBREVIATIONS USED IN THIS DOCUMENT

AR Administrative Record
ARARs Applicable or Relevant and Appropriate Requirements
BGL Below Ground Level
CAD Corrective Action Decision
CAS Corrective Action Study
CCC Commodity Credit Corporation
CI Comprehensive Investigation
CT Carbon Tetrachloride
1,2-DCA 1,2-Dichloroethane
DW Domestic Well
FSIR Final Site Inspection Report
IM Interim Remedial Measures
KDHE Kansas Department of Health and Environment
KRC Kyle Railroad Company
LDB Large Diameter Borehole
LUC Land Use Control
MCL Maximum Contaminant Level

µg/kg micrograms per kilogram
µg/L micrograms per Liter
NCP National Oil and Hazardous Substances Pollution Contingency Plan
NPDES National Pollutant Discharge Elimination System
PWS Public Water Supply
RAO Remedial Action Objective
RSK Risk-based Standards for Kansas
SB Soil Boring
SMPE Site-Specific Monitoring and Performance Evaluation Plan
SVE/AS Soil Vapor Extraction/Air Sparge
USDA United States Department of Agriculture
VI Vapor Intrusion
VOC Volatile Organic Compound
Glossary

Administrative Record (AR) – The body of documents that form the basis for selection of a particular response at a site. Parts of the AR are available in an information repository near the site to permit interested individuals to review the documents and to allow meaningful participation in the remedy selection process.

Air Stripping – The process of forcing air through polluted water to remove harmful chemicals. The air causes the chemicals to change from a liquid to a gas. The gas is collected and treated if necessary.

Aquifer – An underground layer of rock, sand, or gravel capable of storing water within cracks and pore spaces or between grains. When water contained within an aquifer is of sufficient quantity and quality, it can be used for drinking or other purposes. The water contained in the aquifer is called groundwater.

Applicable or Relevant and Appropriate Requirements (ARARs) – The federal and state environmental laws that a remedy will meet. These requirements may vary among sites and alternatives.

Corrective Action Decision (CAD) – The decision document in which KDHE selects the remedy and explains the basis for selection for a site.

Corrective Action Plan (CAP) – A document that serves as the basis for design and implementation of remedial actions.

Corrective Action Study (CAS) – A study conducted to evaluate alternatives for cleanup of contamination.

Exposure – Contact made between a chemical, physical, or biological agent and the outer boundary of an organism. Exposure is quantified as the amount of an agent available at the exchange boundaries of the organism (e.g., skin, lungs, gut).

Groundwater – Underground water that fills pores in soils or openings in rocks to the point of saturation. Groundwater is often used as a source of drinking water via municipal or domestic wells.

Interim Measures (IM) – Actions taken to correct or mitigate risks or threats posed by a contaminated site prior to selection of the final remedy. Some interim measures are implemented to mitigate the source of contamination.

Land Use Controls – A legal mechanism for applying restrictions, prohibitions, and conditions on land use for a property that has environmental contamination at levels prohibiting unrestricted use.

Maximum Contaminant Levels (MCLs) – The maximum permissible level of a contaminant in water that is delivered to any user of a public water system.

Monitoring – Ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action. For example, monitoring wells drilled to different depths would be used to detect any migration of the plume.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – The federal regulations that guide the Superfund program. These regulations can be found at 40 Code of Federal Regulations, Part 300.
National Pollutant Discharge Elimination System (NPDES) – As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches.

Operations and Maintenance (O&M) – Activities conducted at a site after the construction phase to ensure that the cleanup continues to be effective.

Plume – A body of contaminated groundwater flowing from a specific source.

Risk – The probability of adverse health effects resulting from exposure to an environmental agent or mixture of agents.

Tier 2 Level – Calculated risk-based cleanup value for a specific contaminant. These values can be found in Appendix A of the Risk-based Standards for Kansas (RSK) Manual.

Threshold – The dose or exposure below which no harmful effect is expected to occur.

Toxicity – A measure of the degree to which a substance is harmful to human and animal life.

Vapor Intrusion – The migration of vapor forming chemicals from the subsurface into overlying and/or adjacent buildings.

Volatile Organic Compounds (VOCs) – Carbon compounds, such as solvents, which readily volatilize at room temperature and atmospheric pressure. Most are not readily dissolved in water, but their solubility is above health-based standards for potable use. Some VOCs can cause cancer.
1. Purpose of the Corrective Action Decision

The primary purposes of the Corrective Action Decision (CAD) for the Agra United States Department of Agriculture (USDA) Site\(^1\) (Site) are to: 1) summarize information from the key site documents including the Final Site Inspection Report\(^2\) (FSIR), Final Phase I Report and Phase II Work Plan: Expedited Site Characterization\(^3\), Final Report: Phase II Expedited Site Characterization\(^4\), Final Report: Results of the 2005 Investigation of Contaminant Sources\(^5\), Final Remedial Report\(^6\), Results of Temporary Shutdown Testing and Groundwater Pump-Testing and Assessment of Groundwater and Contamination Migration\(^7\) and Corrective Action Study\(^8\) (CAS); 2) briefly describe the alternatives for remediation detailed in the CAS report; 3) identify and describe the Kansas Department of Health and Environment’s (KDHE) preferred remedy for addressing the contamination; and, 4) provide an opportunity for public comment on the preferred remedy.

KDHE has reviewed and considered all information submitted during the 30-day public comment period. The public was encouraged to review and comment on the preferred remedy presented in the Draft CAD. A public notice of the availability of the Draft CAD was published on March 10, 2021 in the Phillips County Review. No comments were received by KDHE during the public comment period, March 10, 2021, through April 10, 2021.

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\(^{1}\) KDHE, Project Code C6-074-00002.
\(^{2}\) KDHE, July 30, 1988, Final Site Inspection Report.
\(^{3}\) Argonne National Laboratory, November 1995, Final Phase I Report and Phase II Work Plan: Expedited Site Characterization, Agra Kansas, prepared on behalf of CCC/USDA.
\(^{4}\) Argonne National Laboratory, May 1996, Final Report: Phase II Expedited Site Characterization, Agra Kansas, prepared on behalf of CCC/USDA.
\(^{5}\) Argonne National Laboratory, July 19, 2006, Final Report: Results of the 2005 Investigation of Contaminant Sources at Agra, Kansas, prepared on behalf of CCC/USDA.
\(^{6}\) Greenfield Contractors, Inc., August 5, 2009, Final Remedial Report, prepared on behalf of CCC/USDA.
\(^{7}\) Argonne National Laboratory, May 2018, Results of Temporary Shutdown Testing and Groundwater Pump-Testing at Agra, Kansas, February-September 2016 and March 2017, and Assessment of Groundwater and Contamination Migration, prepared on behalf of CCC/USDA.
\(^{8}\) Argonne National Laboratory, November 2018, Corrective Action Study for the former USDA/CCC facility at Agra, Kansas, prepared on behalf of CCC/USDA.
The Applied Geosciences and Environmental Management Section of the Environmental Science Division of Argonne National Laboratory (Argonne) prepared the Results of the 2005 Investigation of Contaminant Sources and the CAS on behalf of Commodity Credit Corporation/United States Department of Agriculture (CCC/USDA). Work performed during the 2005 investigation and CAS process followed the terms outlined in the Intergovernmental Agreement between the Farm Services Agency and KDHE.

2. Site Background

2.1 Site Location

The Site is located in Agra, Kansas, a rural city with a population of approximately 250 residents, in the east-central portion of Phillips County; approximately 64 miles north of Hays, Kansas. The Agra USDA Site is located at the north edge of town in Section 27, Township 3 South, Range 16 West as shown in Figure 1. The Site lies within the Kyle Railroad right-of-way, shown in Figure 2. The southern boundary of the Site is approximately 50’ north of the Pro-Ag Marketing Agra Cooperative (Pro-Ag) site. The northern boundary of the Site is approximately 100’ from the Site’s southern boundary. The eastern limit coincides with the northward extension of 4th Street, if 4th Street continued beyond Railroad Ave. The western limit of the Site is bounded by Main Street. The Site itself is mainly used for agriculture, and most of the Site property is now a cultivated field. The adjacent properties are currently zoned as agricultural, commercial, industrial, vacant, and residential. The Pro-Ag site is located just south of the railroad tracks from the Site and is an active commercial agricultural facility that is an additional source for carbon tetrachloride (CT) contamination in the area. Public Water Supply (PWS) Wells #1 and #2 are located approximately 500 feet to the southwest of the Site, while PWS Wells #3 and #4 are located approximately 1,500 feet to the southeast. PWS #5 is located outside of town, approximately 1 mile southeast of the Site.

2.2 Site History

The CCC/USDA operated a grain storage facility from the 1950s to the early 1970s, during which time the facility used CT as a grain fumigant. After the grain storage facility closed, all structures were removed, and the land was incorporated into a cultivated field. KDHE detected CT contamination below the Maximum Contaminant Level (MCL) of 5 micrograms per Liter (µg/L) in PWS #3 and PWS #4 in September 1985 during statewide water supply sampling. Further sampling of these wells in 1986 indicated increasing CT concentrations, up to 12 µg/L in PWS #3. KDHE directed the City of Agra to discontinue use of PWS #3 and PWS #4, except as an emergency water supply.

KDHE conducted a Preliminary Assessment from 1986 through 1988 to assess CT contamination in Agra, during which potential source areas were identified, including the former CCC/USDA facility, the Pro-Ag facility, the public school septic system, and an abandoned retail store. To gain further understanding of the Site KDHE installed three groundwater monitoring wells near the Pro-
Ag facility. Ultimately, KDHE produced the FSIR\textsuperscript{2} which combined the results of the investigation activities conducted between 1986-1988. In 1988 the City permanently disconnected PWS #4 from the distribution system and transferred ownership to the local high school for use as an irrigation well. PWS #5 replaced PWS #4 in 1991. Since 1991 the city has relied on PWS #1, PWS #2, and PWS #5 for their domestic water needs.

In 1995 PRC Environmental Management conducted a Comprehensive Investigation\textsuperscript{11} (CI), which included the sampling and analysis of soil gas, surface and subsurface soils, and groundwater from existing wells as well as borings. Afterwards, Argonne, on behalf of CCC/USDA, performed an initial site characterization that collected and analyzed 31 groundwater samples and 1 soil sample for volatile organic compounds (VOCs), installed one monitoring well and one well point, and performed site characterization. In the second phase of the investigation, surface and near-surface soil samples from 54 locations and groundwater samples from 13 locations were collected for analysis, 4 additional monitoring wells were installed, and a geophysical survey was performed\textsuperscript{3,4}.

In 1996, Argonne advanced one soil boring, and installed one well and 3 piezometers as part of a Feasibility Study\textsuperscript{12}. Two pumping tests were also performed to evaluate aquifer hydraulic properties.

From 1997 through 1999 KDHE conducted additional field studies including completing 27 soil borings, installing 18 monitoring wells in the area, and conducting two groundwater monitoring events.

In 2005 CCC/USDA conducted additional investigation work to further delineate the plume and source areas. The investigation included detailed logging and VOC analyses from 20 soil borings, collecting groundwater samples from 37 new locations and 32 existing wells, installing a new piezometer, and conducting a water well receptor survey.

\textbf{2.3 Hydrogeological Setting}

The Agra Site lies within the Blue Hills-Smoky Hills physiographic region of Kansas. The Site is underlain by recent alluvium and terrace deposits consisting of unconsolidated clays, silts, sands and gravel. The soils belong to the Harvey silt loam series with very little slope (0-1\%) and are considered well drained. These sedimentary sequences overlay Cretaceous aged limestone along with Smoky Hill Chalk of the Niobrara Formation\textsuperscript{2}. The Smoky Hill Chalk is characterized as a fossiliferous chalky blue gray shale which forms the bedrock. The surface of the Cretaceous bedrock is irregular due to paleodrainage patterns\textsuperscript{3}. These irregular erosional surfaces of the Cretaceous bedrock along with downcutting associated with alluvial deposition play a key role in the depositional characteristics, and strongly influence the thickness and presence of the Quaternary sediments\textsuperscript{7}. The distribution of Quaternary sediments strongly influences contaminant mobility. The predominant soil types underlying the former USDA facility and current source area are fine-grained with low transmissivity. These soil properties differ from those soil characteristics


\textsuperscript{12} Argonne National Laboratory, June 1997, \textit{Final Feasibility Study for Remedial Action at Agra, Kansas}, prepared on behalf of CCC/USDA.
underlying the Pro-Ag source area, which is a more permeable, sandy unit that extends to the southeast.

Groundwater flow in the area is predominantly to the south-southeast (Figure 3). Groundwater flow is generally restricted to the upper sandy and overlying silt-clay intervals upgradient of the southern bedrock valley, while a deeper sandy unit, bound by semipermeable silty-clay deposits, occurs downgradient. The water-bearing units are considered a single, multilayered aquifer.

3. Environmental Site Investigation

There were several site investigations completed between 1987 and 2005. Based on the results of previous investigations, and both the Phase I and Phase II Expedited Site Characterization results, KDHE requested CCC/USDA to conduct a source investigation. Argonne, on behalf of CCC/USDA, completed the Final Report: Results of the 2005 Investigation of Contaminant Sources in 2005 and reported results in 2006. Objectives for the investigation were to:

- Determine plume dynamics in the investigation area;
- Delineate the plume identified in previous investigations;
- Investigate potential contributions to the contamination by the Pro-Ag operations;
- Investigate other potential contributions to contamination previously identified adjacent to the Site;
- Sufficiently characterize the Site to support the recommendations for future remedial actions; and
- Identify all potential downgradient receptors.

3.1 Summary of Previous Remedial Investigation Results

3.1.1. Soil

Soil sampling conducted during various investigations from 1995 to 2005 identified CT contamination in shallow and deep soils (also soil gas) associated with the former CCC/USDA grain storage facility, an abandoned retail store, and the Pro-Ag property. The locations of soil samples from the 2005 source investigation can be found on Figure 4.

During the 2005 investigation, CCC/USDA performed detailed, vertical-profile soil sampling and analyses for VOCs, including CT, in areas that had soil detections during previous investigations. A total of 250 subsurface soil samples were collected at 20 locations during the investigation.

On the former USDA property, 79 soil samples were collected from six locations (boreholes SB43, SB45, SB46, SB48, SB49, and SB68). The most significant CT detections in soils were at
boreholes SB46 and SB49. At SB46, CT was detected in 12 of 13 samples, with concentrations ranging from 27 to 2,273 µg/kg; the maximum concentration was detected at a depth of 44 feet below ground level (bgl). At SB49, CT was detected in three of ten samples, with one sample exceeding the soil to groundwater Risk-based Standards for Kansas (RSK) level of 73.4 µg/kg at a depth of 48 feet bgl (Table 1). The residential soil pathway RSK was not exceeded in any sample.

Sample analysis detected CT in 13 soil samples from SB43, SB49, and SB68 at trace levels, far below the KDHE Tier 2 soil-to-groundwater RSK level of 73.4 µg/kg. The remaining 50 soil samples had no detections of CT. Chloroform was detected in four boreholes (SB43, SB46, SB49, and SB68) on the former CCC/USDA facility in trace concentrations; 1,2-Dichloroethane (1,2-DCA) was not found in soils.

On the Pro-Ag property, 159 soil samples were collected from 13 locations (boreholes SB51-SB56, SB58, SB59, SB61-SB64, and SB73). The most significant CT detections in soils on the Pro-Ag property were at boreholes SB59 and SB64. At SB59, concentrations ranged from 2.4 to 728 µg/kg, with the maximum concentration detected at a depth of 48 feet bgl. At SB64, concentrations ranged from 1.9 to 1,604 µg/kg, with the maximum concentration detected at a depth of 48 feet bgl. The residential soil pathway RSK was not exceeded in any sample (Table 1).

Sample analysis detected CT in 26 soil samples at trace levels, far below the soil-to-groundwater RSK level of 73.4 µg/kg. The remaining 133 soil samples had no detection of CT, including all samples from boreholes SB51, SB52, SB54, SB55, SB56, SB61 and SB73. Chloroform was detected in seven boreholes (SB53, SB55, SB56, SB59, SB62, SB63, and SB64) far below the KDHE Tier 2 RSK of 850 µg/kg for the soil-to-groundwater pathway. Trace concentrations of 1,2-DCA were found in only one soil sample (SB53) from the Pro-Ag facility.

Twelve soil samples were collected from one borehole (SB67) at the former retail store. CT was detected at trace levels in two samples in the saturated zone; no other VOCs were detected in any samples.

### 3.1.2. Groundwater

The groundwater investigation generated a total of 196 samples. A total of 162 groundwater samples were collected from 36 boring locations, at depths between 40 feet bgl and 145 feet bgl. The remaining 34 groundwater samples were collected from existing monitoring wells, piezometers, private wells, PWS wells and the newly installed piezometer at location SB72. A cone penetrometer was used to profile groundwater contamination with depth and to determine vertical migration pathways for CT contamination. Groundwater sampling locations were selected using the same rationale as was used to select soil sampling locations. Locations for groundwater samples taken during the 2005 and 2016 investigations are shown in Figures 5-7.

On the former CCC/USDA property, 58 groundwater samples were collected from 12 boreholes (SB43-SB50, SB60, SB68, SB69, and SB71) at depths from 41 feet to 70.5 feet bgl, and 3 monitoring wells. The most significant CT detections in groundwater on the former CCC/USDA property were samples collected at locations MW-P, SB46, SB48, and SB49. At MW-P, CT was detected at a concentration of 423 µg/L. At SB46, concentrations ranged from 2.0 to 1,710 µg/L,
with the maximum concentration detected at a depth of 45-50 feet bgl. At SB48, concentrations ranged from 2.3 to 76 µg/L, with the maximum concentration detected from 60.5-65.5 feet bgl. Lastly, at SB49, concentrations ranged from 2.9 to 731 µg/L, with the maximum concentration detected from 48-68 feet bgl. SB-68 had a CT concentration detected slightly above RSK at 6 µg/L from 44-49 feet bgl. Thirteen groundwater samples exceed the RSK for the groundwater pathway (Table 2).

Sample analysis detected CT in 14 groundwater samples from MW-Q, SB43, SB45, SB47, SB60, SB68, SB69, and SB71 at trace levels, far below the MCL of 5 µg/L. A total of 22 groundwater samples at eight locations (MW-P, SB43, SB46, SB48, SB49, SB68, SB69, and SB71) were at or above the method quantitation limit of 1 µg/L. Chloroform was detected on the former USDA property in 21 groundwater samples from locations MW-P, SB43, SB45, SB46, SB48, SB49 SB60, SB68, and SB71 at trace concentrations or concentrations at or above the method quantitation limit. All chloroform concentrations were far below the MCL of 80 µg/L. No other VOCs, (i.e. methylene chloride, 1,2-DCA) were found in groundwater samples from the former CCC/USDA facility.

Eighty-one groundwater samples were collected from 18 boreholes (SB51-SB56, SB58, SB59, SB61-SB66, SB70, SB73, SB75, and SB78) on or near the Pro-Ag property. Groundwater samples were also collected from monitoring wells KMW02, MW-H, MW-I, MW-J, MW-K, and MW-O. All sampling occurred at discrete depths from between 40 feet and 117 feet bgl. Groundwater samples at nine locations (MW-J, SB51, SB53, SB59, SB61, SB62, SB64, SB65, and SB73) exceeded the MCL of 5 µg/L for CT in groundwater. The most significant CT detections in groundwater on the Pro Ag property were samples from locations MW-P, SB43, SB45, SB46, SB48, SB49 SB60, SB68, and SB71 at trace concentrations or concentrations at or above the method quantitation limit. All chloroform concentrations were far below the MCL of 80 µg/L. No other VOCs, (i.e. methylene chloride, 1,2-DCA) were found in groundwater samples from the former CCC/USDA facility.

Six groundwater samples were collected from three monitoring wells and one boring (SB67) near the former retail store, located on the southeast corner of the intersection of Main Street and Railroad Avenue. The groundwater sample collected from MW-1 had a CT concentration of 0.5 µg/L, below the quantitation limit of 1.0 µg/L. The samples collected from KMW01, MW-2, and all three samples collected from SB67 had CT concentrations exceeding the RSK; the maximum concentration detected was in MW-2 (59 µg/L).
Forty-three groundwater samples were collected from downgradient locations and permanent monitoring points outside the targeted source investigation areas. Samples were collected from two domestic wells (DW07A and DW98), eight monitoring wells (MW B, C, F, G, L, M, N, R), three PWS wells (PWS #1-3), and eleven boring locations (SB15, SB23, SB28, SB36, SB38, SB40, SB41, SB42, SB72, SB79, SB80). CT was not detected in DW07A; CT was detected in DW98, however it was below the quantification limit of 1.0 µg/L. CT was detected in four of eight monitoring wells; CT exceeded the MCL in MW-F, MW-G, MW-L, and MW-N, with a maximum concentration of 445 µg/L in MW-F. CT was not detected in PWS #2 or PWS #3 but was detected in PWS #1 below the quantification limit of 1.0 µg/L. CT was detected in 27 of 30 groundwater samples collected from 11 boring locations. CT was detected above the RSK in 20 samples, with concentrations ranging from 5.1 to 595 µg/L. The maximum concentration (595 µg/L) was in SB40 at 50 - 55 feet bgl. Chloroform was detected in groundwater in generally trace amounts, well below the RSK, in the downgradient and offsite samples. The maximum chloroform concentration detected in groundwater (37 µg/L) was in SB40 from 60 - 65 feet bgl, however, the RSK for chloroform in groundwater is 80 µg/L.

Nitrate was detected in groundwater near the Site during investigation activities, with a maximum concentration of 310 milligrams per liter, taken on the Pro-Ag property during the 2005 CI. Nitrate is not considered a contaminant of concern for the CCC/USDA Site, and therefore nitrate impacts are only considered in context of the National Pollutant Discharge Elimination System (NPDES) permit.

4. Interim Measure Implementation

Interim measures (IM) are actions or activities taken to quickly prevent, mitigate, or remedy unacceptable risk(s) posed to human health and/or the environment by an actual or potential release of a hazardous substance, pollutant, or contaminant.

Use of PWS #3 and PWS #4 was discontinued (except for emergencies), and PWS #5 was installed in 1995. The CCC/USDA implemented an IM in 2009, in response to the results of the 2005 investigation to address the carbon tetrachloride in the soils and groundwater in the central part of the former CCC/USDA facility. Five large-diameter borings (LDBs) were excavated to physically remove contaminated soils, coupled with the installation of a soil vapor extraction (SVE) well and air-sparge (AS) point in each boring to further treat the surrounding soils and underlying groundwater (Figure 7). Soils recovered from the LDBs were treated by land-farming onsite. The IM also included the installation of five new piezometers for groundwater monitoring (GW1-GW5), and six new observation points (in the vadose zone) for soil gas monitoring.

In 2009 Argonne, on behalf of CCC/USDA, developed a Joint Work Plan for Sitewide Monitoring that was signed by CCC/USDA and Pro-Ag. Under the Joint Work Plan, the CCC/USDA and Pro-Ag are to alternate annual groundwater monitoring events. In 2010 Pro-Ag conducted a Groundwater Receptor Survey, which identified 11 private water wells, 7 of which were reported to be for lawn and garden use only, while the other 4 were reported inoperable. In 2012 Pro-Ag performed indoor air sampling at six residences, selected by KDHE, for possible vapor intrusion
(VI). The VI investigation determined that no residences were experiencing unacceptable VI from CT or related contaminants.

CCC/USDA performed a SVE/AS shut down test from 2016 to 2017 to evaluate residual CT concentrations in soil and groundwater. Additionally, CCC/USDA performed single-well slug tests at selected locations to determine the hydraulic characteristics of the local aquifer materials.

Data obtained from these IM activities have indicated that the majority of the CT in the vadose zone was volatilized and removed from the Site through operation of the AS/SCVE system, however, little remediation of the saturated zone has taken place\(^7\). Data obtained from the slug testing indicate that the hydraulic conductivity of the natural aquifer material at the Site is very low compared to that of the back-fill material present in the LDBs, resulting in a restricted radius of influence for the air-sparging process. The beneficial effects of the AS appear to be limited to the groundwater entering each LDB.

The estimated average linear groundwater velocity ranges from \(< 1 \text{ ft/year}\) to \(28-36 \text{ ft/year}\) in the immediate vicinity of the IM treatment area\(^7\). These groundwater velocity measurements represent a limiting factor in the current groundwater remediation; therefore, the current IM does not represent a cost-effective strategy for groundwater remediation.

5. Site Risks

CT was detected in soil at several locations above the RSK for the soil-to-groundwater pathway, which potentially could result in unacceptable human health or environmental exposure risks from ingestion or dermal contact with contaminated groundwater in saturated soil, inhalation of CT vapors, and degradation to the aquifer.

CT in groundwater exceeds the MCL for drinking water of \(5 \mu g/L\). The detected groundwater contamination could present unacceptable health risks associated with the use of groundwater for drinking, exposure to CT vapors released as a result of groundwater use for domestic purposes, or exposure to vapors resulting from VI to indoor air from the subsurface.

Since 1991 the residents of Agra have relied on PWS #1, PWS #2 and PWS #5 for their household water needs. None of the 11 private wells identified in proximity to the former CCC/USDA are used for drinking water purposes; however, potential exposure could occur if there are no restrictions on new well construction. Periodic receptor surveys could eliminate these exposure risks.

Potential exposure could also occur via the movement of contaminant vapors from soil gas within the unsaturated pore space of the vadose zone through the foundation into the interior air space of residential structures. At the request of KDHE, Pro-Ag evaluated the vapor intrusion pathway in Agra. Indoor air sampling was conducted during February 2012 at select residences. Based on the indoor air sampling results, no further indoor air testing is anticipated at this time\(^13\).

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8
6. Remedial Action Objectives

Remedial Action Objectives (RAOs) are media-specific goals for protecting human health and the environment. RAOs were developed taking into consideration the Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered standards, and investigation results presented in the 2005 Investigation of Contaminant Sources Report and CAS. Based on this information, the following RAOs were developed for the Site.

- Prevent human exposure (ingestion, inhalation, and dermal contact) to contaminated groundwater;
- Reduce the concentration, mass, and volume of contaminated soil at the Site that is contributing to groundwater concentration at the Site;
- Reduce the toxicity, mobility and volume of contaminated groundwater associated with the source area at the Site;
- Mitigate potential future risk to human health via the groundwater exposure pathway, associated with the CT contamination in groundwater that has been linked to the Site;
- Minimize the vertical and lateral migration of contaminated groundwater from the targeted treatment zone to other areas of the Site;
- Minimize vertical and lateral expansion of the contamination in groundwater outside the targeted treatment zone, as defined by the compliance groundwater monitoring network to be established;
- Restore groundwater to allow for its most beneficial use.

6.1 Cleanup Levels

Determination of cleanup levels for each medium of concern is discussed below. Cleanup levels are also shown in Table 3.

6.1.1. Soil Cleanup Levels

KDHE’s RSK levels for contaminants of concern in soil are the final remedial cleanup levels. The RSK level for CT for the soil-to-groundwater pathway is 73.4 µg/kg. Previous soil investigations have indicated that CT concentrations in soil do not exceed the RSK level for the soil pathway (8,440 µg/kg). The RSK level for chloroform for the soil-to-groundwater pathway is 850 µg/kg; no chloroform exceedances in soil were indicated based on previous investigations.
6.1.2. Groundwater Cleanup Levels
KDHE's RSK levels and/or the Environmental Protection Agency's MCLs for contaminants of concern in groundwater are the final remedial cleanup levels. The RSK level/MCL for CT in groundwater is 5 µg/L. The RSK level/MCL for chloroform in groundwater is 80 µg/L.

7. Summary of Remedial Alternatives Evaluated
The objective of the CAS is to identify remedial technologies and practices that can meet the site-specific RAOs and then combine the technologies and practices into a suite of remedial alternatives for further evaluation. In accordance with KDHE's Corrective Action Study Scope of Work, several remedial action alternatives were evaluated in detail during the CAS phase. Each remedial alternative was evaluated with respect to its ability to satisfy the following criteria as specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP): overall protection of human health and the environment; compliance with federal and state ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost. The remedial action alternatives were then compared against one another to identify the preferred alternative.

A detailed description of each remedial action alternative and the individual and comparative analyses is presented in the CAS. Brief summaries of the remedial action alternatives, including the preferred remedial action alternative, are provided below.

7.1 Alternative 1 – No Action
The NCP requires the evaluation of a No Action alternative to serve as a baseline for comparison to other remedial action alternatives evaluated. Typically, the No Action alternative means the Site is left unchanged, and no remedial actions are evaluated or taken. No further actions would be taken to reduce contaminant mass, address potential exposure pathways, or reduce the potential for contaminant migration. Since no remedial action is taken, risks to human health and environment would not be addressed. For the purpose of the CAS, the No Action alternative assumes that the mechanisms currently in place are not required; all groundwater monitoring would cease. The cost to implement this alternative is $0 because no additional action would be taken.

7.2 Alternative 2 – Groundwater Extraction, Treatment with a Tray Aerator, Discharge, and Groundwater Monitoring
Alternative 2 includes the installation and operation of three groundwater extraction wells (to be constructed in LDBs 2, 3, and 5). One additional monitoring well near the LDBs is also recommended, to augment the existing monitoring well network. The existing SVE wells in LDBs 2, 3, and 5 will be replaced with larger diameter groundwater extraction wells. A groundwater treatment system would replace the existing SVE/AS treatment trailer and would include a discharge line to Turner Creek. The preferred system design would include air stripping using tray aeration. The system would run for an estimated six years or until asymptotic CT levels are reached at the monitoring wells, whichever occurs first. The

\footnote{National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR 300 et seq.}
effectiveness and performance of the remedial system would be evaluated after five years to
determine if the remedial actions remain protective of human health and the
environment.

Subsequent to the publication of the Final CAD, CCC/USDA will submit a Corrective Action
Plan which will include a pre-final and final design and cost estimate, Operation and
Maintenance Plan, and a Site-Specific Monitoring and Performance Evaluation Plan (SMPE).
SMPE monitoring would include baseline sampling; sampling and analysis of NPDES-
permitted, treated discharge as required by the permitting entity; annual sampling of the
selected Site wells during the duration of the monitoring program; continuous water level
measurements of monitoring wells; and recording groundwater extraction volume and flow
rates pursuant to requirements of the groundwater appropriation regulations. The proposed
conceptual remedial system layout is shown in Figure 8.

Alternative 2 also includes Five-Year Reviews to be performed by CCC/USDA. The Five-
Year Review would include a report based on the review of the following: groundwater
monitoring reports associated with SMPE monitoring reports, site inspection, and a review of
the CAD and its established remedial action objectives. The Five-Year Review serves as a
project management mechanism, the first of which would include recommendations for the
potential need for additional remedial actions or implementation of a contingency remedial
alternative. The present value cost of Alternative 2 is $701,000.

7.3 Alternative 3 – Groundwater Extraction, Treatment with an Inclined Cascade Aerator,
Discharge, and Groundwater Monitoring
Alternative 3 would include the same extraction system installation, operation and monitoring as
Alternative 2; however, instead of a tray aeration system, Alternative 3 would use an inclined
cascade aeration to treat CT. These types of aeration systems are limited to seasonal operation,
when air temperatures are above 32°F; because of this, it is estimated this system would need to
run for an eight-year period to achieve asymptotic CT levels, two years more than Alternative 2.
The present value cost of Alternative 3 is $702,000.

7.4 Alternative 4 – Groundwater Extraction, Treatment and Discharge by Spray Irrigation
and Groundwater Monitoring
Alternative 4 would include the same extraction system installation, operation and monitoring as
Alternative 2 and 3, however, Alternative 4 would rely on a spray irrigation system to mitigate CT
and disperse effluent water along Turner Creek. Spray irrigation systems are limited to seasonal
operation, when air temperatures are above 45°F. Therefore, it is estimated this system would need
to run for a 10-year period to achieve asymptotic CT levels; four years more than Alternative 2.
The present value cost of Alternative 4 is $742,000.

7.5 Alternative 5 – Land Use Control and Monitoring
Alternative 5 would include the use of Land Use Controls (LUCs) to mitigate site risks. Currently,
the property has LUCs associated with the Kyle Railroad Company (KRC) that prohibit installation
of water supply wells and construction of habitable structures. If the existing LUCs are determined
to be inadequate by KDHE, CCC/USDA would establish additional LUCs to further restrict use of the property, either by negotiating a legal agreement with KRC to facilitate a new authorization and license agreement prohibiting installation of water supply wells and construction of habitable structures on the KRC right-of-way formerly occupied by the CCC/USDA facility for the full term of Alternative 5, or some other mechanism (i.e. Environmental Use Controls or Restrictive Covenant). Key components of this alternative would include monitoring current wells in the vicinity of the source area every five years. The present value cost for Alternative 5 for a 21-year period is $256,000.

8. Description of the Preferred Remedy

After evaluation of the individual remedial action alternatives, a comparative analysis of the various alternatives was performed with consideration of the threshold and balancing criteria specified in the NCP as discussed in Section 7.0. On the basis of information available in the AR and summarized above, KDHE has selected Alternative 2, Groundwater Extraction, Treatment with a Tray Aerator, Discharge, Groundwater Monitoring and Five-Year Reviews as the preferred remedy. The results of the comparative analysis support the preferred remedy as outlined below. The total present value cost of the preferred remedy is $701,000. Components of the selected alternative include:

- **Groundwater Extraction, Treatment with a Tray Aerator, Discharge (NPDES or beneficial reuse)** – Alternative 2 uses three extraction wells to remove groundwater, contaminated by CT and a tray aerator to treat the recovered groundwater. The existing 4-inch diameter SVE wells (LDBs 2, 3, and 5) would be replaced with 8-inch diameter extraction wells. The LDB locations are shown on Figure 8. The wells will be constructed using schedule 40 PVC casing and 10 feet of 20-mil-slot screen extending to bedrock (approximately 65 feet bgl) and will be initially test pumped as a precursor to final design of the remaining system components. As currently planned, 2-inch diameter, high-density polyethylene piping will be used to convey extracted groundwater from each extraction well to the treatment facility making use of the existing but now unused SVE/AS piping running from each LDB. Treated effluent water will be discharged via 2-inch diameter, high-density polyethylene piping to the point of discharge at Turner Creek (Figure 8). One newly installed monitoring well (GW6), along with existing monitoring wells (10), will be used to evaluate the performance of the extraction wells both during pump testing and implementation of the remedy.

- **Groundwater Monitoring** – Alternative 2 also incorporates groundwater monitoring for an estimated period of seven years, or until the CT concentrations fall below the MCL and/or otherwise meet the closure criteria outlined in KDHE BER Policy #BER-RS-024. The groundwater monitoring program will involve collecting groundwater samples, laboratory analysis for selected VOCs (CT, chloroform, and methylene chloride), data evaluation, and reporting. The samples will be analyzed for field parameters (dissolved oxygen, oxidation-reduction potential, pH, temperature, and conductivity) at the wellhead. The wells would be sampled for the baseline event in Year 1, semi-annually during Year 2, and then annually from Years 3-7, or until the Site is eligible for closure.
Five-Year Reviews – Alternative 2 incorporates Five-Year Reviews to evaluate remedy performance and protectiveness. Five-Year Reviews will be prepared by CCC/USDA with the first review to take place five years after implementation of the remedy.

The preferred remedy as outlined above satisfies or meets Federal, State, and local requirements, and will be protective of human health and the environment.

8.1 Contingency
In the event that the preferred remedy does not remain protective to human health or the environment, KDHE may require the development and implementation of contingency measures. These measures may include additional characterization, evaluation of remedial alternatives, and/or implementation of active remedial measures.

9. Community Involvement
KDHE developed a Public Relations Strategy as required. Public notice of the availability of the draft CAD was published in the Phillips County Review newspaper. In addition, KDHE has established a webpage dedicated to the Agra USDA Site, available online at http://www.kdheks.gov/remedial/site_restoration/AgraUSDA.html. The public comment period was held from March 10 to April 10, 2021. No comments were received during the public comment period.

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15 KDHE, October 2020, Public Information Strategy.
TABLES
Table 1 – Maximum Concentrations in Soil

<table>
<thead>
<tr>
<th>Compound</th>
<th>Location</th>
<th>Date</th>
<th>Historical Maximum Concentration</th>
<th>Depth (Ft)</th>
<th>KDHE Tier 2 Level(^{1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Tetrachloride</td>
<td>SB46</td>
<td>07/2005</td>
<td>2,273</td>
<td>44</td>
<td>73.4</td>
</tr>
<tr>
<td>Chloroform</td>
<td>SB46</td>
<td>07/2005</td>
<td>17</td>
<td>28, 48</td>
<td>850</td>
</tr>
</tbody>
</table>

\(^{1}\)KDHE Tier 2 Levels default to MCLs where available. Tier 2 Level for soil provided from KDHE’s Risk-based Standards for Kansas (RSK) Manual, October 2010, Revised September 2015.

*Red Bold* = concentration exceeds the applicable RSK.
### Table 2 – Maximum Concentrations in Groundwater

<table>
<thead>
<tr>
<th>Compound</th>
<th>Location</th>
<th>Date</th>
<th>Historical Maximum Concentration</th>
<th>MCL or KDHE Tier 2 Level&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Tetrachloride</td>
<td>SB64</td>
<td>07/2005</td>
<td>6,413</td>
<td>5</td>
</tr>
<tr>
<td>Chloroform</td>
<td>SB64</td>
<td>07/2005</td>
<td>66</td>
<td>80</td>
</tr>
</tbody>
</table>

<sup>2</sup>**KDHE Tier 2 Levels default to MCLs where available. Tier 2 Level for groundwater provided from KDHE’s Risk-based Standards for Kansas (RSK) Manual, October 2010 Revised, September 2015.**

**Red Bold** = concentration exceeds the applicable RSK
Table 3 – Final Cleanup Goals

<table>
<thead>
<tr>
<th>Compound</th>
<th>Media</th>
<th>MCL or KDHE Tier 2 Level</th>
<th>Cleanup Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Tetrachloride</td>
<td>Soil</td>
<td>73.4 µg/kg</td>
<td>73.4 µg/kg</td>
</tr>
<tr>
<td>Chloroform</td>
<td></td>
<td>850 µg/kg</td>
<td>850 µg/kg</td>
</tr>
<tr>
<td>Carbon Tetrachloride</td>
<td>Groundwater</td>
<td>5 µg/L</td>
<td>5 µg/L</td>
</tr>
<tr>
<td>Chloroform</td>
<td></td>
<td>80 µg/L</td>
<td>80 µg/L</td>
</tr>
</tbody>
</table>

KDHE Tier 2 Levels default to MCLs where available. Tier 2 Level for groundwater provided from KDHE's Risk-based Standards for Kansas (RSK) Manual, October 2010, Revised September 2015.
<table>
<thead>
<tr>
<th>Media of Interest</th>
<th>Preferred Alternative</th>
<th>Contingency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated Soil</td>
<td>Alternative 2: Groundwater Extraction and Treatment with Tray Aerator and NPDES Discharge, Groundwater Monitoring, Five Year Reviews</td>
<td>Additional characterization, new evaluation of remedial alternatives, and implementation as determined necessary.</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Alternative 2: Groundwater Extraction and Treatment with Tray Aerator and NPDES Discharge, Groundwater Monitoring, Five Year Reviews</td>
<td>Additional characterization, new evaluation of remedial alternatives, and implementation as determined necessary.</td>
</tr>
</tbody>
</table>
Table 5 - Estimated Cost of the Preferred Alternative

<table>
<thead>
<tr>
<th>Preferred Alternative</th>
<th>Total Capital Cost</th>
<th>Total Operation &amp; Maintenance Cost</th>
<th>Contingency (15%)</th>
<th>Total Cost</th>
<th>Net Present Value (with contingency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 2:</td>
<td>$442,392</td>
<td>$258,964</td>
<td>$105,204</td>
<td>$806,560</td>
<td>$733,865</td>
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<tr>
<td>Groundwater Extraction</td>
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<tr>
<td>and Treatment with</td>
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<tr>
<td>Tray Aerator and NPDES</td>
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<tr>
<td>Discharge, Groundwater</td>
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<tr>
<td>Monitoring, Five Year</td>
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<tr>
<td>Reviews</td>
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*Cost projection provided in the Corrective Action Study Report (Argonne National Laboratory, 2018)*
Figure 1. Site Location
Final Corrective Action Decision
Agra USDA, Agra, Kansas
April 2021

Figure 2. Site Map
Figure 3. Potentiometric Surface, September – October 2016
Figure 4. Carbon Tetrachloride Concentrations in Soil – 2005

Carbon tetrachloride concentrations shown in micrograms per kilogram (μg/kg).

Red indicates an exceedance of the Soil to Groundwater Pathway RSK of 73.4 μg/kg.

ND indicates the analyte was not detected above the reporting limit.

NS indicates that no soil sample was analyzed.

J indicates an estimated concentration below the quantification limit.
Figure 5. Carbon Tetrachloride Concentrations in Groundwater
Near Source Area – 2005
Figure 6. Chloroform Concentrations in Groundwater Near Source Area – 2005

Chloroform concentrations shown in micrograms per liter (ug/L). Only the maximum chloroform detections for each boring are shown. Red indicates an exceedance of the Groundwater RSK (80 ug/L). ND indicates the analyte was not detected above the reporting limit. NS indicates that no groundwater sample was analyzed. J indicates an estimated concentration below the quantitation limit.
Figure 7. Carbon Tetrachloride Concentrations in Groundwater – 2016 Agra USDA Source Area
Figure 8. Proposed Remedy Layout

The proposed remedy layout is preliminary; the final remedial system layout and groundwater monitoring network will be finalized in the Corrective Action Plan.

Locations of large diameter boring extraction wells (blue triangles), aerator treatment building (red triangle), and associated piping (black/blue lines). The approximate radius of influence of the extraction well system is shown as a yellow circle.

Proposed point of treated effluent discharge (Turner Creek)