UNITED STATES DISTRICT COURT

MIDDLE DISTRICT OF NORTH CAROLINA

UNITED STATES OF AMERICA,	)
Plaintiff,	)
	)
v.	)
	)
THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION,	)
Defendant.	)

REMEDIAL DESIGN/REMEDIAL ACTION CONSENT DECREE

FOR OPERABLE UNIT ONE OF THE

ABERDEEN CONTAMINATED GROUNDWATER SUPERFUND SITE

APPENDIX A

Record of Decision Amendment - "AROD"

RECORD OF DECISION AMENDMENT OPERABLE UNIT ONE REPLACING TOWN OF ABERDEEN SUPPLY WELLS

ABERDEEN CONTAMINATED GROUNDWATER SITE

ABERDEEN, MOORE COUNTY NORTH CAROLINA

PREPARED BY:
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA, GEORGIA

September 2014

DECLARATION
ABERDEEN CONTAMINATED GROUNDWATER SUPERFUND SITE
RECORD OF DECISION AMENDMENT
OPERABLE UNIT 1

SITE NAME AND LOCATION

Aberdeen Contaminated Groundwater Site is located along NC Highway 211, approximately 1½ miles east of US Highway 1 in Aberdeen, Moore County, North Carolina.

STATEMENT OF BASIS AND PURPOSE

This decision document presents a change to the selected remedy presented in the March 5, 2012 Interim Action Record of Decision (IROD) for the Aberdeen Contaminated Groundwater Superfund Site in Aberdeen, Moore County, North Carolina. This modification was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This Amendment to the IROD addresses the adverse impact resulting from the Site-related contaminant, trichloroethylene (TCE), on the Town of Aberdeen's public water supply wells #5 and #9. This selected remedy is now considered to be Operable Unit 1 (OU 1) and this decision is based on the Administrative Record for the Site. This Record of Decision Amendment is anticipated to be the final decision for OU 1.

The State of North Carolina concurs with the selected remedy.

DESCRIPTION OF SELECTED REMEDY

The selected alternative, Alternative 3, consists of the installation of new supply well(s) for the Town of Aberdeen in an area where the quality of the underlying groundwater has not been adversely impacted by past anthropic activities to replace supply wells #5 and #9 (attaining the pumping capacity prior to the shutdown of well #5). This remedial action involves the following activities: drilling and testing a test well at each location; purchasing the necessary property and/or easements; drilling/constructing the supply well(s); constructing well head protection enclosure(s); improving well #6 building/treatment to handle the additional flow of water from the new well(s); installing the necessary piping, electrical connections, and controls; and conducting Five-Year reviews.

STATUTORY DETERMINATIONS

This document changes the interim remedy for OU 1 selected in the March 5, 2012 IROD. This remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate for 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 does not satisfy the statutory preference for treatment as a principal element of the remedy; as the objective of this remedy is to replace supply wells #5 and #9 with new supply wells (maintaining the pumping capacity prior to the shutdown of well #5) installed in

an area where the quality of the underlying groundwater has not been adversely impacted by past anthropic activities. Currently, the remediation/restoration of the contaminated groundwater will occur under the selected remedy (Operable Unit 2) in the 2012 IROD. Because the selected action will not achieve levels that allow for unlimited use and unrestricted exposure within five years, EPA will conduct five-year reviews in accordance with EPA policy until cleanup levels established in this ROD are attained or a final ROD is in place. Reviews will begin five years after initiation of the remediation action to ensure that the selected remedy is protective of human health and the environment.

DATA CERTIFICATION CHECKLIST

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2	Baseline Risk Represented by the Chemicals of Concern	pgs 14-25
3	How Source Materials Constituting Principal Threats are Addressed	pg 47
4	Current and Reasonably Anticipated Future Land Use Assumptions and Current and Potential Future Beneficial Uses of Groundwater Used in the Baseline Risk Assessment and the Record of Decision Amendment	pgs 1, 13, 16, 51
5	Potential Land and Groundwater Use that will be Available at the Site as a Result of the Selected Remedy	pg 26
6	Estimated Capital, Annual Operation & Maintenance, and Total Present Worth Costs, Discount Rate, and the Number of Years Over Which the Remedy Cost Estimates are Projected	pg 34
7	Key Factors that Led to Selecting the Remedy (i.e., Describe How the Selected Remedy Provides the Best Balance of Tradeoffs with Respect to the Balancing and Modifying Criteria, Highlighting Criteria Key to the Decision)	pg 51

AUTHORIZING SIGNATURE

The Selected Remedy 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 wavier), is cost effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This remedy was selected by the Environmental Protection Agency with concurrence of North Carolina Department of Environment and Natural Resources.

Carol J. Monell for

Randall Chaffins, Acting Director
Superfund Division

9/30/14
Date

DECISION SUMMARY
RECORD OF DECISION AMENDMENT
OPERABLE UNIT 1

ABERDEEN CONTAMINATED GROUNDWATER SUPERFUND SITE
ABERDEEN, MOORE COUNTY, NORTH CAROLINA

Prepared by:
U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

September 2014

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LIST OF ACRONYMS

ACG	Aberdeen Contaminated Groundwater
ACG Site	Aberdeen Contaminated Groundwater Site
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BHC	benzene hexachloride
BHHRA	Baseline Human Health Risk Assessment
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund)
CFR	Code of Federal Regulations
cm/sec	centimeters per second
COCs	Chemicals of Concern
COPCs	Chemicals of Potential Concern
CSM	conceptual site model
CTC	carbon tetrachloride
DCE	1,1-Dichloroethene
EPA	Environmental Protection Agency
EPC	Exposure Point Concentrations
ERA	Ecological Risk Assessment
FS	Feasibility Study
ft/day	feet per day
ft/ft	feet per feet
GAC	granular activated carbon
gpm	gallons per minute
HEAST	Health Effects Assessment Summary Tables
HQ	Hazard Quotient
HI	Hazard Index
ILCR	Incremental Lifetime Cancer Risk
IR	ingestion rate
IRIS	Integrated Risk Information System
IROD	Interim Action Record of Decision
LBC	Lower Black Creek
MCLs	Maximum Contaminant Levels
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram-day
msl	mean sea level
MW	Monitoring Well
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCDEHNR	North Carolina Department of Environment, Health and Natural Resources
NCDOT	North Carolina Department of Transportation
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List
NC 2L	North Carolina Groundwater Standards

LIST OF ACRONYMS

O&M	Operation and Maintenance
OU	Operable Unit
PCE	Tetrachloroethene
PMP	Powder Metals Products
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
RA	Remedial Action
RAOs	Remedial Action Objectives
RD	Remedial Design
RD/RA	Remedial Design/Remedial Action
R_fD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SF	slope factor, expressed as $(mg/kg\text{-}day)^{-1}$
SLERA	Screening-Level Ecological Risk Assessment
TBC	To Be Considered
TCA	1,1,1-trichloroethane
TCE	trichloroethene
TOA	Town of Aberdeen
µg/kg	microgram per kilogram
µg/L	microgram per liter
UBC	Upper Black Creek
U.S.C.	United States Code
UST	underground storage tank
VOC	volatile organic compounds

RECORD OF DECISION AMENDMENT
OPERABLE UNIT 1
ABERDEEN CONTAMINATED SUPERFUND SITE
ABERDEEN, MOORE COUNTY, NORTH CAROLINA

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

1.0 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

The Aberdeen Contaminated Groundwater Site (ACG Site or Site) is located along NC Highway 211, approximately 1½ miles east of US Highway 1 in Aberdeen, Moore County, North Carolina. **Figure 1** shows the location of the Site. Land use around the ACG Site includes a mixture of residential, commercial, and industrial users. The Site was proposed for the National Priority List (NPL) in March 2008 via the Federal Register (Vol. 73, No. 54, March 2008) and finalized on the NPL in September 2008 via the Federal Register (Vol. 73, No. 171, September 2008). The Environmental Protection Agency's (EPA or the Agency) identification number for the Site is NCN000407447.

The Site was listed on the NPL as a trichloroethene (TCE) groundwater plume Site with no identified source. The plume was identified during the investigations of the following sites and/or facilities in the area: the Geigy Chemical Corporation Superfund Site (Geigy Site), the Crestline Contaminated Well Emergency Response site (formerly known as the Route 211 Contaminated Well Site), the former Lee Paving Company property, and the former Powder Metal Products (PMP) facility. Therefore, the footprint of the ACG Site includes these four sites. The study area, identified by the red dash line on **Figure 1**, is approximately 6,400 feet by 5,600 feet or 1.3 square miles.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

In 1990, during the investigation of groundwater contamination at the Geigy Site, also located along Highway 211 (refer to **Figure 1**), TCE was detected in two deep groundwater monitoring wells. During Phase II of the Geigy groundwater investigation, TCE was detected in the same two deep wells, a residential well along Highway 211, and a supply well on the PMP property. In 1998, EPA determined that the Geigy Site was not the source of TCE being detected in the groundwater and that the TCE originated from another source and was migrating towards the Geigy Site. However, in downgradient areas, the pesticide plume emanating from the Geigy Site and the TCE plume have become comingled.

In May 1990, EPA initiated an emergency response at the "Route 211 Contaminated Well Site". This response included connecting up to 10 private residences/businesses to the Town of Aberdeen (TOA) municipal water system due to lead and TCE being present in the groundwater in this area. In 1991, this emergency response was expanded to include up to 40 residences/businesses. This Site later became known as the "Crestline Contaminated Well Site".

Another nearby area of concern was the former Lee Paving Company property located at Lockey Drive and Lee Paving Road, which is southwest of the former PMP property (refer to **Figure 1**). Currently, the Sandhills Recycling Center is located and operating in the northeast corner of the former Lee Paving Site. The Sandhills Recycling Center buys and sells recyclable metals. The remainder of the Lee Paving property remains vacant.

Between 1964 and 1989, the North Carolina Department of Transportation (NCDOT) and other entities operated an asphaltic aggregate testing laboratory on the Lee Paving Company property. The Lee Paving Company operated an asphalt plant on this property. Since 1989, this property has been used for the storage and handling of recyclable wastes. In 1992, NCDOT and North Carolina Department of Environment, Health, and Natural Resources began assessments of asphaltic materials testing sites in the State. From 1994 to 1996, a NCDOT contractor conducted a site assessment of the geology and hydrogeology of the Lee Paving property. Samples collected as part of this assessment in 1994 and 1995 documented a commingled plume of TCE and 1,1,1-trichloroethane (TCA) in the southern portion of the Lee Paving property and migrating west in the surficial aquifer. Three monitoring wells located on the northern portion of the Lee Paving property showed contamination by TCE only. No other monitoring wells screened in the Upper Black Creek aquifer on the Lee Paving property have shown TCE contamination. Two surficial aquifer monitoring wells north of this plume were not contaminated. Therefore, the assessment concluded that the TCE found in the monitoring wells in the northern portion of the Lee Paving property is part of the ACG Site plume and is different from the plume detected in the southern portion of the Lee Paving property.

The PMP property then became the focus as a potential source of TCE in groundwater. The PMP property is a 26.8 acre parcel with one metal building on it. The building is 200 feet by 150 feet on a concrete slab. A 6-foot chain linked security fence encompasses the building along with approximately 3.8 acres. PMP owned and operated the facility and made precision machine parts from approximately 1980 until 1995. A part of their process reportedly included a solvent dip bath containing TCE. In 1995, PMP sold the property to Diamond Exhaust & Equipment which operated the facility as a wholesale automotive exhaust parts distribution center. It is not known whether Diamond Exhaust & Equipment utilized any chemicals or solvents. This property was recently sold to CALCO Enterprises which is a small company based out of Southern Pines, North Carolina. CALCO Enterprises provides mechanical services (with a specialty in pre-insulated underground piping), process piping services, miscellaneous steel welding, and erection. . The Agency has identified the following entities as potentially responsible parties (PRPs) for the ACG Site (listed alphabetically): CALCO Enterprises, Kaiser Aluminum & Chemical Corporation, Lee Paving Company, NCDOT, Olin Corporation, Powder Metals Products, Inc., and Syngenta Crop Protection.

In 2000, North Carolina Department of Environment and Natural Resources (NCDENR) installed four nested pairs of monitoring wells around the PMP facility. The shallow wells were screened in the surficial aquifer (43-73 feet below ground surface (bgs)) and the deeper wells were screened in the Upper Black Creek aquifer (104-128 feet bgs). These monitoring wells are located northeast, west, southeast, and southwest of the building on the PMP property. Groundwater samples collected from these and other monitoring wells have documented TCE contamination in the western and southern areas around the PMP property. The concentrations detected indicate a higher concentration in the Upper Black Creek (UBC) aquifer than in the surficial aquifer with the highest concentration due west of the facility.

In order to better document if the PMP facility was a source for the TCE contamination, EPA installed an additional nested pair of monitoring wells at the PMP facility, one in the surficial aquifer and the second in the UBC aquifer. In April 2004, these two monitoring wells were sampled. The concentration of TCE in the shallow well was very low and the concentration of TCE in the deeper well was high. 1,1-Dichloroethene (1,1-DCE) and cis-1,2-dichloroethene (cis-1,2-DCE) were also detected in the groundwater sample taken from the deeper monitoring well. These chlorinate chemicals are typically

referred to as volatile organic compounds (VOCs). Although EPA has not named the PMP facility as the sole source of the groundwater contamination associated with the Aberdeen Contaminated Groundwater Site, this facility was most likely a contributor of the TCE currently being detected in the groundwater. The 1994/1995 investigation of the Lee Paving property by NCDOT did document that past activities on this property resulted in chlorinated VOCs reaching the underlying aquifers. And while the possibility of a spill from a railroad tanker on the Aberdeen & Rockfish Railroad line has been mentioned, no documentation has been found to support this and no person has been found to confirm such a spill.

The analytical results indicate a migration of contamination from the surficial aquifer to the Upper and Lower Black Creek (LBC) aquifers. The surficial aquifer does not have sufficient yield for potable uses and does not exist continuously throughout the area. Historically, most of the residential wells in the ACG Site study area were screened in either the Upper or Lower Black Creek Aquifers. Currently, residents in this area obtain potable water from the TOA municipal water supply system. To the best of the Agency's knowledge, existing private wells in this area are only being used for the irrigation of gardens.

On March 5, 2012, EPA issued an Interim Action Record of Decision (IROD). The 2012 IROD included two components:

- install wellhead treatment at municipal supply wells #5 and #9 and
- install and operate a groundwater extraction and treatment system for the restoration of groundwater to its beneficial use.

In May 2012, TOA was directed by the State to shut down supply well #5 due to the elevated levels of TCE being detected in the well. EPA completed the Remedial Designs for these two components in December 2012 and September 2013, respectively. During a meeting in November 2013 with the State of North Carolina which included both NCDENR and NCDOT, EPA was informed by NCDENR that the State was no longer favored a pump and treat system to address the TCE plumes. In addition, NCDENR suggested installing a new supply well(s) in an area not impacted by past anthropic activities; one advantage of this suggestion is that it would restore the loss of TOA water supply without the significant costs associated with the long-term operation and maintenance of the wellhead treatment systems anticipated in the 2012 IROD. As an outcome of this meeting, EPA elected not to implement either design. In February 2014, EPA began to evaluate splitting the Site into two Operable Units. The first Operable Unit (OU 1) will address the adversely impacted supply wells for the Town of Aberdeen and the second OU (OU 2) will address the groundwater contamination in the aquifers (the plumes at large).

3.0 COMMUNITY PARTICIPATION

On January 08, 2009, EPA conducted the Remedial Investigation/Feasibility Study (RI/FS) public kick-off meeting. Due to the lack of public interest at the kick-off meeting, no other public meeting was held until the Interim Action Proposed Plan Public meeting which was held on September 07, 2011. The OU 1 Record of Decision (ROD) Proposed Plan public meeting was held on August 19, 2014. All three of these public meetings were held in the Aberdeen Town Hall.

The Remedial Investigation (RI) Report, Feasibility Study (FS) document, IROD, the Remedial Designs associated with the IROD, the OU 1 ROD Proposed Plan, and all other pertinent documents for the Site were made available to the public in August 2014. All of these documents can be found in the

Administrative Record and the information repository maintained at EPA Superfund Record Center in Region 4 and at the Page Memorial Library located at 100 South Poplar Street, Aberdeen, North Carolina.

The Agency placed two ads in *The Pilot* newspaper, one on August 13, 2014, and the second on August 17, 2014, to announce the OU 1 ROD Proposed Plan public meeting. The Public Meeting was held on August 19, 2014. At this meeting, representatives from EPA and NCDENR answered questions regarding the findings of the RI and the OU 1 proposed remedial alternative for the Site. The 30 day public comment period ran from August 19, 2014, through September 18, 2014. The OU 1 ROD Proposed Plan was disseminated to the public during the week of August 25, 2014. EPA's response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD. Two sets of comments were received during the public comment period. These comments are discussed in Appendix D – Responsiveness Summary.

4.0 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

In 2012, EPA signed an IROD that addressed the entire Site. The interim remedial action addressed the TOA supply wells and the groundwater plumes. The following is the interim remedy selected:

> Component 1 - install wellhead treatment consisting of activated carbon absorption units at two municipal supply wells for the Town of Aberdeen, TOA #5 and TOA #9, monitor the aquifer and the treatment systems, and perform five-year reviews.
>
> Component 2 - install a groundwater extraction and treatment system which includes the necessary piping, electrical connections, and controls. Contaminated groundwater will be extracted from both the UBC and the LBC Aquifers where the levels of trichloroethene exceeded the maximum contaminant level as specified in the Safe Drinking Water Act. Monitor/evaluate the extraction and treatment systems. On-site treatment of the extracted groundwater will be accomplished through activated carbon with the treated water being discharged to an infiltration gallery.

As with many Superfund sites, the problems at the ACG Site are complex. As a result, EPA has decided to organize the work at the Site into two operable units (OUs):

- Operable Unit 1: Addresses the adversely impacted supply wells for the Town of Aberdeen (TOA supply wells #5 and #9). Maintain the pumping capacity of these two supply wells prior to the shutdown of supply well #5. The maximum pumping capacity of supply well #5 was approximately 200 gallons per minute (gpm) and the maximum pumping capacity of supply well #9 is approximately 120 gpm and
- Operable Unit 2: Addresses the groundwater contamination in the UBC and LBC aquifers.

This ROD Amendment is for OU 1 and only addresses the risks posed by the contaminated TOA supply wells #5 and #9. This ROD Amendment modifies the component of the 2012 interim action that addresses the TOA supply wells and is a final action for the TOA supply wells.

OU 2 addresses the contamination in the UBC and LBC aquifers. Ingestion of water extracted from these aquifers poses a current and potential risk to human health because concentrations of TCE are greater than the maximum contaminant level (MCL) for drinking water (as specified in the Safe Drinking Water Act). This ROD Amendment does not modify the interim action for OU 2.

5.0 SITE CHARACTERISTICS

The findings/conclusions for all environmental media (surface soils, subsurface soils, surface water, sediment, and groundwater) were presented in the May 2010 RI Report. This information was summarized/discussed in detail in the 2012 IROD. This ROD Amendment focuses on information pertinent to TOA supply wells #5 and #9.

The Town of Aberdeen is located in the Sandhills region of the southwestern Coastal Plain Province of North Carolina which is characterized by rolling hills and deep sand and sandy soils upon which a dendritic drainage pattern has developed. The altitude of the uplands ranges from 450 to 600 feet above mean sea level (msl). The minimum altitude is about 230 feet along Little River, resulting in 220-370 feet of topographic relief in the Sandhills area. Elevations within the RI Study area ranged from approximately 350 to 500 feet above msl.

Two main soil classifications were found for the ACG Site study area. The Candor Sand makes up the majority of the study area from PMP toward the west and along the middle and northern areas the soil is classified as Vaucluse loamy sand. The most geologically recent, surface unit is the Tertiary Pinehurst formation, which consists of unconsolidated quartz sand. In Aberdeen, the Pinehurst formation is underlain by the late Cretaceous Middendorf Formation, which consists of sand interbedded with clay or sandy-clay lenses. Beneath the Middendorf Formation lays the late Cretaceous Cape Fear Formation, consisting of clay with some interbedded sand units. Beneath this lies the Carolina Slate Belt and Triassic basement rocks, which locally include an upper layer of residual saprolite and partially weathered rock.

The hydrogeologic framework within the study area consists of five distinct hydrogeologic units. These include from top (the surface) to bottom, the surficial aquifer, the UBC aquifer, the LBC aquifer, the Upper Cape Fear aquifer, and the saprolite-bedrock aquifer. To date, groundwater contamination has only been observed in the upper three aquifers. Each aquifer is separated from the overlying aquifer by a confining unit. Each confining unit is informally named for the aquifer it overlies. Refer to **Figure 2** for a generalized cross-section of the geology under the Site. It has been shown that the confining unit between the surficial aquifer and the UBC aquifer and the confining unit between the UBC aquifer and the LBC aquifer are not continuous. Therefore, groundwater along with contaminants can migrate from the surface down to the LBC aquifer. **Figure 3** presents a Conceptual Groundwater Flow Model for this five aquifer system.

The classification of an aquifer in North Carolina is based on the concentration of chloride in the aquifer. Aquifers that contain less than 250 milligrams per liter of chloride are Class GA aquifers. This class of aquifer is either an existing or potential source of potable water. The five aquifers listed above are classified as Class GA aquifers.

5.1 REMEIDAL INVESTIGATION SAMPLING STRATEGY

The location or locations for the source(s) of the TCE associated with the ACG Site groundwater contamination is (are) inexact. It is known that PMP used a dip bath which contained TCE solvent to remove grease from the machine parts they generated. Interviews with local people indicated that the dip bath was located near the northwest corner of the PMP building but no one could confirm the presence of such a tank. The initial environmental investigation of the PMP facility was performed by NCDENR in 2000 and no tank was present at that time. This investigation identified TCE in groundwater at 1,489 micrograms per liter (µg/L) just west of the PMP building, which reinforced the belief that a source was once present at the PMP facility, and resulted in a decision to conduct an RI. Another known source of VOC contamination was the Lee Paving property.

The ACG Site RI was split into two phases. The primary objective of Phase 1 was to try to locate the source of TCE on the PMP property. Phase 2 activities focused on delineating the extent of the TCE plume.

5.2 SUMMARY OF REMEDIAL INVESTIGATION

The RI for the ACG Site began in September 2008, and the final RI report was completed in May 2010. The field work focused primarily on identifying the nature and extent of groundwater contamination through a network of 53 monitoring and residential wells and three municipal wells. A summary of the contaminants identified within the three aquifers associated with ACG Site is presented below. **Figure 4** shows the locations of the monitoring wells sampled at the ACG Site.

Surficial Aquifer

The surficial aquifer occurs only in the upland portion of the study area. The surficial aquifer, including the unsaturated portion, extends from land surface to a depth of about 25-40 feet. The base of the surficial aquifer is the top of the Black Creek confining unit, which is at the top of the UBC aquifer. This Black Creek confining unit consists of a series of discontinuous clay or sandy-clay lenses, sometimes overlapping, with the result being that the confining unit is not continuous and allows water from the surficial aquifer to flow directly into the UBC aquifer, thus recharging that aquifer quickly. The geological make-up of the confining unit between the UBC aquifer and the LBC aquifer is similar to this confining unit which explains why both of these aquifers have been adversely impacted by TCE.

Groundwater samples were collected from 8 monitoring wells screened in the surficial aquifer. No VOCs or pesticides were detected above the applicable groundwater standards. Metals were detected in three of the surficial aquifer wells at concentrations above applicable groundwater standards, but these concentrations were attributed to the high turbidity of the samples and therefore, are not considered to be Site related contamination.

Following a screening level risk evaluation conducted for the surficial aquifer, Site related contaminants were not evaluated for human health risks in the surficial groundwater due to either low concentration levels [i.e., less than the risk-based screening criteria, less than the MCL or the North Carolina Groundwater Classifications and Standards, North Carolina Administrative Code (NCAC) Title 15A

Subchapter 2L)] or non-detects. The levels detected in the surficial aquifer were also too low for soil vapor intrusion to be a concern. The North Carolina Groundwater Classifications and Standards can be found in the NCAC Title 15A Subchapter 2L or frequently referred to as NC 2L standards. The NC 2L standards can be viewed at the following website: http://portal.ncdenr.org/web/wq/ps/csu/gwstandards. Maximum Contaminant Levels (MCLs) are enforceable standards established under the Safe Drinking Water Act (SDWA) (which can be viewed at the following website: http://water.epa.gov/drink/contaminants/index.cfm). The MCL for TCE is 5 µg/L and the NC 2L standard for TCE is 3 µg/L.

Upper Black Creek Aquifer

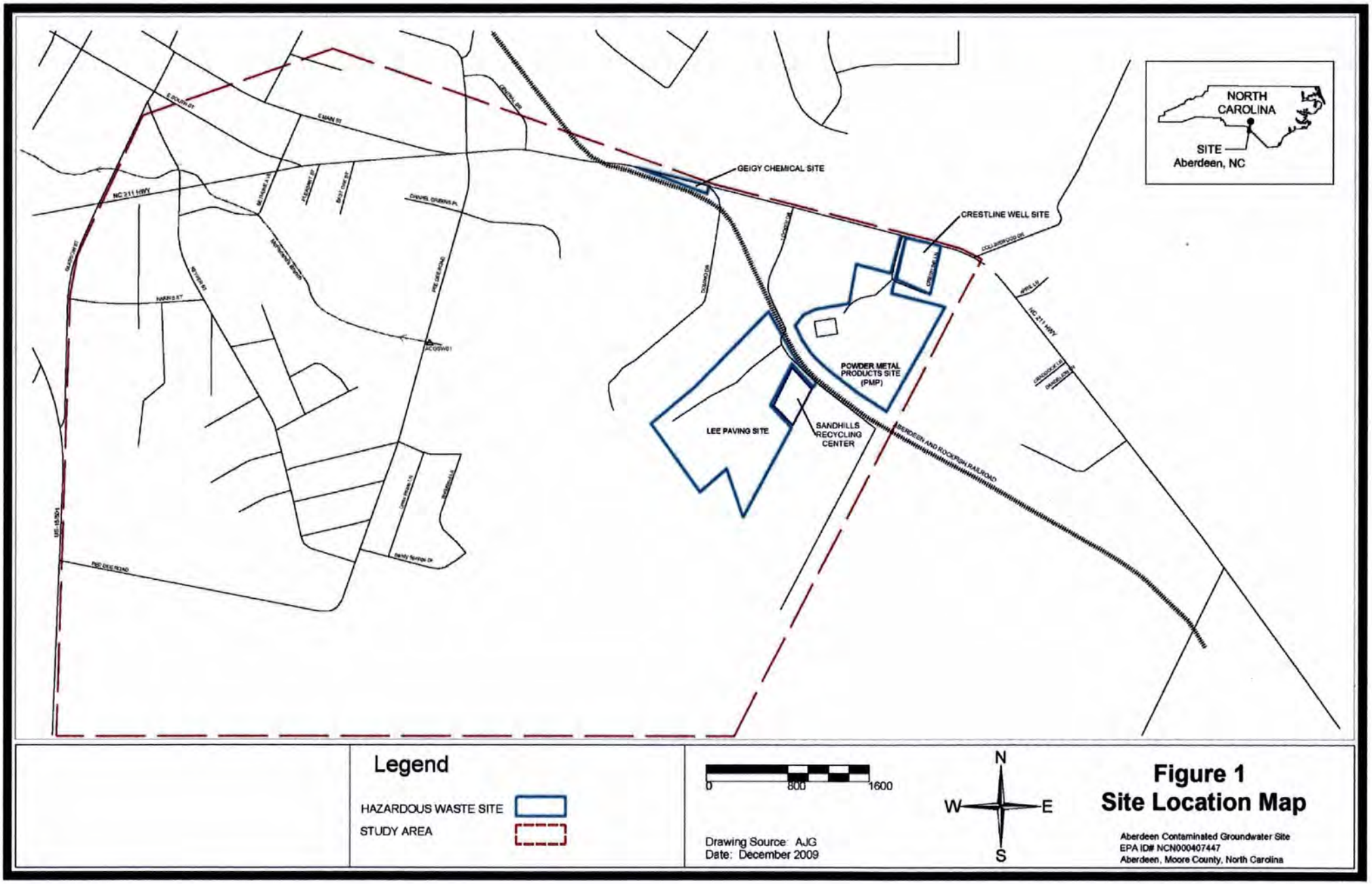
The UBC aquifer is approximately 100 to 125 feet bgs and averages 49 feet in thickness. Groundwater samples were collected from 29 monitoring and 3 private wells screened in the UBC aquifer. The only VOCs detected above the applicable groundwater standard were TCE and chloromethane. TCE was the compound detected most frequently and was detected in 27 of 32 wells with a mean concentration of 63 µg/L and a maximum concentration of 430 µg/L. TCE was detected at concentrations in excess of the NC 2L standard of 3 µg/L in multiple wells. Therefore, the concentration of TCE in this aquifer exceeds the federal MCL of 5 µg/L. Chloromethane was detected in one monitoring well at a concentration of 21 µg/L which is in excess of the NC 2L standard of 3 µg/L. The TCE plume in the UBC aquifer covers approximately 284 acres.

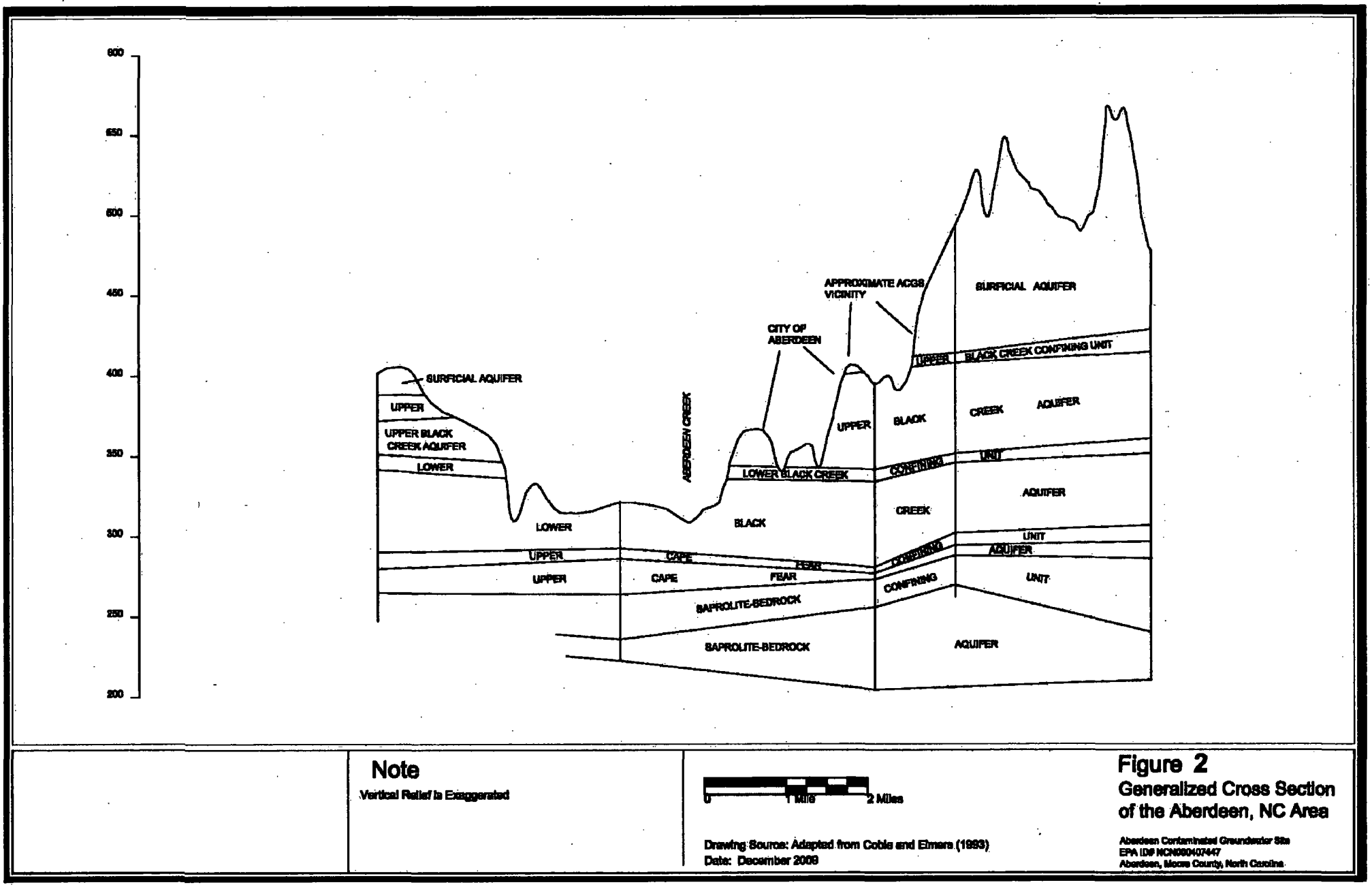
Metals were detected in 15 samples from UBC monitoring and private wells at detections exceeding the MCLs and the NC 2L drinking water standards. Analytes exceeding applicable groundwater standards included aluminum, chromium, iron, lead, manganese, and nickel. Only iron and manganese exceeded the NC 2L groundwater standard. Most of the metals exceeding applicable groundwater standards occurred in two monitoring wells which are located about 3,000 to 4,000 feet downgradient of the PMP property. These metals exceedances are not attributable to the Site since wells between the PMP property and these two wells show much lower metal concentrations so there is not a direct connection between the PMP property and these elevated levels of metals.

Lower Black Creek Aquifer

The LBC aquifer is approximately 120 to 160 feet bgs and averages 35 feet in thickness. Groundwater samples were collected from 15 monitoring wells screened in the Lower Black Creek aquifer. The only VOCs detected above the applicable groundwater standard were TCE and carbon tetrachloride. TCE was detected in 8 of the 15 wells with a mean concentration of 18.5 µg/L and a maximum concentration of 62 µg/L. Therefore, the concentration of TCE in this aquifer exceeds the federal MCL of 5 µg/L and the NC 2L standard of 3 µg/L. The TCE plume in the LBC aquifer covers approximately 220 acres.

Metals were detected in 11 samples from Lower Black Creek monitoring wells at detections exceeding applicable groundwater standards. Analytes exceeding applicable groundwater standards include aluminum, arsenic, beryllium, iron, lead, and manganese. The well with the most metal exceedances is located approximately 6,000 feet downgradient of the former PMP property. These metals are not Site


NORTH CAROLINA
SITE
Aberdeen, NC
GEIGY CHEMICAL SITE
CRESTLINE WELL SITE
POWDER METAL PRODUCTS SITE (PMP)
LEE PAVING SITE
SANDHILLS RECYCLING CENTER
ABERDEEN AND ROCKFISH RAILROAD
NC 211 HWY
Legend
HAZARDOUS WASTE SITE
STUDY AREA
0
800
1600
N
W
E
S
Drawing Source: AJG
Date: December 2009
Figure 1
Site Location Map
Aberdeen Contaminated Groundwater Site
EPA ID# NCN000407447
Aberdeen, Moore County, North Carolina


600
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250
200
SURFICIAL AQUIFER
UPPER
UPPER BLACK CREEK AQUIFER
LOWER
LOWER
UPPER
UPPER
ABERDEEN CREEK
CITY OF ABERDEEN
APPROXIMATE ACGS VICINITY
LOWER BLACK CREEK
BLACK
CAPE
FEAR
CAPE
FEAR
SAPROLITE-BEDROCK
SAPROLITE-BEDROCK
UPPER
BLACK
CREEK
CONFINING
CREEK
CONFINING
CONFINING
SURFICIAL AQUIFER
UPPER BLACK CREEK CONFINING UNIT
BLACK CREEK AQUIFER
UNIT
AQUIFER
UNIT
AQUIFER
UNIT
AQUIFER
Note
Vertical Relief Is Exaggerated
0
1 Mile
2 Miles
Drawing Source: Adapted from Coble and Elmore (1993)
Date: December 2009
Figure 2
Generalized Cross Section of the Aberdeen, NC Area
Aberdeen Contaminated Groundwater Site
EPA ID# NCN000407447
Aberdeen, Moore County, North Carolina

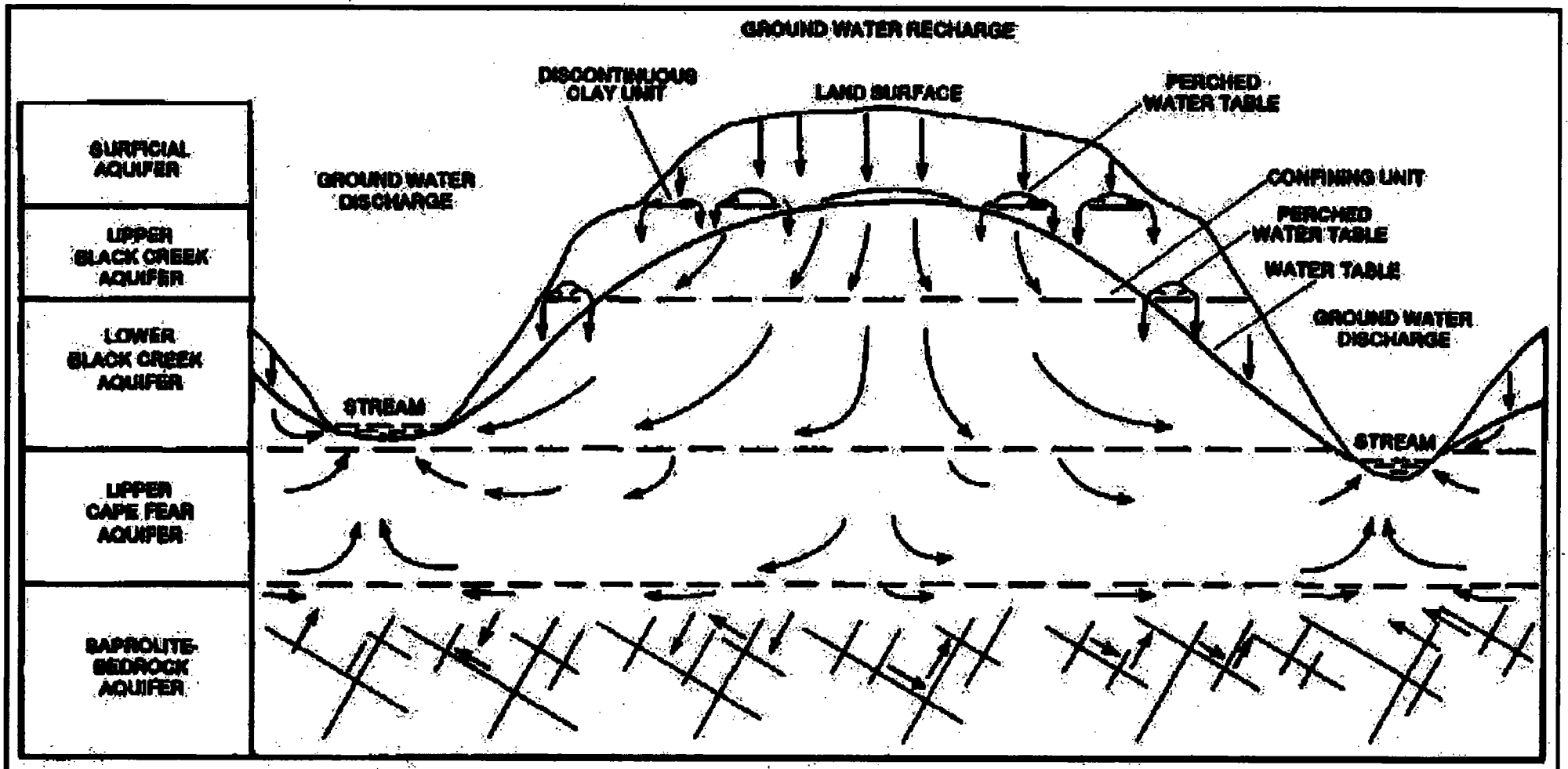


Figure 3 Conceptual Groundwater Flow Model for Sandhills Area


Legend
Upper Black Creek
Lower Black Creek
Site Area
Former Property
Gulley
PMP
Low Parking
N
Feet
0 250 500 1,000
NAD 1983 State Plane North Carolina
KY
WV
VA
TN
NC
SC
GA
Aberdeen, NC
Aberdeen Contaminated Groundwater
US EPA ID # NCN000407447
Aberdeen, Moore County
North Carolina
FIGURE 4
Monitoring
Well
Locations
Aerial Source: Moore County, NC 2010 7/9/2013 Path: V:\EPA\BAC II\rel\0215 Aberdeen 80\GIS Data\Figure 3-2 Monitor Well Locations.mxd User: bcoats

related as a number of monitoring wells between the PMP property and these wells show much lower metal concentrations which substantiates these is not a direct connection between the PMP property and these elevated levels of metals.

TOA Supply Wells

Three Town of Aberdeen public supply wells (TOA #5, TOA #8, and TOA #9) are located downgradient of the Site. As part of the RI these wells were sampled for VOCs, semi-volatile organic compounds, pesticides, and metals. TOA #5 is located approximately 5,600 feet west by southwest of the PMP property, TOA #8 is located approximately 6,230 feet southwest of the PMP property, and TOA #9 is approximately 4,200 feet southwest of the PMP property. To date, no Site related contaminants have been detected in TOA supply #8. The screened sections of these TOA supply wells intersect both the UBC aquifer and the LBC aquifer.

The only contaminants detected in TOA supply well #5 was TCE. The following contaminants were detected in TOA supply well #9: TCE and the following isomers of benzene hexachloride (BHC), a pesticide: alpha-BHC, beta-BHC, and gamma-BHC. **Table 1** provides the concentrations of these contaminants detected in these wells.

Remedial Investigation Conclusions

From the information generated during the RI, EPA made the following conclusions:

1) the former PMP and Lee Paving properties were both potential sources which contributed TCE and lesser amounts of other VOCs to the overall ACG Site plumes;
2) the Crestline Contaminated Well Site may or may not be a source of contamination of the ACG Site plume;
3) based on the limited groundwater data set, the TCE plume appears to be stable which implies there is not a continuing source of TCE;
4) the concentrations of TCE detected in the surficial aquifer are below both the MCL and NC 2L standards;
5) the Geigy site is a source of the pesticide contamination but it is not a source of VOC contamination to the ACG Site plume.
6) in downgradient areas the Geigy Site pesticide plumes and the TCE plumes have become comingled in both the UBC and LBC aquifers; and
7) the ACG Site does not pose an unacceptable ecological risk.

5.3 KNOWN AND/OR SUSPECTED SOURCES OF CONTAMINATION

A January 1997 report, entitled "Comprehensive Site Assessment of the Former Asphaltic Materials Laboratory – Lee Paving Company Site", documented that VOCs were release at this location. This release occurred between 1964 and 1989.

EPA has identified two possible scenarios to explain the source of the TCE contamination at the ACG Site. The first possibility is that the spill occurred so long ago that there is no residual contamination to be found on the PMP or Lee Paving properties. The second possibility is that the PMP or Lee Paving

properties were not the source and there is another source for the TCE in the vicinity of the PMP and Lee Paving properties. The groundwater data tends to support the first supposition as the plume appears to be stable and when evaluating all of the TCE data including the Geigy Site data, it appears that the levels of TCE in the Upper and Lower Black Creek Aquifers have decreased over time indicating that there is not a continuing source for the TCE being detected in the groundwater. Data collected from the Lee Paving property also supports this hypothesis.

5.4 CURRENT AND POTENTIAL FUTURE ROUTES OF EXPOSURE

Figure 5 presents the Human Health Conceptual Site Exposure Model that was developed in the June 2010 Baseline Human Health Risk Assessment (BHHRA). As can be seen in this figure, the only complete exposure pathways for the Site are related to groundwater. The three routes of exposure revolve around the use of contaminated groundwater for potable purposes and include ingestion, dermal contact, and inhalation. These exposure routes exist for both current and future scenarios and for a child and adult resident. Due to the low concentrations of VOCs in the surficial aquifer, exposure through vapor intrusion is not an exposure route of concern.

5.5 LIKELIHOOD FOR MIGRATION

The regional surface geology for the ACG Site study area is known as the Sandhills. Therefore a significant pathway for contaminant migration in the ACG Site study area is percolation of precipitation through soils (sands) which resulted in contaminants migrating from the surface to the underlying aquifers.

The primary mechanisms that are contributing to the migration of contaminants in the aquifers are advection and hydrodynamic dispersion. Advection is the transport of chemical species (dissolved and/or suspended) with flowing groundwater; assuming other chemical and physical reactions are not occurring, the rate of contaminant migration and groundwater flow should be equal. Hydrodynamic dispersion describes the combined influences of (1) molecular diffusion, whereby chemicals move from areas of higher concentration to lower concentration, and (2) mechanical dispersion, which occurs from the mixing of contaminated and non-contaminated water due to varying flow velocities within the soil pore spaces. Historical vertical contaminant migration probably occurred at the PMP property and Lee Paving property.

6.0 CURRENT AND POTENTIAL FUTURE LAND AND WATER USES

Since 2000, the population of Aberdeen has grown approximately 49%. As of 2009, the population was 5,352. Current land use in the area around the ACG Site is a mixture of residential, industrial, and commercial in nature. Several of the industrial areas near ACG Site have been investigated for environmental problems.

The majority of properties near the Site are residential especially to the west and the east side of Pee Dee Road. There is a large new housing development, under construction, located northeast of the intersection of Pee Dee Road and Sandy Springs Drive. However, recent economic constraints have resulted in a significant decrease in new building in this development. The area along NC Route 211 is a mix of older homes and light commercial businesses. An area of new light commercial businesses is sprouting up along Parkway Drive, which is located southeast of the intersection of Old Pee Dee Road and NC Route 211. The only notable industry in the area is the Sandhills Recycling Center just downgradient of ACG Site

and across the railroad tracks, which is an active facility. The former Lee Paving Property is currently vacant. There are no schools in the vicinity of the ACG Site.

All properties in the ACG Site area have access to the Town of Aberdeen municipal water supply system. The known private wells in the impacted area are only used for irrigation purposes.

7.0 SUMMARY OF SITE RISKS

A full discussion of the Risk Assessment can be found in the 2012 IROD. The following discussion focuses on the risks associated with the contamination being detected in TOA supply wells #5 and #9. The baseline risk assessment estimates what risks the Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action.

Figure 5 presents the Human Health Conceptual Site Exposure Model that was developed in the BHHRA. As can be seen in this figure, there were a number of complete pathways for Site related contaminants to impact human receptors. Residential groundwater usage was assumed as the exposure pathway for development of the exposure equations and parameters.

The Ecological Risk Assessment concluded that there are no ecological risks associated with contamination at this Site.

The concentrations of TCE in groundwater in the UBC and LBC Aquifers exceed state and federal standards and have adversely impacted TOA supply wells #5 and #9. As documented in the 2012 IROD, an action is warranted under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The amended response action selected in this document is necessary to protect public health from actual or threatened release of pollutants or contaminants or hazardous substances from the this Site which may present an imminent and substantial endangerment to public health or welfare.

7.1 SUMMARY OF HUMAN HEALTH RISK ASSESSMENT

As detailed above, there are three distinct water-bearing units beneath the ACG Site: the surficial aquifer, the UBC aquifer, and the LBC aquifer. The two lower aquifers (UBC and LBC) are assumed to be somewhat confined but there is hydraulic communication between these aquifers. Of the three aquifers, the Lower Black Creek is the most ideal for supplying potable water based on its yield potential. And as stated previously, TOA supply wells #5 and #9 are screened in both the UBC and the LBC aquifers.

Table 2 summarizes the results for supply wells #5, #8, and #9. This table presents the following information:

- List of contaminants detected in the well.
- Range of detected concentrations.
- Frequency of detection.
- Background values, if available.
- Screening concentrations.

- Whether or not the compound is a chemical of concern (COC) and the reason for selection or deletion.

The BHHRA evaluated exposure media and routes of exposure. The exposure routes associated with use of groundwater throughout ACG Site include ingestion, dermal contact while bathing/showering, and inhalation of vapors while showering. The inhalation of vapors pathway was limited to those COCs that are considered volatile.

Residential groundwater usage was the exposure pathway used for development of the exposure equations and parameters. Risk characterization considered both cancer and non-cancer health effects. Both an adult and a child resident receptor were considered for non-cancer health effects. For lifetime cancer risk, residential exposure was age-adjusted for the young child and adult because it was assumed that children and adults reside at the same location.

TCE was detected in municipal supply wells #5 and #9. No TCE degradation products were detected. Pesticides were detected in supply well #9. Various metals were also detected in each supply well.

TCE was identified as a COC. The total cancer risks for TCE are summarized below and are listed in **Table 3**. This table provides a well by well calculation of cancer risks and noncancer Hazard Quotients and Hazard Indices for detected contaminants. Due to changes in toxicity values published in EPA's Integrated Risk Information System, the estimated risks were recalculated for this ROD.

- Minimum TCE cancer risk: 2.6×10^{-6} (TCE concentration of 3.1 µg/l) at Aberdeen supply well TOA #9.
- Wells with TCE cancer risk greater than 1×10^{-6}: TOA #5 and TOA #9
- Wells with TCE cancer risk greater than 1×10^{-4}: none.
- The ingestion pathway resulted in the highest risk in all cases.
- Noncancer HIs for TCE slightly exceeded an HI = 1 for the child resident exposure scenario at wells TOA #5 (child HI = 1.3) and TOA #9 (child HI = 1.1).

7.1.1 IDENTIFICATION OF CHEMICALS OF CONCERN

COCs were determined from the results of the BHHRA which were based on Region 4 guidance. COCs are chemicals that significantly contribute to an exposure pathway that either exceeds a 1×10^{-4} cumulative site cancer risk or exceeds a noncancer HI of 1. Pesticides were also eliminated since they can be conclusively shown to be associated with the Geigy Superfund Site. The risks associated with these pesticides can be viewed in the 1992 Geigy Chemical Superfund Site ROD. Another method to identify COCs is to compare the concentration of the chemical to state or federal Applicable or Relevant and Appropriate Requirements (ARARs). If the concentration exceeds the federal MCL or NC groundwater standard, the chemical was identified as a COC. Based on the results of this BHHRA and ARAR comparison, the COCs in the Upper and Lower Black Creek aquifers and that are being detected in supply wells #5 and #9 are summarized in **Table 4**.

7.1.2 EXPOSURE ASSESSMENT

The objective of the exposure assessment is to estimate the nature, extent, and magnitude of potential exposure of human receptors to COCs in groundwater considering its current and future use. The exposure assessment involves several steps:

- Evaluating the exposure setting, which includes describing the local land and water uses and identifying the potentially exposed human populations.
- Developing the conceptual site model (CSM) for human exposures, which includes identifying the source of contamination, the contamination transport and release mechanisms, the exposure media, the exposure routes, and the potentially exposed populations.
- Calculating exposure point concentrations (EPCs) for each COC.
- Identifying the exposure models and parameters with which to calculate the exposure doses.
- Calculating exposure doses.

Local Land and Water Uses

Land use near the ACG Site is a mix of residential, commercial, and industrial users. There are private wells located in the vicinity of the ACG Site. Some of these wells were sampled as part of the RI. According to the owners of these private wells, these wells are not being used as potable water sources. They may be used for non-potable uses such as irrigation. The Town of Aberdeen has public water supply wells located in the study area. They are located between 4,200 – 6,230 feet down gradient of the ACG Site. These wells were also sampled during the Phase 1 and Phase 2 investigations. Municipal water service is provided by the Town of Aberdeen to properties in the vicinity of the ACG Site.

Identification of Potentially Exposed Human Populations

Based on the local water uses, residents were identified as potential receptors. Currently, the residents obtain their potable water from the Town of Aberdeen municipal water supply system. It is possible that residents could use the ACG Site groundwater as a potable source at some point in the future.

The CSM describes the contaminant sources, the contaminant release and transport mechanisms, the exposure media, the exposure routes, and the potentially exposed human populations. The primary objective of the CSM is to identify the complete and incomplete exposure pathways. A complete pathway has all of the components listed above, whereas an incomplete pathway is missing one or more of the components. **Figure 5** presents the CSM for human exposures at the ACG Site.

Source of Contamination

The footprint of the ACG Site includes the former PMP property, the Geigy Chemical Site, the Lee Paving site, and the Crestline Well Site. Each of these sites and their impact on or impact by the ACG Site TCE plume is discussed below.

Release and Transport Mechanisms

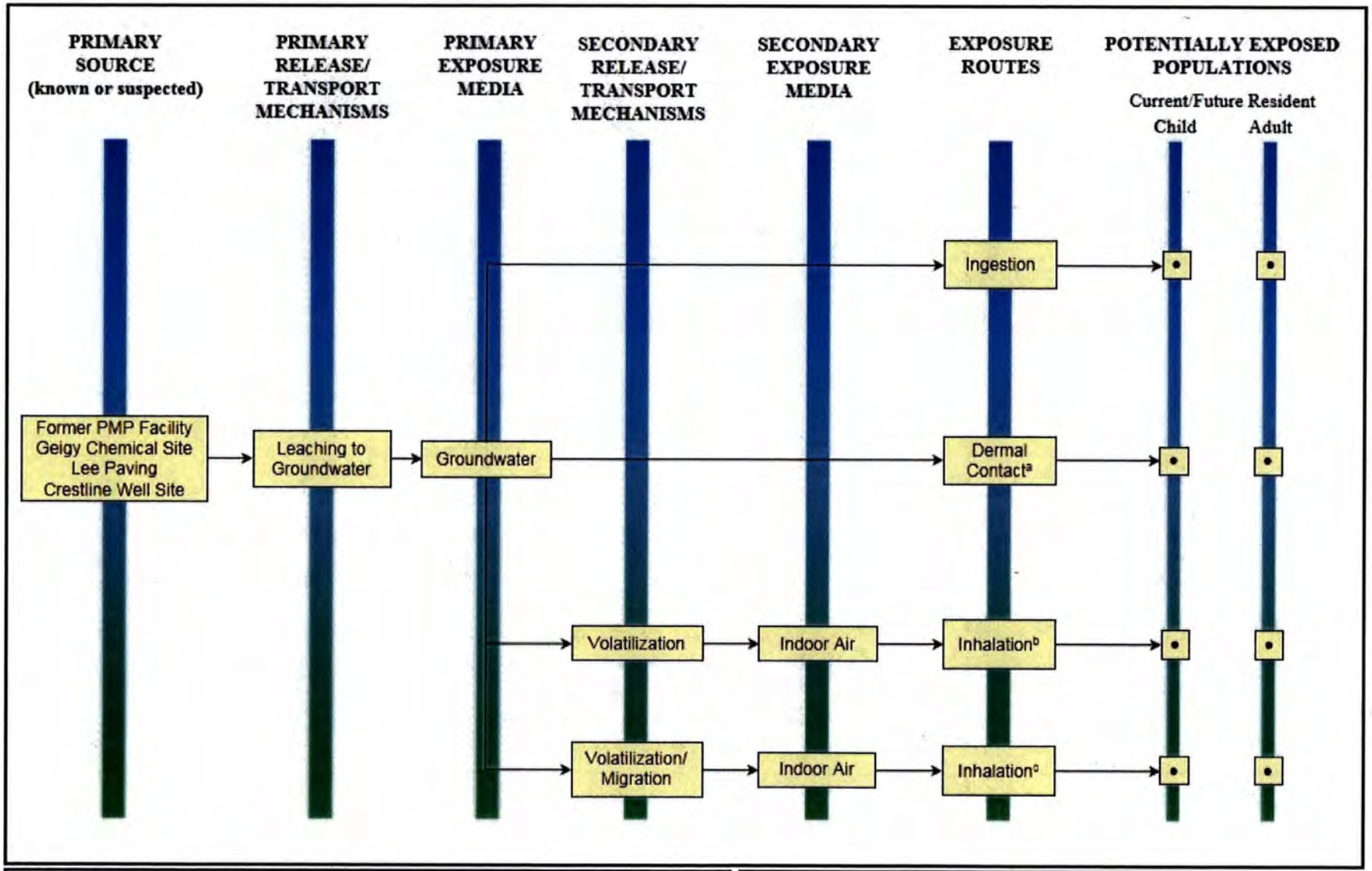
Leaching to groundwater is the primary release and transport mechanism. Following release to the ground surface, infiltration would transport COCs to the groundwater.

TABLE 1 -- ANALYTICAL RESULTS FOR DETECTED COMPOUNDS IN GROUNDWATER SAMPLES FROM LOWER BLACK CREEK AQUIFER WELLS COLLECTED IN 2009, 2010 AND 2011 [All concentrations in this table are in micrograms per liter (µg/L)].

CONSTITUENT	NC 2L	MCL	TOA #5					TOA #8				TOA #9					
Sampling Date			03/02/09	06/26/09	08/27/10	07/13/11	2012	2009	06/26/09	08/27/10	07/13/11	03/02/09	03/02/09 (Duplicate)	06/26/9	08/27/10	07/13/11	2012
VOLATILE ORGANICS																	
1,1-DCE	7	7	---	0.5 U	0.17 J	0.5 U	---	---	0.5 U	0.5 U	0.5 U	---	---	0.5 U	0.5 U	0.5 U	
cis-1,2-DCE	70	70	---	0.5 U	0.11 J	0.5 U	---	---	0.5 U	0.5 U	0.5 U	---	---	0.5 U	0.5 U	0.5 U	
1,3-Dichlorobenzene	200	NA	---	0.1 J	0.5 U	0.5 U	---	---	0.5 U	0.5 U	0.5 U	---	---	---	---	---	---
1,4-Dichlorobenzene	6	75	---	0.12 J	0.5 U	0.5 U	---	---	0.5 U	0.5 U	0.5 U	---	---	---	---	---	---
TCE	3	5	1.5	5.7	11	7.8	8.1	---	0.5 U	0.5 U	0.5 U	[redacted]	[redacted]	2.4	[redacted]	[redacted]	3
1,2,3-Trichlorobenzene	NA	NA	---	0.15 J	0.5 U	0.5 U	----	---	0.5 U	0.5 U	0.5 U	---	---	---	---	---	---
1,2,4-Trichlorobenzene	70	70	---	0.17 J	0.5 U	0.5 U	----	---	0.5 U	0.5 U	0.5 U	---	---	---	---	---	---
PESTICIDES/PCBS																	
alpha-BHC	0.02[b]	NA	---	---	---	---	---	---	---	---	---	---	---	0.087	0.084	0.036 J	---
beta-BHC	0.02[b]	NA	---	---	---	---	---	---	---	---	---	---	---	0.044 J	0.032 J	0.02 U	---
delta-BHC	0.02[b]	NA	---	---	---	---	---	---	---	---	---	---	---	0.023 J	0.023 J	0.02 U	---
gamma-BHC	0.03	0.2	---	---	---	---	---	---	---	---	---	---	---	0.096	0.091	0.039	---
INORGANICS																	
Arsenic	10	10	---	---	10 U	10 U	---	---	--	10 U	1 U	---	---	---	10 U	1 U	
Chromium	50	100	---	---	5 U	10 U	---	---	---	10 U	5 U	---	---	10 U	10 U	5 U	
Cobalt	NA	NA	---	---	5 U	50 U	---	---	---	50 U	5 U	---	---	50 U	50 U	50 U	
Iron	300	300*	---	---	100 U	100 U	---	---	---	110 U	100 U	---	---	100 U	100 U	100 U	
Lead	15	15	---	10 U	1.8	10 U	---	---	16	10 U	1 U	---	---	10 U	10 U	2.1	
Nickel	100	NA	---	40 U	10 U	40 U	---	---	40 U	40 U	10 U	---	---	40 U	40 U	10 U	
Thallium	NA	2	---	25 U	1 U	25 U	---	---	25 U	25 U	1 U	---	---	25 U	25 U	1 U	

Notes :

NC 2L → North Carolina Administrative Code, Title 15A - DENR, Subchapter 2L - Groundwater Classifications and Standards, Section .02 Classifications and Groundwater Quality Standards.
MCL → Maximum Contaminant Level
* → National Secondary Drinking Water Regulations are non-enforceable guidelines regulating contaminants that may cause cosmetic effects or aesthetic effects in drinking water.
TOA → Town of Aberdeen Supply Wells
Shaded cells → Yellow shading denotes reported concentration exceeds federal MCL. [redacted] shading denotes reported concentration exceeds NC 2L standard.
--- → Not detected; not analyzed for; at or above the reporting limit.
a → Screening criteria for background levels equals 2 × the average concentration for the background wells in the Shallow Aquifer.
HBC → Hexachlorocyclohexane isomers (technical grade)
c → Secondary MCL
d → Endrin, total: (includes endrin, endrin aldehyde, and endrin ketone)
NA → No criteria available
J → The identification of the analyte is acceptable; the reported value is an estimate.



LEGEND:

• = Complete exposure pathway.

[a] Assumes dermal contact while bathing for the child and contact while showering for the adult.

[b] Assumes inhalation of VOCs while showering.

[c] The vapor intrusion pathway was not quantitatively evaluated in the HHRA.

FIGURE 5
CONCEPTUAL SITE MODEL
HUMAN HEALTH RISK ASSESSMENT
ABERDEEN CONTAMINATED GROUNDWATER SITE

TABLE 2
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CONTAMINANTS OF POTENTIAL CONCERN
ABERDEEN CONTAMINATED GROUNDWATER SITE - LOWER BLACK CREEK GROUNDWATER

Scenario Timeframe: Current/Future
Medium: Lower Black Creek Groundwater
Exposure Medium: Lower Black Creek Groundwater

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
TOA05 (Supply Well)	**Volatile Organic Compounds**												
	67-66-3	Chloroform	0.12	0.12	µg/L	1/2	0.12	NA	0.19 C	NA	NA	NO	BSL
	541-73-1	1,3-Dichlorobenzene	0.1	0.1	µg/L	1/2	0.1	NA	NA	NA	NA	YES	NBA
	106-46-7	1,4-Dichlorobenzene	0.12	0.12	µg/L	1/2	0.12	NA	0.43 C	NA	NA	NO	BSL
	79-01-6	Trichloroethene	1.5	5.7	µg/L	2/2	5.7	NA	1.7 C	NA	NA	YES	ASL
	87-61-6	1,2,3-Trichlorobenzene	0.15	0.15	µg/L	1/2	0.15	NA	0.82 NC	NA	NA	NO	BSL
	120-82-1	1,2,4-Trichlorobenzene	0.17	0.17	µg/L	1/2	0.17	NA	0.82 NC	NA	NA	NO	BSL
	Inorganics												
	7440-39-3	Barium	17	17	µg/L	1/1	17	NA	730 NC	NA	NA	NO	BSL
	7440-70-2	Calcium	740	740	µg/L	1/1	740	NA	NA	NA	NA	NO	Essential Nutrient
	7439-95-4	Magnesium	520	520	µg/L	1/1	520	NA	NA	NA	NA	NO	Essential Nutrient
	7439-96-5	Manganese	5	5	µg/L	1/1	5	NA	88 NC	NA	NA	NO	BSL
	7440-09-7	Potassium	260	260	µg/L	1/1	260	NA	NA	NA	NA	NO	Essential Nutrient
	7440-23-5	Sodium	2200	2200	µg/L	1/1	2200	NA	NA	NA	NA	NO	Essential Nutrient
TOA08 (Supply Well)	**Volatile Organic Compounds**												
	67-66-3	Chloroform	0.15	0.15	µg/L	1/2	0.15	NA	0.19 C	NA	NA	NO	BSL
	Inorganics												
	7440-39-3	Barium	16	16	µg/L	1/1	16	NA	730 NC	NA	NA	NO	BSL
	7439-92-1	Lead	16	16	µg/L	1/1	16	NA	15	NA	NA	YES	ASL
	7439-95-4	Magnesium	500	500	µg/L	1/1	500	NA	NA	NA	NA	NO	Essential Nutrient
	7440-09-7	Potassium	210	210	µg/L	1/1	210	NA	NA	NA	NA	NO	Essential Nutrient
	7440-66-6	Zinc	35	35	µg/L	1/1	35	NA	1100 NC	NA	NA	NO	BSL
TOA09 (Supply Well)	**Volatile Organic Compounds**												
	67-66-3	Chloroform	0.17	0.17	µg/L	1/2	0.17	NA	0.19 C	NA	NA	NO	BSL
	79-01-6	Trichloroethene	2.4	3.7	µg/L	2/2	3.7	NA	1.7 C	NA	NA	YES	ASL
	Pesticides												
	319-84-6	alpha-BHC	0.087	0.087	µg/L	1/1	0.087	NA	0.011 C	NA	NA	YES	ASL
	319-85-7	beta-BHC	0.044	0.044	µg/L	1/1	0.044	NA	0.037 C	NA	NA	YES	ASL
	319-86-8	delta-BHC	0.023	0.023	µg/L	1/1	0.023	NA	0.037 C	NA	NA	NO	BSL
	58-89-9	gamma-BHC	0.096	0.096	µg/L	1/1	0.096	NA	0.061 C	NA	NA	YES	ASL
	Inorganics												
	7440-39-3	Barium	15	15	µg/L	1/1	15	NA	730 NC	NA	NA	NO	BSL
	7440-70-2	Calcium	640	640	µg/L	1/1	640	NA	NA	NA	NA	NO	Essential Nutrient

TABLE 2
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CONTAMINANTS OF POTENTIAL CONCERN
ABERDEEN CONTAMINATED GROUNDWATER SITE - LOWER BLACK CREEK GROUNDWATER

Scenario Timeframe: Current/Future
Medium: Lower Black Creek Groundwater
Exposure Medium: Lower Black Creek Groundwater

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Detection Frequency	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
	7439-95-4	Magnesium	480	480	µg/L	1/1	480	NA	NA	NA	NA	NO	Essential Nutrient
	7439-96-5	Manganese	8.1	8.1	µg/L	1/1	8.1	NA	88 NC	NA	NA	NO	BSL
	7440-09-7	Potassium	210	210	µg/L	1/1	210	NA	NA	NA	NA	NO	Essential Nutrient
	7440-23-5	Sodium	1400	1400	µg/L	1/1	1400	NA	NA	NA	NA	NO	Essential Nutrient

TABLE 3
WELL BY WELL CALCULATION OF CANCER RISKS AND NONCANCER HAZARD QUOTIENTS AND HAZARD INDICES
ABERDEEN CONTAMINATED GROUNDWATER SITE - LOWER BLACK CREEK GROUNDWATER

			Cancer Risks				Hazard Quotients							
			Age-Adjusted				Child Resident				Adult Resident			
Exposure Point	Contaminant	EPC (µg/L)	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
TOA05 (Supply Well)	**Volatile Organic Compounds**													
	1,3-Dichlorobenzene	0.1	—	—	—	—	—	—	—	—	—	—	—	—
	Trichloroethene	3.6	3.0E-06	5.0E-07	3.8E-06	7.3E-06	0.4	-0.005	0.9	1.3	0.2	0.004	0.9	1.1
	Total		**3.0E-06**	**5.0E-07**	**3.8E-6**	**3.6E-06**	**0.4**	**0.005**	**0.9**	**1.3**	**0.2**	**0.004**	**0.9**	**1.1**
TOA08 (Supply Well)	**Inorganics**													
	Lead	16	—	—	not volatile	—					—	—	not volatile	—
	Total		—	—	—	—								
TOA09 (Supply Well)	**Volatile Organic Compounds**													
	Trichloroethene	3.05	2.6 E-06	4.2E-07	3.2E-06	6.1E-06	-0.3	0.04	0.7	1.1	0.2	0.02	0.7	0.9
	Pesticides													
	alpha-BHC	0.087	8.3E-06	6.5E-06	not volatile	1.5E-05	0.00070	0.001	—	0.001	0.00030	0.0002	not volatile	0.0005
	beta-BHC	0.044	1.2E-06	9.3E-07	not volatile	2.1E-06	—	—	—	—	—	—	not volatile	—
	gamma-BHC	0.096	1.6E-06	1.2E-06	not volatile	2.8E-06	0.020	0.02	—	0.04	0.0088	0.01	not volatile	0.02
	Total		**1.4 E-05**	**9.1E-06**	**3.2E-06**	**2.6E-05**	**0.3**	**0.06**	**0.7**	**1.2**	**0.2**	**0.03**	**0.7–**	**0.09**

Table 4 Summary of Chemicals of Concern		
COC	**Aquifer**	**Basis**
TCE	Upper Black Creek/Lower Black Creek	Exceeds MCL and NC 2L Groundwater Standard; HI exceeds 1, Minimal contributor to cancer risk (2.6×10^{-6})

Exposure Media and Routes of Exposure

Exposure routes associated with the use of the groundwater included ingestion, dermal contact while bathing/showering, and inhalation of vapors while showering. The inhalation of vapors pathway was limited to those COCs that were considered volatile.

Exposure Point Concentrations

For groundwater risk assessment, the arithmetic average from the wells in the highly contaminated area of the plume was used as the exposure point concentration for the calculation of risk. The plume was not delineated in a manner that would allow the highly contaminated area to be readily identified at the time of the development of the BHHRA. As a result, the exposure points for the potential groundwater exposures were identified as the current monitoring well locations. This evaluation consisted of estimating the risks for each monitoring well. The EPC for a given COC was the detected concentration in each well since only one round of groundwater data was collected in the majority of the cases. Additional analytical groundwater data collected since the issuance of the 2012 IROD substantiated that the BHHRA used the worst case scenario (i.e., the highest concentration) of TCE contamination in the groundwater. **Table 5** presents the EPCs for the supply wells #5, #8, and #9.

7.1.3 TOXICITY ASSESSMENT

The primary purpose of the toxicity assessment is to describe and identify the toxicity values for the COCs used in the estimation of cancer risks and noncancer health effects. It also provides a description of the terms that were used to estimate toxic effects (i.e., cancer and noncancer effects) along with the applicable data sources.

Cancer Effects

For cancer effects, the toxicity values are expressed as oral cancer slope factors (CSF_o) in units of milligrams of COC per kilogram of body weight per day $(mg/kg\text{-}day)^{-1}$ or as inhalation unit risk factors (URF_i) in units of micrograms of COC per cubic meter $(\mu g/m^3)^{-1}$. The use of a toxicity value depends on the route of exposure being evaluated. The CSF_o is used to evaluate exposure from ingestion routes (e.g., drinking water) and the URF_i is used to evaluated inhalation exposures (e.g., inhaling VOCs while showering).

TABLE 5
EXPOSURE POINT CONCENTRATION SUMMARY
ABERDEEN CONTAMINATED GROUNDWATER SITE - LOWER BLACK CREEK GROUNDWATER

Scenario Timeframe: Current/Future
Medium: Lower Black Creek Groundwater
Exposure Medium: Lower Black Creek Groundwater

Exposure Point	Contaminant of Potential Concern	Units	Arithmetic Mean	Maximum Concentration	Exposure Point Concentration		
					Value	Statistic	Rationale
TOA05	**Volatile Organic Compounds**						
(Supply Well)	1,3-Dichlorobenzene	µg/L	0.1	0.1	0.1	Detected Concentration	Only two sampling rounds
	Trichloroethene	µg/L	3.6	5.7	3.6	Average Concentration	Only two sampling rounds
TOA08	**Inorganics**						
(Supply Well)	Lead	µg/L	16	16	16	Detected Concentration	Only one sampling round
TOA09	**Volatile Organic Compounds**						
(Supply Well)	Trichloroethene	µg/L	3.05	3.7	3.05	Average Concentration	Only two sampling rounds
	Pesticides						
	alpha-BHC	µg/L	0.087	0.087	0.087	Detected Concentration	Only one sampling round
	beta-BHC	µg/L	0.044	0.044	0.044	Detected Concentration	Only one sampling round
	gamma-BHC	µg/L	0.096	0.096	0.096	Detected Concentration	Only one sampling round

EPA has assigned each contaminant a "weight-of-evidence", category that represents the likelihood of it being a human carcinogen. Six weight-of-evidence categories exist:

- A – Human carcinogen;
- B1 – Probable human carcinogen, limited human data are available;
- B2 – Probable human carcinogen, sufficient evidence in animals and inadequate or no evidence in humans;
- C – Possible human carcinogen;
- D – Not classifiable as to human carcinogenicity; and
- E – Evidence of non-carcinogenicity for humans.

EPA revised the weight-of-evidence categories to include the following five cancer hazard descriptors:

- Carcinogenic to humans;
- Likely to be carcinogenic to humans;
- Suggestive evidence of carcinogenic potential;
- Inadequate information to assess carcinogenic potential;
- Not likely to be carcinogenic in humans.

Noncancer Effects

Noncarcinogens refer to contaminants that cause toxic effects other than cancer. Noncancer effects can include, for example, central nervous system damage, reproductive effects, and other systemic effects. For noncancer effects, the toxicity values are expressed as oral reference doses (R_fD_o) in units of mg/kg-day

and reference concentrations (R_fCs) in units of mg/m^3. The premise of noncancer toxicity values is that there is an exposure level below which deleterious noncancer effects are not expected to occur. As with the cancer toxicity values, the use of a noncancer toxicity value depends on the route of exposure being evaluated, the R_fD_o used to evaluate exposure from ingestion routes and the R_fC used to evaluate exposure from inhalation.

The toxicity values used in this risk assessment were obtained from the following sources in the order presented:

- Tier 1 – Integrated Risk Information System (IRIS).
- Tier 2 – EPA's Provisional Peer Review Toxicity Values (PPRTVs) as presented in the EPA RSL Table.
- Tier 3 – Other Toxicity Values - can include the National Center for Environmental Assessment [NCEA] values presented on the RSL Table, the Health Effects Assessment Summary Tables, California EPA values, and the Agency for Toxic Substances and Disease Registry [ATSDR] Minimal Risk Levels [MRLs].

Dermal Exposure

Toxicity values have not been developed for the dermal absorption pathway. Dermal toxicity values were derived from the oral toxicity values as described in EPA's dermal risk assessment guidance. In general, the oral CSFs and oral R_fDs are expressed as administered doses (i.e., the amount of a chemical administered per unit time and weight). Conversely, exposures resulting from the dermal pathway are expressed as absorbed doses. Therefore, it is necessary to adjust the oral toxicity value to account for the contaminant-specific absorption efficiency.

The fraction of a COC that is absorbed in the gastrointestinal tract, also known as ABS_{GI}, is a critical factor when adjusting from an administered to an absorbed dose. The ABS_{GI} values used in this risk assessment were obtained from EPA (2004). The oral CSFs and oral R_fDs were adjusted to an absorbed dose using different methods. The dermal CSF (CSF_d) was derived by dividing the oral CSF by the ABS_{GI} as shown below.

$$CSF_d = \frac{CSF_o}{ABS_{GI}}$$

Where:

CSF_d = Dermal cancer slope factor $(mg/kg\text{-}day)^{-1}$
CSF_o = Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
ABS_{GI} = Fraction of contaminant absorbed in the gastrointestinal tract (unit less)

The dermal reference dose (R_fD_d) was derived by multiplying the oral R_fD by the ABS_{GI} as shown below:

$$RfD_d = RfD_o \times ABS_{GI}$$

Where:

R_fD_d = Dermal reference dose (mg/kg-day)
R_fD_o = Oral reference dose (mg/kg-day)
ABS_{GI} = Fraction of contaminant absorbed in the gastrointestinal tract (unit less)

Toxicity Values Used in the Risk Assessment

Tables B-1, **B-2**, **B-3**, and **B-4**, which can be found in **Appendix B**, present the available toxicity values (oral, dermal, and inhalation) for each COC, as well as the source, the EPA weight-of evidence category, the route of administration, and the critical effect. Please note that **Tables B-2** and **B-4** present the inhalation toxicity factors for volatile COCs only. These were the only compounds that were evaluated for the inhalation of volatile compounds pathway.

7.1.4 RISK CHARACTERIZATION

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$Risk = CDI \times SF$$

where:

Risk = a unitless increased probability (e.g., 2×10^{-5}) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as (mg/kg-day)-1.

An excess lifetime cancer risk of 1×10^{-6} 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 site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual in the United States of developing some type of cancer has been estimated to be one in three. EPA's generally acceptable risk range for site-related exposures is 1×10^{-4} to 1×10^{-6}.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a reference dose (R_fD) derived for a similar exposure period. An R_fD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). A HQ less than 1 indicates that a receptor's dose to a single contaminant is less than the R_fD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index is generated by adding the HQs for all COCs that affect the same target 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. A HI less than 1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. A HI greater than 1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = CDI/R_fD$$

where:

CDI = Chronic daily intake
R_fD = reference dose

CDI and R_fD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Table 3 summarizes the carcinogenic and noncarcinogenic risks posed by the contaminants in TOA supply wells #5, #8, and #9.

7.1.5 UNCERTAINTIES

Uncertainties in the BHHRA included several factors. These are discussed in the following paragraphs.

- Available groundwater data – The BHHRA was based in large part on a single round of groundwater sampling results obtained during the Phase II investigation. The available data are an instantaneous representation of the current groundwater conditions. When performing groundwater BHHRAs, it is advantageous to use data from multiple sampling rounds to derive an average groundwater concentration to which receptors could be exposed over a prolonged period. Using a limited temporal dataset as was done in this BHHRA introduces a significant amount of uncertainty. It is unclear whether this uncertainty would result in an under or overestimation of risk.
- Surficial aquifer – Given the lack of use of the surficial aquifer as a water supply due to its relatively low yield potential, the risks estimated for this aquifer are significantly overestimated. In addition, no VOCs exceeded the applicable groundwater standard during the most recent sampling event.
- The selection of exposure scenarios – The hypothetical future residential exposure scenario results in a conservative, upper bound estimate of the potential exposure and risks. The exposures and risk estimates evaluated in the BHHRA are intended to support subsequent risk management decisions.
- The selection of exposure assumptions – It is very likely that the RME approach taken in developing exposure assumptions would overestimate realistic exposures, and therefore, overestimate the risk. The RME is defined as the "maximum exposure that is reasonably expected to occur at the site" (USEPA 1989). Several significant variables that determined the exposure doses are based on upper bound estimates (typically 90th to 95th percentile values and sometimes higher). These include intake/contact rates (2 L/day), exposure frequency (350 days/year), and exposure duration (30 years). The calculated exposure dose for any given chemical is a product of these upper bound estimates. The integration of all of these variables, compounds the conservatism and results in an overestimate of the likely exposure dose.
- The use of conservative toxicity factors – Both cancer risks and noncancer health effects were evaluated using EPA-approved (or provisional) toxicity criteria. CSFs, URFs, R_fDs, and R_fCs are derived to be health protective and tend to overestimate the true toxicity of a COPC in humans. Therefore, the estimated risks, which are partially based on the toxicity of a COPC, may be overstated in general. The exact degree of overestimation cannot be determined and each COPC must be evaluated on a case-by-case basis.
- Chromium – The noncancer HIs estimated for chromium in this BHHRA were based on hexavalent chromium toxicity. Using a hexavalent chromium value would tend to overestimate the chromium risks because it is unlikely that the chromium observed in the groundwater is in the hexavalent form. However, as a conservative measure, the hexavalent chromium toxicity value was used in the BHHRA.

- Vapor phase intrusion evaluation – the vapor phase intrusion screening was performed absent a clear understanding of the various aquifers. In certain cases, it is likely that VOC concentrations in a particular aquifer would be precluded from upward migration by the existence of an additional groundwater aquifer closer to the surface or a confining clay layer. In these cases, the screening evaluation would be overestimated. Additional investigation may be considered prior to further evaluation of the vapor intrusion pathway from groundwater into the living space of a future residential building.

Considering all the above-mentioned uncertainties, the BHHRA would likely overestimate actual risk to a significant degree in the surficial aquifer, and overestimate risks to a lesser degree in the other two aquifers where future groundwater use is more likely. Therefore, these site-related risks should be evaluated in light of this overestimation of potential risk.

7.2 SUMMARY OF ECOLOGICAL RISK ASSESSMENT

The results of the ecological screening evaluation indicated that further ecological evaluation was not warranted.

8.0 REMEDIAL ACTION OBJECTIVES

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by Section 121(b) of Superfund Amendments and Reauthorization Act of 1986 (SARA), requires the selection of remedial actions that attain a degree of cleanup which ensures protection of human health and the environment, are cost effective, and use permanent solutions and alternative treatment technologies or resource technologies to the maximum extent practicable. The remedial action objectives (RAOs) in the 2012 IROD addressed all the contamination, including the contamination in TOA supply wells # 5 and #9. To satisfy CERCLA requirements, RAOs were developed for this ROD Amendment. These RAOs will be protective of current and future residents. Since no unacceptable ecological risks were identified, only RAOs pertaining to the protection of human health were developed. The specific RAOs for this action are presented in **Table 6.**

Table 6 – Remedial Action Objectives
1. Prevent ingestion or direct contact with groundwater containing constituents, which pose a human health carcinogenic risk greater than 1×10^{-4} or have a Hazard Index (HI) greater than 1.0 for non-carcinogens.
2. Prevent ingestion or direct contact with groundwater containing constituents above MCLs.
3. To replace or restore the drinking water capacity supplied by TOA supply wells #5 and #9 with clean and suitable water.

9.0 BASIS FOR THIS ACTION

Following the issuance of the 2012 IROD, EPA initiated and completed the design for the pump and treat component called for by the IROD. As part of the design process, EPA installed a number of additional groundwater wells at the Site in 2011 and 2012. These efforts resulted in the installation of the following wells: 9 monitoring wells, 3 extractions wells, and 4 observation wells. These wells provided information

needed to complete the design of the pump and treat system as well as to complete the delineation of the TCE plumes in the UBC and LBC aquifers. The following information including the figures are from the October 2013 Final Remedial Design – Groundwater Extraction and Treatment System.

The first two figures depict the groundwater flow in the UBC and LBC aquifers, respectively. Groundwater is flowing in a southwesterly to westerly direction in the UBC Aquifer (**Figure 6**) and groundwater is flowing in a westerly to southwesterly direction in the LBC Aquifer (**Figure 7**). **Figure 8** provides the isoconcentration map for TCE in the UBC Aquifer and **Figure 9** provides the isoconcentration map for TCE in the LBC Aquifer. As can been seen in **Figure 8**, the TCE plume in the UBC aquifer encompasses TOA #5 and covers approximately 284 acres. And as can be seen in **Figure 9** the TCE plume in the LBC aquifer encompasses TOA #9 and covers approximately 220 acres. TCE was detected in TOA municipal supply well #5 in excess of the MCL and NC 2L standards and in municipal supply well #9 at a concentration slightly below the MCL but above the NC 2L standard. **Table 7** provides the analytical data for TCE detected in these two supply wells for the past 20 years.

Further discussions with the state and the NCDOT, a responsible party at the Site, regarding implementation of the well head treatment for the supply wells have been conducted. NCDOT is willing to install new supply wells for the Town of Aberdeen instead of implementing the well head treatment system. Creating new supply wells in a clean portion of the aquifer is much more beneficial for the community then having a treatment system that will need maintenance, monitoring and over time need replacement.

10.0 DESCRIPTION OF ALTERNATIVES

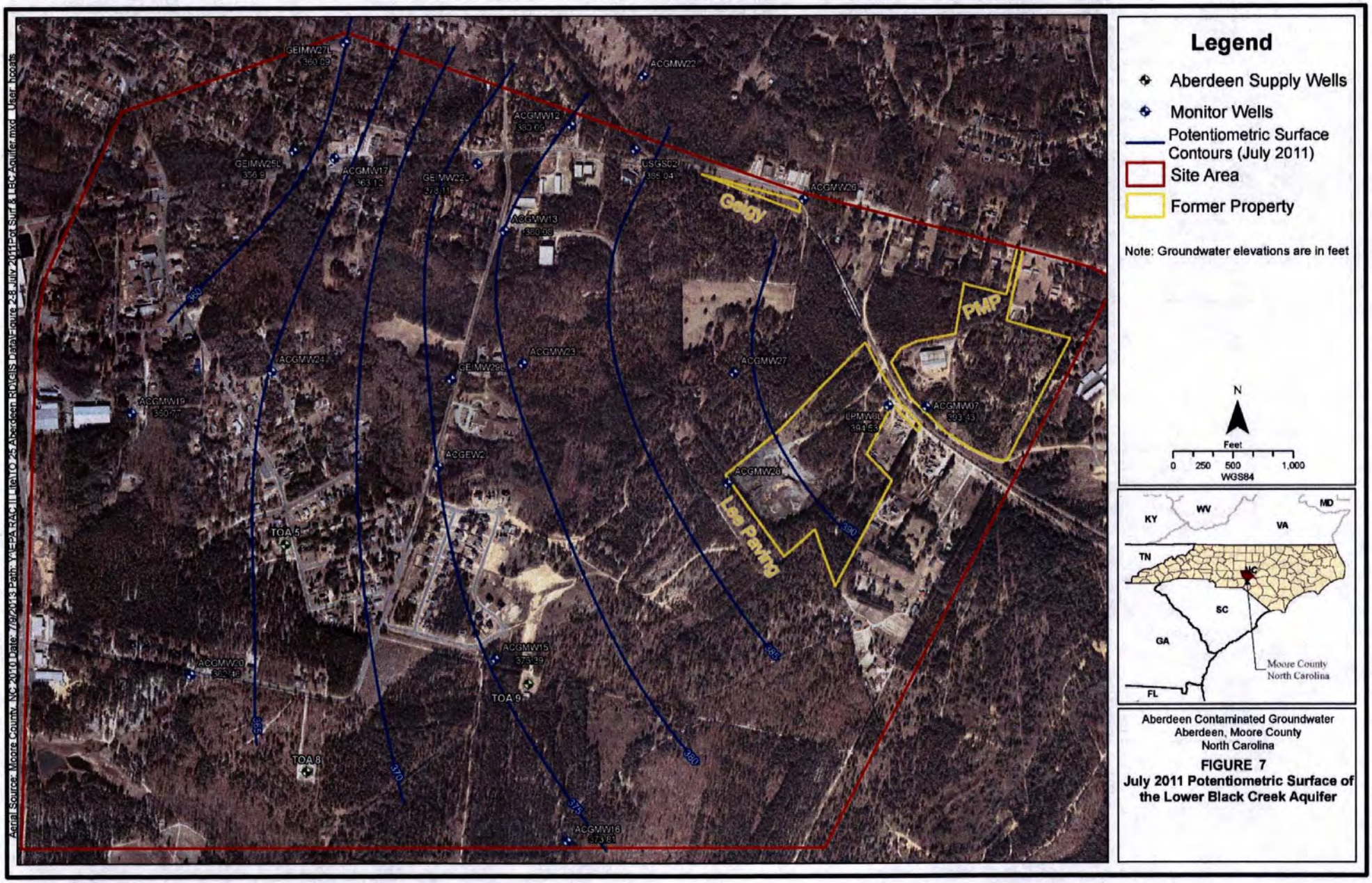
The alternatives below were developed to address only the TOA supply wells. Alternative 1, no action is standard and required under the CERCLA remedy selection process. Alternative 2 employs wellhead treatment and was considered and evaluated in the 2012 IROD. Alternative 3 involves installing new supply well(s) in an area of town where the quality of the underlying groundwater has not been adversely impacted by past anthropic activities. These remediation alternatives were presented and evaluated from a technical, environmental, and cost-effectiveness perspective. Also provided for each alternative (where possible) is the construction time-frame, capital, annual operation & maintenance (O&M), total present worth costs, and estimated time-frame for the alternative to achieve the clean-up levels. Where applicable, the total present worth cost was developed using a duration of 30 years (for those applicable activities at a discount rate of 7%). The disposal or placement of any excavated material will meet any land disposal restrictions.

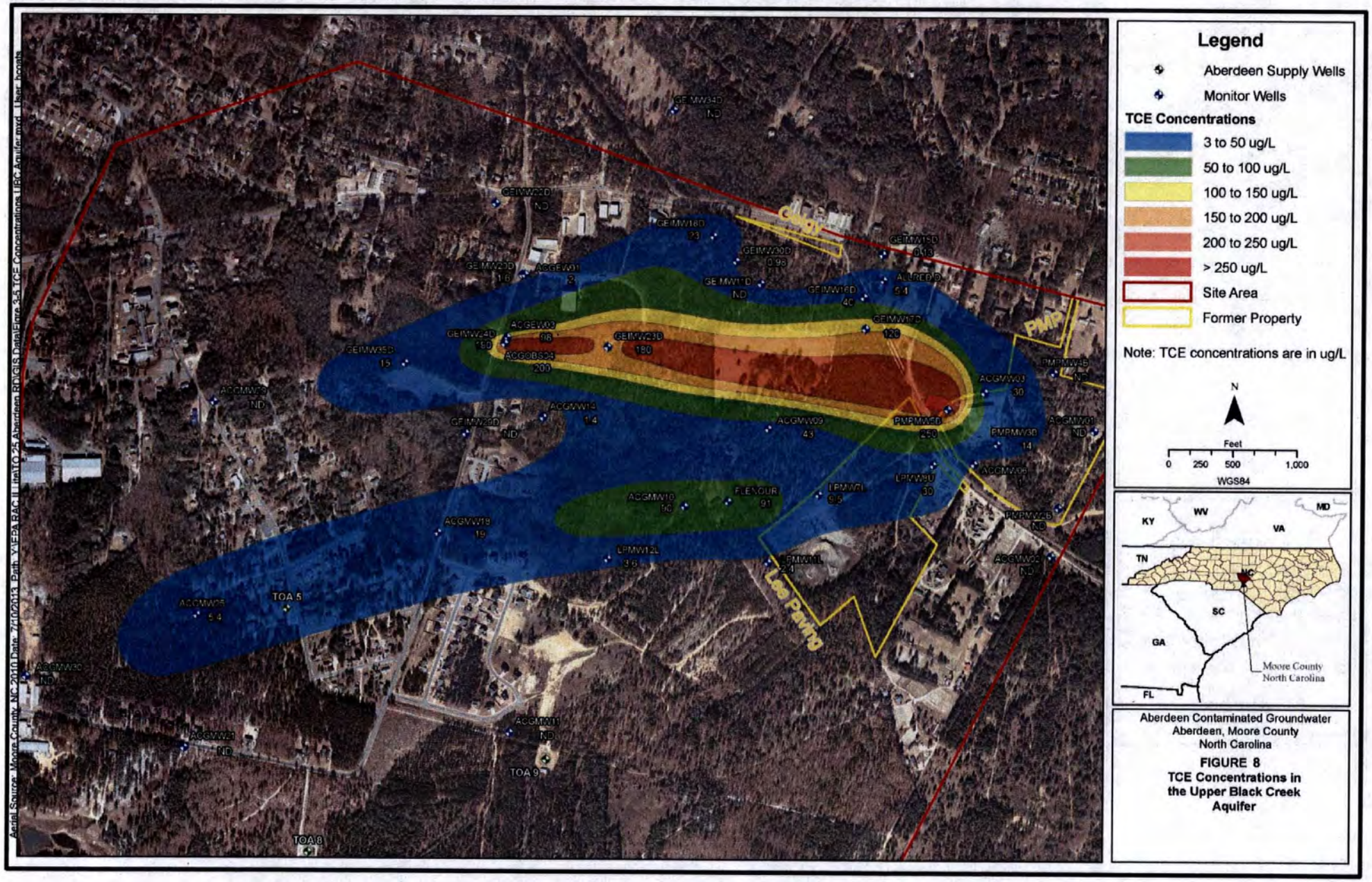
10.1 DESCRIPTION OF REMEDY COMPONENTS

10.1.1 Alternative 1: No Action

Estimated Capital Cost: $0
Estimated O&M Cost every 5-years: $70,200
Estimated Total O&M Cost Over 30 Years: $421,200
Estimated Total Cost: $421,200
Estimated Construction Timeframe: None
Estimated Time to Achieve RAOs: Would not be achieved.

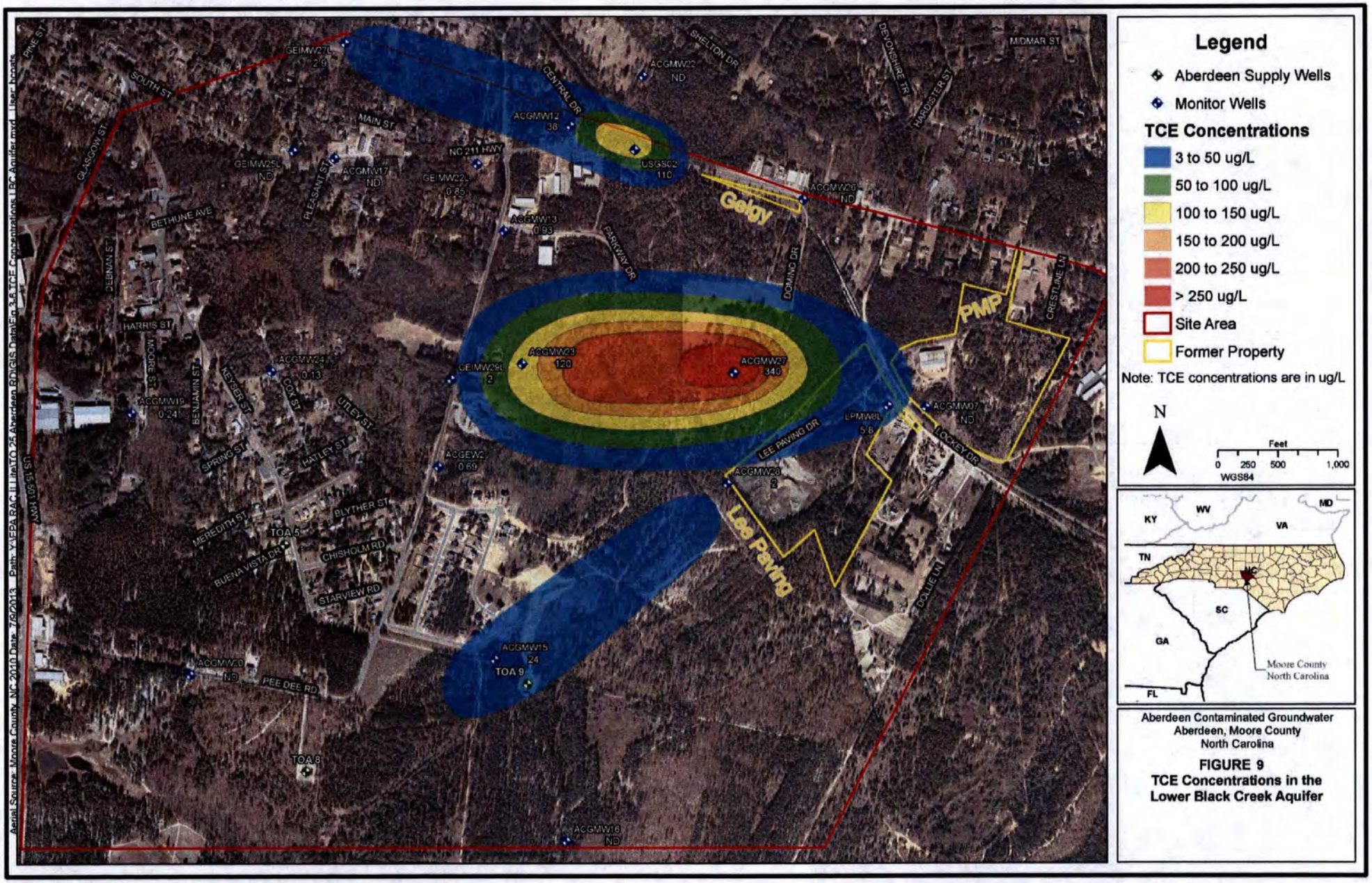

Legend
Aberdeen Supply Wells
Monitor Wells
Potentiometric Surface Contours (July 2011)
Site Area
Former Property
Note: Groundwater elevations are in feet.
N
Feet
0 250 500 1,000
WGS84
KY
WV
VA
MD
TN
NC
SC
GA
FL
Moore County North Carolina
Aberdeen Contaminated Groundwater
Aberdeen, Moore County
North Carolina
FIGURE 6
July 2011 Potentiometric Surface of the Upper Black Creek Aquifer
HIGH AVE
SOUTH ST
GLASGOW ST
NC 211 HWY
MAIN ST
DEBNAN ST
HARRIS ST
BENJAMIN ST
MEREDITH ST
BLYTHER ST
CHISHOLM RD
STARVIEW RD
PEE DEE RD
CENTRAL DR
SHELTON DR
WOOD DR
DEVONSHIRE TR
HARDISTER ST
MIDMAR ST
DOMINO DR
ALLRED D
LOCKEY DR
Geigy
PMP
Lee Paving
GEIMW34D
GEIMW22D
GEIMW20D
GEIMW24D
379.99
GEIMW23D
384.96
GEIMW35D
374.38
ACGMW14
382.14
ACGMW10
387.01
ACGMW18
374.93
ACGMW11
375.67
ACGMW09
391.61
ACGMW03
396.21
ACGMW01
397.15
ACGMW06
395.09
ACGMW29
ACGMW30
ACGMW21
387.56
TOA 5
TOA 9


GEIMW27L
360.09
ACGMW22
ACGMW12
380.09
GEIMW25L
356.9
ACGMW17
363.12
GEIMW21
378.11
USGS02
385.04
ACGMW28
Galey
ACGMW13
380.09
PMP
ACGMW24
GEIMW23L
ACGMW23
ACGMW27
ACGMW19
380.77
LPMW3L
394.53
ACGMW7
389.43
ACGEW2
ACGMW29
Lee Paving
TOA 5
ACGMW15
378.39
ACGMW20
382.48
TOA 9
TOA 8
ACGMW16
373.81
Legend
Aberdeen Supply Wells
Monitor Wells
Potentiometric Surface Contours (July 2011)
Site Area
Former Property
Note: Groundwater elevations are in feet
N
Feet
0 250 500 1,000
WGS84
KY
WV
MD
VA
TN
NC
SC
GA
FL
Moore County
North Carolina
Aberdeen Contaminated Groundwater
Aberdeen, Moore County
North Carolina
FIGURE 7
July 2011 Potentiometric Surface of the Lower Black Creek Aquifer



Aberdeen Contaminated Groundwater
Aberdeen, Moore County
North Carolina

FIGURE 8
TCE Concentrations in the Upper Black Creek Aquifer



Aerial Source: Moore County, NC 2010 Date: 7/8/2013 Path: Y:\EPA RAC II\ReTO 25 Aberdeen RD\GIS Data\Fig 3-8 TCE Concentrations LBC Aquifer.mxd User: bpotts

Table 7 – Concentration of TCE Being Detected in Town of Aberdeen Supply Wells #5, #8, and #9
(All concentrations in micrograms per liter (µg/L).

Supply Well	Sampling Year																	
	1993	1994	1995	1996	1997	1998	1999	20002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
TOA #5	3	3.61	4.1	3.6	2.7	3.6	3.2	3.1	2.4	7.3	7.9	6.6	6.4	7	7.8	11	8.1	NA
TOA #8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5U 0.5U	0.5U	0.5U	NA	0.5U
TOA #9	NA	NA	NA	NA	NA	1.6	1.8	3.5	1.1	2.7	2.3	2.4	<0.5	4.3	3.7	3.7	3	NA

NA – No data available.
MCL for TCE is 5 µg/L
NC 2L standard for TCE is 3 µg/L
Yellow shading indicates detected concentration of TCE above the NC 2L standard of 3 µg/L.
Red shading indicates detected concentration of TCE above the MCL of 5 µg/L.

Alternative 1 would not involve any active or passive remedial actions, and the TOA supply wells would remain in their present condition. This alternative, required by the NCP and CERCLA, is a baseline alternative against which the effectiveness of the other alternatives can be compared. Under the no action alternative, the TOA supply wells are left "as is" and no action would be taken to address the impacts on the TOA supply wells. Samples would be analyzed for VOCs, organochlorine pesticides, and metals.

Since site-related contaminants would remain in place, CERCLA requires Five-Year Reviews to ensure that the overall human health and the environment are protected. Preparing Five-Year Reviews will continue until there is unlimited use and unrestricted exposure associated with the groundwater. Each Five-Year Review would consist, at a minimum, of a Site visit, review of existing documents and monitoring data, interviews, and report preparation.

No capital costs would be associated with this alternative because no remedial actions would be conducted. There are O&M costs associated with conducting the five-year reviews. For costing purposes, it was assumed groundwater samples would be collected and analyzed from a number monitoring wells and TOA supply wells #5 and #9 as part of the five-year review process. This monitoring effort would include both the UBC and LBC aquifers. The O&M costs associated with Alternative 1 is estimated to be $70,200 every 5 years. The life of the No Action alternative is assumed to be 30 years; therefore, the total estimated cost is $421,200.

10.1.2 Alternative 2: Wellhead Treatment using Activated Carbon and Continued Monitoring

Estimated Capital Cost: $631,100
Estimated Annual O&M Costs for First Year: $245,500
Estimated Annual Costs for Years 2-30: $131,700
Estimated Total O&M Cost Over 30 Years: $4,064,800
Estimate Total Cost: $4,695,900
Estimated Construction Timeframe: 9-12 months
Estimated Time to Achieve RAOs: Upon completion of construction

Alternative 2 (wellhead treatment for TOA supply wells #5 and #9) involves the following activities:

- Mobilization and Site Preparation
- Upgrade/construct new building additions
- Addition of carbon adsorption units to supply wells #5 and #9
- Operation and Maintenance (O&M) of the carbon adsorption vessels
- Monitoring carbon adsorption performance and aquifers
- Transportation and disposal of spent carbon
- Five-Year Reviews

Wellhead treatment would be accomplished by diverting the pumped well water initially into vessels containing granular activated carbon for removing any contamination present. The water would then be redirected back into the existing header where other chemical addition is already being performed. Since the flow rate for supply well #5 is higher than supply well #9 and the concentration of TCE is also higher, the estimated activated carbon requirement is higher for supply well #5 than for supply well #9. One carbon adsorber would require exchange once per year for each well. For supply well #5, it is estimated

that two vessels each containing 5,000 pounds of activated carbon will be needed. The supply well #9 municipal well would utilize two vessels each containing 1,500 pounds of activated carbon. These vessels will be operated in series to allow bypassing of either vessel to provide opportunity of activated carbon removal and replacement without stopping pumping of groundwater. The carbon vessel will be housed in a newly erected building adjacent to each existing pump house. This building will be designed to protect the equipment against tampering and weather. Wellhead treatment will be terminated when the levels of contaminants meet state and federal MCLs as identified in the 2012 IROD for groundwater cleanup levels. Activated carbon is the preferred treatment technology as activated carbon will remove both TCE and pesticides from the water stream. To date, only TCE is above the MCL in supply well #5. However, low levels of BHC isomers are being detected in supply well #9. The estimated construction timeframe is 9-12 months.

The key chemical-specific ARARs associated with this alternative include: the Safe Drinking Water Act National Revised Primary Drinking Water Regulations: MCLs for organic contaminants specified in 40 CFR 141.61(a). Significant action-specific ARARs will focus on the characterization of hazardous waste (spent carbon) and the transportation and disposal of the spent carbon.

Once the well-head treatment systems are installed, the RAOs would be achieved.

This action does not address the contaminated groundwater plumes. The focus of this action is to ensure the Town of Aberdeen has a safe and adequate water supply system.

Since the site-related contaminants would remain in place, CERCLA requires Five-Year Reviews to ensure that the overall human health and the environment are protected. Each Five-Year Review would, at a minimum, consist of a Site visit, review of existing documents and monitoring data, interviews, and report preparation. Five-Year Review for this alternative would be the same as described in Alternative 1.

The capital costs include both direct and indirect capital costs. The direct capital costs include replacing/upgrading pump buildings; carbon adsorption units; installing piping and electrical systems; O&M for the carbon adsorption vessels; and sampling and analyses. The total capital cost for Alternative 2 is estimated to be approximately $631,100 which includes the costs for modifying the existing buildings at each well location.

The O&M costs associated with implementing Alternative 2 include the cost of the exchange of the GAC and sampling and analysis of carbon adsorption performance, and 5-year reviews. The O&M costs were developed for 30 years. The annual O&M costs for wellhead treatment include the following activities/items: maintaining wellhead treatment building, changing out spent activated carbon, monitoring the use of the activated carbon, conducting five-year reviews, and a 15% contingency. The total O&M outlay for 30 years is estimated to be $4,064,800. The Total Cost is $4,695,900.

10.1.3 Alternative 3: Installation of New Supply Well(s) to Replace the Adversely Impacted Supply Wells #5 and #9 (maintain the pumping capacity prior to the shutdown of Supply Well #5)

Estimated Capital Cost: $822,900
Estimated Annual O&M Cost: $0
Estimated Total O&M Cost Over 30 Years: $0

Estimated Construction Timeframe: 6 months
Estimated Time to Achieve RAOs: Upon completion of construction

Alternative 3 involves the installation of new supply well(s) in an area where the quality of the underlying groundwater has not been adversely impacted by past industrial activities to replace supply wells #5 and #9 (maintain the pumping capacity prior to the shutdown of supply well #5). The following activities are anticipated to occur under this alternative:

- Mobilization and Site Preparation
- Drill a test well at each location
- Test the test well for water quality and production capacity
- Purchase necessary property and/or easements
- Drill/construction supply well(s)
- Construct well head protection enclosure
- Improve the existing chlorination system at supply well #6 location to handle the additional flow of water from the new well(s)
- Install the necessary piping, electrical connections, and controls
- Five-Year Reviews

This alternative involves activities associated with locating areas within the aquifer that is not contaminated and suitable to install a new supply well(s). Each needed well will be constructed to a depth of approximately 160 to 180 feet. These new wells will provide enough capacity comparable to supply wells # 5 and #9. **Figure 10** provides the tentative locations for the replacement supply wells. Once the supply wells are installed and online, the RAOs will be achieved.

The key chemical-specific ARARs associated with this alternative include: the Safe Drinking Water Act National Revised Primary Drinking Water Regulations: maximum contaminant levels (MCLs) for organic contaminants specified in 40 CFR 141.61(a). Significant potential action-specific ARARs include: NCAC 15A Subchapter 2C - Well Construction Standards and NCAC 15A Subchapter 18C - NC Rules Governing Public Water Systems.

This action does not address the contaminated groundwater plumes. The focus of this action is to ensure the Town of Aberdeen has a safe and adequate water supply system.

The capital costs include both direct and indirect capital costs. The direct capital costs include the purchase of the necessary property and/or easements; the installation and testing of a test well; installation and necessary piping/electrical/control system of supply well; construction well head protection structure; and chlorination equipment. With the addition of indirect costs, the total capital cost for Alternative 3 is estimated to be approximately $822,900. These costs were developed by TOA and reviewed by EPA and the State. This alternative also includes $100,000 for the purchase of the necessary property/easements and associated costs.

As this well or maybe these wells will become part of the municipal water supply system of the Town of Aberdeen, future O&M costs associated with this well (these wells) will become the responsibility of the Town of Aberdeen. Therefore, there is no O&M costs associated with Alternative 3. As this alternative involves the installation of supply wells in a "clean" area, monitoring the plumes at large will be implemented under OU 2, and therefore, no cost for this activity was included in this estimate.

Since the site-related contaminants would remain in place, CERCLA requires Five-Year Reviews to ensure that the overall human health and the environment are protected. Each Five-Year Review would, at a minimum, consist of a Site visit, review of existing documents and monitoring data, interviews, and report preparation. Five-Year Review for this alternative would be the same as described in Alternative 2.

11.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

Sections 10.1.1 – 10.1.3 describe the remedial alternatives set forth in the August 2014 Proposed Plan. This section summarizes the detailed evaluation of the groundwater remediation alternatives in accordance with the nine (9) criteria specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Section 300.430(e)(9)(iii). This evaluation, in accordance with the nine criteria, is summarized in **Table 8**.

11.1 THRESHOLD CRITERIA

In order for an alternative to be eligible for selection, it must be protective of both human health and the environment and comply with Applicable or Relevant and Appropriate Requirements (ARARs). However, the requirement to comply with ARARs can be waived in accordance to 40 CFR Section 300.430(f)(1)(ii)(C). If an alternative fails to protect human health or the environment, or does not comply with ARARs, then this alternative cannot be selected. Below is a discussion of the alternatives in comparison with these two threshold criteria.

11.1.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Overall protection of human health and the environment addresses whether each 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 treatment, engineering controls, and/or institutional controls. This assessment considers both short-term and long-term time frames.

Alternatives 2 and 3 are protective of human health and the environment by eliminating, reducing, or controlling risks posed by the Site through the extraction and treatment of groundwater or supplying an alternative source of potable water. Alternatives 2 and 3 will significantly reduce or eliminate the risk of direct exposure to contaminants in groundwater and protect human health and environment to the same degree. Alternative 1 would not be protective of human health.

11.1.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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 which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA section 121(d)(4).

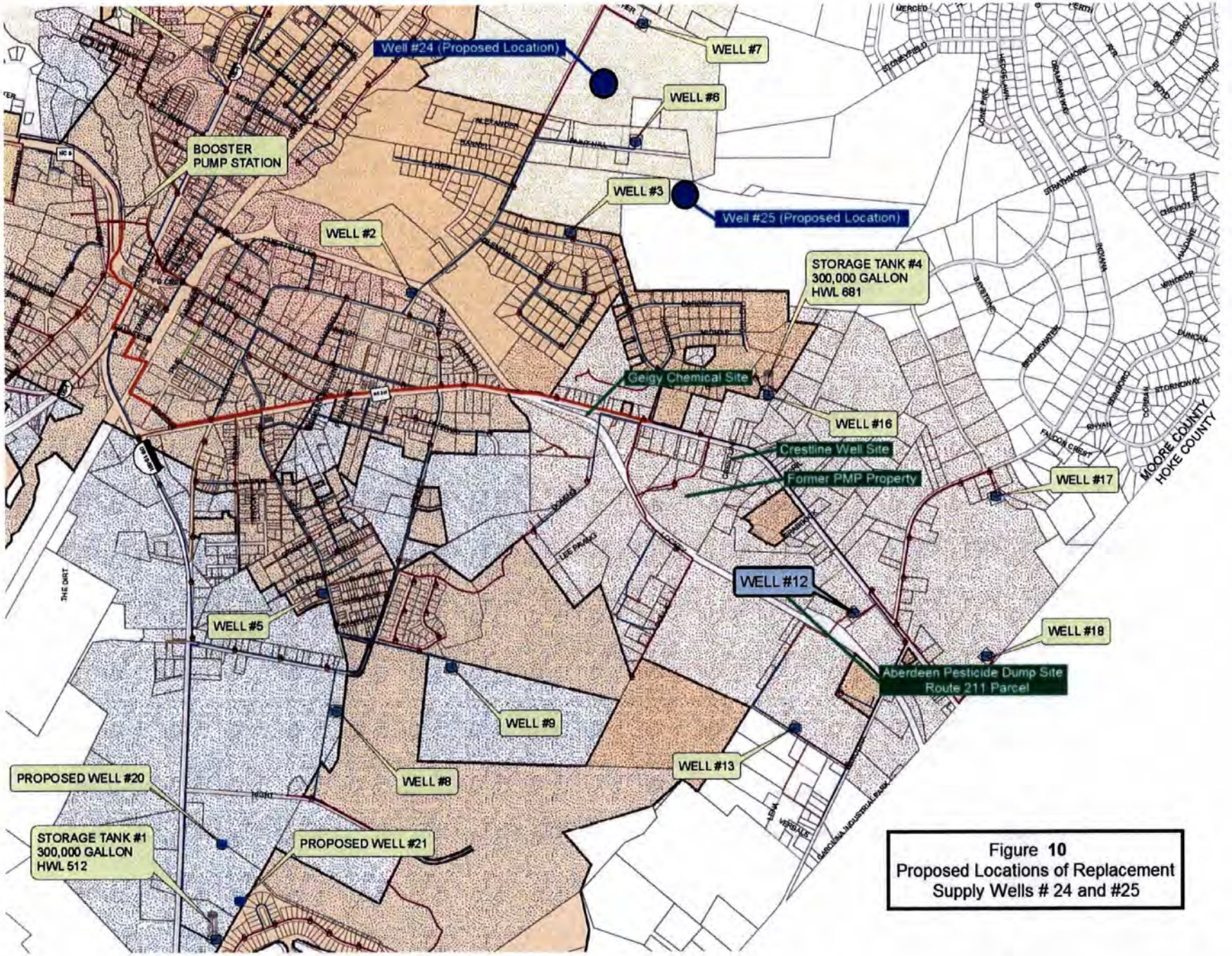


Figure **10**
Proposed Locations of Replacement
Supply Wells # 24 and #25

Table 8 – Comparative Analysis of Retained Alternatives

Evaluation Criteria	**Alternative 1** **No Action with monitoring**	**Alternative 2** **Wellhead treatment and monitoring**	**Alternative 3** **Installation of new supply well(s) to replace supply wells #5 and #9**
Overall Protection of Human Health and Environment	This alternative would not provide protection of human health or the environment. No RAOs would be satisfied.	Wellhead treatment would protect Aberdeen's municipal water supply system. RAOs would be achieved with the installation/operation of the wellhead treatment systems.	This alternative would be protective by replacing the adversely impacted supply wells with "clean" supply well(s). RAOs would be achieved upon connecting the new supply wells to the municipal water supply system.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	This alternative would not meet chemical-specific ARARs or TBCs.	This alternative will meet all Federal and State ARARs including those associated with the periodic handling of spent carbon.	This alternative would meet all Federal and State ARARs.
Long-Term Effectiveness and Permanence	This alternative does not provide long-term effectiveness and permanence.	Long-term risk to TOA's municipal water supply system would be reduced through wellhead treatment. Supply wells #5 and #9 would continue to extract contaminated groundwater from the fringes of the plume. This alternative will require long-term maintenance, monitoring, disposal of spent carbon and replacement.	This alternative would provide long-term effectiveness and permanence as this alternative would provide clean drinking water with sufficient quantity to the TOA municipal supply system.
Reduction of Toxicity, Mobility, and Volume through Treatment	This alternative does not reduce toxicity, mobility or volume.	This alternative will not reduce toxicity, mobility, and volume of the contaminants in the groundwater.	This alternative would not achieve any reduction in the mobility, toxicity, and volume of contaminants as the new supply well(s) would be installed in an area where the groundwater is clean.

Table 8 – Comparative Analysis of Retained Alternatives			
Evaluation Criteria	**Alternative 1** **No Action with monitoring**	**Alternative 2** **Wellhead treatment and monitoring**	**Alternative 3** **Installation of new supply well(s) to replace supply wells #5 and #9**
Short-term Effectiveness	With no activity under this alternative, there is no increase in short-term risk.	Some short-term risk increase due to the construction of the building needed to house the activated carbon vessels.	The short-risks associated with implementing this alternative are the same risks associated with any construction project.
Implementability	Easy to implement since only monitoring is involved.	This alternative is easily implementable.	This alternative is easily implementable.
Total Cost - All Costs are for 30 year timeframe	$421,200	$4,695,900	$822,900

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 in 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 addresses problems or situations 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 that are more stringent than Federal requirements many be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the ARARs of other Federal and State environmental statues or provides a basis for invoking a waiver.

Alternatives 2 and 3 had common ARARs. All alternatives will attain their respective Federal and State ARARs. **Table 9** identifies the Chemical-Specific ARARs/TBCs and **Table 10** identifies the Potential Action-Specific ARARs/TBCs.

Alternatives 2 and 3 would comply with all location- and action-specific ARARs and are anticipated to comply with all chemical-specific ARARs.

11.2 PRIMARY BALANCING CRITERIA

These criteria are used to evaluate the overall effectiveness of a particular remedial alternative.

11.2.1 LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

Alternative 2 would provide minimal removal of the contaminants, by removing contaminants through carbon filters, resulting in an effective solution to address the risks posed by supply wells #5 and #9. For Alternative 3, the location of the new supply well(s) would ensure the production of clean potable water, and this alternative would achieve long-term effectiveness and permanence. Alternative 1 would not achieve either long-term effectiveness or permanence.

Long-term monitoring programs and five-year reviews will be required for all three alternatives. Maintenance and/or periodic inspections would need to be performed on a regular basis for Alternatives 2 and 3. Long-term maintenance would be more involved for Alternative 2.

11.2.2 REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

Reduction of toxicity, mobility, and volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of the remedy.

Alternative 2 is the only alternative that implements treatment as a component of the remedy and may marginally accomplish a reduction in toxicity, mobility, and volume as the existing supply wells #5 and #9 extract contaminated groundwater that will be treated using activated carbon. The absorped contaminants would be destroyed when the activated carbon is regenerated off-site. Alternative 2 meets the statutory preference for treatment as a principal element of remediation.

11.2.3 SHORT-TERM EFFECTIVENESS

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

The risk to community and workers would be minimal for all alternatives. None of the risks would be uncontrollable. Nearby residents may be exposed to contaminated dusts during the installation of the two supply wells and carbon treatment buildings. These risks would be controllable by the use of dust suppressants. The risk to workers would be controlled by proper use of personnel protection equipment and monitoring during site activities.

11.2.4 IMPLEMENTABILITY

Implementability addresses 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 government entities are also considered.

Alternative 2 involves groundwater extraction and treatment to reduce contaminant concentrations in TOA's public water supply. This alternative utilizes a proven technology and can be readily implemented with a proper design. Alternative 3 involves installing additional supply well(s) and connecting these new supply wells to the existing distribution system. This alternative can be readily implemented.

11.2.5 COST

This criterion assesses the cost of an alternative in terms of total present worth cost. Total present worth was calculated by combining the capital cost plus the present worth of the annual operation and maintenance (O&M) costs. Capital cost includes engineering and design, mobilization, Site development, equipment, construction, demobilization, utilities, and sampling/analyses. Operating costs were calculated for activities that continue after completion of construction, such as routine operation and maintenance of treatment equipment, and groundwater monitoring. The present worth of an alternative is the amount of capital required to be deposited at the present time at a given interest rate to yield the total amount necessary to pay for initial construction costs and future expenditures, including O&M and future replacement of capital equipment. Where applicable, the total present worth cost was developed using a duration of 30 years (for those applicable activities at a discount rate of 7%).

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Table 9 – Chemical-Specific ARARs			
Action/Media	**Requirements**	**Prerequisite**	**Citation(s)**
Classification of groundwater	Groundwaters in the state naturally containing 250 mg/L or less of chloride are *classified as GA* under 15A NCAC 02L .0201(1) Best usage: Existing or potential source of drinking water supply for humans.	Groundwaters located within the boundaries or under the extraterritorial jurisdiction of the State of North Carolina – **relevant and appropriate**	15A NCAC 02L .0201(1) Groundwater Classifications
	Groundwaters in the state naturally containing greater than 250 mg/L of chloride are *classified as GSA* under 15A NCAC 02L .0201(2) Best usage: Existing or potential source of water supply for potable mineral water and conversion to fresh waters.		15A NCAC 02L .0201(2)
Supply of groundwater for potable water use	Shall not exceed the Safe Drinking Water Act National Revised Primary Drinking Water Regulations: maximum contaminant levels (MCLs) for organic contaminants specified in 40 CFR § 141.61(a). • TCE: 5 µg/L	Public water system as defined in G.S. 130A-313. – **relevant and appropriate**	40 CFR § 141.61(a) 15A NCAC 18C .1518

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
General construction standards – All land–disturbing activities (i.e., excavation, trenching, drilling wells, grading etc.)			
Managing storm water runoff from land-disturbing activities	Shall install erosion and sedimentation control devices and practices sufficient to retain the sediment generated by the land-disturbing activity within the boundaries of the tract during construction. Shall plant or otherwise provide permanent ground cover sufficient to restrain erosion after completion of construction.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-53) of more than 1 acre of land – **applicable**	N.C.G.S. Ch.113A-57(3) *Mandatory standards for land-disturbing activity*
	The land-disturbing activity shall be conducted in accordance with the approved erosion and sedimentation control plan. *NOTE: Plan which meets the objectives of 15A NCAC 4B.0106 would be included in the CERCLA Remedial Design or Remedial Action Work Plan*		N.C.G.S. Ch.113A-57(5)
	Shall take all reasonable measures to protect all public and private property from damage caused by such activities.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land – **applicable**	15A NCAC 4B.0105
Managing storm water runoff from land-disturbing activities con't	Erosion and sedimentation control plan must address the following basic control objectives: (1) Identify areas subject to severe erosion, and off-site areas especially vulnerable to damage from erosion and sedimentation. (2) Limit the size of the area exposed at any one time. (3) Limit exposure to the shortest feasible time. (4) Control surface water run-off originating upgrade of exposed areas (5) Plan and conduct land-disturbing activity so as to prevent off-site sedimentation damage. (6) Include measures to control velocity of storm water runoff to the point of discharge.		15A NCAC 4B.0106

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Managing storm water runoff from land-disturbing activities cont.	Erosion and sedimentation control measures, structures, and devices shall be planned, designed, and constructed to provide protection from the run-off of 10 year storm.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land – **applicable**	15A NCAC 4B.0108
	Shall conduct activity so that the post-construction velocity of the ten year storm run-off in the receiving watercourse to the discharge point does not exceed the parameters provided in this Rule.		15A NCAC 4B.0109
	Shall install and maintain all temporary and permanent erosion and sedimentation control measures.		15A NCAC 4B.0113
Control of fugitive dust emissions	The owner/operator of a facility shall not cause fugitive dust emissions to cause or contribute to the substantive complaints or visible emissions.	Activities potentially generating fugitive dust as defined in 15A NCAC 02D .0540 (a)(2) – **relevant and appropriate**	15A NCAC 02D .0540
Construction and Operation Standards – Water Supply Wells			
Standards of Construction for new water supply wells	Drilling Fluids and Additives shall not contain organic or toxic substances or include water obtained from surface water bodies or water from a non-potable supply and may be comprised only of: the formational material encountered during drilling; or materials manufactured specifically for the purpose of borehole conditioning or water well construction.	Construction of new water supply well - **applicable**	15A NCAC 02C.0107(c)
Well casing construction and installation	Shall meet the requirements and specifications in subparagraphs (1) for steel casing and (2) for thermoplastic casing.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(d)
	In constructing any well, all water-bearing zones that contain contaminated, saline, or other non-potable water shall be cased and grouted so that contamination of overlying and underlying groundwater zones shall not occur.		15A NCAC 02C.0107(d)(3)
	Shall meet the requirements and specifications described in subparagraphs (A) through (D) for casing depth.		15A NCAC 02C.0107(d)(4)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	The top of the casing shall be terminated at least 12 inches above land surface, regardless of the method of well construction and type of pump to be installed.		15A NCAC 02C.0107(d)(5)
	The casing in wells constructed to obtain water from a consolidated rock formation shall meet the requirements specified in Subparagraphs (d)(1) through (d)(5) of this Rule and shall be: (A) adequate to prevent any formational material from entering the well in excess of the levels specified in Paragraph (h) of this Rule; and (B) firmly seated at least five feet into the rock.		15A NCAC 02C.0107(d)(6)
	The casing in wells constructed to obtain water from an unconsolidated rock formation (such as gravel, sand or shells) shall extend at least one foot into the top of the water-bearing formation.		15A NCAC 02C.0107(d)(7)
Well casing construction and installation *cont.*	Upon completion of the well, the well shall be sufficiently free of obstacles including formation material as necessary to allow for the installation and proper operation of pumps and associated equipment.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(d)(8)
	Prior to removing equipment from the site, the top of the casing shall be sealed with a water-tight cap or well seal, as defined in G.S. 87-85(16), to preclude the entrance of contaminants into the well.		15A NCAC 02C.0107(d)(9)
Allowable Grouts	Shall meet the requirements for allowable grouts delineated in subparagraphs (A) through (F) whenever grout is required.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(e)
	With the exception of bentonite chips or pellets, the liquid and solid components of all grout mixtures shall be blended prior to emplacement below land surface.		15A NCAC 02C.0107(e)(2)
	No fly ash, other coal combustion byproducts, or other wastes may be used in any grout.		15A NCAC 02C.0107(e)(3)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Grout Emplacement	Casing shall be grouted to a minimum depth of twenty feet below land surface except that: (A) In those areas designated by the Director to meet the criteria of Rule .0116 of this Section, grout shall extend to a depth of two feet above the screen or, for open end wells, to the bottom of the casing, but in no case less than 10 feet. (B) In those areas designated in Rule .0117 of this Section, grout shall extend to a minimum of 35 feet below land surface.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(f)(1)
Grout Emplacement *cont.*	In addition to the grouting required by Subparagraph (f)(1) of this Rule, the casing shall be grouted as necessary to seal off all aquifers or zones that contain contaminated, saline, or other non-potable water so that contamination of overlying and underlying aquifers or zones shall not occur.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(f)(2)
	Bentonite slurry grout may be used in that portion of the borehole that is at least three feet below land surface. That portion of the borehole from land surface to at least three feet below land surface shall be filled with a concrete or cement-type grout or bentonite chips or pellets that are hydrated in place.		15A NCAC 02C.0107(f)(3)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	Grout shall be placed around the casing by one of the following methods: (A) Pressure. Grout shall be pumped or forced under pressure through the bottom of the casing until it fills the annular space around the casing and overflows at the surface; (B) Pumping. Grout shall be pumped into place through a hose or pipe extended to the bottom of the annular space which can be raised as the grout is applied. The grout hose or pipe shall remain submerged in grout during the entire application; or (C) Other. Grout may be emplaced in the annular space by gravity flow in such a way to ensure complete filling of the space. Gravity flow shall not be used if water or any visible obstruction is present in the annular space within the applicable minimum grout depth specified in Subparagraph (f)(1) of this Rule at the time of grouting, with the exception that bentonite chips or pellets may be used if water is present, if designed for that purpose.		15A NCAC 02C.0107(f)(4)
Grout Emplacement *cont.*	If a Rule of this Section requires grouting of the casing to a depth greater than 20 feet below land surface, the pumping or pressure method shall be used to grout that portion of the borehole deeper than 20 feet below land surface, with the exception of bentonite chips and pellets, used in accordance with Part (f)(4)(C) of this Rule.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(f)(5)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	(6)If an outer casing is installed, it shall be grouted by either the pumping or pressure method. (7) Bentonite chips or pellets shall be used in compliance with all manufacturer's instructions including pre-screening the material to eliminate fine-grained particles, installation rates, hydration methods, tamping, and other measures to prevent bridging. (8) Bentonite grout shall not be used to seal zones of water with a chloride concentration of 1,500 milligrams per liter or greater. (9) The well shall be grouted within seven days after the casing is set. (10) No additives which will accelerate the process of hydration shall be used in grout for thermoplastic well casing.		15A NCAC 02C.0107(f)(6)-(10)
	Where grouting is required by the provisions of this Section, the grout shall extend outward in all directions from the casing wall to a minimum thickness equal to either one-third of the diameter of the outside dimension of the casing or two inches, whichever is greater; but in no case shall a well be required to have an annular grout seal thickness greater than four inches.		15A NCAC 02C.0107(f)(11)
Well Screens	(1)The well, if constructed to obtain water from an unconsolidated rock formation, shall be equipped with a screen that will prevent the entrance of formation material into the well after the well has been developed and completed. (2) The well screen shall be of a design to permit the optimum development of the aquifer with minimum head loss consistent with the intended use of the well. The openings shall be designed to prevent clogging and shall be free of rough edges, irregularities or other defects that may accelerate or contribute to corrosion or clogging. (3) Multi-screen wells shall not connect aquifers or zones which have differences in water quality which would result in contamination of any aquifer or zone.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(g)(1-3)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Well development	All water supply wells shall be developed by the well contractor. Development shall include removal of formation materials, mud, drilling fluids and additives such that the water contains no more than: (1) five milliliters per liter of settleable solids; and (2) 10 NTUs of turbidity as suspended solids. Development does not require efforts to reduce or eliminate the presence of dissolved constituents which are indigenous to the ground water quality in that area.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(i)
Wellhead completion	Access Port. Every water supply well shall be equipped with a usable access port or air line, except those with a multi-pipe deep well jet pump or adapter mounted on the well casing or well head, and wells with casing two inches or less in diameter where a suction pipe is connected to a suction lift pump. The access port shall be at least one half inch inside diameter opening so that the position of the water level can be determined at any time. The port shall be installed and maintained in such manner as to prevent entrance of water or foreign material.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(j)(1)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Well Contractor Identification Plate.	(A) An identification plate, showing the well contractor and certification number and the information specified in Part (j)(2)(E) of this Rule, shall be installed on the well within 72 hours after completion of the drilling. (B) The identification plate shall be constructed of a durable weatherproof, rustproof metal, or other material approved by the Department as equivalent. (C) The identification plate shall be permanently attached to either the aboveground portion of the well casing, surface grout pad or enclosure floor around the casing where it is readily visible and in a manner that does not obscure the information on the identification plate. (D) The identification plate shall not be removed by any person. (E) The identification plate shall be stamped to show the: (i) total depth of well; (ii) casing depth (feet) and inside diameter (inches); (iii) screened intervals of screened wells; (iv) packing interval of gravel-or sand-packed wells; (v) yield, in gallons per minute (gpm), or specific capacity in gallons per minute per foot of drawdown (gpm/ft.-dd); (vi) static water level and date measured; (vii) date well completed; and (viii) the well construction permit number or numbers, if such a permit is required.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(j)(2)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Pump Installation Information Plate	(A) An information plate, showing the well contractor and certification number of the person installing the pump, and the information specified in Part (j)(3)(D) of this Rule, shall be permanently attached to either the aboveground portion of the well casing, surface grout pad or the enclosure floor, if present, where it is readily visible and in a manner that does not obscure the information on the identification plate within 72 hours after completion of the pump installation; (B) The information plate shall be constructed of a durable waterproof, rustproof metal, or other material approved by the Department as equivalent; (C) The information plate shall not be removed by any person; and (D) The information plate shall be stamped or engraved to show the: (i) date the pump was installed; (ii) the depth of the pump intake; and (iii) the horsepower rating of the pump.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(j)(3)
Pitless adapters or units	Pitless adapters or pitless units are allowed as a method of well head completion under the following conditions: (A) Design, installation and performance standards are those specified in PAS-97(04), which is hereby incorporated by reference, including subsequent amendments and editions, and can be obtained from the Water System Council National Programs Office, 1101 30th Street, N.W., Suite 500, Washington, DC 20007 at no cost; (B) The pitless device is compatible with the well casing; (C) The top of the pitless unit extends at least 12 inches above land surface; (D) The excavation surrounding the casing and pitless device is filled with grout from the top of the casing grout to the land surface; and (E) The pitless device has an access port.	Construction of new water supply well – **applicable**	15A NCAC 02C.0107(j)(5)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Sealing of wiring and piping	All openings for piping, wiring, and vents shall enter into the well at least 12 inches above land surface, except where pitless adapters or pitless units are used, and shall be adequately sealed to preclude the entrance of contaminants into the well.		15A NCAC 02C.0107(j)(6)
Disinfection of water supply wells	Any person constructing, repairing, testing, or performing maintenance, or installing a pump in a water supply well shall disinfect the well upon completion of construction, repairs, testing, maintenance, or pump installation.	Construction of new water supply well – **applicable**	15A NCAC 02C .0111(a)
	Any person disinfecting a well shall perform disinfection in accordance with the following procedures in subparagraphs (1) and (2).		15A NCAC 02C .0111(b)
Construction and Operation Standards – Distribution Systems and Pumping Equipment			
Distribution System Design Standards - Water Pipe Materials	Distribution mains shall be cast iron, ductile iron, asbestos-cement, reinforced concrete, plastic, or other material designed for potable water system service and shall be the appropriate AWWA standards, section C, or NSF Standards No. 14 and No. 15 that is hereby incorporated by reference including any subsequent amendments and editions. The pressure rating class of the pipe shall be in excess of the maximum design pressure within that section of the water distribution system. The quality of pipe to be used shall be stated in the project specifications.	Construction of distribution systems designed for potable water system service –**applicable**	15 NCAC 18C.0406(a)
Distribution Systems Design Standards - Cross Connections	No potable water supply shall be connected by any means to another source of water supply or to a storage facility unless such connection has been previously approved by the Department. No connection shall be made to any plumbing system that does not comply with the North Carolina State Building Code, volume II, or any applicable local plumbing code.	Construction of distribution systems designed for potable water system service –**applicable**	15 NCAC 18C.0406(b)(1)
	No person shall introduce any water into the distribution system of a public water supply through any means other than from a source of supply duly approved by the Department or its representatives, or		15 NCAC 18C.0406(b)(2)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	make a physical connection between an approved supply and unapproved supply unless authorized in an emergency by the Department or its representative		
Design and operation of Pumps and Pumping Equipment	The pumping capacity of the pump shall be consistent with the intended use and yield characteristics of the well.	Installation of pumps and equipment for use with new water supply well – **applicable**	15A NCAC 02C .0109(a)
	The pump and related equipment for the well shall be located to permit easy access and removal for repair and maintenance.		15A NCAC 02C .0109(b)
	The base plate of a pump placed directly over the well shall be designed to form a watertight seal with the well casing or pump foundation.		15A NCAC 02C .0109(c)
Design and operation of Pumps and Pumping Equipment *cont.*	In installations where the pump is not located directly over the well, the annular space between the casing and pump intake or discharge piping shall be closed with a watertight seal. .	Installation of pumps and equipment for use with new water supply well – **applicable**	15A NCAC 02C .0109(d)
	The well head shall be equipped with a screened vent to allow for the pressure changes within the well except if a suction lift pump or single-pipe jet pump is used or artesian, flowing well conditions are encountered.		15A NCAC 02C .0109(e)
	The person installing the pump in any water supply well shall install a threadless sampling tap at the wellhead for obtaining water samples except as provided in subparagraphs (1) –(3) The threadless sampling tap shall be turned downward, located a minimum of 12 inches above land surface, floor, or well pad, and positioned such that a water sample can be obtained without interference from any part of the wellhead.		15A NCAC 02C .0109(f)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	A priming tee shall be installed at the well head in conjunction with offset jet pump installations.		15A NCAC 02C .0109(g)
	Joints of any suction line installed underground between the well and pump shall be tight under system pressure.	Installation of pumps and equipment for use with new water supply well – **applicable**	15A NCAC 02C .0109(h)
Design and operation of Pumps and Pumping Equipment *cont*	The drop piping and electrical wiring used in connection with the pump shall meet all applicable underwriters specifications.		15A NCAC 02C .0109(i)
	Only potable water shall be used for priming the pump.		15A NCAC 02C .0109(j)
Abandonment of Water Supply Wells			
Abandonment of water supply well – Temporary	Any well which is temporarily removed from service shall be temporarily abandoned in accordance with the following procedures: (1) The well shall be sealed with a water-tight cap or well seal, as defined in G.S. 87-85 (16), compatible with the casing and installed so that it cannot be removed without the use of hand tools or power tools. (2) The well shall be maintained whereby it is not a source or channel of contamination during temporary abandonment.	Construction and abandonment of new water supply well – **relevant and appropriate**	15A NCAC 02C.0113(a)
Abandonment of water supply well(s)	For any well which has been abandoned permanently: • All casing and screen materials may be removed prior to initiation of abandonment procedures if such removal will not cause or contribute to contamination of the groundwaters. Any casing not grouted in accordance with 15A NCAC 2C .0107(e) of this Section shall be removed or properly grouted. • The entire depth of the well shall be sounded before it is sealed to ensure freedom from obstructions that may interfere with sealing operations. • Except in the case of temporary wells and monitoring wells, the well shall be disinfected in accordance with Rule .0111(b)(1)(A)	Permanent abandonment of water supply wells (other than bored or hand dug wells) – **applicable**	15A NCAC 02C .0113(b)(1)-(6)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	through .0111(b)(1)(C) of this Section. • In the case of gravel-packed wells in which the casing and screens have not been removed, neat-cement, or bentonite grout shall be injected into the well completely filling it from the bottom of the casing to the top. • Wells, other than "bored" wells, constructed in unconsolidated formations shall be completely filled with cement grout, or bentonite grout by introducing it through a pipe extending to the bottom of the well which can be raised as the well is filled. • Wells constructed in consolidated rock formations or that penetrate zones of consolidated rock may be filled with cement grout, bentonite grout, sand, gravel or drill cuttings opposite the zones of consolidated rock. The top of the cement grout, bentonite grout, sand, gravel or cutting fill shall terminate at least 10 feet below the top of the consolidated rock or five feet below the bottom of casing. Cement grout or bentonite grout shall be placed beginning 10 feet below the top of the consolidated rock or five feet below the bottom of casing and extend five feet above the top of consolidated rock. The remainder of the well, above the upper zone of consolidated rock, shall be filled with cement grout or bentonite grout up to land surface. For any well in which the depth of casing or the depth of the bedrock is not known or cannot be confirmed, then the entire length of the well shall be filled with cement grout or bentonite grout up to land surface.		

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Waste characterization – Primary (contaminated media) and Secondary Wastes (wastewaters, spent treatment media, etc.)			
Characterization of *solid waste* (all primary and secondary wastes)	Must determine if solid waste is a hazardous waste using the following method: • Should first determine if waste is excluded from regulation under 40 CFR261.4; and • Must then determine if waste is listed as a hazardous waste under subpart D 40 CFR part 261.	Generation of solid waste as defined in 40 CFR261.2 – **applicable**	40 CFR § 262.11(a) and (b) 15A NCAC 13A .0106, .107
	Must determine whether the waste is (characteristic waste) identified in subpart C of 40 CFR part 261by either: (1) Testing the waste according to the methods set forth in subpart C of 40 CFR part 261, or according to an equivalent method approved by the Administrator under 40 CFR §260.21; or (2) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.		40 CFR § 262.11(c) 15A NCAC 13A .0106
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste	Generation of solid waste which is determined to be hazardous – **applicable**	40 CFR § 262.11(d); 15A NCAC 13A .0106
Characterization of *hazardous waste* (all primary and secondary wastes)	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 CFR 264 and 268.	Generation of RCRA-hazardous waste for storage, treatment or disposal – **applicable**	40 CFR § 264.13(a)(1) 15A NCAC 13A .0109
Determinations for management of hazardous waste	Must determine if the hazardous waste has to be treated before land disposed. This is done by determining if the waste meets the treatment standards in 40 CFR 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste. This determination can be made concurrently with the hazardous waste determination required in 40 CFR 262.11.	Generation of RCRA hazardous waste for storage, treatment or disposal – **applicable**	40 CFR § 268.7(a)(1) 15A NCAC 13A .0106

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	Must comply with the special requirements of 40 CFR § 268.9 in addition to any applicable requirements in 40 CFR § 268.7.	Generation of waste or soil that displays a hazardous characteristic of ignitability, corrosivity, reactivity, or toxicity for storage, treatment or disposal – **applicable**	40 CFR § 268.7(a)(1) 15A NCAC 13A .0112
	Must determine each EPA Hazardous Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under 40 CFR 268 *et seq.* This determination may be made concurrently with the hazardous waste determination required in Sec. 262.11 of this chapter.	Generation of RCRA characteristic hazardous waste for storage, treatment or disposal – **applicable**	40 CFR § 268.9(a) 15A NCAC 13A .0112
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the characteristic waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non–wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal – **applicable**	40 CFR § 268.9(a) 15A NCAC 13A .0112
Characterization of industrial wastewater	Industrial wastewater discharges that are point source discharges subject to regulation under section 402 of the CWA, as amended, are not solid wastes for the purpose of hazardous waste management. [Comment: This exclusion applies only to the actual point source discharge. It does not exclude industrial wastewaters while they are being collected, stored or treated before discharge, nor does it exclude sludges that are generated by industrial wastewater treatment.]	Generation of industrial wastewater and discharge into surface water – **applicable**	40 CFR § 261.4(a)(2)
Waste Storage – Primary (contaminated media) and Secondary Wastes (wastewaters, spent treatment media, etc.)			
Storage of solid waste	All solid waste shall be stored in such a manner as to prevent the creation of a nuisance, insanitary conditions, or a potential public health hazard.	Generation of solid waste which is determined *not* to be hazardous – **relevant and appropriate**	15A NCAC 13B .0104(f)

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	Containers for the storage of solid waste shall be maintained in such a manner as to prevent the creation of a nuisance or insanitary conditions. Containers that are broken or that otherwise fail to meet this Rule shall be replaced with acceptable containers.		15A NCAC 13B .0104(e)
Temporary Storage of hazardous waste in Containers	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 40 CFR 265.171–173; and	Accumulation of RCRA hazardous waste on site as defined in 40 CFR §260.10 – **applicable**	40 CFR § 262.34(a); 15A NCAC 13A .0107 40 CFR §262.34(a)(1)(i); 15A NCAC 13A .0107
	• the date upon which accumulation begins is clearly marked and visible for inspection on each container; • container is marked with the words "hazardous waste"; or		40 CFR § 262.34(a)(2) and (3) 15A NCAC 13A .0107
	• container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste or one quart of acutely hazardous waste listed in §261.33(e) at or near any point of generation – **applicable**	40 CFR § 262.34(c)(1) 15A NCAC 13A .0107
Use and management of hazardous waste in containers	If container is not in good condition (e.g. severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition.	Storage of RCRA hazardous waste in containers – **applicable**	40 CFR § 265.171 15A NCAC 13A .0109
	Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired.		40 CFR § 265.172 15A NCAC 13A .0109

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	Containers must be closed during storage, except when necessary to add/remove waste. Container must not opened, handled and stored in a manner that may rupture the container or cause it to leak.		40 CFR § 265.173(a) and (b) 15A NCAC 13A .0109
Storage of hazardous waste in container area	Area must have a containment system designed and operated in accordance with 40 CFR §264.175(b).	Storage of RCRA–hazardous waste in containers with *free liquids* – **applicable**	40 CFR §264.175(a) 15A NCAC 13A .0109
	Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or Containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA–hazardous waste in containers that *do not contain free liquids* (other than F020, F021, F022, F023,F026 and F027) – **applicable**	40 CFR § 264.175(c)(1) and (2) 15A NCAC 13A .0109
Closure performance standard for RCRA container storage unit	Must close the facility (e.g., container storage unit) in a manner that: • Minimizes the need for further maintenance; • Controls minimizes or eliminates to the extent necessary to protect human health and the environment, post–closure escape of hazardous waste, hazardous constituents, leachate, contaminated run –off, or hazardous waste decomposition products to the ground or surface waters or the atmosphere; and • Complies with the closure requirements of subpart, but not limited to, the requirements of 40 CFR 264.178 for containers.	Storage of RCRA hazardous waste in containers – **applicable**	40 CFR § 264.111 15A NCAC 13A .0109
Treatment/Disposal of Wastes – Primary (contaminated media) and Secondary Wastes (wastewaters, spent treatment media, etc.)			
Disposal of solid waste	Shall ensure that waste is disposed of at a site or facility which is permitted to receive the waste.	Generation of solid waste intended for off-site disposal – **relevant and appropriate**	15A NCAC 13B .0106(b)
Disposal of RCRA–hazardous waste in a land–based unit	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR §268.40 before land disposal.	Land disposal, as defined in 40 CFR § 268.2, of restricted RCRA waste – **applicable**	40 CFR § 268.40(a) 15A NCAC 13A .0112

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
	All underlying hazardous constituents [as defined in 40 CFR §268.2(i)] must meet the Universal Treatment Standards, found in 40 CFR §268.48 Table UTS prior to land disposal.	Land disposal of restricted RCRA characteristic wastes (D001 –D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well – **applicable**	40 CFR §268.40(e) 15A NCAC 13A .0112
Disposal of RCRA–hazardous waste in a land–based unit *con't*	To determine whether a hazardous waste identified in this section exceeds the applicable treatment standards of 40 CFR § 268.40, the initial generator must test a sample of the waste extract or the entire waste, depending on whether the treatment standards are expressed as concentration in the waste extract or waste, or the generator may use knowledge of the waste. If the waste contains constituents (including UHCs in the characteristic wastes) in excess of the applicable UTS levels in 40 CFR § 268.48, the waste is prohibited from land disposal, and all requirements of part 268 are applicable, except as otherwise specified.	Land disposal of RCRA toxicity characteristic wastes (D004 –D011) that are newly identified (i.e., wastes, soil, or debris identified by the TCLP but not the Extraction Procedure) – **applicable**	40 CFR § 268.34(f) 15A NCAC 13A .0112
	Must be treated according to the alternative treatment standards of 40 CFR § 268.49(c) or according to the UTSs [specified in 40 CFR § 268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR § 268.2, of restricted hazardous *soils* – **applicable**	40 CFR § 268.49(b) 15A NCAC 13A .0112
Disposal of RCRA wastewaters into CWA wastewater treatment unit	Are not prohibited, if the wastes are managed in a treatment system which subsequently discharges to waters of the U.S. pursuant to a permit issued under 402 of the CWA (i.e., NPDES permitted) unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR §268.40, or are D003 reactive cyanide.	Land disposal of hazardous *wastewaters* that are hazardous only because they exhibit a hazardous characteristic and are not otherwise prohibited under 40 CFR Part 268 – **applicable**.	40 CFR § 268.1(c)(4)(i) 15A NCAC 13A .0112

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Disposal of RCRA characteristic wastewaters in a POTW	Are not prohibited, if the wastes are treated for purposes of the pre-treatment requirements of section 307 of the CWA unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR §268.40, or are D003 reactive cyanide.		40 CFR § 268.1(c)(4)(ii) 15A NCAC 13A .0112
Operation of Treatment System – Air Quality			
Toxic air emissions	A facility shall not emit toxic air pollutants in quantities that may cause of contribute beyond the premises to any significant ambient air concentrations that may adversely affect human health. *NOTE: See Table in the cited regulation for list of toxic air pollutants and accompanying air concentrations*	Activities potentially generating air emissions – **applicable**	15A NCAC 02D .1104
Emissions of VOCs from groundwater treatment (e.g. sparging system)	Shall install and operate reasonable available control technology to limit emissions of VOCs	Air emissions of VOCs from facilities where there is no other applicable emissions control rule – **relevant and appropriate**	15A NCAC 02D.0951(c)(1)
	One of the applicable test methods in Appendix M in 40 CFR part 51 or Appendix A in 40 CFR part 60 shall be used to determine compliance with VOC emission standards.	VOC emission source not covered by 15A NCAC 02D.2613(b) through (e) – **relevant and appropriate**	15A NCAC 02D.2613(g)
Standards for closed vent systems and control devices used in treatment of VOC contaminated groundwater	For each closed vent system and control device you use to comply with the requirements above, you must meet the operating limit requirements and work practice standards in Sec. 63.7925(d) through (j) that apply to the closed vent system and control device. *NOTE: EPA approval to use alternate work practices under paragraph (j) in 40 CFR § 63.7925 will be obtained in a CERCLA document.*	*Closed vent system* and control devices as defined in 40 CFR § 63.7957 that are used to comply with § 63.7890(b) – **relevant and appropriate**.	40 CFR § 63.7890(c) 15A NCAC 02D .1110 NESHAPS

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Monitoring of closed vent systems and control devices used in treatment of VOC contaminated groundwater	Must monitor and inspect the closed vent system and control device according to the requirements in 40 CFR § 63.7927 that apply to the affected source. *NOTE: Monitoring program will be developed as part of the CERCLA process and included in an appropriate CERCLA document.*	*Closed vent system* and control devices as defined in 40 CFR § 63.7957 that are used to comply with § 63.7890(b) – **relevant and appropriate**.	40 CFR § 63.7892 15A NCAC 02D .1110 NESHAPS
Transportation of Wastes – Primary and Secondary Wastes			
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 CFR 171–180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material – **applicable**	49 CFR § 171.1(c)
Transportation of hazardous waste *off site*	Must comply with the generator requirements of 40 CFR Sect. 262.20–23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding and Sect. 262.40, 262.41(a) for record keeping requirements and Sect. 262.12 to obtain EPA ID number.	Preparation and initiation of shipment of RCRA hazardous waste off-site – **applicable**	40 CFR § 262.10(h) 15A NCAC 13A .0108
Transportation of hazardous waste *on–site*	The generator manifesting requirements of 40 CFR Sect. 262.20–262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR § 263.30 and § 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right–of–way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way – **applicable**	40 CFR § 262.20(f) 15A NCAC 13A .0108

Table 10. Action-specific ARARs and TBCs
Aberdeen Superfund Site, Aberdeen, Moore County, North Carolina

Action-Specific ARARs			
Action	**Requirements**	**Prerequisite**	**Citation(s)**
Management of samples (i.e. contaminated soils and wastewaters)	Are not subject to any requirements of 40 CFR Parts 261 through 268 or 270 when: • The sample is being transported to a laboratory for the purpose of testing; • The sample is being transported back to the sample collector after testing; and • The sample collector ships samples to a laboratory in compliance with U.S.DOT, U.S. Postal Service, or any other applicable shipping requirements, including packing the sample so that it does not leak, spill or vaporize from its packaging.	Generation of samples of hazardous waste for purpose of conducting testing to determine its characteristics or composition – **applicable**	40 CFR § 261.4(d)(1)(i) and (ii) 15A NCAC 13A .0108 40 CFR § 261.4(d)(2) 15A NCAC 13A .0108

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
CWA = Clean Water Act of 1972
DOT = U.S. Department of Transportation
EPA = U.S. Environmental Protection Agency
NCAC = *North Carolina Administrative Code*
N.C.G.S = North Carolina General Statutes
NPDES = National Pollutant Discharge Elimination System
POTW = Publicly Owned treatment Works
HMR = Hazardous Materials Regulations
HMTA = Hazardous Materials Transportation Act
RCRA = Resource Conservation and Recovery Act of 1976
TBC = to be considered
UTS = Universal Treatment Standard
WWTU = waste water treatment unit

Table 11 summarizes the costs associated with each alternative. Alternative 2 costs $4,695,900 and Alternative 3 costs $822,900. Alternative 3 is the least costly of the two alternatives.

11.3 MODIFYING CRITERIA

State and community acceptance are modifying criteria that shall be considered in selecting the remedial action.

11.3.1 STATE/SUPPORT AGENCY ACCEPTANCE

The State of North Carolina has reviewed and provided EPA with comments on the pertinent RI/FS related reports/documents, on the Remedial Design documents, and all the cost estimates developed by the Town of Aberdeen. NCDENR reviewed the August 2014 Proposed Plan for OU 1 ROD, attended the Proposed Plan public meeting that was held in Aberdeen, North Carolina on August 19, 2014, and reviewed a draft version of this ROD Amendment. The State's concurrence letter for this ROD dated September 30, 2014 can be found in **Appendix C**.

11.3.2 COMMUNITY ACCEPTANCE

The Proposed Plan was distributed to interested residents, to local newspapers and radio and TV stations, and to local, State, and Federal officials the week of August 25, 2014. The Proposed Plan public meeting was held on a Tuesday evening, August 19, 2014. The public comment period on the Proposed Plan began August 19, 2014 and closed on September 18, 2014.

Two sets of written comments were received during the public comment period and no strong contrary opinion was expressed during the Proposed Plan public meeting. Refer to Section 3.0 of the Responsiveness Summary (**Appendix D**).

Neither set of written comments expressed concern about the selected remedy. These comments offered different viewpoints about the distribution of TCE and/or pesticides in the aquifers.

12.0 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat waste 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. The RI did not identify any principal threat wastes associated with this Site. As discussed in Section 5, no continuing source of groundwater contamination has been found. Therefore, there are no principal threat wastes associated with the ACG Site.

13.0 SELECTED REMEDY

The selected action for the adversely impacted TOA supply wells # 5 and #9 is Alternative 3 - Replace the pumping capacity of Town of Aberdeen Supply Wells #5 and #9 with New Supply Well(s).

Table 11 – COST COMPARISON OF ALTERNATIVES

Alternative	Description of Alternative	Capital Cost	O&M Cost	Number Years O&M	Total O & M Outlay	Total Cost over 30 Years
1	No Action (with continued monitoring)	$0	$70,200 every five years	30	$421,200	$421,200
2	Install Wellhead Treatment on Town of Aberdeen Supply Wells #5 and #	$631,100	$245,500 for the first year and $131,700 for years 2 through 30	30	$4,064,800	$4,695,900
3	Replace the pumping capacity of Town of Aberdeen Supply Wells #5 and #9 with New Supply Well(s)	$822,900	$0*	30	$0*	$822,900

Notes:
* - It is assumed that the Town of Aberdeen will take responsibility of paying for all O&M activities as these new supply wells will become a part of their municipal system.

13.1 SUMMARY OF THE RATIONALE FOR THE SELECTED REMEDY

The primary reason for the selection of Alternative 3 over Alternative 2 is with Alternative 3 there are no long-term monitoring costs. Alternative 2 requires frequent monitoring to ensure that activated carbon in the treatment vessels are carefully maintained and regularly changed out when the carbon is spent and the cost to exchange and dispose of the spent carbon. Alternative 3 requires the installation of new supply wells in an area where clean water will be extracted. These wells are expected to be 160-180 feet in depth and will have a total capacity of approximately 320 gpm. The Town of Aberdeen has accepted daily operation and maintenance of these new well(s) as part of operating the Town of Aberdeen municipal water system. In addition, NCDOT, one of the identified PRPs has expressed an interest in implementing Alternative 3 and it is the least costly alternative.

13.2 DESCRIPTION OF THE SELECTED REMEDY

Alternative 3 involves replacing the Town of Aberdeen supply wells #5 and #9 with new supply well(s) (to maintain the capacity of the municipal system prior to the shutdown of well #5). This alternative provides for the installation of new supply well(s) in an area where the quality of the underlying groundwater has not been adversely impacted by past anthropic activities to replace supply wells #5 and #9. This alternative will involve the following activities:

- Mobilization and Site Preparation
- Drill a test well at each location
- Test the test well for water quality and production capacity
- Purchase necessary property and/or easements
- Drill/construction supply well(s)
- Construct well head protection enclosure
- Improve the existing chlorination system at supply well #6 location to handle the additional flow of water from the new well(s)
- Water line extension
- Install the necessary piping, electrical connections, and controls
- Five-Year Reviews

This action (OU 1) will protect public health by providing an alternative source of drinking water. The contaminated groundwater plumes (OU 2) will be addressed by the remedy in the 2012 IROD.

13.3 SUMMARY OF ESTIMATED REMEDY COSTS

The capital cost for the selected remedy (Alternative 3) is $822,900 and there is no annual operation and maintenance (O&M) cost for EPA as the Town of Aberdeen will assume these costs. **Table 12** provides a break of the capital costs. This cost information is based on the best available information regarding the anticipated scope of the remedial alternative. 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 alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference, or a ROD Amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +5 to -30 percent of the actual project cost.

Table 12 – CAPITAL COST ESTIMATE FOR SUPPLY WELL REPLACEMENT

Supply Well	Construction Activity	Construction Cost	Engineering & Design (20% of Construction Costs)	Contingency (15% of Construction Costs)	Capital Costs
TOA #23 (on State Park property)	Power Delivery to Site	$21,000.00		$3,150.00	$24,150.00
	Test Well	$11,000.00	$2,200.00	$1,650.00	$14,850.00
	Testing of Test Well	$2,500.00	$500.00	$375.00	$3,375.00
	Well #23 Construction	$75,000.00	$15,000.00	$11,250.00	$101,250.00
	Testing - Well #23	$8,500.00	$1,700.00	$1,275.00	$11,475.00
	Well #23 (Fiberglass Enclosure Only)	$10,000.00	$2,000.00	$1,500.00	$13,500.00
	Well #6 Building Improvements	$75,000.00	$15,000.00	$11,250.00	$101,250.00
	Treatment	$13,500.00	$2,700.00	$2,025.00	$18,225.00
	Water Main Extension to Well #6	$62,000.00	$12,400.00	$9,300.00	$83,700.00
	SCADA / Telemetry	$5,000.00	$1,000.00	$750.00	$6,750.00
	Electrical Improvements	$12,500.00	$2,500.00	$1,875.00	$16,875.00
	Sub-Total Well #23				**$395,400.00**
TOA #25 (off State Park property)	Power Delivery to Site	$30,000.00		$4,500.00	$34,500.00
	Test Well	$11,000.00	$2,200.00	$1,650.00	$14,850.00
	Testing of Test Well	$2,500.00	$500.00	$375.00	$3,375.00
	Well #24 Construction	$75,000.00	$15,000.00	$11,250.00	$101,250.00
	Testing - Well #24	$8,500.00	$1,700.00	$1,275.00	$11,475.00
	Pump House	$88,000.00	$17,600.00	$13,200.00	$118,800.00
	Treatment	$13,500.00	$2,700.00	$2,025.00	$18,225.00
	SCADA / Telemetry	$5,000.00	$1,000.00	$750.00	$6,750.00
	Electrical Improvements	$13,500.00	$2,700.00	$2,025.00	$18,225.00
	Sub-Total Well #25				**$327,450.00**
	TOTAL BOTH WELLS (#23 & #25)	***$522,000.00***	***$98,400.00***	***$78,300.00***	***$722,850.00***
Estimated costs to purchase and/or lease necessary property					**$100,000.00**
TOTAL CAPITAL COSTS					**$822,850.00**

Power delivery will be by Duke-Progress Energy and estimate provided has not been verified.
Tentative site for Well #24 must be investigated to insure no impacts from previous residential use (septic, underground tanks, etc.).

13.4 EXPECTED OUTCOMES OF THE SELECTED REMEDY

The new supply well(s) will restore the distribution capacity of the Town of Aberdeen municipal drinking water system back to the level maintained prior to the shutdown of supply well #5. This remedial action will not significantly reduce the toxicity, mobility, or volume of TCE in the plumes associated with the ACG Site.

13.4.1 AVAILABLE LAND USE AFTER CLEANUP

The goal of the selected remedy is to ensure a sufficient quantity and quality of drinking water for the Town of Aberdeen. This ROD, planned to be final, only addresses the risks posed by the contaminated TOA supply wells #5 and #9.

13.4.2 ANTICIPATED ENVIRONMENTAL AND ECOLOGICAL BENEFITS

Since this Site is not located in a sensitive ecological environment, nor has this Site impacted the any ecological environment, therefore, no environmental or ecological benefits are anticipated from this action.

14.0 STATUTORY DETERMINATIONS

14.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

This action will be protective of human health and the environment from the identified exposure pathways in the short term. The ARARs identified in **Tables 10** and **11** focus on the implementation of the OU 1 remedy which is to help ensure the Town of Aberdeen can provide adequate, safe potable water.

14.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The Federal and State ARARs, potential ARARs, and requirements which are To Be Considered, that are relevant to the Site and the Selected Remedy are presented in **Tables 10** and **11**. The selected remedy will comply with all ARARs in these tables that are listed as either "Applicable" or "Relevant and Appropriate".

14.3 COST EFFECTIVENESS

This section explains how the selected action meets the statutory requirement that all Superfund remedies be cost-effective. A cost-effective remedy in the Superfund program is one whose "costs are proportional to its overall effectiveness" (NCP §300.430(f)(1)(ii)(D)). The "overall effectiveness" is determined by evaluating the following three of the five balancing criteria used in the detailed analysis of alternatives: (1) Long-term effectiveness and permanence; (2) Reduction in toxicity, mobility, and volume; and (3) Short-term effectiveness. "Overall effectiveness is then compared to cost" to determine whether a remedy is cost-effective (NCP §300.430(f)(1)(ii)(D)).

For determination of cost-effectiveness, a cost effectiveness matrix was utilized. In the matrix, the alternatives were listed in order of increasing costs. For each alternative, information was presented on long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, and short-term effectiveness. The information in those three categories was compared to the prior alternative listed and evaluated as to whether it was more effective, less effective or of equal effectiveness. The selected remedy is considered cost effective because this remedy will achieve RAOs upon being connected to the existing distribution system and is a permanent solution that reduces human health risks to acceptable levels at less expense than Alternative 2. Refer to **Table 13**.

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

The selected remedy provides a permanent solution by providing clean potable water to the Town of Aberdeen. As discussed above, this remedy does not address the contaminants in the UBC and LBC aquifers.

14.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

As stated earlier, this action does not meet the statutory preference for treatment as a principal element. The goal of this ROD is to supply the Town of Aberdeen with sufficient clean potable water. The remediation of the groundwater contaminated plumes will occur under the OU 2 with the remedy selected in the 2012 IROD.

14.6 FIVE-YEAR REQUIREMENTS

A review (in accordance with 40 CFR 300.430(f)(4)(ii)) is required at a minimum every five years if a remedy is selected that results in hazardous substances, pollutants, or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure. Because the selected action will not achieve levels that allow for unlimited use and unrestricted exposure within five years, EPA will conduct five-year reviews in accordance with EPA policy until unlimited use and unrestricted exposure is achieved. Reviews will begin five years after the remedy is completed.

15.0 DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

There were no significant changes from the Proposed Plan to this Decision Document. However, the Proposed Plan incorrectly identified this action as a new and stand-alone action and not as an amendment to the IROD signed in 2012.

Table 13 Cost Effectiveness Matrix – Relevant Considerations for Cost Effectiveness Determination					
Alternative	Cost Effective?	Present Worth Cost	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, and Volume Through Treatment	Short-Term Effectiveness
1 – No Action (with continued monitoring)	No[1]	$421,200	No reduction in Long-Term risk	No reduction on Toxicity, Mobility, and Volume	Continued Risk to Community and Environment
2 – Install Wellhead Treatment on Town of Aberdeen Supply Wells #5 and #9	Yes	$616,900	Achieves RAOs with the completion of construction and the wellhead treatment systems put online; however, long monitoring of the treatment system and disposal of spent carbon is required	Will achieve some reduction in Toxicity, Mobility, and Volume at the fringe of the TCE plumes	Controllable Risk to Workers, Reduces Other Risks
3 – Replace the pumping capacity of Town of Aberdeen Supply Wells #5 and #9 with New Supply Well(s)	Yes	$882,900	Achieves RAOs when the supply wells are connected to the municipal distribution system, O&M to be supplied by the Town of Aberdeen	Will not achieve any reduction in Toxicity, Mobility, and Volume of the TCE plumes	Controllable Risk to Workers, Reduces Other Risks
Notes: 1 -- These alternatives do not reduce risks to either human health or the environment and therefore are not considered cost effective					

APPENDIX A

August 2014 Proposed Plan

PROPOSED PLAN for OPERABLE UNIT 1
ABERDEEN CONTAMINATED GROUNDWATER SITE
ABERDEEN, MOORE COUNTY, NORTH CAROLINA
AUGUST 2014

This Proposed Plan is not to be considered a technical document but has been prepared to provide an abridged summary to the public.

You are Invited to Comment on this Proposed Cleanup for the Aberdeen Contaminated Groundwater Site, Aberdeen, NC

This Proposed Plan identifies the Preferred Alternative for Operable Unit 1 (OU 1) for the Aberdeen Contaminated Groundwater Site (the Site). OU 1 addresses the adverse impact resulting from Site related contamination on the Town of Aberdeen (TOA) public water supply wells #5 and #9 and provides the rationale for this preference. The Preferred Alternative is #3 - Replace TOA supply wells #5 and #9 with a new supply well(s) that will maintain current drinking water capacity. In addition, this Plan includes summaries of other cleanup alternatives evaluated to address the impacted supply wells. This document is issued by the U.S. Environmental Protection Agency (EPA), the lead agency for Site activities, and the North Carolina Department of Environment and Natural Resources (NCDENR), the support agency. EPA, in consultation with the NCDENR, will select a final remedy for the water supply wells after reviewing and considering all information submitted during the 30-day public comment period. In the future, EPA will evaluate what other responses that may be needed for other parts of the Site including addressing the groundwater contamination that is impacting the TOA supply wells #5 ad #9. EPA, in consultation with the NCDENR, may modify this Preferred Alternative or select another alternative presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan.

EPA is issuing this Proposed Plan as part of its public participation responsibilities under the Superfund law (*Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA)), Section 117(c) and Section 300.435(f)(2) of the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP). This Proposed Plan summarizes and identifies key information that can be found in greater detail in the Remedial Investigation (RI) and Feasibility Study (FS) documents, the Remedial Designs associated with the March 2012 Interim Record of Decision (ROD), and other documents contained in the Administrative Record file for this Site. The Administrative Record and Information Repository can be found in the Page Memorial Library at 100 South Poplar Street in Aberdeen, North Carolina and in EPA's, Region IV Information Center at 61 Forsyth Street, Sam Nunn Atlanta Federal Center, Atlanta, Georgia.

Tell Us What You Think

Public Comment Period	Attend the Public Meeting	Locations of Administrative Record and Information Repository
August 19 through September 18, 2014 EPA will accept written comments on this Proposed Plan during the public comment period. You may submit written comments three (3) ways: **BY MAIL** Jon Bornholm U.S. EPA - Region 4 61 Forsyth Street, SW Atlanta, Georgia 30303-3104 **BY EMAIL** bornholm.jon@epa.gov **BY FACSIMILE** 404-562-8788 Addressed to Jon Bornholm	You are invited to attend a public meeting sponsored by EPA to hear about this Proposed Plan. At the meeting you will be able to voice your views about the cleanup. The meeting will be held: Tuesday, August 19, 2014 from 6:30 – 8:30 p.m. Location: Aberdeen Town Hall 115 North Poplar St. Aberdeen, NC	Page Memorial Library 100 South Poplar Street Aberdeen, NC 28315 Phone: 910-944-1200 **Hours:** Mon – Fri, 2:00 – 6:00 p.m. and EPA, Region 4's Information Center 61 Forsyth Street Sam Nunn Atlanta Federal Center Atlanta, Georgia 30303 404-562-8946 Hours: Mon – Fri, 8:00 a.m. – 5:00 p.m.

EPA and NCDENR encourage the public to review these documents to gain a more comprehensive understanding of the Site and Superfund activities that have been conducted at the Site. These two agencies want to hear your views about this Proposed Plan and all the alternatives presented. You can comment on the Proposed Plan for OU 1 at the 6:30 p.m. public meeting on Tuesday, August 19, 2014, at the Aberdeen Town Hall located at 115 North Poplar Street in Aberdeen, North Carolina. Comments can also be submitted through the mail, via facsimile, or email (refer to the box at the bottom of the first page for additional information).

This Proposed Plan presents the preferred remedial action alternative for the final Record of Decision (ROD) for OU 1:

- Replace TOA supply wells #5 and #9 with new supply well(s) (maintain current capacity). The new well(s) will be installed in an area of town where the quality of the underlying groundwater has not been adversely impacted by anthropic activities.

You are encouraged to comment during the public comment period. You have until Friday, September 18, 2014 to submit written comments on the Proposed Plan for OU 1 or other material in the Administrative Record file. At the end of the comment period, EPA and NCDENR will review the comments/suggestions and make a final decision about the Site cleanup. Your input on this Proposed Plan is an important part of the decision-making process. We want to hear from you and will consider your comments in making the final decision.

INTRODUCTION

This Proposed Plan provides:

- a brief description and history of the Site;
- a summary of the nature and extent of contamination;
- a summary of the Baseline Risk Assessment;
- summary of cleanup technologies considered and evaluated in order
- a list of cleanup levels for the chemicals of concern;
- the Agency's preferred alternative for OU 1;
- encouragement to the public to submit comments on the proposed cleanup alternative; and
- a list of contacts and locations for more information.

SITE HISTORY/SITE CHARACTERISTICS

The Site is located along NC Highway 211, approximately 1½ miles east of US Highway 1 in Aberdeen, Moore County, North Carolina. **Figure 1** is the Site Location Map. Land use in the area of the Site is a mixture of industrial, commercial, and residential. The Site was proposed for the National Priority List (NPL) in the Federal Register (Vol. 73, No. 54, March 2008) and finalized on the NPL via the Federal Register (Vol. 73, No. 171, September 2008). EPA's identification number for the Site is NCN 000 407 447.

The Site was listed on the NPL as a ground water contaminated plume Site with no identified source. The plume was identified during the investigations of the following sites and facilities in the area: the Geigy Chemical Corporation Superfund Site (Geigy Site), the Crestline Contaminated Well Emergency Response Site (formerly known as the Route 211 Contaminated Well Site), the former Lee Paving Company property, and the former Powder Metal Products (PMP) facility. The study area, identified by the red dash line on **Figure 1**, is approximately 6,400 feet by 5,600 feet or 1.3 square miles.

In 1990, during the investigation of groundwater contamination at the Geigy Site (refer to **Figure 1**), trichloroethylene (TCE) was detected in two deep groundwater monitoring wells (MWs), a residential well along Highway 211, and a supply well at the PMP facility. TCE is a colorless liquid which is used as a solvent for cleaning metal parts. These types of compounds are typically referred to as volatile organic compounds (VOCs). In 1998, EPA determined that the Geigy Site was not the source of TCE being detected in the groundwater and that the TCE originates from somewhere else and is migrating towards the Geigy Site.

In May 1990, EPA initiated an emergency response action at the "Route 211 Contaminated Well Site". This response included connecting up to 10 private residences/businesses to the TOA municipal water system due to lead and TCE being present in the groundwater in this area. In 1991, this emergency response was expanded to include up to 40 residences/businesses. This Site later became known as the "Crestline Contaminated Well Site".

Another nearby area of environmental concern was the former Lee Paving Company property which is located southwest of the former PMP property (refer to **Figure 1**). The former Lee Paving Company property lies entirely within the study area of the Aberdeen Contaminated Groundwater Site. The Lee Paving Company manufactured asphalt on this property. Currently, the Sandhills Recycling Center is located and operating in the northeast corner of the former Lee Paving Site. The Sandhills Recycling Center buys and sells recyclable metals.

From 1964 until 1989, the North Carolina Department of Transportation (NCDOT) operated an aggregate testing

laboratory on the Lee Paving Company property. Since 1989, this property has been used for the storage and handling of recyclable wastes. In 1992, NCDOT and North Carolina Department of Environment, Health, and Natural Resources began assessments of asphaltic materials testing sites in the State. From 1994 to 1996, a NCDOT contractor conducted a comprehensive site assessment of the geology and hydrogeology of the Lee Paving property. This study found TCE, 1,1,1-trichloroethane (TCA), carbon tetrachloride, and their degradation products in the groundwater beneath and downgradient of this property. Samples collected in 1994 and 1995 documented a plume of TCE and TCA originating in the southern portion of the Lee Paving property and migrating west in the surficial aquifer. Three MWs located on the northern portion of the Lee Paving property showed contamination by TCE only. Two surficial aquifer MWs north of the documented plume were not contaminated. Therefore, this study concluded that the TCE found in the MWs in the northern portion of the Lee Paving property is from an off-site source and distinct and separate from the documented plume on the Lee Paving property.

The PMP property is upgradient from Lee Paving and became the focus as a potential source of TCE in groundwater. The PMP property is a 26.8 acre parcel with one metal building on it. The building is 200 feet by 150 feet on a concrete slab. A 6-foot chain linked security fence encompasses the building along with approximately 3.8 acres. PMP owned and operated the facility and made precision machine parts from approximately 1980 until 1995. A part of their process reportedly included a solvent dip bath containing TCE. In 1995, PMP sold the property to Diamond Exhaust & Equipment which operated the facility as a wholesale automotive exhaust parts distribution center. It is not known whether Diamond Exhaust & Equipment utilized any chemicals or solvents. This property was recently sold to Calco Enterprises which is a small company based out of Southern Pines, North Carolina. Calco Enterprises provides mechanical services (with a specialty in pre-insulated underground piping), process piping services, miscellaneous steel welding, and erection. The following entities have been identified as potentially responsible parties (PRPs) for the Site: Calco Enterprises; Lee Paving Company; Powder Metal Products, Inc.; NCDOT; and the PRPs associated with the Geigy Chemical Corporation Superfund Site.

A RI is an in-depth study designed to gather data needed to determine the nature and extent of contamination at a Superfund site; support the Baseline Risk Assessment; establish site cleanup criteria; identify preliminary alternatives for remedial action; and support technical and cost analyses of alternatives in the FS.

The Town of Aberdeen is located in the Sandhills region of the southwestern Coastal Plain Province of North Carolina which is characterized by rolling hills and deep sand and sandy soils. The hydrogeologic framework within the study area consists of five distinct hydrogeologic units. These include from top (the surface) to bottom, the surficial aquifer, the Upper Black Creek (UBC) aquifer, the Lower Black Creek (LBC) aquifer, the Upper Cape Fear aquifer, and the saprolite-bedrock aquifer. To date, groundwater contamination has only been observed in the upper three aquifers. Each aquifer is separated from the overlying aquifer by a non-continuous semi-confining unit. Each semi-confining unit is informally named for the aquifer it overlies. Refer to **Figure 2** for a generalized cross-section of the geology under the Site. It has been shown that the confining unit between the surficial aquifer and the UBC aquifer and the semi-confining unit between the UBC aquifer and the LBC aquifer are not continuous. Therefore, groundwater along with contaminants can migrate from the surface down to the LBC aquifer. The classification of an aquifer in North Carolina is based on the concentration of chloride in the aquifer. Aquifers that contain less than 250 milligrams per liter of chloride are Class GA aquifers. This class of aquifer is either an existing or potential source of potable water. The five aquifers listed above are classified as Class GA aquifers.

In 2012, TOA was directed by the State to shut down supply well #5 due to the elevated levels of TCE being detected in the well. In March 2012, EPA issued an Interim ROD and completed the Remedial Designs for the two components required by the Interim ROD in December 2012 and September 2013. The two components are:

- install and operate a groundwater extraction and treatment system for the plume at large and
- install wellhead treatment at municipal supply wells #5 and #9.

However, EPA did not implement either design. In a November 2013 meeting with the State of North Carolina, EPA was informed that the State was no longer in favor a pump and treat system to address the plume at large and that installing a new supply well(s) in an area not impacted by past anthropic activities, would eliminate the costs associated with the long-term operation and maintenance of the wellhead treatment systems. In February 2014, EPA began to evaluate splitting the Site into two Operable Units with the first OU addressing the impacted supply wells for the Town of Aberdeen and the second OU addressing the groundwater contamination in the aquifers.

REMEDIAL INVESTIGATION

SOILS

Soil sampling was not able to confirm a TCE source on the former PMP property and no dip-bath vat was found on the property. A potential source identified at the PMP property was a concrete underground storage tank (UST), assumed to be the septic tank for the property, found directly west of the building, which contained 4,200 micrograms per liter (µg/L) of cis-1,2-DCE. TCE can degrade to cis-1,2-DCE. This UST was pumped out by an EPA Emergency Response Team in 2009.

GROUNDWATER

The RI focused on three aquifers: the surficial, the UBC, and the LBC. However, for this Proposed Plan, **Table 1** only shows the analytical results for TCE in TOA supply wells #5, #8, and #9.

Concentrations of contaminants in the groundwater were compared to the following two groundwater standards:

- Maximum Contaminant Level (MCL) established under the EPA Safe Drinking Water Act (SDWA) which can be viewed at the following website: http://water.epa.gov/drink/contaminants/index.cfm and
- North Carolina Groundwater Classifications and Standards, North Carolina Administrative Code (NCAC) Title 15A Subchapter 2L which can be viewed at the following website: http://portal.ncdenr.org/web/wq/ps/csu/gwstandards. The MCL for TCE is 5 µg/L and the NC 2L Standard for TCE is 3 µg/L.

Water level measurements were made along with collecting groundwater samples. **Figure 3** depicts potentiometric surface of the UBC aquifer which shows that groundwater is flowing in a southwesterly to westerly direction. The only VOCs detected above the applicable groundwater standards were TCE and chloromethane. TCE was the compound detected most frequently and was detected in 27 of 32 wells with a mean concentration of 63 µg/L and a maximum concentration of 430 µg/L. **Figure 4** delineates the extent of TCE contamination in the UBC aquifer. As can be seen in this figure, the TCE plume in the UBC aquifer encompasses TOA #5 and covers approximately 284 acres. **Figure 5** depicts potentiometric surface of the LBC aquifer which shows that groundwater is flowing in a westerly to south westerly direction. **Figure 6** delineates the extent of TCE contamination in the UBC aquifer. TCE was detected in 8 of 15 wells in the LBC aquifer with a mean concentration of 18.5 µg/L and a maximum concentration of 62 µg/L. As can be seen in this figure, the TCE plume in the LBC aquifer encompasses TOA #9 and covers approximately 220 acres. TCE was detected in TOA municipal supply well #5 in excess of the MCL and in municipal supply well #9 at a concentration slightly below the MCL.

Table 1 – Concentration of TCE Being Detected in Town of Aberdeen Supply Wells #5, #8, and #9 (All concentrations in micrograms per liter (µg/L).

Supply Well	Sampling Year																	
	1993	1994	1995	1996	1997	1998	1999	20002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
TOA #5	3	3.61	4.1	3.6	2.7	3.6	3.2	3.1	2.4	7.3	7.9	6.6	6.4	7	7.8	11	8.1	NA
TOA #8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5U 0.5U	0.5U	0.5U	NA	0.5U
TOA #9	NA	NA	NA	NA	NA	1.6	1.8	3.5	1.1	2.7	2.3	2.4	<0.5	4.3	3.7	3.7	3	NA

NA – No data available.
MCL for TCE is 5 µg/L
NC 2L standard for TCE is 3 µg/L
Yellow shading indicates detected concentration of TCE above the NC 2L standard of 3 µg/L.
Red shading indicates detected concentration of TCE above the MCL of 5 µg/L.

EPA has not named the PMP facility as the sole source of the TCE contamination associated with the Site; this facility is likely a contributor of the TCE being detected in the groundwater downgradient of this facility. The distribution of VOCs in the groundwater may also be influenced by the groundwater extraction occurring at the Geigy Chemical Superfund site and the TOA supply wells in the area.

SUMMARY OF SITE RISKS

As part of the RI, a baseline human health risk assessment (HHRA) and ecological risk assessment (ERA) were prepared for the Site. These risk assessments evaluated risks to human and ecological populations that may be exposed to chemicals present in soils, sediment, surface water and groundwater at the Site under current and future conditions. These risk assessments provide the basis for taking action and identify the contaminants and exposure pathways that should be addressed by the preferred remedial alternative.

Human Health Risk Assessment (HHRA)

The purposes of the HHRA are to evaluate the contaminants of potential concern (COPCs) in the groundwater plume associated with the Site and determine which COPCs are contaminants of concern (COCs) that could result in unacceptable risks to humans consuming or coming into contact with the groundwater.

To recap, there are four sites that may have been contributors to the groundwater contamination detected in the plume. These four sites include the former PMP facility, the former Lee Paving Site, the Geigy Chemical Superfund Site, and the Crestline Well Site. These potential sources may have contributed VOCs, including TCE, and/or pesticides to the groundwater.

Following a screening level risk evaluation conducted for the surficial aquifer, Site related contaminants were not evaluated for human health risks in the surficial groundwater due to either low concentration levels (i.e., less than the risk-based screening criteria, less than the MCL) or non-detects. Risks due to ingestion or inhalation in connection with potable water use (e.g., during showering) are unlikely given the lack of groundwater use as a potable water source due to very low yields from this groundwater zone. The levels detected in the surficial aquifer were also too low for soil vapor intrusion to be a concern.

The following risk scenarios were evaluated as part of the HHRA. Under current conditions: exposure to contaminated groundwater through ingestion, dermal contact to groundwater, and inhalation via potable use of groundwater. The above scenarios were evaluated for both children and adults. The same exposure pathways and receptors were also evaluated in the HHRA for future conditions. The soil vapor intrusion scenario was not evaluated as an exposure pathway scenario due to the very low concentrations of TCE in the surficial aquifer.

Upper Black Creek Aquifer

Seven monitoring wells resulted in total cancer risks greater than EPA's acceptable cancer risk of 1×10^{-4}. The total cancer risks in these wells were dominated by pesticides. TCE was a risk contributor at some wells but the total cancer risks from TCE did not exceed the EPA cancer risk range (1×10^{-4} to 1×10^{-6}) in any individual well. The risks (cancer and noncancer) on a well by well basis are summarized below:

- Maximum total cancer risk: 8.5×10^{-4} at well GEIMW30D. Three pesticides had a total cancer risk greater than 1×10^{-4} [dieldrin, toxaphene, and beta-benzene hexachloride (BHC)] at this well.
- Other wells with a total cancer risk greater than 1×10^{-4} included: ACGWM12 due to presence of alpha-BHC; ACGMW13 due to presence of alpha-BHC; GEIMW11D due to presence of beta-BHC, dieldrin, and toxaphene; GEIMW18D due to presence of beta-BHC; GEIMW23D due to presence of TCE, and GEIMW24D due to presence of alpha-BHC.
- Maximum TCE cancer risk: 9.8×10^{-5} at well GEIMW23D.
- The ingestion pathway resulted in the highest risk in all cases.

Lower Black Creek Aquifer

The risks (cancer and noncancer) are summarized below. Four monitoring wells resulted in total cancer risks greater than EPA's cancer risk range. The total cancer risks in three of these wells were dominated by pesticides. Arsenic was the primary risk driver at one of these wells. TCE was a risk contributor at some wells but the total cancer risks solely from the presence of TCE did not exceed the EPA cancer risk range. The risks (cancer and noncancer) on a well by well basis are summarized below:

- Maximum cancer risk: 6.0×10^{-4} at well ACGMW17. Alpha-BHC, gamma-BHC, and beta-BHC were the risk drivers.
- Other wells with a total cancer risk greater than 1×10^{-4} included: ACGMW17 due to presence of alpha-BHC; ACGMW20 due to presence of arsenic; GEIMW25L due to presence of alpha-BHC; and GEIMW27L due to presence of alpha-BHC and beta-BHC.
- Maximum TCE cancer risk: 8.7×10^{-6} at well GEIGS02-4.
- The ingestion pathway resulted in the highest risk in all cases.

In general, the cancer risk calculated in this HHRA was dominated by pesticides, which are attributable to the nearby Geigy Superfund Site. All of the wells with elevated

risks from pesticides are located downgradient of the Geigy Superfund Site. Those contaminants are being addressed by the remedy selected for the Geigy Chemical Superfund Site.

And as stated earlier, TOA had to shut down supply well #5 due to concentrations of TCE being detected in this well exceeding the MCL of 5 µg/L. Elevated concentrations of TCE are also being detected in supply well #9 and there is a possibility that some time in the future the concentration of TCE in this supply well will also exceed the MCL for TCE. The combine yield of these two supply wells is approximately 320 gallons per minute. **Table 2** presents the cancer and noncancer risks associated with the contaminants that have been detected in TOA supply wells #5 and #9.

Ecological Risk Assessment (ERA)

A preliminary ecological risk screening was conducted for surface water near the Site. Due to the ephemeral nature of flow in the nearest streams, there is not an established aquatic community present. In addition, no VOCs were detected above the screening criteria. Therefore, the results of this ecological screening evaluation indicate that further ecological evaluation is not warranted.

Table 2 – Well by Well Calculation of Cancer Risks and Noncancer Hazard Quotients and Hazard Indices

Exposure Point	Contaminant	EPC (µg/L)	Cancer Risks – Age Adjusted				Hazard Quotients – Child Resident				Hazard Quotients – Adult Resident			
			Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
TOA #5	TCE	3.6	7.1E-07	1.2E-07	6.3E-07	8.2E-07	—	—	—	—	—	—	—	—
		Total	7.1E-07	1.2E-07	6.3E-07	8.2E-07	—	—	—	—	—	—	—	—
TOA #9	TCE	3.05	6.0E-07	9.8E-08	5.4E-11	7.0E-07	—	—	—	—	—	—	—	—
	alpha-BHC	0.087	8.3E-06	6.5E-06	Not volatile	1.5E-05	0.0007	0.001	Not volatile	0.001	0.0003	0.0002	Not volatile	0.0005
	beta-BHC	0.044	1.2E-06	9.3E-07	Not volatile	2.1E-06	—	—	Not volatile				Not volatile	
	gamma-BHC	0.096	1.6E-06	1.2E-06	Not volatile	2.8E-06	0.02	0.02	Not volatile	0.04	0.0088	0.01	Not volatile	0.02
		Total	1.2E-05	8.7E-06	5.4E-11	2.0E-05	0.021	0.02	—	0.04	0.0091	0.01	—	0.02

Notes:
EPC - exposure point concentrations
TOA – Town of Aberdeen
TCE – Trichloroethene
BHC - benzene hexachloride, a pesticide
µg/L – microgram per liter

Contaminants of Concern

The COCs determined from the results of the HHRA were identified based on EPA's guidance. COCs are the COPCs that significantly contribute to an exposure pathway that either exceeds a 1×10^{-4} cumulative site cancer risk or exceeds a noncancer HI of 1. Pesticides were not included as they can be conclusively shown to be associated with the Geigy Superfund Site, and as such, are currently being addressed under the ongoing Geigy Site Remedial Action. Another method to identify COCs is to compare COPC concentrations to applicable groundwater standards (MCLs or NC groundwater standard). If the COPC concentration exceeds the MCL or NC groundwater standard, the COPC is identified as a COC. Based on the results of this HHRA and Applicable and Relevant and Appropriate Requirement (ARAR) comparison, the COCs in the Upper and Lower Black Creek aquifers are summarized in the **Table 3** below.

Historically, most of the residential and TOA supply wells in the study area are screened in the Upper and Lower Black Creek aquifers. Currently, residents in this area obtain potable water from the TOA municipal water supply system. To the best of the Agency's knowledge, existing private wells in this area are only used for the irrigation purposes.

Table 3 – CONTAMINANTS OF CONCERN

COC	Aquifer	Basis
TCE	UBC/ LBC	Significant contributor to 1×10^{-4} cumulative cancer risk; Exceeds MCL and NC 2L
Chloromethane	UBC	Exceeds NC 2L

TCE – trichloroethene
MCL – maximum contaminant level
NC 2L – North Carolina groundwater standard

SCOPE AND ROLE OF OPERABLE UNIT

The 2012 Interim ROD dealt with the cleanup for this Site under one OU. However, in 2014, the Agency in

consultation with NCDENR, decided to divide the Site into two OUs. OU 1 will address TOA public supply wells #5 and #9 (refer to **Figure 5** for the location of these two wells, identified as TOA #5 and TOA #9). The forthcoming OU 2 will address the groundwater contamination in all aquifers.

REMEDIAL ACTION OBJECTIVES

This is the final ROD for OU 1. The Remedial Action Objectives (RAOs) developed for OU 1 are as follows:

1. Prevent ingestion or direct contact with groundwater containing constituents, which pose a human health carcinogenic risk greater than 1×10^{-4} or have a Hazard Index greater than 1.0 for non-carcinogens.

2. To replace the drinking water capacity supplied by TOA supply wells #5 and #9 with clean and suitable water supplied from a new well(s).

SUMMARY OF REMEDIAL ALTERNATIVES

As described previously, no soil contamination and no adverse ecological impacts were identified; therefore, the FS focused on remediating the groundwater. The risks associated with the groundwater contamination will be addressed by this action for OU 1 and a future action for OU 2. The following three (3) remedial groundwater remediation alternatives were developed for addressing TOA supply wells #5 and #9:

ALTERNATIVE	REMEDIATION ALTERNATIVE
Alternative 1	No Action with continued monitoring
Alternative 2	Wellhead treatment for TOA supply wells #5 and #9 and continued monitoring
Alternative 3	Replace TOA supply wells #5 and #9 with a new supply well(s) (maintain current capacity) and continued monitoring

Alternative 1: No Action with Continued Monitoring

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $70,200
Estimated Total O&M Cost Over 30 Years: $2,106,200
Estimated Total Cost: $2,176,400
Estimated Construction Timeframe: None
Estimated Time to Achieve RAOs: Would not be achieved.
Alternative 1 would not involve any active or passive remedial actions, and the site would remain in its present condition. This alternative, required by the NCP and CERCLA, is a baseline alternative against which the effectiveness of the other alternatives can be compared. Under the no action alternative, the TOA supply wells are left "as is" and no funds would be expended to further address the impacts on the TOA supply wells. However, within the no action alternative continued monitoring of groundwater would be conducted. Monitoring would be conducted in the Upper and Lower Black Creek aquifers and TOA supply wells #5 and #9. Samples would be analyzed for VOCs, organochlorine pesticides, and metals. Since site-related contaminants would remain in place, CERCLA requires Five-Year Reviews to ensure that the overall human health and the environment are protected. Each Five-Year Review would consist, at a minimum, of a site visit, review of existing documents and monitoring data, interviews, and report preparation.

MWs would be monitored on the following frequency:

- Quarterly for years 1 and 2
- Semi-annually for years 3 and 4
- Annually for years 5 through 7
- Based on recommendations from the first Five-Year Review, adjust the number of MWs being sampled and/or adjust the frequency of sampling as well as the type of analyses
- Based on recommendations from the second Five-Year Review, adjust both the number and frequency of sampling until the next Five-Year review.

Continued adjustment of the number of wells to be sampled and/or frequency of sampling will be based on each subsequent Five-Year Review.

Preparing Five-Year Reviews will continue until there is unlimited use and unrestricted exposure associated with the groundwater.

No capital costs would be associated with this alternative because no remedial actions would be conducted. There are O&M costs associated with the continued monitoring and the five-year reviews to be performed at the site. It is assumed that a site visit would be conducted every 5 years, and a summary report would be prepared to document the findings of the site visit. The average annual O&M costs associated with Alternative 1 are estimated to be $70,205. The life of the No Action alternative is assumed to be 30 years; therefore, the present worth cost over 30 years assuming a 7 percent discount rate, would be $276,700.

Alternative 2: Install Wellhead Treatment on Town of Aberdeen Supply Wells #5 and #9

Estimated Capital Cost: $631,100
Estimated Annual O&M Costs for First Year: $245,500

Estimated Annual Costs for Years 2-30: $131,700
Estimated Total O&M Cost Over 30 Years: $4,064,800
Estimate Total Cost: $4,695,900
Estimated Construction Timeframe: 9-12 months
Estimated Time to Achieve RAOs: Upon completion of construction

Alternative 2 (wellhead treatment for TOA supply wells #5 and #9) involves the following activities:

- Mobilization and Site Preparation
- Upgrade/construct new building additions
- Addition of carbon adsorption units to supply wells #5 and #9
- Operation and Maintenance (O&M) of the carbon adsorption vessels, and
- Sampling and analysis of carbon adsorption performance
- Transportation and disposal of spent carbon
- Five-Year Reviews

Wellhead treatment would be accomplished by diverting the pumped well water initially into vessels containing granular activated carbon for removing any contamination present. The water would then be redirected back into the existing header where other chemical addition is already being performed. Since the flow rate for supply well #5 is higher than supply well #9 and the concentration of TCE is also higher, the estimated activated carbon requirement is higher for supply well #5 than for supply well #9. One carbon adsorber would require exchange once per year for each well. For supply well #5, it is estimated that two vessels each containing 5,000 pounds of activated carbon will be needed. The supply well #9 municipal well would utilize two vessels each containing 1,500 pounds of activated carbon. These vessels will be operated in series to allow bypassing of either vessel to provide opportunity of activated carbon removal and replacement without stopping pumping of groundwater. The carbon vessel will be housed in a newly erected building adjacent to each existing pump house. This building will be designed to protect the equipment against tampering and weather. Wellhead treatment will be terminated when the levels of contaminants are consistently below the performance standards that will be specified in the OU 1 Record of Decision.

The key chemical-specific ARARs associated with this alternative include: classification of contaminated groundwater which comes from North Carolina Administrative Code (NCAC) Title 15A Subchapter 2L - Groundwater Classifications and Standards and the Safe Drinking Water Act National Revised Primary Drinking Water Regulations: MCLs for organic contaminants specified in 40 CFR 141.61(a). Significant potential action-specific ARARs will focus on the characterization of hazardous waste (spent carbon) and the transportation and disposal of the spent carbon.

Once the well-head treatment systems are installed, the RAOs would be achieved.

It is not feasible to calculate the time estimate to achieve cleanup as OU 1 does not address the plume at large. The focus of OU 1 is to ensure the Town of Aberdeen has a safe and adequate water supply system.

Since the site-related contaminants would remain in place, CERCLA requires Five-Year Reviews to ensure that the overall human health and the environment are protected. Each Five-Year Review would, at a minimum, consist of a Site visit, review of existing documents and monitoring data, interviews, and report preparation. Five-Year Review for this alternative would be the same as described in Alternative 1.

The capital costs include both direct and indirect capital costs. The direct capital costs include replacing/upgrading pump building; carbon adsorption units; installing piping and electrical systems; O&M for the carbon adsorption vessels; and sampling and analyses. The total capital cost for Alternative 2 is estimated to be approximately $631,100 which includes the costs for modifying the existing buildings at each well location.

The O&M costs associated with implementing Alternative 2 include the cost of the exchange of the GAC and sampling and analysis of carbon adsorption performance, and 5-year reviews. The O&M costs were developed for 30 years. The annual O&M costs for wellhead treatment include the following activities/items: maintaining wellhead treatment building, changing out spent activated carbon, monitoring the use of the activated carbon, conducting five-year reviews, and a 15% contingency. The total O&M outlay for 30 years is estimated to be $4,064,800. The Total Cost is $4,695,900.

Alternative 3: Replace the Town of Aberdeen Supply Wells #5 and #9 with New Supply Well(s) (maintain current capacity)

Estimated Capital Cost: $822,900
Estimated Annual O&M Cost: $0
Estimated Total O&M Cost Over 30 Years: $0
Estimated Construction Timeframe: 6 months
Estimated Time to Achieve RAOs: Upon completion of

construction

Alternative 3 [installation of new supply well(s) in an area where the quality of the underlying groundwater has not been adversely impacted by past industrial activities to replace supply wells #5 and #9 (maintaining the current pumping capacity)] involves the following activities:

- Mobilization and Site Preparation
- Drilling a test well at each location
- Testing of test well
- Drilling/construction of supply well(s)
- Construct well head protection enclosure
- Improvements to well #6 building/treatment to handle the additional flow of water from the new well(s)
- Water line extension
- Supervisory **control and data acquisition** (SCADA) system/telemetry equipment
- Electrical improvements
- Purchase of property and/or easements
- Five-Year Reviews

Figure 7 provides the tentative locations for the replacement supply wells. Once the supply wells are installed and online, the RAOs will be achieved.

The key chemical-specific ARARs associated with this alternative include: classification of contaminated groundwater which comes from North Carolina Administrative Code (NCAC) Title 15A Subchapter 2L - Groundwater Classifications and Standards, and the Safe Drinking Water Act National Revised Primary Drinking Water Regulations: maximum contaminant levels (MCLs) for organic contaminants specified in 40 CFR 141.61(a). Significant potential action-specific ARARs include: NCAC 15A Subchapter 2C - Well Construction Standards and NCAC 15A Subchapter 18C - NC Rules Governing Public Water Systems.

It is not feasible to calculate the time estimate to achieve cleanup as OU 1 does not address the plume at large. The focus of OU 1 is to ensure the Town of Aberdeen has a safe and adequate water supply system.
The capital costs include both direct and indirect capital costs. The direct capital costs include the purchase of the necessary property and/or easements; the installation and testing of a test well; installation and necessary piping/electrical/control system of supply well; construction well head protection structure; and chlorination equipment. With the addition of indirect costs, the total capital cost for Alternative 3 is estimated to be approximately $822,900. These costs were developed by TOA and reviewed by EPA and the State. This alternative also includes $100,000 for the purchase of the necessary property/easements and associated costs.

As this well or maybe these wells will become part of the municipal water supply system of the Town of Aberdeen, future O&M costs associated with this well (these wells) will become the responsibility of the Town of Aberdeen. Therefore, there is no O&M costs associated with the Alternative 3. As this alternative involves the installation of supply wells in a "clean" area, monitoring the plume at large will be implemented under OU 2, and therefore, no cost for this activity was included in this estimate.

Since the site-related contaminants would remain in place, CERCLA requires Five-Year Reviews to ensure that the overall human health and the environment are protected. Each Five-Year Review would, at a minimum, consist of a Site visit, review of existing documents and monitoring data, interviews, and report preparation. Five-Year Review for this alternative would be the same as described in Alternative 2.

EVALUATION OF ALTERNATIVES

The selection of the preferred alternative for OU 1 at this Site, as described in this Proposed Plan, is the result of a comprehensive screening and evaluation process. The April 2011 FS identified and analyzed appropriate remediation technologies/alternatives for addressing the contamination at the Site, namely Alternative 1 and 2. A November 11, 2013 meeting with NCDENR and NCDOT identified Alternative 3. As stated above, the costs for Alternative 3 were developed by the Town of Aberdeen and these costs were included in the Administrative Record/Information Repository.

EPA uses the following nine criteria to evaluate the identified alternatives. The remedial alternative selected for a Superfund site must achieve the two threshold criteria as well as attain the best balance among the five evaluation criteria. EPA's Preferred Alternative may be altered or changed based on the two modifying criteria. The nine criteria are as follows:

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES

THRESHOLD CRITERIA

Overall Protectiveness of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Compliance with **Applicable or Relevant and Appropriate Requirements (ARARs)** evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

EVALUATION CRITERIA

Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost 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.

MODIFYING CRITERIA

State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 (No Action) would not protect human health from the contaminants in the groundwater associated with the Site, specifically groundwater extracted by TOA supply wells #5 and #9. No remedial actions would be implemented and as a result, human exposure to contaminated groundwater would remain at current levels as would the associated risk. Continued monitoring would be included under no action to monitor the concentration and migration of TCE.

Alternatives 2 and 3 would be equally protective of human health because the groundwater extracted would meet all drinking water requirements; therefore, both alternatives would be protective of human health and protect the Town of Aberdeen's water supply system.

Alternatives 2 and 3 would achieve the RAOs. Alternative 2 would help remediate the plume at large as supply wells #5 and #9 would extract and treat contaminated groundwater.

COMPLIANCE WITH ARARS AND TBCS

Remedial actions must comply with ARARs) of federal and state laws, statutes, and regulations. ARARs are determined by applying a two-tiered test to determine first whether the requirement is applicable and second to determine whether the requirement is relevant and appropriate. Applicable requirements are those cleanup standards, controls, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a Superfund site. Relevant and appropriate requirements are those cleanup standards, standards of control, or other substantive environmental provisions that do not directly and fully address site conditions but address similar situations or problems to those encountered at a Superfund site. Whether or not a requirement is appropriate (in addition to being relevant) will vary depending on factors such as the duration of the response action, the form or concentration of the chemicals present, the nature of the release, the availability of other standards that more directly match the circumstances at the site, and other factors.

In addition, nonpromulgated advisories or guidance documents issued by federal or state governments, referred to as To Be Considered (TBC), should also be identified. TBCs are not considered legally enforceable and, therefore, are not considered to be applicable for the site but are evaluated along with ARARs as part of the risk assessment to set protective cleanup goal targets.

There are three types of ARARs: chemical-specific, action-specific, and location-specific. Chemical-specific ARARs are usually health or risk-based restrictions on the amount or concentration of a chemical that may be found in or discharged to the environment. Action-specific ARARs establish controls or restrictions on the remedial activities which are part of the remedial solution. Action-specific ARARs are triggered by the specific activity rather than the

chemicals present. Location-specific ARARs prevent damage to unique or sensitive areas, such as floodplains, historic places, wetlands, and fragile ecosystems, and restrict other activities that are potentially harmful because of where they take place. Chemical-specific, action-specific, and location-specific ARARs including TBCs for the Site have been identified and are listed in the 2011 FS.

Alternative 1 would not comply with ARARs.

Alternatives 2 and 3 would comply with all ARARs.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 does not provide long-term effectiveness and permanence.

Alternatives 2 and 3 would provide long-term effectiveness and permanence as these two alternatives would provide clean drinking water with sufficient quantity to the TOA municipal supply system. Alternative 2 would provide some removal of the contaminants through groundwater extraction and treatment.

More frequent maintenance and/or periodic inspections would be needed for Alternative 2. Minimum maintenance is anticipated for Alternative 3 which would be supplied by TOA.

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME

Alternative 1 would not reduce toxicity, mobility or volume of contaminants.
Alternative 2 would result in a minimal reduction in the mobility, toxicity, and volume of contaminants through active treatment and the removal of contaminated groundwater within the zone of influence of each supply well. Spent activated carbon from the carbon treatment systems would be removed and regenerated thereby destroying the adsorped contaminants. Alternative 3 would not achieve any reduction in the mobility, toxicity, and volume of contaminants as the new supply well(s) would be installed in an area where the groundwater is clean.

SHORT TERM EFFECTIVENESS

There would be no increased risk to workers or the surrounding community during implementation of Alternative 1 because no new wells would be installed in the contaminated groundwater, only existing wells would be utilized.

There is a short term risk associated with implementing Alternative 2 due to possibility of being exposed to contaminated groundwater during construction activities. However, through the proper use of personal protection equipment (PPE) and monitoring during site activities, this risk can be minimized. In addition, all workers would be properly trained and informed of the risks. The only risk associated with implementing Alternative 3 is the same risks associated with any construction project.

For Alternatives 2 and 3, the time to complete construction is estimated to be from 6 to 9 months. The time to complete Alternative 1 is minimal.

IMPLEMENTABILITY

Alternative 1 only includes groundwater monitoring of existing wells and would be the easiest to implement. Alternative 2, which involves treatment through activated carbon vessels would be more difficult to implement than Alternative 3 due to the need to build larger structures to house the groundwater treatment systems at each supply well. In addition, spent carbon from Alternative 2 would need to be transported off site for proper disposal/regeneration. Alternative 3 requires the drilling of a test well prior to the installation of the actual supply well to ensure the groundwater is of suitable quality and quantity.

COST

Cost estimates are summarized in **Table 3.**

SUMMARY OF PREFERRED ALTERNATIVE

Since the levels of TCE are above the federal MCL, EPA action, under CERCLA is warranted to ensure that the residents have safe drinking water as a result of groundwater contamination from the Site adversely impacting the drinking water aquifer.

Using the above information/assumptions, the Agency's preferred remedial alternative for the Aberdeen Contaminated Groundwater Site is Alternative 3.

As described earlier, this alternative includes the following components:

- Mobilize the necessary personnel and equipment to the Site
- Drill a test well at each necessary location to ensure adequate capacity and that the underlying groundwater is of acceptable quality

Table 3 – COST COMPARISON OF ALTERNATIVES

Alternative	Description of Alternative	Capital Cost	Avg. Annual O&M Cost	Number Years O&M	Total O & M Outlay	Total Cost over 30 Years	Total Present Worth
1	No Action (with continued monitoring)	$0	$70,200	30	$2,106,200	$2,106,200	$276,700
2	Install Wellhead Treatment on Town of Aberdeen Supply Wells #5 and #	$631,100	$ For first year: $245,500 For years 2-30: $131,700/year	30	$4,064,800	$4,695,900	$616,900
3	Replace the pumping capacity of Town of Aberdeen Supply Wells #5 and #9 with New Supply Well(s)	$822,900	$0*	30	$0*	$822,900	$108,100

Notes:
* - It is assumed that the Town of Aberdeen will take responsibility of paying for all O&M activities as these new supply wells will become a part of their municipal system.
The Present Worth value was calculated using a 7% discount rate.

- Install supply well(s) along with the necessary piping and electrical connections, controls, and protective structure
- Improve/enlarge the building/treatment system at supply well #6 to handle the additional volume of water.

PUBLIC PARTICIPATION

The public meeting for the OU 1 Proposed Plan will begin at 6:30 p.m. on Tuesday, August 19, 2014, at the Aberdeen Town Hall located at 115 North Poplar Street in Aberdeen, North Carolina.

EPA and NCDENR has provided information regarding the cleanup of the Site to the public through Fact Sheets, public meetings, announcements in The Pilot, and the Administrative Record file. In addition to reading this Proposed Plan, EPA and NCDENR encourages the public to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted at the Site by reviewing the documents contained in the Administrative Record/Information Repository.

For further information on the Site, please contact:

Jon Bornholm
Remedial Project Manager
(404) 562-8820 or (800) 435-9233
E-mail: bornholm.jon@epa.gov

or

Angela Miller
Community Involvement Coordinator
(404) 562-8561 or (800) 435-9233
E-mail: miller.angela@epa.gov

US EPA Region 4
61 Forsyth Street, SW
Atlanta, GA 30303-8960

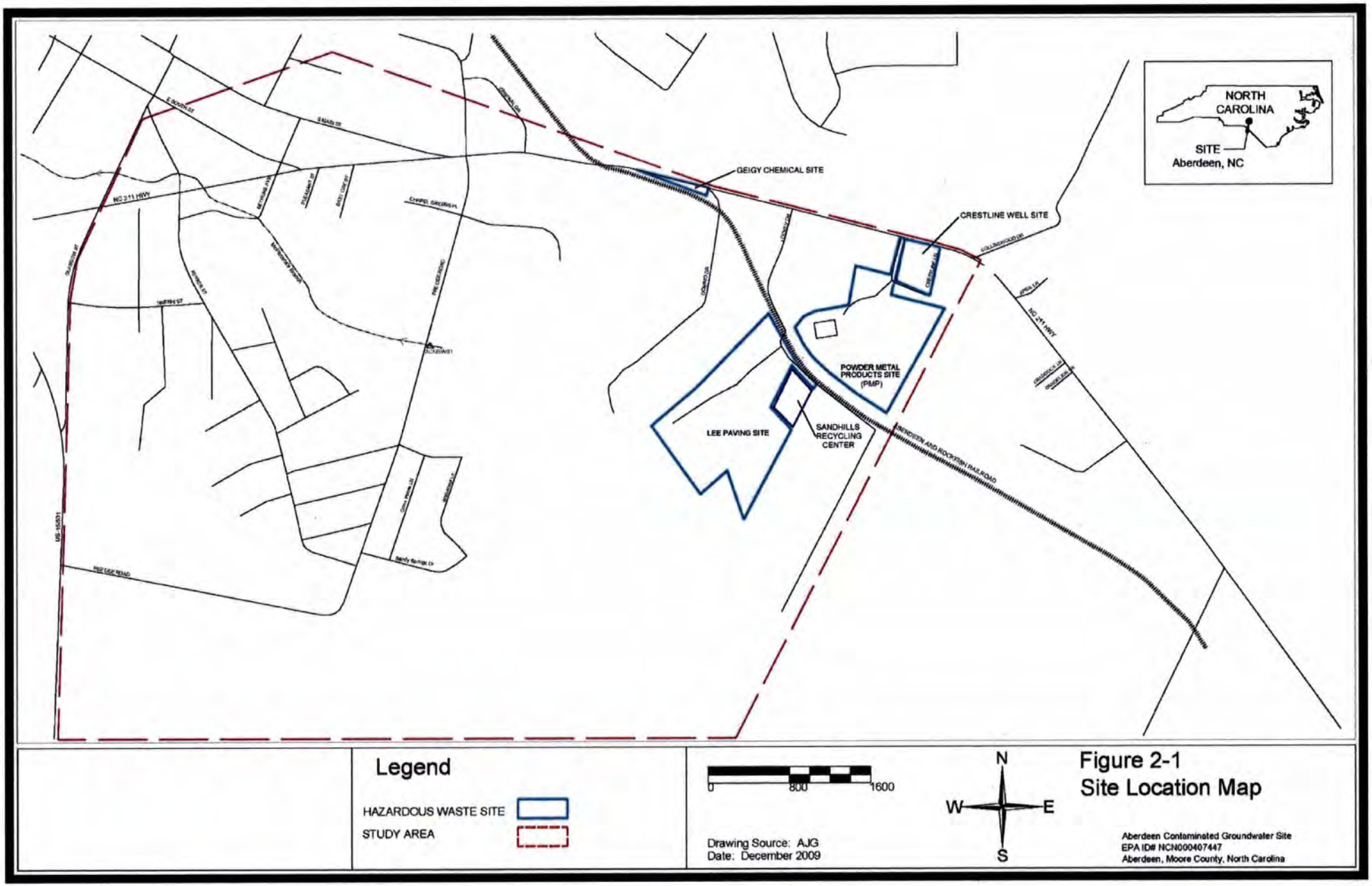
DOCUMENT INFORMATION

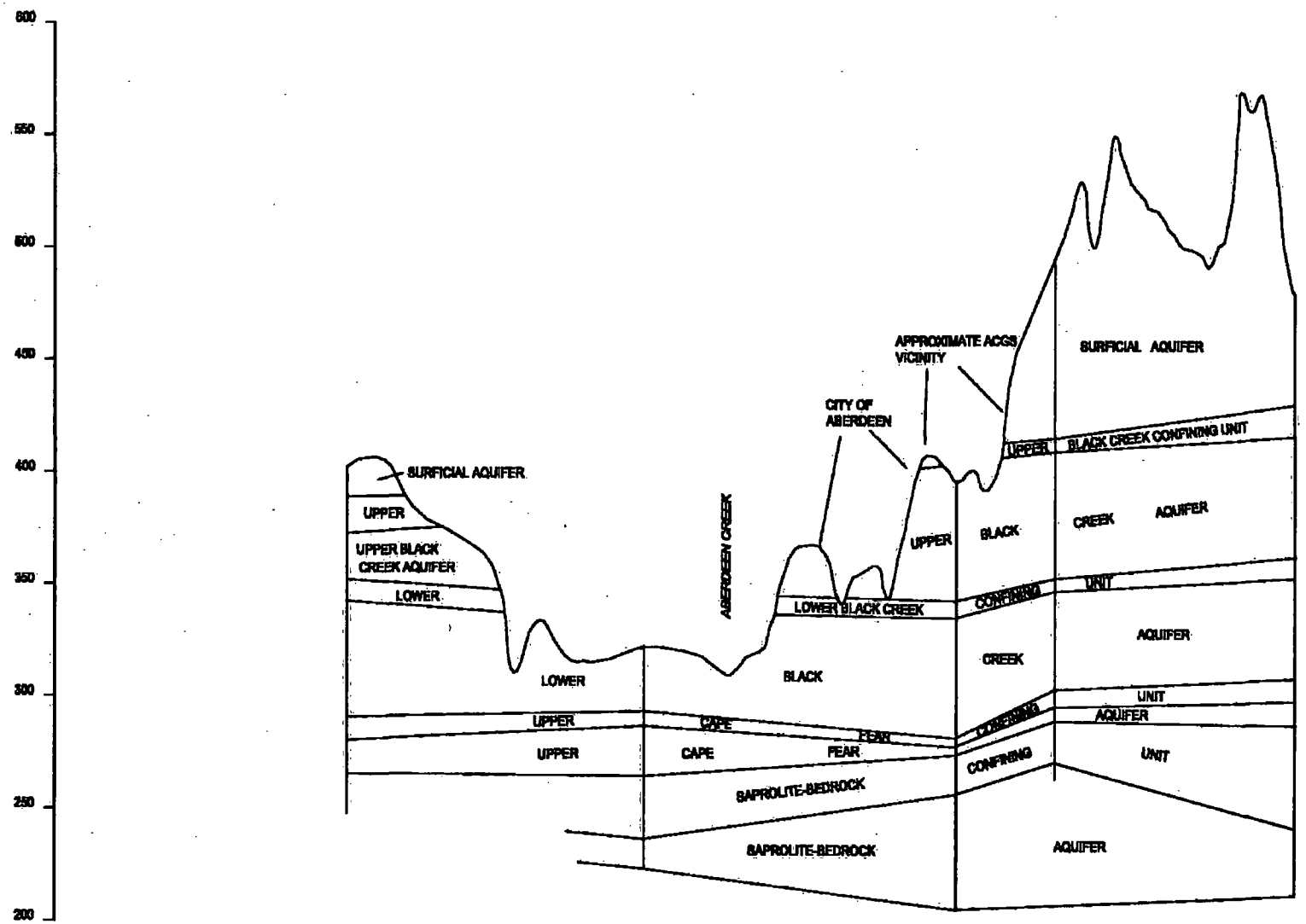
The Administrative Record contains all the information used by the Agency to select a Remedial Action. Copies of the Administrative Record are kept at:

Page Memorial Library
100 South Poplar Street
Aberdeen, NC
910-944-1200
Hours: Monday-Friday 2:00 pm - 6:00 pm

and

U.S. Environmental Protection Agency
Region IV - Records Center
61 Forsyth Street, SW
Atlanta, Georgia 30303-3104
404-562-8820
Hours: Monday - Friday 8:00 a.m. - 5:00 p.m.


NORTH CAROLINA
SITE
Aberdeen, NC
GEIGY CHEMICAL SITE
CRESTLINE WELL SITE
POWDER METAL PRODUCTS SITE (PMP)
LEE PAVING SITE
SANDHILLS RECYCLING CENTER
NC 211 HWY
US 15/501
Legend
HAZARDOUS WASTE SITE
STUDY AREA
0
800
1600
N
W
E
S
Drawing Source: AJG
Date: December 2009
Figure 2-1
Site Location Map
Aberdeen Contaminated Groundwater Site
EPA ID# NCN000407447
Aberdeen, Moore County, North Carolina



Note

Vertical Relief is Exaggerated

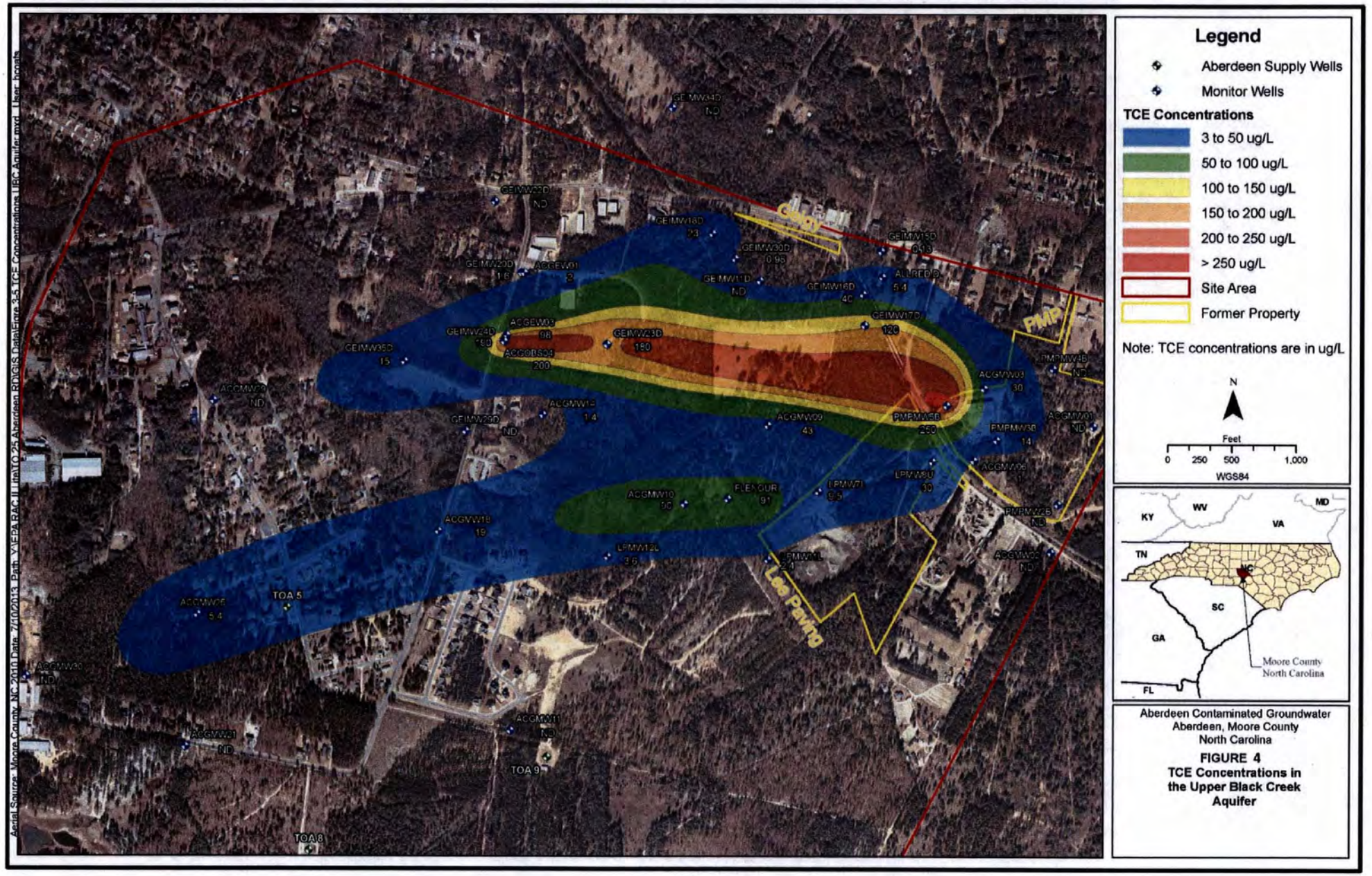
0 1 Mile 2 Miles

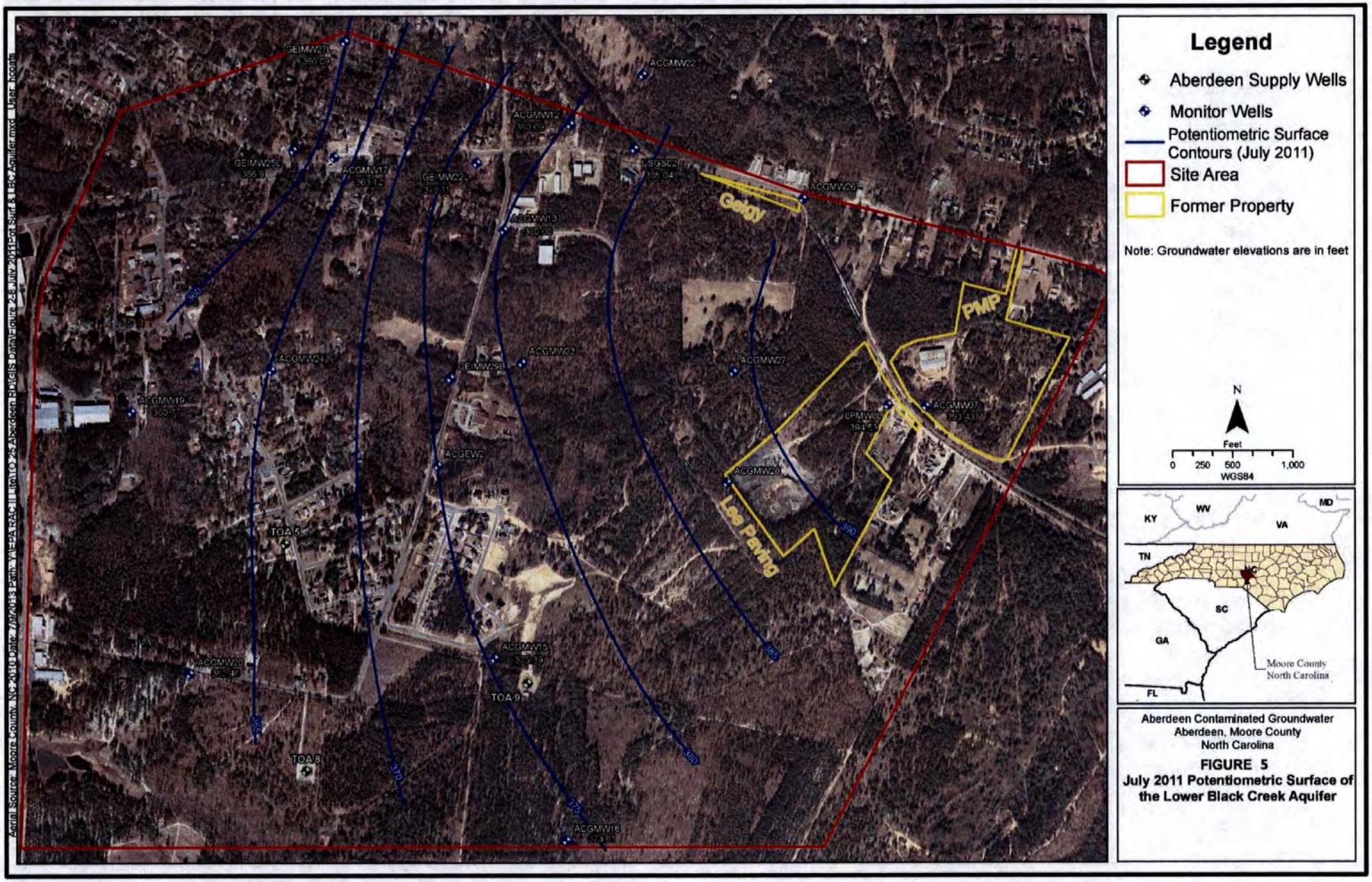
Drawing Source: Adapted from Cobis and Elmers (1993)
Date: December 2009

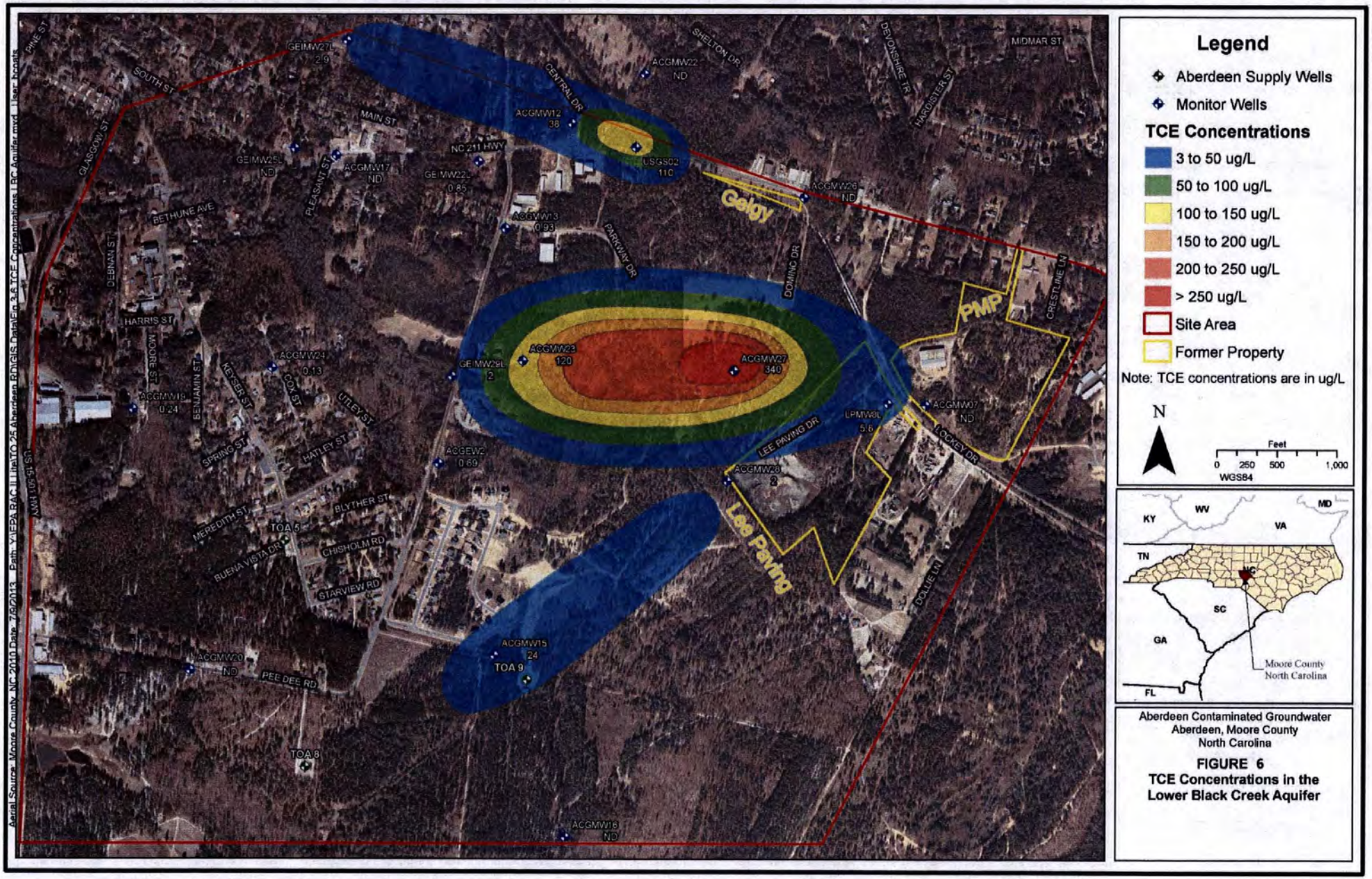
Figure 2
Generalized Cross Section of the Aberdeen, NC Area

Aberdeen Contaminated Groundwater Site
EPA ID# NCN000407447
Aberdeen, Moore County, North Carolina


Legend
Aberdeen Supply Wells
Monitor Wells
Potentiometric Surface Contours (July 2011)
Site Area
Former Property
Note: Groundwater elevations are in feet.
N
Feet
0 250 500 1,000
WGS84
KY
WV
MD
VA
TN
NC
SC
GA
FL
Moore County North Carolina
Aberdeen Contaminated Groundwater
Aberdeen, Moore County
North Carolina
FIGURE 3
July 2011 Potentiometric Surface of the Upper Black Creek Aquifer


Legend
Aberdeen Supply Wells
Monitor Wells
TCE Concentrations
3 to 50 ug/L
50 to 100 ug/L
100 to 150 ug/L
150 to 200 ug/L
200 to 250 ug/L
> 250 ug/L
Site Area
Former Property
Note: TCE concentrations are in ug/L
N
Feet
0 250 500 1,000
WGS84
Canopy
Lee Paving
PMP
TOA 5
TOA 8
TOA 9
KY
WV
MD
VA
TN
NC
SC
GA
FL
Moore County
North Carolina
Aberdeen Contaminated Groundwater
Aberdeen, Moore County
North Carolina
FIGURE 4
TCE Concentrations in
the Upper Black Creek
Aquifer


Legend
Aberdeen Supply Wells
Monitor Wells
Potentiometric Surface Contours (July 2011)
Site Area
Former Property
Note: Groundwater elevations are in feet
N
Feet
0 250 500 1,000
WGS84
Geigy
PMP
Lee Paving
ACGMW22
ACGMW12
ACGMW17
ACGMW25L
ACGMW13
ACGMW23
ACGMW24
ACGMW19
ACGMW27
ACGMW17
ACGMW26
ACGEW2
TOA 6
TOA 9
TOA 8
ACGMW16
KY
WV
MD
VA
TN
SC
GA
FL
Moore County
North Carolina
Aberdeen Contaminated Groundwater
Aberdeen, Moore County
North Carolina
FIGURE 5
July 2011 Potentiometric Surface of the Lower Black Creek Aquifer


Legend
Aberdeen Supply Wells
Monitor Wells
TCE Concentrations
3 to 50 ug/L
50 to 100 ug/L
100 to 150 ug/L
150 to 200 ug/L
200 to 250 ug/L
> 250 ug/L
Site Area
Former Property
Note: TCE concentrations are in ug/L
N
Feet
0 250 500 1,000
WGS84
KY
WV
MD
VA
TN
NC
SC
GA
FL
Moore County
North Carolina
Aberdeen Contaminated Groundwater
Aberdeen, Moore County
North Carolina
FIGURE 6
TCE Concentrations in the
Lower Black Creek Aquifer
Geigy
PMP
Lee Paving
ACGMW23
120
ACGMW27
340
ACGMW12
38
USGS02
110
ACGMW26
ND
ACGMW22
ND
GEIMW27L
2.9
GEIMW25L
ND
ACGMW17
ND
GEIMW22L
0.85
ACGMW13
0.93
GEIMW29L
2
ACGMW24
0.13
ACGMW19
0.24
ACGEW2
0.69
ACGMW28
2
LPMW8L
5.6
ACGMW07
ND
ACGMW15
24
ACGMW20
ND
ACGMW16
ND
TOA 5
TOA 9
TOA 8
MAIN ST
NC 211 HWY
CENTRAL DR
SHELTON DR
DEVONSHIRE TR
HARDISTER ST
MIDMAR ST
PARKWAY DR
DOMING DR
CRESTLINE LN
BETHUNE AVE
HARRIS ST
LEE PAVING DR
LOCKEY DR
DOLLIE LN
MEREDITH ST
BLYTHER ST
CHISHOLM RD
BUENA VISTA DR
STARVIEW RD
PEE DEE RD
SPRING ST
HATLEY ST
UTLEY ST
COX ST
KEYSER ST
BENJAMIN ST
MOORE ST
DEEMAN ST
GLASGOW ST
PINE ST
SOUTH ST
PLEASANT ST
Aerial Source: Moore County, NC 2010 Date: 7/6/2013 Path: Y:\EPA_RAC_II\Task\TO 25 Aberdeen RI\GIS Data\Fig 3-8 TCE Concentrations LBC Aquifer.mxd User: hoots

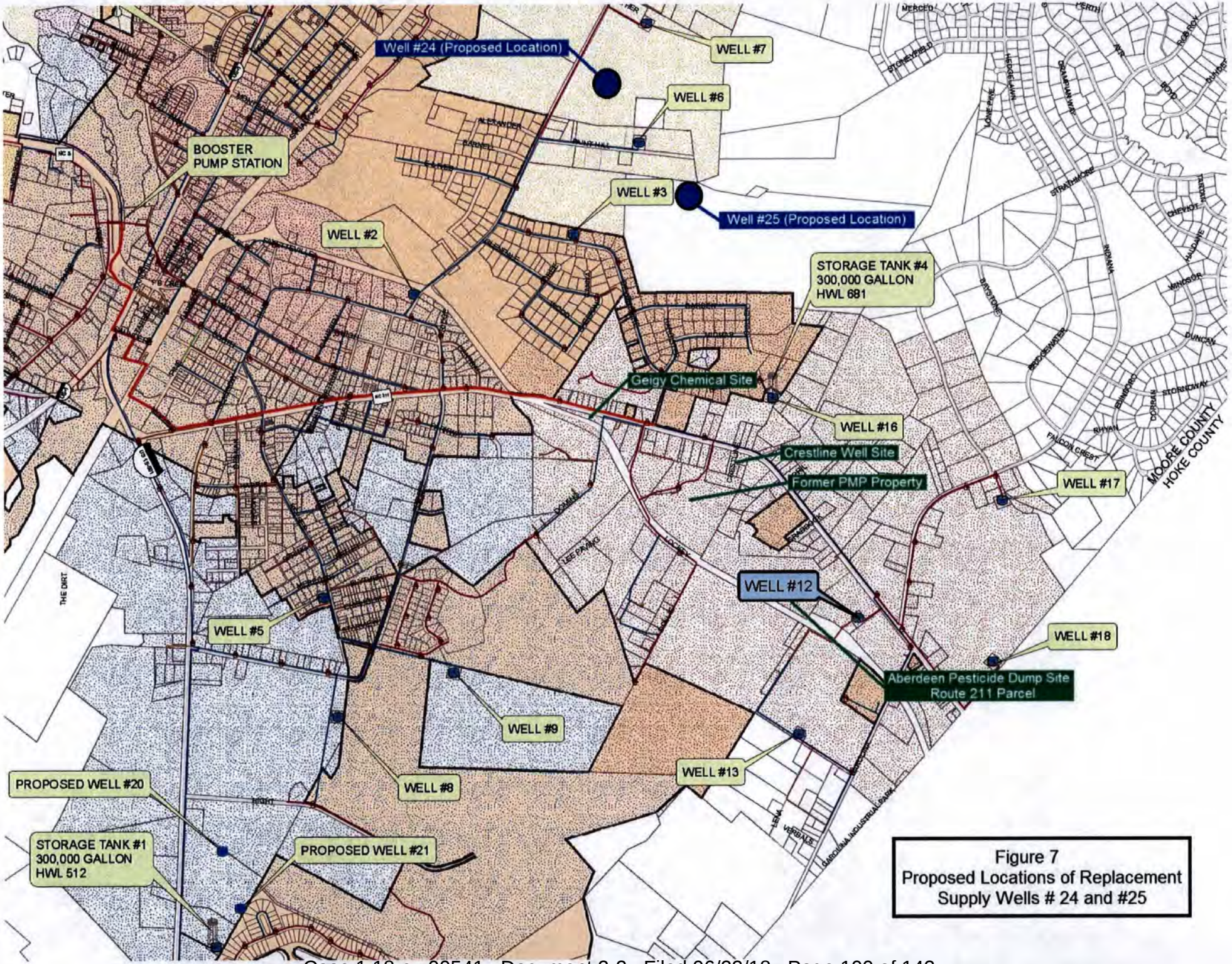


Figure 7
Proposed Locations of Replacement
Supply Wells # 24 and #25

Table 4-2 Action-specific ARARs and TBCs
Cape Fear Wood Preserving Superfund Site Fayetteville, North Carolina

U.S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, Georgia 30303

North Site Management Branch
Angela Miller, Community Involvement Coordinator
Jon Bornholm, Remedial Project Manager

Official Business
Penalty for Private Use $300

Appendix B

Additional Tables

TABLE B-1
NON-CANCER TOXICITY DATA – ORAL/DERMAL
ABERDEEN CONTAMINATED GROUNDWATER SITE

Contaminant of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Dates (2)
Volatile Organic Compounds										
Trichloroethene	---	5.00E-04	(mg/kg-day)	1.0	2.0E-03	(mg/kg-day)	Developmental	10	IRIS	09/28/2011
Pesticides										
alpha-BHC	Chronic	8.00E-03	(mg/kg-day)	1.0	8.00E-03	(mg/kg-day)	Liver	100	ATSDR	2008 MRL Table
beta-BHC	---	NA	---	---	NA	---	---	---	---	---
delta-BHC	---	NA	---	---	NA	---	---	---	---	---
gamma-BHC	Chronic	3.00E-04	(mg/kg-day)	1.0	3.00E-04	(mg/kg-day)	Liver and kidney	1,000	IRIS	11/12/2009
Inorganics										
Lead	---	NA	---	---	NA	---	---	---	---	---
Manganese	Chronic	2.40E-02	(mg/kg-day)	0.040	9.60E-04	(mg/kg-day)	Nervous system	3	IRIS	11/12/2009

(1) Source: RAGS Part E Guidance
(2) Represents date source was searched.

Note: Hexavalent chromium value was used for chromium.

Definitions: ATSDR=Agency for Toxic Substances and Disease Registry
HEAST=Health Effects Assessment Summary Tables
IRIS=Integrated Risk Information System
NA=Not available
PPRTV = Provisional Peer-Reviewed Toxicity Value

TABLE B-2
NON-CANCER TOXICITY DATA -- INHALATION
ABERDEEN CONTAMINATED GROUNDWATER SITE

Contaminant of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC: Target Organ(s)	
		Value	Units			Source(s)	Dates (1)
Volatile Organic Compounds							
Trichloroethene	---	0.002	mg/m3	Developmental	10	IRIS	09/28/2011
Pesticides							
alpha-BHC	Not volatile						
beta-BHC	Not volatile						
delta-BHC	Not volatile						
gamma-BHC (Lindane)	Not volatile						
Inorganics							
Lead	Not volatile						
Manganese	Not volatile						

(1) Represents date source was searched.

Definitions: ATSDR=Agency for Toxic Substances and Disease Registry
IRIS=Integrated Risk Information System
NA=Not available
PPRTV = Provisional Peer-Reviewed Toxicity Value

TABLE B-3
CANCER TOXICITY DATA -- ORAL/DERMAL
ABERDEEN CONTAMINATED GROUNDWATER SITE

Contaminant of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Dates (2)
Volatile Organic Compounds								
Trichloroethene	1.30E-02	$(mg/kg\text{-}day)^{-1}$	1.0	1.30E-02	$(mg/kg\text{-}day)^{-1}$	No information	CalEPA	11/12/2009
Pesticides								
alpha-BHC	6.30E+00	$(mg/kg\text{-}day)^{-1}$	1.0	6.30E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	11/12/2009
beta-BHC	1.80E+00	$(mg/kg\text{-}day)^{-1}$	1.0	1.80E+00	$(mg/kg\text{-}day)^{-1}$	C	IRIS	11/12/2009
delta-BHC	NA	---	---	NA	---	D	IRIS	11/12/2009
gamma-BHC	1.10E+00	$(mg/kg\text{-}day)^{-1}$	1.0	1.10E+00	$(mg/kg\text{-}day)^{-1}$	No information	CalEPA	11/12/2009
Inorganics								
Lead	NA	---	---	NA	---	B2	IRIS	11/12/2009
Manganese	NA	---	---	NA	---	D	IRIS	11/12/2009

(1) Source: RAGS Part E Guidance
(2) Represents date source was searched.

Definitions: CalEPA=California Environmental Protection Agency
IRIS = Integrated Risk Information System
NA = Not available.
A - Human carcinogen.
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen.
D - Not classifiable as a human carcinogen.

TABLE B-4
CANCER TOXICITY DATA -- INHALATION
ABERDEEN CONTAMINATED GROUNDWATER SITE

Contaminant of Potential Concern	Unit Risk		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units		Source(s)	Dates (1)
Volatile Organic Compounds					
Trichloroethene	2.00E-06	$(\mu g/m^3)^{-1}$	No information	CalEPA	11/12/2009
Pesticides					
alpha-BHC	Not volatile				
beta-BHC	Not volatile				
delta-BHC	Not volatile				
gamma-BHC (Lindane)	Not volatile				
Inorganics					
Lead	Not volatile				
Manganese	Not volatile				

(1) Represents date source was searched.

Definitions: CalEPA=California Environmental Protection Agency
IRIS = Integrated Risk Information System.

NA = Not available.
A - Human carcinogen.
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen.
D - Not classifiable as a human carcinogen.

TABLE B-5
HISTORICAL VOLATILE ORGANIC COMPOUNDS 1991 - 2009
ABERDEEN CONTAMINATED GROUNDWATER SITE

Well Number	1991	1993		1994	1995						1996										1997
(µg/L)	TCE	BTEX	TCE	TCE	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	PCE	TCE	CHCl3	1,1 DCA	1,2 DCA	1,1 DCE	TCA	1,1,2 TCA	PCE	TCE
TOA Well #5	–	–	3	3.61	4.1	–	–	–	–	–	–	–	3.6	–	–	–	–	–	–	–	2.7
TOA Well #9	–	–	ND	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Well Number	1998	1999										2000	2001									
(µg/L)	TCE	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4	TCE	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4
TOA Well #5	3.6	3.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TOA Well #9	1.6	1.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Well Number	2003																			
(µg/L)	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4
TOA Well #5	ND	–	–	–	–	–	–	–	–	–	3.1	–	–	–	–	–	–	–	–	–
TOA Well #9	ND	–	–	–	–	–	–	–	–	–	3.5	–	–	–	–	–	–	–	–	–

Well Number	2004										2005									
(µg/L)	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4
TOA Well #5	2.4	–	–	–	–	–	–	–	–	–	7.3	–	–	–	–	–	–	–	–	–
TOA Well #9	1.1	–	–	–	–	–	–	–	–	–	2.7	–	–	–	–	–	–	–	–	–

Well Number	2006										2007									
(µg/L)	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4
TOA Well #5	7.9	–	–	–	–	–	–	–	–	–	6.6	–	–	–	–	–	–	–	–	–
TOA Well #9	2.3	–	–	–	–	–	–	–	–	–	2.4	–	–	–	–	–	–	–	–	–

Well Number	2008								ACGS RI 2009		
(µg/L)	TCE	TCA	CH2Cl2	cis 1,2 DCE	1,1 DCE	1,2 DCA	1,1 DCA	CHCl3	C2H5Cl	CCL4	TCE
TOA Well #5	2.5	–	–	–	–	–	–	–	–	–	5.7
TOA Well #9	<0.5	–	–	–	–	–	–	–	–	–	2.4

Special Notes:

1. If there were multiple sample events for a year, the data above represents the highest concentration detected for that year.

2. The data was gathered from reports provided from multiple contractors conducting investigations at sites in the vicinity of ACGS.

"–" = No sample collected.

ND = Not detected.

BQL = Below Quantitation Limit

TCE - Trichloroethene; TCA - 1,1,1 trichloroethane: CH2CL2 - Methylene chloride; cis 1,2 DCE- cis 1,2 dichloroethene; 1,1 DCE - 1,1 dichloroethene; 1,2 DCA - 1,2 dichloroethane; 1,1 DCA - 1,1 dichloroethane; CHCl3 - chloroform; C2H5Cl - chloroethane; CCL4 - carbon tetrachloride; PCE - tetrachloroethane

Appendix C

State Letter of Concurrence

NCDENR
North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

John E. Skvarla, III
Secretary

September 30, 2014

U.S. EPA – Region 4
Attn: Mr. Randall Chaffins, Acting Director
Superfund Division
61 Forsyth Street, SW
Atlanta, GA 30303-3104

RE: Concurrence with the Final Record of Decision (ROD) Amendment for OU-1
Replacing Town of Aberdeen Supply Wells
Aberdeen Contaminated Groundwater Site
NCN 000 407 447
Aberdeen, Moore County, North Carolina

Dear Mr. Chaffins:

The State of North Carolina by and through its Department of Environment and Natural Resources, Division of Waste Management (herein after referred to as "the state"), reviewed the Record of Decision (ROD) for Operable Unit #1 (OU-1) at the Aberdeen Contaminated Groundwater Site (ACGWS), received by the Division on 29 September 2014 and concurs with the selected remedy, subject to the following conditions:

1. State concurrence on the OU-1 ROD for this site is based solely on the information contained in the ROD received by the State on September 29, 2014. Should the State receive new or additional information which significantly affects the conclusions or amended remedy contained in the ROD, it may modify or withdraw this concurrence with written notice to EPA Region IV.

2. State concurrence on this ROD in no way binds the State to concur in future decisions or commits the State to participate, financially or otherwise, in the clean-up of the site. The State reserves the right to review, overview comment, and make independent assessment of all future work relating to this site.

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-707-8200 \ Internet: http://portal.ncdenr.org/web/wm

The State of North Carolina appreciates the opportunity to comment on the ROD and looks forward to working with EPA on the remedy for the subject site. If you have any questions or comments, please contact Mr. Doug Rumford at (919) 707-8334 or email doug.rumford@ncdenr.gov .

Sincerely,

Linda M. Culpeper, Director
Division of Waste Management

cc: Jim Bateson, Chief NC Superfund Section
David Lown, Head, Federal Remediation Branch NC Superfund
Doug Rumford, NC Superfund

Appendix D

Responsiveness Summary

RESPONSIVENESS SUMMARY
OPERABLE UNIT 1 RECORD OF DECISION

ABERDEEN CONTAMINATED GROUNDWATER SITE
ABERDEEN, MOORE COUNTY, NORTH CAROLINA

Based on Public Comment Period
August 19, 2014, through September 18, 2014
Public Meeting Held On August 19, 2014

Aberdeen Town Hall
Aberdeen, Moore County, North Carolina

Prepared by:
U.S. Environmental Protection Agency, Region IV

September 2014

RESPONSIVENESS SUMMARY
OPERABLE UNIT 1 RECORD OF DECISION
ABERDEEN CONTAMINATED GROUNDWATER SUPERFUND SITE

TABLE OF CONTENTS

ATTACHMENTS

1.0 OVERVIEW

The development of this Responsiveness Summary is in accordance to the requirement set forth in 40 CFR Section 300.430(f)(3)(i)(F). This community relations Responsiveness Summary is divided into the following sections:

Section 2.0 BACKGROUND This section discusses the Environmental Protection Agency's preferred alternative for remedial action and provides a brief history of community interest.

Section 3.0 SUMMARY OF MAJOR ISSUES/CONCERNS/QUESTIONS/ STATEMENTS VOICED DURING PROPOSED PLAN PUBLIC MEETING This section provides a summary of issues/concerns and questions/comments voiced by the local community and responded to by the Agency during the Proposed Plan public meeting. "Local community" may include local homeowners, businesses, the municipality, and not infrequently, potentially responsible parties.

Section 4.0 SUMMARY OF MAJOR ISSUES/CONCERNS/QUESTIONS/ STATEMENTS VOICED DURING PUBLIC COMMENT PERIOD This section provides a comprehensive response to all significant written comments received by the Agency and is comprised primarily of the specific legal and technical questions raised during the public comment period.

2.0 BACKGROUND

The Environmental Protection Agency (EPA) conveyed its preferred remedial alternative for Operable Unit 1 at the Aberdeen Contaminated Groundwater Superfund Site (Site) Proposed Plan public meeting on August 19, 2014. The Site is located along NC Highway 211, approximately 1½ miles east of US Highway 1 in Aberdeen, Moore County, North Carolina. Land use in the area of the Site is a mixture of industrial, commercial, and residential. The Site was listed on the National Priority List (NPL) as a ground water plume Site with no identified source. The plume was identified during the investigations of the following sites and facilities in the area: the Geigy Chemical Corporation Superfund Site (Geigy Site), the Crestline Contaminated Well Emergency Response site (formerly known as the Route 211 Contaminated Well Site), the former Lee Paving Company property, and the former Powder Metal Products (PMP) facility. The study area is approximately 6,400 feet by 5,600 feet or 1.3 square miles.

In 1990, during the investigation of groundwater contamination at the Geigy Site, located along Highway 211 and Lockey Drive, trichloroethene (TCE) was detected in two deep groundwater monitoring wells. During phase II of the Geigy groundwater investigation, TCE was detected in the same two deep wells, a residential well along Highway 211, and a supply well at the PMP facility. In 1998, EPA determined that the Geigy Site was not the source of TCE being detected in the groundwater and that the TCE originates from another source and is migrating towards the Geigy Site.

From 1964 until 1989, the North Carolina Department of Transportation (NCDOT) operated an aggregate testing laboratory on the Lee Paving Company property. Since 1989, this property has been used for the storage and handling of recyclable wastes. From 1994 to 1996, a NCDOT contractor conducted a comprehensive site assessment of the geology and hydrogeology of the Lee

Paving property. This study focused on TCE, 1,1,1-trichloroethane (TCA), carbon tetrachloride, and their degradation products. Samples collected in 1994 and 1995 documented a commingled plume of TCE and TCA originating in the southern portion of the Lee Paving property and migrating west in the surficial aquifer. Three monitoring wells located on the northern portion of the Lee Paving property showed contamination by TCE only. No other monitoring wells screened in the Upper Black Creek aquifer on the Lee Paving property have shown TCE contamination. Two surficial aquifer monitoring wells north of the documented plume were not contaminated. Therefore, EPA concluded that the TCE found in the monitoring wells in the northern portion of the Lee Paving property is isolated from the documented plume on the Lee Paving property.

The PMP property then became the focus as the potential source of TCE in groundwater. The PMP property is a 26.8 acre parcel with one metal building on it. The building is 200 feet by 150 feet on a concrete slab. A 6-foot chain linked security fence encompasses the building along with approximately 3.8 acres. Powder Metals Products owned and operated the facility and made precision machine parts from approximately 1980 until 1995. A part of their process included a solvent dip bath containing TCE. In 1995, PMP sold the property to Diamond Exhaust & Equipment which operated the facility as a wholesale automotive exhaust parts distribution center. It is not known whether Diamond Exhaust & Equipment utilized any chemicals or solvents. This property was recently sold to CALCO Enterprises which is a small company based out of Southern Pines, North Carolina. CALCO Enterprises provides mechanical services (with a specialty in pre-insulated underground piping), process piping services, miscellaneous steel welding, and erection. To date, no viable potentially responsible parties have been identified for the ACG Site.

Although EPA has not named the PMP property as the sole source of the groundwater contamination associated with the Aberdeen Contaminated Groundwater Site, this property is most a likely contributor as the TCE being detected in the groundwater is downgradient of this property.

The analytical results indicate a migration of contamination from the surficial aquifer to the Upper and Lower Black Creek aquifers. The surficial aquifer does not have sufficient yield for potable uses and does not exist continuously throughout the area. Historically, most of the residential wells in the ACG Site study area were screened in the Upper and Lower Black Creek aquifers. Currently, residents in this area obtain potable water from the Town of Aberdeen municipal water supply system. To the best of the Agency's knowledge, existing private wells in this area are only being used for the irrigation of gardens.

Currently, no Technical Assistance Grant (TAG) has been formed.

3.0 SUMMARY OF ISSUES/CONCERNS/QUESTIONS/STATEMENTS VOICED DURING PROPOSED PLAN PUBLIC MEETING AND RESPONSES

The questions/concerns expressed during the Proposed Plan public meeting can be grouped into four (4) categories which are conveyed below. Below this list are the paraphrased issues/concerns/questions/statements for each category. Each category is a new heading in **bold print**, the text of the issues/concerns/questions/statements is *italicized*, and the Agency's response, where appropriate follows as the "Response":

- Cost of wells
- Levels of TCE increasing
- Volume of groundwater withdrawn
- Number of supply wells

What will is the cost of these new supply wells?

Response: Approximately $800,000.

The levels of TCE are increasing?

Response: Yes, the plume is migrating towards these wells.

How much water is withdrawn by these two wells?

Response: Approximately 320 gallons per minute.

How many new wells are anticipated?

Response: Two.

4.0 SUMMARY OF ISSUES/CONCERNS/QUESTIONS/STATEMENTS VOICED DURING PUBLIC COMMENT PERIOD

Two sets of written comments were received during the public comment period. These can be found in Attachments B and C. The letter in Attachment B contains 4 comments. The first two comments make statements and do not need a response. The third comment states: "Pesticides attributable to the Geigy Site are being addressed by EPA-approved remedial actions on-going at the Geigy Site. Three consecutive five-year Record of Decision Effectiveness reviews conducted by USEPA for the Geigy Site conclude that the Geigy Site remedy continues to be effective at addressing pesticides at the Site. The suggestion or assertion that pesticides detected throughout the Aberdeen Contaminated Groundwater Site can be conclusively linked to the Geigy Site is not supported by the available data and disregards the historic usage of properties within the boundaries of the Aberdeen Contaminated Groundwater Site."

EPA's Response: EPA acknowledges that past agricultural usage of some properties within the Aberdeen Contaminated Groundwater Site may have contributed to pesticide concentrations detected in some areas of the ACGS plume. However, previous investigations, including those conducted by Geigy, have documented that the ACGS plume and the Geigy plume are commingled; generally in the area from the former Geigy facility southwest to McFarland's Branch.

The fourth comment states: "The Proposed Plan suggests that the existing pump and treat remedy of the Geigy Site has influenced the distribution of Volatile Organic Compounds (VOCs) in groundwater. This statement is incorrect and is contrary to existing information and data. TCE

was present in groundwater underlying the Geigy Site prior to the installation of the existing Geigy groundwater treatment system."

EPA's Response: EPA acknowledges that TCE was present in the groundwater beneath the Geigy Site prior to installation of the Geigy groundwater treatment system. However, site data suggests that contaminants appear to have been drawn to the north (generally cross-gradient to groundwater flow). The distribution of VOCs may have been influenced by groundwater extraction to the north, which would include pumping from former Town of Aberdeen wells 3 and 4, which are now abandoned.

The letter in Attachment C contains 3 comments. The first comment supports the selected remedy. The second comments states: "The plan mentions that the plume has no identified source. However, H&H believes that the data indicate that the former PMP site is the source of the plume that impacted the Town Wells. The highest concentrations of chlorinated solvents detected in groundwater were detected on the PMP site. In addition, the PMP site is situated in an upgradient position relative to the Town Wells. EPA did not find the soil source area for the impacts at the PMP site, but the testing conducted was inadequate. Based on a review of prior reports, no testing was conducted at the reported trichloroethene (TCE) dip vat which was likely situated in the building. No soil sampling was conducted beneath the building slab which is a common location for source areas in manufacturing buildings. Secondly, no soil sampling was conducted beneath the septic tank where the potential TCE degradation product cis-1,2-dichloroethene was detected in residual tank fluids. Although soil testing was conducted in select locations outside of the building, the septic lines were not traced from the septic tank to the leach field. Therefore, it is unknown if any soil samples were collected within or beneath the leach field. H&H believes that a soil source area likely exists at the former PMP site and that the presence of such a source would support the position that the PMP site is the source of the plume that impacted the Town Wells."

EPA's Response: The ROD Amendment states that the "Site was listed on the NPL as a trichloroethene (TCE) groundwater plume Site with no identified source." EPA lists several potential sources of TCE contamination in the ROD Amendment, including the former PMP site, the former Lee Paving facility, the Crestline Contaminated Well Site, and a potential unconfirmed/undocumented spill from a railroad tanker on the Aberdeen & Rockfish Railroad line.

After the Site was listed on the NPL, EPA spent a significant amount of time and resources during the Remedial Investigation and subsequent investigations searching for a source area on the former PMP property, including advancing 12 Membrane Interface Probe (MIP) borings, performing a geophysical investigation of the property, collecting soil samples from 24 soil borings, and excavating 12 exploratory test pits. These activities found no contaminants in the site soils indicative of a source area on the former PMP property. In addition, TCE has not been detected at elevated concentrations in the surficial aquifer groundwater at the former PMP site, which would be expected if a significant TCE release occurred on the property. While EPA does not discount the former PMP site as a potential source of the TCE plume, it is the opinion of EPA that if a significant contaminant source area is present on the former PMP property, some

indication of it would have been detected by the investigative activities completed to date.

The third comment states: "H&H is also providing comment on Figure 4 which depicts the TCE concentrations in the Upper Black Creek (UBC) Aquifer. The TCE UBC figure depicts a southern plume lobe near ACGMW10 and the FLENOUR monitoring points that does not follow the principles of hydrogeology. If that plume lobe was oriented with the potentiometic surface presented as Figure 3, the southern plume lobe would be directly downgradient of the PMP site. In addition, certain data were omitted from Figure 4. An UBC aquifer TCE plume map that is consistent with available data and the potentiometric map is attached.

EPA's Response: The interpretation of TCE concentrations in the Upper Black Creek Aquifer presented in Figure 4 was developed as a collaborative effort between EPA's technical support contractor that performed the Remedial Investigation and EPA Region 4 Technical Services Section personnel based on careful evaluation of the groundwater analytical data and hydrogeological data collected by EPA and its contractors. EPA believes that this interpretation is technically accurate and defensible, although EPA acknowledges that multiple interpretations of the data are possible given the large areal extent of the plume and the large spacing between some monitoring wells. EPA plans to install additional monitoring wells to further characterize some areas of the plume prior to implementation of a remedy to address the groundwater plume, which has been designated as Operable Unit 2.

The primary difference between the plume interpretation on Figure 4 and the alternate interpretation presented by Hart & Hickman is the use of data from a 2009 sample collected from a private water supply well, designated as WS-23 (Harris) by Hart & Hickman. EPA does not agree with the use of WS-23 as an Upper Black Creek monitoring point since previous Hart & Hickman reports list the depth of the well as unknown. It is unknown whether this well draws from the Upper or Lower Black Creek Aquifer, although the reported 2009 concentration of 320 µg/L is more consistent with EPA's interpretation of the contaminant plume in the Lower Black Creek Aquifer (Figure 8). EPA has not been able to sample well WS-23 (Harris) because the well has been out of service since prior to implementation of the Remedial Investigation.

Attachment A

Transcript of Public Meeting

PROPOSED PLAN for OPERABLE UNIT 1

ABERDEEN CONTAMINATED GROUNDWATER SITE

Aberdeen, Moore County, North Carolina

August 19, 2014

Public Meeting

6:30 P.M.

Aberdeen Town Hall

115 North Poplar Street

Aberdeen, NC

presented by: MR. JOHN BORNHOLM

Angela Miller

EPA - Region 4

MS. MILLER: Thank you guys so much for coming out. My name is Angela Miller. I'm with the Environmental Protection Agency, Community Involvement Coordinator, and I worked with John Bornholm on this site. We are here tonight to talk about the proposed plan for Operable Unit One for the Aberdeen Contaminated Groundwater Site.

I do have a court reporter present. She is going to transcribe the meeting for us. So if you have questions, if you would state your name and spell any unusual names for her. We have a comment period on this site. It actually started today, and it runs through September 18th. So your comments and questions will be reported tonight in the transcript. Then if you have any additional, you can email John and you can mail him. The information is on the front page of the proposed plan.

He is going to go through the presentation, which will take 30 or 40 minutes or so. Then we'll open it up to questions and answers. Okay. Thank you much.

MR. BORNHOLM: Thank you, Angela. My name is John Bornholm, and I'm the Remedial Project Manager for all the sites here in Aberdeen. Unfortunately it's a few. This one Aberdeen contaminated groundwater site.

Basically goes these kind of quickly, describe the superfund process, describe the history as we know about the Powder Metals property and the Aberdeen contaminated groundwork site contamination. Go through key components of the proposed plan itself, and then like Angela said, questions and answers.

Basically they typical superfund process, once the site is discover, it's placed on the national priority list. We have about 2,500 on that list now. We do what's a remedial investigation which feeds into the baseline risk assessment, and I'll try and describe all these a little bit more in detail later. Feasibility study, proposed plan, which is where we're at now, that part of the process. After tonight, and the 30-day time public comment period, the Agency will issue the record of decision, which is the decision document, which is a legal document that we issue. And it describes the actual remedy that will be implemented at the site.

Then once we decide what the remedy is, we're going the design, and then we actually implement the cleanup, and then we go into operation and maintenance after that.

Basically the Aberdeen Contaminated Groundwater Site, this is just an overview, a pretty

simple one. Route 211 comes up through here. This is Aberdeen Rock --

(Unidentified speaker): Rockfish.

MR. BORNHOLM: -- Rockfish Railroad. Thank you. This is the Superfund site known as Geigy Chemical that was cleaned up back in the early nineties. This is Crestline which was an emergency response due to groundwater contamination. EPA hooked up around 40 businesses and homes to public water supplies. This is Lee Paving where they used to make asphalts. And North Carolina Department of Transportation had a testing lab on that property. And then this is the Powder Metals property where Powder Metals reportedly had a TCE, trichloroethene dip, which they used to clean their metal parts.

And using modern technology basically, this is a County of Moore map, GIS system. The same idea identified Geigy, the same properties that I just went over. There's another Superfund site here, which is part of the Aberdeen pesticide dump site. It's one of the five parcels. And then the main reason why we are here is the Town Wells Number 9, Town Well Number 5, have been impacted by contaminated groundwater. And there's a third supply well for the Town of Aberdeen here, which has been -- which is clean, and hopefully

it will stay clean.

So again, Powder Metals used the property from '80s to 1995. They made machine parts, and they had a solvent bath there. They went bankrupt. The property was sold to Diamond Exhaust which reportedly just used the property and building as a warehouse. And recently that property was sold to CALCO, which just used the property to work out of.

Again, going back to Lee Paving property, north Carolina Department of Transportation had a lab there where they tested the aggregates of asphalt and they used solvents to dissolve the black top. And reportedly when tests were done, they just dumped the liquids out the back door.

Again, this TCE, trichloroethene, which is the solvent that was typically used as a solvent, started showing up in the Geigy Chemical wells. And that's how it became drawn out. And then again, as I mentioned before, we had emergency response in 1990 where we hooked up the 40 homes and businesses. And that again was due to TCE in people's private wells as well as some lead contamination.

The Aberdeen contaminated groundwater site was placed on the national priorities list as I had mentioned before in 2008. It was described as just a

plume with -- a plume is just contamination in the groundwater with no identified source. And we've done the remedial investigation feasibility study from 2009 to 2012.

Part of our process in the superfund process is to identify who we think are the potentially responsible parties. These were six that we had identified to date. Power Metals is a defunct company, so they're a nonviable PRP. Diamond Exhaust, same idea. CALCO, they probably will be settled as a diminless (phonetic) PRP. Lee Paving, there are remnants of Lee Paving around. So we are in communication with them. DOT, Department of Transportation, we're in contact with them. And then as I've mentioned, the PRP associated with Geigy Chemicals. We're in communication with all those folks. Eventually the idea is they'll pay the majority of our bills.

I think only one person might have been here at this 2009 meeting. That was our public kickoff meeting for the remedial investigation, feasibility study. Remedial investigation, basically the whole idea of that is to determine what's the contaminant? How far has it migrated? And what type of environmental media; soils, groundwater, surface water,

and sediments, and then what concentrations do you have.

For this, basically we basically did it two phases. We looked at the Powder Metals property itself to see if there was a continuing source on that property, which we did not find. And then phase two, how far has the contamination migrated?

And just to kind of go through the geology of the area, we were basically talking about three aquifers in this area: the surfisial aquifer, the Upper Black Creek, and the Lower Black Creek Aquifer.s And the two Black Creek Aquifers are basically the aquifers that are used to supply drinking water in this area.

The schematics of the geology, again this would be your surface aquifer, your Upper Black Creek, your Lower Black Creek, and then the other two aquifers down there.

Okay. Go through the findings of the remedial investigation; again, we did not find a continuing source, which in essence is a good idea or a good thing. We did find trichloroethene, and it's above federal and state cleanup numbers. The Upper Black Creek Aquifer, which is approximately 100 feet below ground surface, again, we found TCE pretty widely

spread out. And the federal level is five, the state level is three, and we're finding concentrations in the four hundreds. So it's there. The size of the plume is approximately 280 acres.

And then for the Lower Black Creek, which is a little bit -- it's below the Upper Black Creek, we again found TCE, not as high concentrations and it's not as big. It's only about 220 acres in size. And I guess the other good news is, we're not finding any TCE in surface water or sediments. Then this background, I know it's probably hard to see, but this basically give you the levels of TCE detected in the monitoring wells in our system out there.

The main reason why we're here tonight is because the levels we're finding in the Town of Aberdeen Supply Wells Number 5 and Number 9. Number 5, once we go above five, which I've highlighted in red, that's above the federal drinking standard, and the Town was required to shut this well down back in 2012 because of the level of TCE.

We are also starting to see levels of TCE in Well Number 9. And we also have detection of pesticides in Well Number 9 as well.

So try to tie all that information and basically groundwater is flowing in this direction.

Aberdeen Creek is down here. So Aberdeen Creek is basically the discharge point for groundwater. And this is the Upper Black Creek Aquifer. And again, this is the Powder Metals property, Lee Paving, and Geigy sites over there. And this is basically what we're finding as the TCE, the trichloroethene, plume. The heart of the plume is in that direction. And we're finding an arm coming down here. And again, this is Town Supply Well Number 5. So it is in one of the arms of the plume.

For Lower Black Creek, again groundwater is basically flowing in this direction. And for the extent of groundwater contamination, we have a little arm coming off this way. This is Supply Well Number 9 for the town. So that will help explain why we're seeing contamination in that supply well. Again, this is the heart of the plume here, and then we have a sliver coming off that way.

As far as contaminants are concerned for this particular aquifer unit, it is trichloroethene. So that will be the main contaminant that we -- or the only contaminant we basically monitored as part of this cleanup.

All of this information is fed into the based line risk assessment, which takes a look at the

contaminants, the toxicity of those contaminants, routes of the exposure, and again, as I just mentioned, the toxicity. In order to have a risk, you've got to have a chemical that has some toxicity, and you also have to have an exposure. If you don't have either, you don't have any risk. Superfund is a risk driven program.

We looked at the risks both quantitatively and qualitatively for both carcinogens and non-carcinogens, we looked at the current situation, and we also looked at the future. And usually the future involves building houses on the property. That's the most conservative approach we can use.

Again as I mentioned, superfunds is a risk driven program, and it's placing a number line, 0 going down to 10 -7. EPA's acceptable risk range is 10 -4 to 10 -6. If the calculated risk falls on this side where it's red, we deem it as an unacceptable risk and it that triggers a cleanup action from the EPA. That's for the cancer side. For a non-cancer side, we use a hazard quotient where if it's greater than one it is deemed an unacceptable risk and triggers a response. Again, this is our acceptable risk range, described here. These numbers -- it might be hard to read up there, but these are the risk numbers associated with

the contaminants we're finding in the wells.

Basically as the conclusion from the risk assessment, the risk is not that great due to the TCE. But we do have, like I mentioned, we do have some pesticides that come from the Geigy Chemical site, not the acting contaminated groundwater site. But we do have TCE that does exceed both federal and state levels. And again, as I mentioned earlier, there are no ecological risks. Surface water and sediments are not being impacted by the sites.

For remedial action objectives; one is to prevent the congestion of the contaminated groundwater outside the risk range. The second one is to replace the capacity of the wells that are being adversely impacted by the trichloroethene plumes, which basically Supply Wells Number 5 and Number 9. Their combined capacity is approximately 320 gallons per minute.

After we go through the remedial investigation and risk assessment, then we go into our feasibility study where we look at the types of technologies that are available to address present contaminates and where we find those contaminates.

So we identify those technologies. We screen them. We combined them if appropriately, and then we evaluate in a more detailed process. And basically from

that effort, we came up with three alternatives to address the supply wells for Supply Wells Number 5 and Number 9.

One which we are required to keep and to evaluate is no action. Then we compared everything back to that alternative.

Number 2, was the alternative that we had identified back in 2012 as our preferred alternative, and that was to put wellhead treatment on the wells themselves, using activated carbon that would remove all the contaminants, and the water would then enter into the distribution system.

Then alternative three, which is our new alternative, after meeting with the state and discussing -- other than alternative two, they identified alternative three, and said it was a better approach because it would eliminate any operation and maintenance dealing with the activated carbon and the monitoring that we would have to do associated with keeping our eyes on the activated carbon, so when it gets filled with contaminants we would have to change out the carbon.

So putting a cost to all this. Alternative one, doing nothing, we estimate it costs about two million dollars over 30 years, and that's due to

monitoring the groundwater as well as running what we have to do the five-year reports every year.

Alternative two was estimated at four million -- no, sorry, 4.7 million basically, again over 30 years. Most of that cost is associated with monitoring the program, monitoring the groundwater as well as the treatment system. And then the third alternative came in at a little over 800,000. That's basically installing some new supply wells in an area where groundwater we believe is clean.

Basically for alternative three to be assessed that we implemented, mobilize our equipment to the site or the town will, drill a test locations, make sure the groundwater is actually clean and it will produce sufficient quantities of water. And if the testing proves positive, then we need to go through and purchase the property or easement. That would be done then actually implement or install the actual supply well. And then hook it up to the existing distribution system. And we also have to five year duties.

Basically I think this slide, the two areas where we're thinking about putting the -- identified for the location of the new supply wells. Again, here's the Powder Metals property here, and here is Well Number 9 and Well Number 5 since there are two

wells impacted. We are thinking these are two locations where we've identified to put the new wells which are in the same vicinity as the existing supply wells. So we have a pretty good feeling that the groundwater over in that area is clean.

As far as the plume at large, I'll be back here probably a year or two years to present what we feel is the preferred alternative to deal with the plume at large, which I showed you in the previous slides. This is some of the information that's on the front page of the proposed plan. Just kind of repeating that. If there's any questions.

MR.____ How much is that costing, the two wells?

MR. BORNHOLM: I would estimate about 800,000, a little over 800,000 to put the new wells in there, and that includes purchasing any property or easements need to be purchased and paid for.

MR. JOHN WYLES: When you did the initial cleanup and everything was fine. Then from 2005 on the TCE levels grow. And that's because the plume is moving/migrating?

MR. BORNHOLM: Migrating groundwater supply, yes.

What we're anticipating again, if -- well, we

know that this has a source. Again, the source is probably gone because we're talking about a sandy area. The same here. I think the source is gone, and then the plume is going to be moving as the groundwater marches down.

Unidentified speaker: How much water is drawn by those wells.

MR. BORNHOLM: The combined flow from these two wells is estimated to be 320 gallons a minute.

UNIDENTIFIED SPEAKER: The biggest well -- the town's biggest well is Well 5. That produces about 230 gallons a minute, maximum capacity. And they lost that back in 2012.

(UNIDENTIFIED SPEAKER): So that who area can support the 320 --

MR. BORNHOLM: The whole idea is how many wells it takes to come to that capacity or close to that capacity is our goal.

MR. BORNHOLM: So we're estimating, hopefully two wells. If we're lucky it could take only one well. Or it may take three wells. It could take four.

(UNIDENTIFIED SPEAKER:) Sufficient water supply in that area to cover that?

MR. BORNHOLM: That's is what the test wells will tell us. First they put down call it ____ well,

run tests on it before they put six or eight-inch wells you guys usually put down? Drilling in this area is pretty easy.

Any other questions or comments?

(End of presentation.)

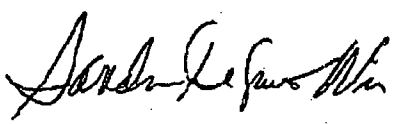
State of North Carolina

County of Hoke

I, Sandra Wise, Nationally Certified Verbatim Reporter, Master, do hereby certify that the foregoing proceeding was reported by me and was thereafter transcribed under my direction into typewriting; that the foregoing is a full, complete and true record of said proceeding.

I further certify that I am not of counsel or attorney for either or any of the parties in the foregoing proceeding and caption named, or in any way interested in the outcome of the cause named in said caption.

In witness whereof, I have hereunto set my hand this 3rd day of September 2014.



Sandra DeGarmo Wise, CVR-M
Certified by test (1887)

My Commission Expires 4/29/19.

Attachment B

Comments received from the Geigy Superfund Site Potentially Responsible Parties

Geigy Chemical Corporation Site
Aberdeen, NC
Joint PRP Correspondence

Delivered via email and hard copy

September 18, 2014

Mr. Jon Bornholm
U.S. EPA – Region 4
61 Forsyth Street, SW
Atlanta, GA 30303-3104

Subject: **Aberdeen Contaminated Groundwater Site (Site)**
Comments on Proposed Plan
Operable Unit 1

Mr. Bornholm:

This letter is intended to provide comments on the Proposed Plan distributed to the public at large by USEPA for Operable Unit 1 (OU1) at the Site referenced above. The Proposed Plan sets forth remedial options for OU1 to address the adverse impact resulting from Site related contamination on the Town of Aberdeen (TOA) public water supply wells #5 and #9. Trichloroethylene (TCE) is presented in the Proposed Plan as the constituent of concern. The Proposed Plan also lists the potentially responsible parties (PRPs) for OU1 as Calco Enterprises, Lee Paving Company, Powder Metal Products, Inc. (PMP), the North Carolina Department of Transportation (NCDOT), and the PRPs associated with the Geigy Chemical Corporation Superfund Site (Geigy Site). This correspondence is being provided on behalf of the Geigy Site PRPs.

The Proposed Plan for addressing OU1 impacts is replacement of TOA water supply wells #5 and #9 with newly installed wells at new, non-impacted locations. The Geigy Site PRPs provide the following comments regarding the Proposed Plan.

1. The Proposed Plan correctly states that the Geigy Site is <u>not</u> the source of TCE and that TCE observed in Geigy Site groundwater originated from another site.

2. The Proposed Plan recognizes that the former PMP and Lee Paving facilities are the likely sources of TCE.

3. Pesticides attributable to the Geigy Site are being addressed by EPA-approved remedial actions on-going at the Geigy Site. Three consecutive five-year Record of Decision Effectiveness reviews conducted by USEPA for the Geigy Site conclude that the Geigy Site remedy continues to be effective at addressing pesticides at the Site. The suggestion or assertion that pesticides detected throughout the Aberdeen Contaminated Groundwater Site can be conclusively linked to the Geigy Site is not supported by the available data and disregards the historic usage of properties within the boundaries of the Aberdeen Contaminated Groundwater Site.

4. The Proposed Plan suggests that the existing pump and treat remedy of the Geigy Site has influenced the distribution of Volatile Organic Compounds (VOCs) in groundwater. This statement is incorrect and is contrary to existing information and data. TCE was present in groundwater underlying the Geigy Site prior to the installation of the existing Geigy groundwater treatment system.

Thank you for giving careful consideration to these comments as the Record of Decision for the Site is being drafted.

Sincerely,

OLIN CORPORATION

James M. Cashwell
Manager, Environmental Remediation

Cc: George Crouse, Syngenta

Attachment C

Comments received from Hick-Hartman on behalf of North Carolina Department of Transportation

hart hickman

SMARTER ENVIRONMENTAL SOLUTIONS

Via Email

September 16, 2014

US EPA – Region 4
61 Forsyth Street, SW
Atlanta, GA 30303-3104

Attention: Mr. Jon Bornholm

Re: Comments to Proposed Plan for Operable Unit 1
Aberdeen Contaminated Groundwater Site
Aberdeen, North Carolina

Dear Mr. Bornholm:

On behalf of NC DOT, Hart & Hickman, PC (H&H) is providing these comments on the Proposed Plan for Operable Unit 1 of the Aberdeen Contaminated Groundwater Site (the "Plan"). H&H agrees with the overall approach to replace the impacted Town of Aberdeen Water Supply Wells with new wells in an area with no suspected groundwater impacts. H&H is providing this letter to provide technical comment on two items provided in the Plan.

The plan mentions that the plume has no identified source. However, H&H believes that the data indicate that the former PMP site is the source of the plume that impacted the Town Wells. The highest concentrations of chlorinated solvents detected in groundwater were detected on the PMP site. In addition, the PMP site is situated in an upgradient position relative to the Town Wells. EPA did not find the soil source area for the impacts at the PMP site, but the testing conducted was inadequate. Based on a review of prior reports, no testing was conducted at the reported trichloroethene (TCE) dip vat which was likely situated in the building. No soil sampling was conducted beneath the building slab which is a common location for source areas in manufacturing buildings. Secondly, no soil sampling was conducted beneath the septic tank where the potential TCE degradation product cis-1,2-dichloroethene was detected in residual tank fluids. Although soil testing was conducted in select locations outside of the building, the septic lines were not traced from the septic tank to the leach field. Therefore, it is unknown if

any soil samples were collected within or beneath the leach field. H&H believes that a soil source area likely exists at the former PMP site and that the presence of such a source would support the position that the PMP site is the source of the plume that impacted the Town Wells.

H&H is also providing comment on Figure 4 which depicts the TCE concentrations in the Upper Black Creek (UBC) Aquifer. The TCE UBC figure depicts a southern plume lobe near ACGMW10 and the FLENOUR monitoring points that does not follow the principles of hydrogeology. If that plume lobe was oriented with the potentiometic surface presented as Figure 3, the southern plume lobe would be directly downgradient of the PMP site. In addition, certain data were omitted from Figure 4. An UBC aquifer TCE plume map that is consistent with available data and the potentiometric map is attached.

We appreciate this opportunity to provide feedback to EPA. If you have any questions or wish to discuss the above points, please do not hesitate to contact me.

Sincerely,

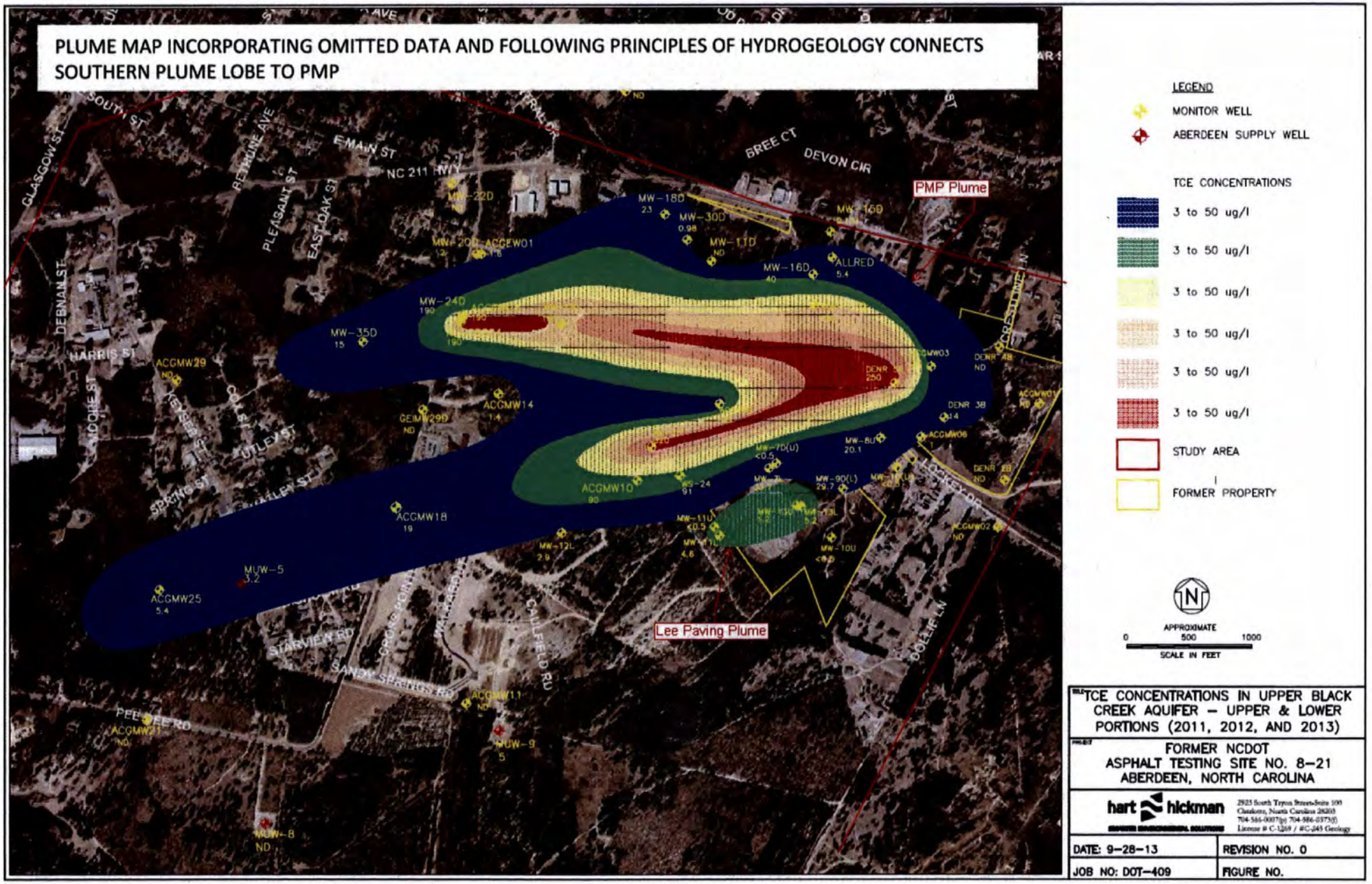
Hart & Hickman, PC

Matt Bramblett, PE
Principal

Attachment

Cc: Mr. Chris Niver, NC DOT (via email)
Mr. Ethan Caldwell, NC DOT (via email)

hart hickman


PLUME MAP INCORPORATING OMITTED DATA AND FOLLOWING PRINCIPLES OF HYDROGEOLOGY CONNECTS SOUTHERN PLUME LOBE TO PMP
PMP Plume
Lee Paving Plume
LEGEND
MONITOR WELL
ABERDEEN SUPPLY WELL
TCE CONCENTRATIONS
3 to 50 ug/l
3 to 50 ug/l
3 to 50 ug/l
3 to 50 ug/l
3 to 50 ug/l
3 to 50 ug/l
STUDY AREA
FORMER PROPERTY
N
APPROXIMATE
0
500
1000
SCALE IN FEET
TCE CONCENTRATIONS IN UPPER BLACK CREEK AQUIFER – UPPER & LOWER PORTIONS (2011, 2012, AND 2013)
FORMER NCDOT
ASPHALT TESTING SITE NO. 8–21
ABERDEEN, NORTH CAROLINA
hart hickman
DATE: 9–28–13
REVISION NO. 0
JOB NO: DOT–409
FIGURE NO.