FINAL
DECISION DOCUMENT
FOR
FORMER WALDORF NIKE (W-44) SITE, LAUNCH AREA WALDORF, MARYLAND

Contract No.: W912DR-09-D-0061, Delivery Order 0009

FUDS Property: Former Waldorf Nike Missile Battery (W-44) Launch Area

CERCLA Phase: Decision Document

Project Name: Waldorf Nike (W-44) Site, Launch Area

Prepared for:

US Army Corps of Engineers®

BUILDING STRONG®

February 2015

This page intentionally left blank

Final
Decision Document
for
Former Waldorf Nike (W-44) Site, Launch Area
Waldorf, Maryland

Prepared for:

U.S. Army Corps of Engineers
Baltimore District

Contract No.: W912DR-09-D-0061
Delivery Order 0009

This page intentionally left blank

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF ABBREVIATIONS AND ACRONYMS

AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
AS	air sparging
CCl_4	carbon tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
COMAR	Code of Maryland Regulations
CW	circulation well
DD	Decision Document
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
ERT	ERT, Inc.
FFS	Focused Feasibility Study
FS	Feasibility Study
FUDS	Formerly Used Defense Sites
GAC	granular activated carbon
GRA	general response action
HI	hazard index
IWAS	in-well air stripping
ISCR	in-situ chemical reduction
LUC	land use control
MCL	maximum contaminant level
MDE	Maryland Department of the Environment
MNA	monitored natural attenuation
MW	monitoring well
m^3	cubic meter
mg/L	milligrams per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
PRAP	Proposed Remedial Action Plan
PRB	permeable reactive barrier
RA	risk assessment
RAO	remedial action objective
RG	remediation goal
RI	Remedial Investigation
SSHP	site safety and health plan
SVE	soil vapor extraction
TBC	to be considered
TCE	trichloroethylene
TMV	toxicity, mobility, or volume
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency

UST	underground storage tank
VOC	volatile organic compound
Weston	Weston Solutions
ZVI	zero valent iron
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter

1.0 DECLARATION

1.1 Site Name and Location

The U.S. Army Corps of Engineers (USACE) Baltimore District has extensively investigated environmental conditions at the former Waldorf Nike (W-44) Site, Launch Area within the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). The site is located along the border between Charles County and Prince George's County, Maryland, approximately 15 miles southeast of the center of Washington, D.C.

1.2 Statement of Basis or Purpose

This Decision Document (DD) presents USACE Baltimore District's selected remedial action to address chlorinated compound contamination in shallow groundwater at the site.

This remedial action was chosen in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code (USC) § 9601 et seq as amended by the Superfund Amendments and Reauthorization Act and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The remedial action will be conducted within the DERP-FUDS and the USACE Baltimore District is the lead agency for CERCLA response actions concerning this FUDS. The site is not listed on the National Priorities List and the lead regulatory agency is the Maryland Department of the Environment (MDE). MDE has provided concurrence with the selected remedial action as presented in the Final Proposed Remedial Action Plan (PRAP) (ERT, 2013).

The remedial action was selected based on information documented in the Administrative Record (AR) for this site, including the Final Focused Feasibility Study (Weston, 2011). This DD highlights key information presented in the Remedial Investigation/Feasibility Study (RI/FS) reports and AR, presents the selected remedial action, and summarizes the rationale for the selection of the preferred remedial alternative over other alternatives considered in the FS.

The remedy was selected based on a detailed analysis of remedial action alternatives and comparison to nine criteria as required by the NCP. The selected remedial action was presented to the community for review in the PRAP and at a formal public meeting. The USACE Baltimore District provided at least thirty days, as required by the NCP, for the public to submit formal comments in response to the PRAP. MDE has reviewed the PRAP and provided formal concurrence with the selected remedial action.

1.3 Assessment of the Site

The response action selected in this DD is necessary and appropriate to protect human health and the environment from chlorinated compound contamination in shallow groundwater at this site Chlorinated compounds, specifically carbon tetrachloride (CCl_4) and trichloroethylene (TCE) having historical Department of Defense (DoD) applications as solvents and degreasers, are contaminating shallow groundwater encountered at approximately 15 feet below the ground surface and were identified as constituents of concern (COCs) in the 2005 RI (Weston Solutions [Weston], 2005). CCl_4 and TCE were used at former Nike Missile Launch sites to remove oils, greases, and corrosion from system components (USACE, 2003). These COCs are present in a groundwater plume underneath the site and extending approximately to Cedar Tree Lane located west of the site. Historically, specifically in 2001 (i.e., sample from temporary monitoring point) and in 2006 (i.e., sample from MW-18), COCs were detected in groundwater to the west of Cedar Tree Lane; however, the most recent sampling data collected from MW-18 in 2008 and

2011 indicate CCl4 and TCE concentrations below project screening criteria to the west of Cedar Tree Lane.

Exposure to CCl_4 and TCE may be associated with negative health effects in humans and in the environment. Both compounds are considered by the U.S. Environmental Protection Agency (USEPA) to be possible human carcinogens. The chlorinated organic compounds CCl_4 and TCE exhibit certain characteristics making both compounds more prone to volatilization.

Total carcinogenic risk associated with the site-specific COCs for future child and future adult residents (i.e., 7.0×10^{-6} and 2.3×10^{-6}, respectively) is within the USEPA acceptable range of risk for suspected carcinogens (i.e., between 1.0×10^{-4} and 1.0×10^{-6}). Although USEPA does not require further action for potential carcinogenic risk that falls within this range, it is recommended by USEPA that further environmental management be considered.

Total non-carcinogenic risk to potential future child residents (i.e., hazard index (HI) of 2.7) exceeds the USEPA hazard index threshold of 1.0 for overall potential non-carcinogenic effects. Therefore, the remedial alternative presented in this DD has been selected by USACE Baltimore District to protect public welfare from potential future inhalation exposure of CCl_4 and TCE vapors emanating from groundwater.

1.4 Description of Selected Remedy

Remedial action objectives (RAOs) describe the goals that the selected remedial action are expected to accomplish. The RAOs for the site are to:

- Prevent human exposure via inhalation of CCl_4 and TCE concentrations above risk-based concentrations.
- Prevent the use of groundwater until the CCl_4 and TCE concentrations in groundwater are below the USEPA MCL of 5 µg/L.

The RAOs for this site are medium-specific (i.e., groundwater-specific) and are based on the constituent-specific USEPA MCL for groundwater and site-specific applicable or relevant and appropriate requirements (ARARs). By addressing COCs in groundwater, the associated risks to future resident receptors related to groundwater and soil gas will be mitigated to levels that are considered acceptable by the USEPA.

In-situ chemical reduction (ISCR) with the implementation of land use controls (LUCs) is the selected remedy for the site. LUCs will be implemented to prevent the use of groundwater for drinking purposes at the site and the impacted area downgradient of the site, and prevent indoor activities at Buildings 23 and 31 unless the area is ventilated until groundwater COCs achieve the RAOs for the site. The main components of the selected remedy include:

- Installing of additional groundwater monitoring wells (MWs) downgradient of the groundwater plume and a baseline groundwater sampling event.
- Injecting environmentally-safe chemicals (e.g., zero valent iron [ZVI] or similar) into the groundwater plume where physical and chemical processes will combine to create conditions conducive to destroying CCl_4 and TCE in groundwater.
- Post-treatment performance monitoring groundwater sampling events.
- Quarterly performance monitoring of groundwater the first year after the injection event and semi-annual monitoring until achievement of the RAOs is verified.

- Implementing LUCs to prevent the use of groundwater for drinking purposes at the site and the impacted area downgradient of the site, if necessary, until CCl_4 and TCE concentrations achieve the RAOs.
- If at any point in the future the groundwater plume has migrated under any current structures or if any future structures are to be constructed within the footprint of the plume (e.g., residential homes), indoor air samples and/or soil vapor samples may be required in order to determine if a vapor intrusion pathway is present.

1.5 Statutory Determinations

The selected remedial action is protective of human health and the environment; complies with Federal and State ARARs; is cost effective; and utilizes permanent solutions to address the risk associated with the localized groundwater plume. The selected remedial alternative satisfies the statutory preference for treatment as a principal element of the remedy, permanently and significantly reducing the toxicity, mobility, or volume of the contaminants. It is expected that within five years of implementation of this remedial action, no hazardous substances, pollutants, or contaminants will remain at concentrations above regulatory levels preventing unlimited use or unrestricted exposure. Therefore, it is anticipated that one CERCLA Five-Year review will be conducted to ensure effectiveness of the remedial action; however, continued CERCLA Five-Year Reviews should not be warranted. In the event that the RAOs are not achieved within the anticipated five-year time frame, per the requirements of Section 121 of CERCLA and the NCP, Five-Year Reviews will be continue until the COCs do not remain in concentrations above regulatory levels preventing unlimited use or unrestricted exposure. The cost of the treatment is expected to be low to moderate. The treatment technologies may result in potential short-term risks to remedial workers. All remedial activities including mixing, injection, and follow-up sampling would be conducted in accordance with site safety and health plans and would pose little to no danger to the surrounding community, workers, or to the environment. Any potential risks to the community will be minimized by taking appropriate measures and by complying with applicable local and state requirements.

1.6 Decision Document Data Certification Checklist

The following bulleted information related to the selected remedial action is included in the Decision Summary section of this document, and satisfies the certification requirements for this DD.

- Identified COCs (CCl_4 and TCE) and their reported concentrations in groundwater.
- Baseline human health risk values represented by the concentrations of CCl_4 and TCE in groundwater.
- Basis for the remedial action.
- Potential source materials constituting principal threats.
- Current and reasonably anticipated future land use assumptions.
- Estimated capital, annual operation and maintenance, and total present worth costs.
- Key factors that led to selecting the remedy.
- Description of the selected remedial action.

Additional site information, including the RI and FS Reports, can be found in the AR file for this site. The AR file is located at:

P.D. Brown Memorial Branch Library, 50 Village Street, Waldorf, MD 20602

1.7 Authorizing Signature

19 Jun 2015

J. Richard Jordan, III **Date**
Colonel, Corps of Engineers
District Engineer

2.0 DECISION SUMMARY

2.1 Site Name, Location and Description

The site is located along the border between Charles County and Prince George's County, Maryland, approximately 15 miles southeast of the center of Washington, D.C. (**Figure 2-1**).

The site was part of the Washington D.C. defense area network that was established in 1955. The site remained operational until 1971. The site included a former acid fueling building, personnel barracks, a gate house, a generator building, vehicle maintenance building, warhead maintenance building, a kennel, a missile assembly and test building, an oil shed, a sand filter building, three underground storage tanks (USTs), two underground missile silos (A and B), and an electrical utility system.

2.2 Site History

Between 1965 and 1986, the DoD declared 27.72 acquired acres, 35.98 acres of easement, and a 0.89-acre lease formerly consisting of the Waldorf Nike Battery, Launch Site and Control Area, as excess and subsequently conveyed the property to other owners.

The Waldorf Nike (W-44) Site Launch Area (referred to in this document as the "site") contains 15.14 acres of the former DoD parcel, and it is currently owned by Charles County and is leased to the Maryland Indian Heritage Society for use as a cultural center. The Maryland Indian Heritage Society uses the former personnel barracks, vehicle maintenance building, warhead maintenance building, and generator building remaining at the site (**Figure 2-2**).

Operations and maintenance included the use of chlorinated solvents such as CCl_4 and TCE as cleaning agents for bare metals parts, missile bodies, steering fins, stabilizer fins, ailerons, rocket motor fins, and system components including filters for the launching control group, power simulator group, flight simulator group, and launcher interconnection box. Additionally, CCl_4 and TCE were used as degreasing agents, and to remove corrosion-prevention compounds from unpainted surfaces of missile stabilizer fins (USACE, 2003).

2.3 Previous Investigations

Beginning in 1986, a series of investigation activities were conducted by USACE Baltimore District to address potential environmental concerns associated with previous DoD activities (Donohue & Associates, Inc., 1987).

A 1986 Confirmation Study recommended removal of a UST near the vehicle maintenance building, due to concentrations of total petroleum hydrocarbons of 110 parts per million in one soil sample collected in association with the UST. This UST (i.e., Tank 6, an 8,000-gallon diesel UST) was subsequently removed in December 1994. Groundwater downgradient from UST Tank 6 was investigated as part of the limited RI in 1995 (via MW-4, MW-7, and MW-5) (Weston, 2005).

During environmental investigations conducted in 1991, groundwater samples from MWs at the site were analyzed for volatile organic compounds (VOCs), petroleum hydrocarbons, metals, semi-volatile organic compounds, polychlorinated biphenyls, and pesticides. Analytical data identified CCl_4 and TCE in shallow groundwater (approximately 15 feet deep) at concentrations above the RAOs.

In 2003, samples of standing water were collected from Silo A and Silo B and analyzed for VOCs, perchlorate and total metals. Perchlorate and VOCs were not detected in samples collected from either silo. Lead was detected in the water sample collected from Silo B at 64 µg/L, exceeding the USEPA action level for lead in groundwater of 15 µg/L for groundwater (Weston, 2005).

Three downgradient MWs were installed to assess potential leaching of constituents from within the silos. Groundwater samples collected from each of the three MWs downgradient of the silos did not detect the presence of any constituents of potential concern, including lead. A dye tracer test was performed in order to determine if standing water within the silos was potentially leaching into the adjacent groundwater. The dye tracer test confirmed that the silos were not leaking. The silos were therefore considered not to be a hazard to human health or the environment (Weston, 2005).

The following conclusions were presented in the 2005 RI report: (1) the two former missile silos at the site are not leaking infiltrated standing water; (2) CCl_4 (maximum detected concentration of 360 µg/L) and TCE (maximum concentration of 16 µg/L) concentrations in groundwater were detected above project screening criteria and are considered COCs; (3) the unnamed stream to the west of the site is not contaminated and could be considered as unthreatened by contamination from the site; (4) potential future groundwater use and the inhalation of vapors associated with COC concentrations are potential exposure pathways; (5) risk associated with concentrations of COCs in groundwater are within the acceptable carcinogenic risk range as defined by USEPA (1×10^{-4} and 1×10^{-6}), and (6) non-carcinogenic risks to future child receptors (HI of 2.7) exceeds the USEPA HI threshold of 1.0.

In 2009, an RI Addendum was conducted to evaluate the potential risk of COC soil gas intrusion into future on-site and off-site buildings. The RI Addendum concluded that: (1) concentrations of CCl_4 and TCE in shallow soil gas are below USEPA risk-based screening levels for residential air (USEPA, 2011); (2) concentrations of TCE and CCl_4 in groundwater decrease radially and downgradient of the potential source area; and (3) concentrations of CCl_4 and TCE in groundwater continue to exceed the USEPA MCL (ERT, Inc. [ERT], 2009).

In 2011, a second RI Addendum was completed to address data gaps related to the location of a potential source area and to refine the extent of the groundwater plume (ERT, 2012). During the investigation, TCE was detected in one soil sample at a concentration above the USEPA protection of groundwater screening level of 1.8 micrograms per kilogram. The location of this soil sample was approximately 15 feet to the north-northwest of an empty, deteriorating steel 55-gallon drum found on site. The 55-gallon drum was corroded, broken, and tipped on its side in a ditch. Due to the drum's apparent age and condition, its location upgradient of the groundwater plume, and the concentrations of TCE in soil samples adjacent to the drum, the deteriorated drum was determined to be one potential source of the groundwater plume (ERT, 2012).

In addition, indoor air samples were collected in 2010 from the basement and first floor of the residential structure situated on Lot 9, west of Cedar Tree Lane to address the potential for a vapor intrusion pathway in residential structures to the west of Cedar Tree Lane. Per USEPA and MDE guidance, indoor air sampling is the most definitive approach for determining if a potential vapor intrusion pathway exists. Based on the results of the indoor air sampling, no COC concentrations were detected, and therefore, it was determined that no vapor intrusion pathway exists for residential structures west of Cedar Tree Lane (ERT, 2012).

Attachment 1 provides the results for all groundwater samples with concentrations detected above project screening criteria collected during RI activities between 1987 and 2011.

The 2011 Focused Feasibility Study (FFS) established RAOs for the COCs and evaluated potential remedial alternatives for addressing the COCs (Weston, 2011). The FFS evaluated remedies to address two potential exposure pathways for the COCs: (1) vapors present in the unsaturated zone entering basements on adjacent residential Cedar Tree Properties, and (2) potential future groundwater use. Results of the FFS were utilized to develop the proposed remedial response action identified in the PRAP and formally selected in this DD.

In 2014, additional Vapor Intrusion Screening Level and Johnson and Ettinger modeling of potential vapor intrusion from VOCs in groundwater was conducted (ERT, 2014). The intent of these modeling calculations was to address potential vapor intrusion issues at Building 23 and Building 31. Based on the results of the modeling which utilized the the most current groundwater concentrations of CT and TCE at the site, the following conclusions were made:

- Concentrations of CT in groundwater do not present a carcinogenic or non-carcinogenic vapor intrusion risk site-wide.
- Concentrations of TCE in groundwater do not present a carcinogenic or non-carcinogenic vapor intrusion risk at Building 23 and Building 31.
- Concentrations of TCE in groundwater do not present a carcinogenic vapor intrusion risk site-wide.
- Concentrations of TCE in groundwater present a potential non-carcinogenic risk when the highest detected concentrations of TCE (37.3 µg/L) and a HI of 1 are used in the modeling. However, the highest concentration of TCE detected in groundwater is located in a wooded area, away from any site structures, and therefore the vapor intrusion pathway is not complete.

2.4 Community Participation

CERCLA and NCP (40 Code of Federal Regulations [CFR] § 300.430(f)(3)) requirements of public participation have been met during the investigation of this site and the selection of the remedial action. Associated project documents have been updated on a regular basis in the AR and the information repository maintained at the P.D. Brown Memorial Branch Library, 50 Village Street, Waldorf, MD 20602. The RI/FS and PRAP for the site are available to the public at the AR and on the USACE internet site:

http://www.nab.usace.army.mil/Missions/Environmental/FormerlyUsedDefenseSites/WaldorfNikeMissileSite.aspx

The PRAP was made available to the public via the internet on August 17, 2013. A notice of availability of the PRAP in the AR was published by USACE in the Enquirer-Gazette from September 13, 2013 through October 31, 2013. A notification of the PRAP public meeting was published by USACE in the Enquirer-Gazette from September 13, 2013 through September 18, 2013. USACE held a public meeting at the Waldorf West Branch Library, 10405 O'Donnell Pl, Waldorf, MD 20603 on September 18, 2013. The intent of the public meeting was to allow community attendees the opportunity to interact with the project delivery team and discuss the proposed remedial action.

During the public meeting, a brief history of remedial investigation efforts was imparted to community members. USACE explained that groundwater at the site, specifically the contaminated groundwater, is not a source of drinking water in the area, and that the most recent sample data infer that concentrations of CCl_4 and TCE exceeding the RAOs remain east and north of Cedar Tree Lane.

In accordance with the NCP, a public comment period was afforded to review the proposed remedial action between August 17, 2013 (i.e., the date that the PRAP was made available to the public via the USACE Baltimore District website) and October 31, 2013.

2.5 Scope and Role of Response Action

The selected remedial action will be executed by USACE Baltimore District within the framework of the DERP-FUDS and in accordance with CERCLA. Regulatory oversight of the previously completed RI/FS and forthcoming remedial action is being performed by MDE.

ISCR with LUCs to prevent the use of groundwater for drinking purposes at the site and the impacted area downgradient of the site is the selected remedy for the site. The main components of the selected remedy include:

- *Implementing LUCs to prevent the use of groundwater for drinking purposes at the site and the impacted area downgradient of the site, until contaminant concentrations achieve the RAOs:* The selected remedy will prevent the use of groundwater for drinking water through LUCs until the RAOs are achieved (and documented via at least one CERCLA Five-Year review. Until the RAOs are achieved, the selected remedy will provide for legal controls (e.g., permitting and deed restrictions) preventing the installation of drinking water wells (via permitting). Individual property owners presented no objections during the public comment period to planned legal controls that may be implemented during the remediation event through deed restrictions (Weston, 2011).
- *Installing of additional MWs downgradient of the groundwater plume to serve as sentinel sampling locations and perform a baseline groundwater sampling event*: During the preliminary design phase for the implementation of the selected remedy, additional groundwater sample collection outside of the existing groundwater monitoring network will be necessary to confirm the current groundwater plume boundary, establish additional sentinel monitoring locations, establish a current groundwater COC baselines for the remedial action.
- *Injecting environmentally-safe chemicals (e.g., ZVI solution or similar) into the groundwater plume where physical and chemical processes will combine to create conditions conducive to destroying contaminants in groundwater*: The intent of this action is to inject environmentally-safe chemicals into the groundwater plume where physical and chemical processes will combine to create conditions conducive to destroying the CCl_4 and TCE in the groundwater. The ISCR alternative will substantially reduce, if not completely eliminate, the potential risk to human health and the environment that is associated with the elevated concentrations of CCl_4 and TCE in groundwater.
- *Post-treatment performance monitoring groundwater sampling events:* Upon completion of the ISCR injection, performance monitoring through groundwater sampling will be conducted to ensure the remedy has been effectively implemented.
- *Quarterly performance monitoring of groundwater the first year after the injection event and semi-annual monitoring:* Monitoring will continue until achievement of the RAOs is verified, which is anticipated to include no more than 3 total years of post-treatment monitoring. In the event that the RAOs are not achieved within the expected 5 year remediation timeframe, the site will be re-evaluated to determine if further remedial actions are required. If ISCR with monitoring is still determined to be the preferred

remedial response, the monitoring may continue for up to 30 years or until the RAOs have been achieved, and will include the completion of CERCLA Five-Year Reviews.

- *Potential for additional indoor air/soil vapor sampling:* If at any point in the future the groundwater plume has migrated under any current structures or if any future structures are constructed within the footprint of the plume (e.g., residential homes), indoor air samples and/or soil vapor samples may be required in order to determine if a vapor intrusion pathway is present.

2.6 Site Characteristics

The site is located on approximately 15.14 acres of relatively flat terrain that is approximately 205 to 210 feet above mean sea level, sloping from northwest to southeast.

Based on historical DoD operations, a remnant drum, and associated TCE in surface soil, the presumed source of contamination at the site is chlorinated solvents used for cleaning. Oils, greases, and corrosion were removed from system components using chlorinated solvents (USACE, 2003). Chlorinated solvents, such as the COCs CCl_4 and TCE were typically managed onsite and stored in small bulk storage units such as 55-gallon drums.

During RI activities, samples were collected from soil, groundwater, surface water, and sediment, and submitted for full suite laboratory analysis. Potential human health risk concerns were identified solely in groundwater and specific to CCl_4 and TCE. The most current sampling data indicates that the CCl4 and TCE concentrations in groundwater that are to be remediated are presented in **Figure 2-3** and **Figure 2-4**. Baseline sampling, completed prior to the implementation of the remedial action, may result in revisions to the CCl4 and TCE plumes. The groundwater plume is approximately 175 feet (north to south) by 75 feet (west to east) at its largest points. Contamination is confined to the shallow unconfined groundwater unit encountered at approximately 15 feet below ground surface.

A potential former source area is associated with the location of a deteriorating 55-gallon drum where TCE concentrations have been identified in surface soil slightly above the USEPA protection of groundwater standard. Detected concentrations do not pose potential excess risk to human and/or environmental receptors, but may have contributed to observed concentrations of TCE in groundwater.

2.7 Current and Potential Future Land Use

After the DoD declared the Waldorf Nike Battery excess between 1965 and 1986, the property was conveyed to other owners. The site is currently owned by Charles County and is leased to the Maryland Indian Heritage Society for use as a cultural center.

The property remains in use by the Maryland Indian Heritage Society, which uses the former personnel barracks, vehicle maintenance building, warhead maintenance building, and generator building remaining at the site (future use is expected to be the same).

Land use adjacent to the site is primarily low-density residential. The Cedar Tree Development residential properties are immediately adjacent to the site and will continue to be so for the foreseeable future.

Shallow unconfined groundwater at the site is not currently used as a potable source of water and will likely not be used in the future. However, the selected remedy will prevent the use of shallow unconfined groundwater until the groundwater concentrations for CCl_4 and TCE achieve the RAOs.

There are three private deep wells within a 4 mile radius of the site which acquire groundwater from the Magothy Formation, a confined aquifer that underlies both the confined Aquia formation and unconfined Monmouth Formation (i.e., shallow groundwater). The Magothy Formation begins at approximately 310 feet below ground surface.

2.8 Summary of Site Risks

During the development of the RI, a baseline risk assessment was conducted in 1996 and later updated in 2004 that identified two COCs: CCl_4 and TCE.

In an effort to be conservative, the baseline risk assessment was conducted assuming current and potential future residential use, although the site is currently utilized as industrial/commercial property.

Potential human health risks associated with identified COCs have been evaluated for both carcinogenic and non-carcinogenic risk.

The risk assessment was performed assuming reasonable maximum exposure scenarios for COC concentrations observed in the groundwater during the RI. In order to estimate potential human health risks, the risk assessment focused on contaminants detected during various site investigations, potential exposure pathways, estimated exposure point concentrations of the contaminants, and toxicity values of the contaminants.

2.8.1 Exposure Assessment

The exposure assessment utilized USEPA groundwater risk-based screening levels and evaluated potential risk resulting from current and potential future residential land use. Current and potential future receptor populations included children and adult residents of the Cedar Tree Property development. Groundwater is not currently used by the current residents, and is not expected to be used by future residents. Regardless, the remedial action will reduce concentrations of COCs to levels below their respective USEPA MCLs, in accordance with 40 CFR Section 141.

One exposure pathway was evaluated for the receptor population during the risk assessment: inhalation of vapor-phase CCl_4 and TCE enclosed in the basement.

2.8.2 Estimation of Exposure Point Concentrations

Exposure point concentrations represent the chemical concentrations in environmental media that the receptor will potentially contact during the exposure period. The exposure point concentrations utilized in the exposure assessment are summarized in **Table 2-1**.

2.8.3 Toxicity Assessment

CCl_4 and TCE are types of chlorinated organic compounds that exhibit certain characteristics that make them more prone to volatilization. Exposure to CCl_4 and TCE can be associated with negative health effects in humans and environment. Based on laboratory studies, both CCl_4 and TCE are considered by USEPA to be possible human carcinogens, meaning that prolonged exposure to either could potentially cause cancer in humans above expected rates given sufficient time and exposure levels.

Table 2-1. Summary of Exposure Point Concentrations

Chemical	Selected Input Groundwater Concentration (µg/L)[a]	Selected Input Soil Gas Concentration (µg/L-vapor)[b,c]	Indoor Air Concentration Based on Groundwater to Enclosed-Space Air Modeling (µg/m^3-air)	Indoor Air Concentration Based on Soil Gas to Enclosed-Space Air Modeling (µg/m^3-air)
CCl_4	110	3.9	1.1	5.7
TCE	6.0	0.08	0.025	0.076

Legend:
a Represents the maximum detected groundwater concentration measured in on-site well MW-4 in 2003 (central location of the plume circa 2003).
b Represents the 95% upper confidence limit (UCL) or the maximum detected soil gas concentration (if the UCL exceeded the maximum) in lots 8, 9, and 10.
c 1 µg/L = 1,000 µg/m^3
µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter
Source: Final Focused Feasibility Study Nike Battery Launch Area (W-44) Formerly Used Defense Site, Waldorf, Maryland (Weston, 2011).

2.8.4 Risk Characterization

Total carcinogenic risk associated with the inhalation of site-specific COCs (i.e., 2.3 x 10^{-6} for the future adult resident due to groundwater/1.2 x 10^{-5} for the future adult resident due to soil gas and 1.3 x 10^{-6} for the future child resident due to groundwater/7.0 x 10^{-6} for the future child resident due to soil gas) is within the USEPA acceptable target range of risk for suspected carcinogens (i.e., between 1.0 x 10^{-6} and 1.0 x 10^{-4}). Although USEPA does not require further action for potential carcinogenic risk that falls within this range, site-specific circumstances may require that further environmental management be considered.

The HI associated with inhalation of site-specific COCs for the future child receptor (i.e., 2.7 HI due to soil gas) exceeds the USEPA acceptable target of 1.0 for overall potential non-carcinogenic effects. The HI for the future child receptor due to groundwater was 0.52, the HI for the future adult receptor due to groundwater was 0.18, and the HI for the future adult receptor due to soil gas was 0.91.

The results of the 2004 updated risk assessment suggest that the future adult and child inhalation risks as a result of potential vapor intrusion from groundwater sources into residences are decreasing since the initial risk assessment was performed in 1996. However, USACE and MDE recognizes that CCl_4 and TCE concentrations in groundwater are above their applicable groundwater USEPA MCLs and the concentrations contribute to an unacceptable HI for the future child receptor due to inhalation exposure. Based on this information and in accordance with CERCLA, USACE will implement the response action selected in this DD to ensure the protection of public health from CCl_4 and TCE present in the shallow groundwater at the site.

Additionally, for the purpose of clarification as part of this DD that a summary of the 2004 risk assessment results presented in the Section 1.4.5 of the FFS (Weston, 2011) inadvertently misrepresented the risk assessment data. However, Appendix A, Tables A-2 and A-3 of the FFS

(Weston, 2011) accurately represent a summary of the risk assessment as determined by the 2004 risk assessment.

An ecological risk assessment was not performed because, based on the concentrations of constituents and the media affected, potential risks to ecological receptors is not expected to be significant.

2.9 Remedial Action Objectives

RAOs describe the goals that the selected remedial action are expected to accomplish. RAOs consist of medium-specific (e.g., groundwater) goals for protecting human health and the environment. RAOs for this site are based on site-specific ARARs, and the current and potential future land use as residential property. The RAOs for the site are:

- Prevent human exposure to CCl_4 and TCE concentrations above risk-based concentrations.
- Prevent the use of groundwater until the CCl_4 and TCE concentrations are below the USEPA MCL of 5 µg/L.

The selected remedy, ISCR with the implementation of LUCs until groundwater RAOs are achieved will (1) reduce the toxicity, mobility, and volume of CCl_4 and TCE in the shallow groundwater, (2) further reduce the potential excess risk associated with exposure to CCl_4 and TCE by reducing their concentrations in groundwater, (3) prevent installation of drinking water wells and the use of shallow groundwater at the site until the shallow unconfined groundwater quality meets RAOs, and (4) implement monitoring of groundwater COC concentrations until the shallow unconfined groundwater quality meets the RAOs.

2.10 Description of Potential Remedial Alternatives

A number of general response actions (GRAs) and associated technologies were identified and screened during the FFS as potential remedial actions to satisfy the RAOs for groundwater at the site. The GRAs considered were:

- No Action
- Institutional Actions
- Containment
- Recovery
- Treatment

In total, 13 technology types and process options associated with the identified GRAs were screened for applicability based on effectiveness, implementability and cost to achieve the site-specific RAOs for groundwater.

Based on the initial screening of the 13 technology types and process options, six potential remedial alternatives were developed and analyzed in detail in the FFS against nine criteria in order to select the preferred alternative to achieve the RAOs. The six remedial alternatives analyzed were:

- *No Action* – Under the No Action alternative, no active remedial action or monitoring will be implemented. The No Action alternative was evaluated as required by the NCP, to provide a baseline against which other alternatives may be compared.

- *Monitored Natural Attenuation (MNA)* – EPA defines MNA as "the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remedial objectives within a timeframe that is reasonable compared to those offered by other more active methods" (EPA, 1999). The processes that contribute to natural attenuation include biodegradation, dilution, dispersion, absorption, adsorption, volatilization, and chemical transformation. MNA is a cost-effective technology. Under favorable site conditions, MNA can be used effectively to remediate a range of organic compounds from groundwater. The primary components of the MNA alternative at the site include:
  - Semi-annual sampling and analysis from five shallow groundwater MWs. Three existing MWs (MW-4, MW-11 and MW-12) and two newly installed downgradient sentinel MWs would be included in the semi-annual sampling event.
  - Implementation of LUCs to prevent the use of groundwater for drinking purposes from the site and impacted areas downgradient of the site. Institutional controls would be implemented through deed restrictions.
- *Air Sparging (AS)/Soil Vapor Extraction (SVE)* – AS is a technology that mechanically injects air under pressure below the water table, using an air compressor to feed a series of injection wells. Volatile and semi-volatile organic compounds that are dissolved in the groundwater volatilize into the vapor-phase as the air bubbles move up through the groundwater to the unsaturated soil above. This vapor is captured by an SVE system, in which a vacuum is applied to the soil through a series of vapor extraction vents to induce the controlled flow of air and remove the vapor from the soil. The gas leaving the soil may be treated to recover or destroy the contaminants or released to the atmosphere, depending on local and State air discharge regulations. The primary components of the AS/SVE alternative at the site include:
  - Predesign investigation of an AS/SVE system, including pilot testing
  - Installation of an AS/SVE system.
  - Operation and maintenance of an AS/SVE system and above ground gaseous treatment system (if required).
  - Semi-annual sampling and analysis of five shallow groundwater MWs. Three existing MWs (MW-4, MW-11 and MW-12) and two newly installed downgradient sentinel MWs would be included in the semi-annual sampling event.
  - Implementation of LUCs to prevent the use of groundwater for drinking purposes from the site and impacted areas downgradient of the site. Institutional controls would be implemented through deed restrictions.
- *Circulation Well (CW) with In-Well Air Stripping* (IWAS) – The groundwater circulation well with in-well air stripping alternative involves two physical processes: groundwater circulation and in-well air stripping. The groundwater circulation well is used to mobilize contaminated groundwater to the circulation cell around the well. Groundwater is drawn into the circulation well at either the top or the bottom of the aquifer and discharged back into the aquifer at the opposite end (bottom or top) of the well. This vertical flow of groundwater through the circulation well creates a vertical circulation cell in the aquifer that is superimposed on top of the natural groundwater flow patterns. After it is released in the unsaturated zone, the water percolates back down to the groundwater table. Volatile compounds vaporize within the well at the top of the water table as the air bubbles out of the water. Contaminant concentrations are gradually reduced as the

process is repeated. Vapors released in the wells are captured by a vapor extraction system and treated to recover or destroy the contaminants or released to the atmosphere without treatment, depending on local and State air discharge regulations. The primary components of the CW with IWAS alternative at the site include:

- Predesign investigation of groundwater CW with IWAS, including pilot testing.
- Installation of groundwater CW with IWAS and above ground gaseous treatment system (if required).
- Operation and maintenance of the groundwater CW with IWAS.
- Semi-annual sampling and analysis of five shallow groundwater MWs. Three existing MWs (MW-4, MW-11 and MW-12) and two newly installed downgradient sentinel MWs would be included in the semi-annual sampling event.
- Implementation of LUCs to prevent the use of groundwater for drinking purposes from the site and impacted areas downgradient of the site. Institutional controls would be implemented through deed restrictions.

- *Permeable Reactive Barrier (PRB)* – PRBs are installed across the flow path of a contaminated groundwater plume, allowing the water portion of the plume to flow through the wall. These barriers allow the passage of water while prohibiting the movement of contaminants by employing such agents as zero valent metals, chelators (ligands selected for their specificity for a given metal), sorbents, microbes, and others. The reactive materials may be mixed with sand to make it easier for water to flow through the wall, rather than around it. A number of firms specialize in design and construction of PRBs. Most of them have developed their proprietary reactive materials for specific chemicals, or will develop site-specific reactive materials during the design stage based on site contaminants and concentrations. The PRB will be designed to reduce the CCl_4 and TCE concentrations in groundwater leaving the wall to less than 5 μg/L. The primary components of the PRB alternative at the site include:
  - Investigation (including groundwater sampling, direct-push soil sampling, and bench scale testing), design, and installation of the PRB.
  - Semi-annual sampling and analysis of five shallow groundwater MWs. Three existing MWs (MW-4, MW-11 and MW-12) and two newly installed downgradient sentinel MWs would be included in the semi-annual sampling event.
  - Implementation of LUCs to prevent the use of groundwater for drinking purposes from the site and impacted areas downgradient of the site. Institutional controls would be implemented through deed restrictions.

- *ISCR* – ISCR amendments, typically consisting of fibrous organic carbon and micro-scale ZVI, are injected into the saturated portion of the COC source zone where a number of physical and chemical processes combine to create strongly reducing conditions that stimulate the rapid and complete dechlorination of the contaminants. Small ZVI particles provide substantial reactive surface area that stimulates direct, abiotic chemical dechlorination of the COCs through the generation of strong reducing conditions, which also results in an additional drop in the redox potential of the groundwater via chemical oxygen scavenging. The extremely low redox potentials (i.e., ORP levels <-500 mV) yield thermodynamic conditions that will physically degrade most persistent organic constituents, thereby avoiding the accumulation of dead end catabolites such as chloroform from CCl4. The primary components of the ISCR alternative at the site include:

- Microcosom baseline testing of groundwater for the presence of dechlorinating bacteria and the effects of various ISCR amendments on site contaminants and geochemistry.
- Pilot testing and full-scale implementation of ISCR injection program
- Quarterly performance groundwater sampling of up to 9 MWs for the first year following amendment injections, followed by no less than two years of semi-annual sampling and analysis of groundwater. The final approved plans for the remedial action will be developed among stakeholders and be presented in the remedial action work plan.
- An additional round of soil gas sampling would be performed in Lots 8, 9 and 10 at the Cedar Tree Properties located immediately downgradient of the site to verify that there is no remaining vapor intrusion risk. The final approved plans for the remedial action will be developed among stakeholders and be presented in the remedial action work plan..
- Implementation of LUCs to prevent the use of groundwater for drinking purposes from the site and impacted areas downgradient of the site. Institutional controls would be implemented through deed restrictions.

Detailed analysis consisted of comparing each remedial alternative using nine specified evaluation criteria contained within 300.430(3)(9) of the NCP. These include:

- Overall Protection of Human Health and the Environment – Alternatives were assessed to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site by eliminating, reducing, or controlling exposures to levels established during development of remediation goals consistent with s 300.430(e)(2)(i) of the NCP. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

- Compliance with ARARs – The alternatives were assessed to determine whether they attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility siting laws or provide grounds for invoking one of the waivers under paragraph 300.430(f)(1)(ii)(C) of the NCP.

- Long-Term Effectiveness and Permanence – Alternatives were assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. Factors that were considered, as appropriate, included the following: (1) Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residuals were considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility, and propensity to bioaccumulate. (2) Adequacy and reliability of controls such as containment systems and institutional controls necessary to manage treatment residuals and untreated waste. This factor addresses in particular the uncertainties associated with land disposal for providing long-term protection from residuals; the assessment of the potential need to replace technical components of the alternative, such as a cap, a slurry wall, or a treatment system; and the potential exposure pathways and risks posed should the remedial action need replacement.

- Reduction in Toxicity, Mobility, or Volume through Treatment – The degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume was assessed, including how treatment is used to address the principal threats posed by the site. Factors that shall be considered, as appropriate, include the following: (1) The treatment or recycling processes the alternatives employ and materials they will treat; (2) The amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated, or recycled; (3) The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment or recycling and the specification of which reduction(s) are occurring; (4) The degree to which the treatment is irreversible; (5) The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents; and (6) The degree to which treatment reduces the inherent hazards posed by principal threats at the site.
- Short-Term Effectiveness – The short-term impacts of alternatives were assessed considering the following: (1) Short-term risks that might be posed to the community during implementation of an alternative; (2) Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures; (3) Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigation measures during implementation; and (4) Time until protection is achieved.
- Implementability – The ease or difficulty of implementing the alternatives were assessed by considering the following types of factors as appropriate: (1) Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy. (2) Administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions); (3) Availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and availability of prospective technologies.
- Cost – The types of costs that were assessed included the following: (1) Capital costs, including both direct and indirect costs; (2) Annual operation and maintenance costs; and (3) Net present value of capital and operations and maintenance costs.
- Regulatory Acceptance –The state concerns that were assessed included the following: (1) The state's position and key concerns related to the preferred alternative and other alternatives; and (2) State comments on ARARs or the proposed use of waivers.
- Community Acceptance – this assessment included determining which components of the alternatives interested persons in the community support, have reservations about, or oppose.

2.11 Summary of Comparative Analysis of Potential Remedial Alternatives

A summary of the comparative of potential remedial alternatives conducted for the FFS (Weston, 2011) is presented in Section 2.10 in relation to each of the nine evaluation criteria is provided in **Table 2-2**. Complete details of the alternatives analysis process are available in the FFS (Weston, 2011).

2.11.1 Overall Protection of Human Health and the Environment

The No Action alternative would not be protective of human health or the environment. The potential risk from the inhalation of COCs in residential basements would continue to exist on Lots 8 and 10, if houses are built on these lots. In the absence of a groundwater monitoring program, the extent of any contaminant reduction would not be known. The remaining alternatives would ultimately provide protection to human health and the environment, although alternatives AS/SVE, CW with IWAS, and ISCR would achieve protection in a timelier manner.

AS/SVE, CW with IWAS, and ISCR are more aggressive than MNA because of active, focused remediation process being targeted directly within the source area. Active remediation, in conjunction with the naturally occurring processes, would result in achieving the RAOs within a shorter timeframe than MNA. PRB focuses on reducing the plume concentrations downgradient, but does not address the on-site groundwater plume source area concentrations. On-site COC concentrations would gradually decrease through natural attenuation processes.

2.11.2 Compliance with ARARs

Chemical-Specific ARARs: Chemical-specific ARARs would not be achieved in a reasonable timeframe utilizing the No Action and MNA alternatives because they rely on natural attenuation processes. Additionally, without a monitoring program, compliance with the chemical-specific ARARs could not be determined for the No Action alternative. The PRB alternative would achieve chemical-specific ARARs downgradient of the the PRB, but upgradient concentrations would rely on natural attenuation processes and not achieved in a reasonable timeframe. AS/SVE, CW with IWAS and ISCR would achieve the chemical-specific ARARs in a timely manner.

Location-Specific ARARs: There are no location-specific ARARs associated with the site.

Action-Specific ARARs: There are no action-specific ARARs associated with the No Action alternative. The remaining remedial alternatives would be compliant with action-specific ARARs.

2.11.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of the No Action alternative cannot be determined without a monitoring program. The potential risks to the future residents through inhalation of COCs in the basements of houses built on adjacent lots may persist. The remaining remedial alternatives would be effective in the long-term. The MNA alternative would reduce the magnitude of residual risk to acceptable levels through reduction in COC concentrations, and the alternative would require a significantly longer timeframe to achieve the RAOs. The PRB alternative would actively remediate groundwater COC concentrations downgradient of the PRB, but would rely on a longer timeframe to reduce concentrations upgradient of the PRB via natural attenuation processes. The AS/SVE, CW with IWAS, and ISCR alternative actively remediate the groundwater COC concentrations.

All alternatives will reduce the COC concentrations into harmless compounds and achieve the RAOs, but the degradation cannot be verified with the No Action alternative due to the lack of a monitoring program. The transformation processes associated with every alternative are irreversible.

2.11.4 Reduction of Toxicity, Mobility, and Volume

The No Action and MNA alternatives would not actively treat the contaminated groundwater, but natural process would reduce the toxicity, mobility and volume (TMV) over time. Without a monitoring program the reduction in TMV could not be verified with the No Action alternative.

The AS/SVE and CW with IWAS alternatives would reduce the TMV of contaminants and transform the COCs to harmless compounds if activated carbon is used to treat the extracted gas, as opposed to direct release to the atmosphere.

The PRB alternative would reduce the TMV and transform the COCs to harmless compounds gradually over time due to chemical reactions between the COCs and the reactive barrier. Upgradient of the PRB natural process would reduce the TMV gradually over time

The ISCR alternative would rapidly reduce the TMV of the COCs due to abiotic chemical reactions that occur between the COCs and the amendment material.

The AS/SVE, CW with IWAS, PRB and ISCR alternatives all meet the statutory preference for treatment as a principal element of the remedy.

2.11.5 Short-Term Effectiveness

The No Action alternative would present no additional risk to the community and site workers.

The MNA alternative presents minimal additional risk to the community and site workers because of limited construction activities associated with drilling, installation of additional MWs, and groundwater sampling.

The AS/SVE and CW with IWAS alternatives presents minimal short-term risks to the community and site workers due to activities associated with drilling and installing wells, installation of the vapor extraction system, installation of additional MWs, and groundwater sampling. Due to relatively low COC concentrations, emissions from the treatment system would be negligible.

The PRB alternative presents short-term risk to the community and site workers due to activities associated with the excavation and installation of the PRB, installation of additional MWs, and groundwater sampling.

The ISCR alternative presents short-term risk to the community and site workers due to activities associated with the installation of MWs and injection points, the handling of chemical amendments, and groundwater sampling. However, the chemical amendments are naturally occurring compounds which would pose little exposure risk.

Potential risks to the community from alternatives would be minimized by taking appropriate measures prior to the execution of any work and complying with applicable state requirements. On-site workers will be protected during the site activities by following standard safety measures and complying with a site-specific health and safety plan. Therefore site activities would not present any danger to the surrounding community, workers or the environment.

RAOs would be achieved most quickly with the AS/SVE, CW and IWAS, and ISCR alternatives.

2.11.6 Implementability

The No Action, MNA, AS/SVE, and CW with IWAS can be easily implemented. No technical or administrative issues are associated with implementing the No Action alternative. Standard sampling and construction techniques would be used for the MNA, AS/SVE, CW with IWAS alternatives. The remediation technologies are well understood and the labor force is readily available. Implementation of MW installation and deed restrictions can be coordinated with state and local authorities.

Specialized vendors are available to provide technical expertise, reactive materials, and chemical amendments for the implementation of the PRB and ISCR alternatives. Standard construction techniques can be used to perform excavation for the installation of the PRB. The injection of chemical amendments (i.e., ZVI solution or similar) for the ISCR alternative is well understood and the labor force is readily available. Implementation of MW installation and deed restrictions can be coordinated with state and local authorities.

2.11.7 Cost

There are no costs associated with the No Action alternative. The cost associated with each of the remaining alternatives is presented in **Table 2-2**.

2.11.8 Regulatory Acceptance

It is unlikely that the MDE will be accepting of the No Action alternative because COC concentrations pose an excess risk to the community.

MDE has indicated it is unlikely that it will be accepting of the MNA alternative unless additional evidence is presented further demonstrating MNA as a viable alternative..

It is unlikely that the MDE will be accepting of the PRB alternative unless coupled with a remedial alternative to address the on-site groundwater contamination, as the PRB alternative will only remediate groundwater that is migrating from the site.

It is highly likely that the MDE will be accepting of the AS/SVE, CW with IWAS, and ISCR alternatives. These alternatives satisfy the statutory preference for active remediation that permanently reduces the TMV, and enhances the natural degradation process.

2.11.9 Community Acceptance

Based on feedback from the Proposed Plan public meeting held for community participation, it is unlikely that the community would be accepting of the No Action Alternative or the MNA alternative because no active remediation is being conducted to address COC concentrations and reduce potential exposure risks.

Based on feedback verbally communicated during the Proposed Plan public meeting held for community participation, it is moderately likely that the community would be accepting of the AS/SVE, CW with IWAS, and PRB alternatives because each alternative reduces COC concentrations and eliminates potential exposure risks. However, the timeframe for each remedy to achieve the RAOs would be equal to or greater than the timeframe anticipated with the ISCR approach.

Based on feedback from the Proposed Plan public meeting held for community participation, it is highly likely that the community would be accepting of the ISCR alternatives because it expeditiously reduces COC concentrations and eliminated potential exposure risks.

This page intentionally left blank

Table 2-2. Comparison of Remedial Alternatives for Groundwater at the Waldorf Nike (W-44) Site, Launch Area

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction in Toxicity, Mobility or Volume (TMV)	Short-Term Effectiveness	Implementability	Cost	Regulatory Acceptance	Community Acceptance
No Action	The No Action alternative would not be protective of human health or the environment.	Without a monitoring program, compliance with chemical-specific ARARs cannot be determined. There are no location specific ARARs associated with this alternative. Action-specific ARARs are not applicable because there is no remedial work associated with this alternative.	The No Action alternative could be effective in the long-term as a result of contaminant reduction due to natural attenuation processes, but its effectiveness cannot be determined without groundwater monitoring. The potential risk of inhalation of COC vapors in a future residential basement on Lots 8, 9, and 10 would continue to exist. Without the implementation of institutional controls, the potential risk of using contaminated groundwater for drinking purposes would continue	In the No Action alternative, there would be no active treatment process for the contaminated groundwater. Therefore, TMV may only be reduced through natural attenuation processes. The extent or the rate of reduction would not be known without a groundwater monitoring program. This alternative would not satisfy the statutory preference for treatment as a principal element of a remedial action.	There would be no additional risks to the community or the workers because there would be no remedial work at the site.	No technical or administrative issues are associated with the No Action alternative.	$0	Unlikely	Unlikely

*Table 2-2 legend is presented on page 27

Table 2-2. Comparison of Remedial Alternatives for Groundwater at the Waldorf Nike (W-44) Site, Launch Area

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction in Toxicity, Mobility or Volume (TMV)	Short-Term Effectiveness	Implementability	Cost	Regulatory Acceptance	Community Acceptance
MNA	Natural attenuation processes are slowly reducing VOC concentrations to acceptable levels, and have the potential to provide protection to human health and the environment over a reasonably long timeframe. Institutional controls would be required to restrict installation of drinking water wells until the COC levels are reduced to below the MCL of 5 µg/L.	Would achieve chemical-specific ARARs through natural attenuation There are no location-specific or action-specific ARARs associated with the site.	The MNA alternative would be effective in the long-term. The magnitude of residual risk is expected to decline over the long-term to acceptable levels. MNA would be an adequate and reliable response action to address the groundwater contamination at the site. To the extent that the contaminants are transformed into harmless compounds through natural attenuation processes, the process is irreversible.	In the MNA alternative, there would be no active treatment process to treat contaminated groundwater. Reduction in the TMV of contaminants is expected to occur through natural attenuation processes based on historical data and groundwater model predictions. This alternative would not satisfy the statutory preference for active treatment as a principal element of a remedial action.	There would be minimal additional risk to the community in the short-term since there is only limited activity associated with the MNA alternative. Potential risks to the community will be minimized by taking appropriate measures prior to the execution of any work and by complying with applicable state emission requirements. Workers will be protected during site activities by taking standard safety measures and complying with the SSHP.	The MNA alternative can be easily implemented. Standard construction techniques may be used to install additional groundwater MWs, if required. Periodic groundwater sampling and analysis can be conducted by employing trained personnel using standard sampling techniques. Sample analyses can be performed using an environmental laboratory. Implementation of groundwater well installation and deed restrictions will be coordinated with state and local authorities.	Total Present Worth Cost: Option A*: $171,000 Option B***: $440,000	Unlikely. MDE has indicated that additional evidence further demonstrating MNA as a viable alternative for this site is required.	Unlikely

*Table 2-2 legend is presented on page 27

Table 2-2. Comparison of Remedial Alternatives for Groundwater at the Waldorf Nike (W-44) Site, Launch Area

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction in Toxicity, Mobility or Volume (TMV)	Short-Term Effectiveness	Implementability	Cost	Regulatory Acceptance	Community Acceptance
AS/SVE	Would provide protection to human health and the environment. AS/SVE are well proven technologies for removing a range of organic compounds from groundwater, including the COCs found at Nike Launch Area. Institutional controls would be required to restrict installation of drinking water wells until the COC levels are reduced to below the MCL of 5 µg/L.	Would achieve chemical-specific ARARs through treatment. There are no location-specific or action-specific ARARs associated with the site. The vapors collected from the air stripping process will meet all applicable federal and state (if state requirements are more stringent than federal requirements) emission requirements.	The AS/SVE alternative would be effective in the long-term. The magnitude of residual risk is expected to decline over the long-term to acceptable levels. The rate of reduction of contaminant levels and mass would be known through periodic groundwater sampling. Treatment processes associated with this alternative and natural attenuation processes that transform site contaminants into harmless compounds are permanent and irreversible.	Toxicity of the contaminants would not change during the air sparging /SVE process, since the process involves only removal of organic contaminants. However, regeneration of GAC (if used) would transform contaminants to harmless compounds, thereby reducing the toxicity. Mobility and volume of contaminants would be reduced because they are permanently removed from the site groundwater. This alternative would satisfy the statutory preference for active treatment as a principal element of a remedial action.	Short-term risks to the community from this alternative would be due to activities associated with drilling and installation of AS wells, SVE vents, vapor treatment system, installation of groundwater MWs (if required), and groundwater sampling. All activities will be performed in accordance with an SSHP. Potential risks to the community will be minimized by taking appropriate measures prior to the execution of any work and by complying with applicable state emission requirements. Workers will be protected during site activities by taking standard safety measures and complying with the SSHP. This source treatment alternative would achieve remedial action objectives (RAOs) in a timeframe commensurate with Alternatives CW with IWAS and PRB.	AS/SVE alternative can be easily implemented. Materials, equipment, and qualified personnel for installation of air-sparging wells and SVE vents are readily available. Standard construction techniques may be used to install additional groundwater MWs, if required. Periodic groundwater sampling and analysis can be conducted by employing trained personnel using standard sampling techniques. A pilot study would be conducted to optimize the effectiveness of the system.	Total Present Worth Cost: Option A*: $831,000 Option B**: $1,064,000	Highly Probable	Moderately Probable

*Table 2-2 legend is presented on page 27

Table 2-2. Comparison of Remedial Alternatives for Groundwater at the Waldorf Nike (W-44) Site, Launch Area

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction in Toxicity, Mobility or Volume (TMV)	Short-Term Effectiveness	Implementability	Cost	Regulatory Acceptance	Community Acceptance
CW with IWAS	Would provide protection to human health and the environment. Groundwater circulation wells and in-well air stripping are well-proven technologies for removing a range of VOCs from groundwater, including the COCs found at Nike Launch Area. Institutional controls would be required to restrict installation of drinking water wells until the COC levels are reduced to below the MCL of 5 µg/L.	Would achieve chemical-specific ARARs through treatment. There are no location-specific or action-specific ARARs associated with the site. The vapors collected from the air stripping process will meet all applicable federal and state (if state requirements are more stringent than federal requirements) emission requirements.	The groundwater circulation wells and in-well air stripping alternative would be effective in the long-term. The magnitude of residual risk is expected to decline over the long-term to acceptable levels. The rate of reduction of contaminant levels and mass would be determined through periodic groundwater sampling. Treatment processes associated with this alternative and natural attenuation processes that transform site contaminants into less harmful compounds are permanent and irreversible.	Toxicity of the contaminants would not change during the air stripping process since the process involves only removal of organic contaminants. However, regeneration of GAC (if used) would transform contaminants to harmless compounds, thereby reducing the toxicity. Mobility and volume of contaminants would be reduced because they are permanently removed from the site groundwater. This alternative would satisfy the statutory preference for active treatment as a principal element of a remedial action.	Short-term risks to the community from this alternative would be due to activities associated with drilling and installation of groundwater circulation wells, vapor extraction vents, vapor treatment system, installation of groundwater MWs (if required), and groundwater sampling. All activities will be performed in accordance with a site-specific health and safety plan. Potential risks to the community will be minimized by taking appropriate measures prior to the execution of any work and by complying with applicable state emission requirements. Workers will be protected during site activities by taking standard safety measures and complying with the SSHP. This source treatment alternative would achieve RAOs in a timeframe commensurate with AS/SVE and PBR.	Groundwater circulation wells/in-well air stripping alternative can be easily implemented. Materials, equipment, and qualified personnel for installation of the groundwater circulation well/in-well air stripping system are readily available. Standard construction techniques may be used to install additional groundwater MWs, if required. Periodic groundwater sampling and analysis can be conducted by employing trained personnel using standard sampling techniques. A pilot study would be conducted to optimize the effectiveness of the system.	Total Present Worth Cost: Option A*: $897,000 Option B**: $1,176,000	Highly Probable	Moderately Probable

*Table 2-2 legend is presented on page 27

Table 2-2. Comparison of Remedial Alternatives for Groundwater at the Waldorf Nike (W-44) Site, Launch Area

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction in Toxicity, Mobility or Volume (TMV)	Short-Term Effectiveness	Implementability	Cost	Regulatory Acceptance	Community Acceptance
PRB	Would provide protection to human health and the environment by controlling contaminant migration to Lots 8, 9, and 10, and reducing the COC concentrations to below the MCL of 5 µg/L. Although this alternative does not address the source area located upgradient of the wall, there are no identified impacts to human health from site-related contaminants upgradient of the proposed location of the PRB. Institutional controls would be required to restrict installation of drinking water wells until the COC levels are reduced to below the MCL of 5 µg/L.	Would achieve chemical specific ARAR through treatment. There are no location-specific or action-specific ARARs associated with the site.	The PRB alternative would be effective in the long-term. The magnitude of residual risk is expected to reduce over the long-term to acceptable levels. The rate of reduction of contaminant levels and mass would be known through periodic groundwater sampling. The treatment process that takes place in the reactive medium of the PRB and natural attenuation processes that transform site contaminants into harmless compounds are permanent and irreversible.	Toxicity, mobility, and volume of contaminants will be reduced gradually over time due to chemical reactions that occur between contaminants and the reactive material of the PRB. Mobility and volume of contaminants would be reduced because they are permanently removed from the site groundwater. This alternative would satisfy the statutory preference for active treatment as a principal element of a remedial action, but it would not address source area contamination.	Short-term risks to the community from this alternative would be due to activities associated with excavation and installation of the PRB, installation of groundwater MWs (if required), and groundwater sampling. All activities will be performed in accordance with a site-specific health and safety plan. Potential risks to the community will be minimized by taking appropriate measures prior to the execution of any work and by complying with applicable state emission requirements. Workers will be protected during site activities by taking standard safety measures and complying with the SSHP.	Excavation of the PRB and installation of additional groundwater wells can be performed using standard excavation and construction techniques. There are firms specialized in design and construction of PRBs who perform design and provide expertise and reactive medium for PRB construction. Periodic groundwater sampling and analysis can be conducted by employing trained personnel using standard sampling techniques. A bench-scale test would be conducted to determine the optimal PRB design parameters.	Total Present Worth Cost: *: $668,000	Unlikely, unless coupled with a remedial alternative addressing on-site groundwater contamination, as the PRB alternative will only remediate groundwater that is migrating from the site.	Highly Probable

*Table 2-2 legend is presented on page 27

Table 2-2. Comparison of Remedial Alternatives for Groundwater at the Waldorf Nike (W-44) Site, Launch Area

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction in Toxicity, Mobility or Volume (TMV)	Short-Term Effectiveness	Implementability	Cost	Regulatory Acceptance	Community Acceptance
ISCR	Would provide protection to human health and the environment in a timely manner by abiotically and degrading COC concentrations in place within the source zone on-site. By destroying the COC source zone on-site, the mass flux of VOCs migrating downgradient and off-site would also be significantly reduced in a timely manner. Institutional controls would be required to restrict installation of drinking water wells until the COC levels are reduced to below the MCL of 5 µg/L.	Would achieve chemical specific ARARs through treatment. There are no location-specific or action-specific ARARs associated with the site.	The in situ chemical degradation of the VOC source zone would be effective in the long-term. The magnitude of residual risk is expected to decline quickly to acceptable levels relative to the non-source treatment alternatives. The rate of contaminant mass reduction will be determined through periodic groundwater monitoring. The in situ treatment and destruction processes associated with this Alternative transform VOCs into harmless end products which are irreversible.	Toxicity, mobility and volume of contaminants will be reduced quickly through abiotic chemical reduction reactions that occur between the VOCs and the reactive iron amendments. Additional reductions in TMV of contaminants will occur more gradually via biological transformation processes stimulated by the carbon portion of the in situ amendments. This alternative would satisfy the statutory preference for active treatment as a principal element of a remedial action.	Short-term risks to the community from this alternative would be due to activities associated with the installation and sampling of groundwater MWs, drilling of injection borings, and the handling/mixing of in situ treatment amendments. In general, the treatment amendments are naturally occurring compounds such as ZVI and food grade, fibrous organic carbon which present little or no human health risk. Potential risks to the community will be minimized by taking appropriate measures prior to the execution of any work and by complying with applicable state emission requirements. Workers will be protected during site activities by taking standard safety measures and complying with the SSHP. This source treatment alternative would achieve RAOs in a timeframe commensurate with AS/SVE and CW with IWAS	Installation of additional groundwater MWs or drilling of injection borings can be performed using standard construction and direct push drilling techniques. There are firms readily available who specialize in the design, handling and injection of in situ ISCR amendments. Periodic groundwater sampling and analysis can be conducted by employing trained personnel using standard sampling techniques. Pilot-scale testing of this alternative would likely be conducted in the focused source area to optimize effectiveness of the system.	Total Present Worth Cost: Option A*: $425,000 Option B***: $625,000	Highly Probable	Highly Probable

*Table 2-2 legend is presented on page 27

Table 2-2. Comparison of Remedial Alternatives for Groundwater at the Waldorf Nike (W-44) Site, Launch Area

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction in Toxicity, Mobility or Volume (TMV)	Short-Term Effectiveness	Implementability	Cost	Regulatory Acceptance	Community Acceptance

Legend:

ARAR	*applicable or relevant and appropriate requirement*	*PRB*	*permeable reactive barrier*
AS/SVE	*air sparging with soil vapor extraction*	*RAO*	*remedial action objective*
COC	*constituent of concern*	*RG*	*remediation goal*
CW	*circulation wells*	*SSHP*	*site safety and health plan*
GAC	*granular activated carbon*	*TMV*	*toxicity, mobility, or volume*
ISCR	*in-situ chemical reduction*	*VOC*	*volatile organic compound*
IWAS	*in-well air stripping*	*	*Based on 5-year system operation. For ISCR, includes baseline sampling, 1 year of in situ treatment ,1 year of quarterly a performance monitoring, and 3 years of semi-annual monitoring/MNA groundwater sampling (5 years total)*
MCL	*maximum contaminant level*	**	*Based on 10-year system operation*
MNA	*monitored natural attenuation*	***	*Based on 30-year system operation. For ISCR includes baseline sampling, 1 year of in situ treatment ,1 year of quarterly performance monitoring and 28 years of annual monitoring/MNA groundwater sampling (30 years total)*
MW	*monitoring well*		
	Selected remedial alternative		

Source: Final Focused Feasibility Study Nike Battery Launch Area (W-44) Formerly Used Defense Site, Waldorf, Maryland (Weston, 2011).

This page intentionally left blank

2.12 Principal Threat Waste

Principal threat wastes are those source materials considered to be highly toxic and/or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. There are no source materials and no principal threat wastes threats present on the site.

2.13 Selected Remedial Alternative

Based on the detailed analysis conducted in association with the FFS (Weston, 2011), ISCR has been identified by USACE as the preferred remedy with which to address site-specific groundwater contamination. In order to fiscally plan for the long-term obligation of the USACE to monitor the site in the event that the selected remedial alternative does not achieve the RAOs in the expected time-frame, two pricing options have been evaluated for the selected remedial alternative of ISCR. Option A which has a total life-cycle cost estimate of $425,000 is based on the expected performance of the remedial alternative to achieve the RAOs within 5 years. In the event that RAOs are not achieved with the 5 year time frame, Option B was developed to evaluate the full potential life-cycle costs associated with a 30 year remediation and groundwater monitoring life-cycle. The total life-cycle cost of Option B is estimated to be $625,000. In summary the comparative analysis of the selected remedial alternative to the nine evaluation criteria are as follows:

- Protection of Human Health and the Environment: The selected remedy of ISCR Option A will satisfy the threshold criterion of protection of human health and the environment by reducing the contaminant mass in groundwater to the point where RAOs are attained. As a threshold criterion, protection of human health and the environment must be met for the alternative to be selected.
- Compliance with ARARs: the selected remedy will comply with the chemical-specific ARARs by attaining the RAOs. As a threshold criterion, compliance with ARARs must be met for the alternative to be selected. There are no location-specific or action-specific ARARs associated with the site.
- Long-Term Effectiveness and Permanence: The selected remedy will be effective in the long-term at maintaining reduced groundwater contaminant concentrations in the current plume location and in the downgradient, offsite portions of the site. The reduction in contaminant mass and groundwater concentrations will be documented during performance monitoring until ARARs have been satisfied.
- Reduction of Toxicity, Mobility, or Volume through Treatment: The selected remedy will satisfy the criterion fairly rapidly (9-12 months after injection) because the degradation processes are stimulated through the injection of the reactive materials that are part of the ISCR technology.
- Short-term Effectiveness: There will be minimal risks to the onsite workers during the selected remedy field activities relating to injection and groundwater monitoring. Onsite workers will perform field activities in accordance with an approved health and safety plan that is specific to the potential risks associated with completing remedial activities. The activities, including mixing, injection, and follow-up sampling, will be conducted in accordance with the approved remedial design/work plan and site safety and health plan. Potential risks to the community will be minimized by taking appropriate measures prior to the execution of any work and complying with the applicable state requirements.
- Implementability: The selected ISCR remedy would be easily implemented with readily available equipment and labor force. USACE will work to meet substantive requirements

of any state or local permits or regulations that concern the proposed work, although implementation of groundwater well installation, deed restrictions, and groundwater monitoring well permits do not require approval and cooperation of state and local authorities.

- Cost: The present worth cost of the selected remedy includes final delineation of the CCl_4 source area, a pilot study application of ISCR amendment material, followed by a full-scale design and application process of the technology. The present worth is calculated to be $425,000 (+50% to -30% of actual implementation cost). It is assumed that baseline groundwater sampling will be conducted. Following one year of in-situ treatment, performance monitoring will be conducted quarterly for 1 year and conducted semi-annually thereafter until the RAOs are achieved. It is anticipated that two years of semi-annual monitoring will be required until the RAOs are achieved. In the event that the RAOs are not achieved within the expected timeframe of five years from the initial injection event, monitoring would continue until the RAOs are achieved, or a total period of 25 additional years.
- State Acceptance: State representatives have formally approved the selected remedy.
- Community Acceptance: The selected remedy was formally presented for review to the community through the PRAP and a public meeting. A few general comments were received, for which responses have been provided by USACE. No comments specifically affecting the community acceptance of the selected remedy were received from the public. Therefore, community acceptance is inferred. The Responsiveness Summary provides the comments raised by the public and responses to those comments.

The following subsections provide summaries regarding the rationale for the selected remedy as presented in the FFS (Weston, 2011), description of the selected remedy, estimated remedial costs, and expected outcomes of implementing the selected remedy.

2.13.1 Summary of the Rationale for the Selected Remedy: ISCR

The selected remedy consists of utilizing ISCR to reduce COC concentrations within groundwater plume to achieve the RAOs, and implement LUCs until the RAOs are achieved. Environmentally-safe chemicals (e.g., a ZVI and vegetable oil solution) will be injected into the contaminant plume where physical and chemical processes will combine to create conditions conducive to destroying the CCl_4 and TCE in the groundwater. Based on a comparative analysis of proposed remedial alternatives, the selected remedy provides the most effective solution when compared to the NCP's nine remedial evaluation criteria.

The selected remedy protective of human health and environment, complies with ARARs, is cost-effective, and is a permanent solution. Most notably, it provides the most cost effective and permanent solution to address the contamination in the groundwater.

2.13.2 Description of the Selected Remedy

Prior to active remediation, LUCs will be implemented to restrict site personnel from indoor activities at Buildings 23 and 31 without proper ventilation. LUCs will also be implemented to prevent the use of groundwater for drinking purposes at the site and the impacted area downgradient of the site, if necessary, until contaminant concentrations achieve RAOs. Cooperation with the current property owners will be required in order to implement the LUCs. LUC deed restrictions will be coordinated with state and local authorities.

Additional MWs will be installed downgradient of the groundwater plume as sentinel groundwater monitoring locations. Prior to injection of the chemical amendments, a baseline groundwater sampling event will be conducted to determine the then-current state of the groundwater plume. Groundwater samples will be analyzed for CCl_4 and TCE, breakdown products, metals, and groundwater quality indicators.

ISCR refers to the use of chemical amendments to promote physical and chemical reduction of contaminants. ISCR technology creates conditions within an aquifer that promote dechlorination of compounds such as CCl_4 and TCE (the primary site groundwater contaminants), and minimizes the formation of toxic breakdown products. A nano-scale or micro-scale ZVI complex will be introduced with vegetable oil as a liquid solution into the contaminant plume via multiple temporary injection points. A pre-design pilot study will be utilized in order to determine the appropriate ZVI amendment solution and spacing of injection points.

An area of approximately 100 feet long by 100 feet wide and 10-15 feet below the ground surface will be injected with environmentally-safe chemicals. Spacing of the injection points and the volume of amendment material to be injected will be calculated as part of the remedial design and based on the results of the pilot study. It is anticipated that only one injection event will be necessary at the site due to the low concentrations of CCl_4 and TCE, site-specific groundwater and soil chemistry, and the long lasting effects of the injected environmentally-safe chemicals. However, polishing injections events may be considered as a conservative measure to ensure that the RAOs are achieved within the estimated 5 year period.

Performance monitoring will be conducted for a short time period after the injection event. Typically, performance monitoring is conducted over a period of one to three months, and includes four to six sampling events from an established network of performance monitoring locations. The performance monitoring network and laboratory analysis required to monitor the effectiveness of the remedial action will be established as part of the remedial design.

Groundwater monitoring will be conducted within an established monitoring network quarterly for the first year after the injection and on a semi-annual basis thereafter until concentrations achieve the RAOs. It is anticipated that the RAOs will be achieve at the completion of three years of monitoring, and four years from the implementation of the remedial action. The monitoring network will be established as part of the remedial design.

Once three consecutive groundwater sampling results confirm contaminant concentrations have consistently achieve the RAOs for CCl_4 and TCE, groundwater monitoring will be halted and LUCs will be lifted from the site.

2.13.3 Summary of the Estimated Remedial Costs

Approximate costs associated with the preferred remedial alternative and the other five remedial alternatives evaluated, as calculated in the FFS (Weston, 2011), are provided in **Table 2-3**.

This page intentionally left blank

Table 2-3. Estimated Costs for ISCR Alternative

Item	Quantity	Unit Price	Subtotal	Total
Capital Costs				
Well and Land Use Restrictions	Lump Sum	$12,000	$12,000	
Installation of 2 MWs	Lump Sum	$13,500	$13,500	
Soil Gas Survey	Lump Sum	$7,000	$7,000	
Bio Trap Sampling	Lump Sum	$7,400	$7,400	
Microcosm Testing	Lump Sum	$27,400	$27,400	
Design and Application of Amendments	Lump Sum	$108,400	$108,400	
20% Contingency for Design and Application of Amendments			$21,680	
Baseline Groundwater and Indoor Air Assessment[1]	Lump Sum	$17,820	$17,820	
20% Contingency for Baseline Groundwater Assessment			$3,550	
Total Estimated Capital Cost				**$218,750**
Operations and Maintenance Costs				
Quarterly Groundwater Sampling (1 Year)[1]	Lump Sum	$86,960	$86,960	
20% Contingency for Quarterly Groundwater Sampling (1 Year)			$17,390	
Semi-Annual Groundwater Sampling (2 Years)[1]	Lump Sum	$86,960	$86,960	
20% Contingency for Semi-Annual Groundwater Sampling (2 Years)			$17,390	
Total Operations and Maintenance Costs				**$208,700**
Total Present Worth Cost (Rounded)				**$425,000**

Legend:
1 – Cost estimate for baseline sampling, quarterly sampling, and semi-annual groundwater sampling includes the sampling of 9 MWs for 3 years, totaling 9 events. Four QA/QC samples are also estimated for each round. Price also includes data validation for each sample.

This page intentionally left blank

2.13.4 Expected Outcomes of the Selected Remedy

The goal of the selected remedial action is to reduce concentrations of COCs below the USEPA MCL, thus restoring the groundwater as a potential drinking water source, and reducing the potential risk to current and future residents from potential inhalation exposure of CCl4 and TCE vapors emanating from groundwater. Achieving RAOs, will allow for unlimited use and unrestricted exposure, which is suitable for unrestricted residential use. The selected remedial alternative will address potential environmental concerns resulting only from former DoD use, its scope is not directed at addressing non-DoD impacts. Therefore, the attainment of unlimited use and unrestricted exposure is based solely on addressing environmental contamination related to past DoD disposal of hazardous substances at this property and not to any contamination that may be associated with use of the property by current owners. It is assumed that the remedy from development of work plans, implementation of LUCs, remedial construction, and monitoring will be completed within 5 years, according to the FFS (Weston, 2011).

2.14 Statutory Determinations

The selected remedial action is protective of human health and the environment; complies with ARARs; is cost effective; and utilizes permanent solutions to the extent practicable to address the potential risks associated with concentrations of CCl_4 and TCE in groundwater. This remedial action will not result in hazardous substances, pollutants, or contaminants remaining on-site above regulatory levels that would prevent unrestricted use and unlimited exposure. The selected remedial alternative satisfies the statutory preference for treatment as a principal element of the remedy, and will permanently and significantly reduce the toxicity, mobility, and volume of CCl_4 and TCE at the site.

The selected remedial action involves injecting environmentally-safe chemicals into the groundwater plume where physical and chemical processes will combine to create conditions conducive to destroying the CCl_4 and TCE in the groundwater.

It is expected that within five years of implementation of this remedial action, no hazardous substances, pollutants, or contaminants will remain at concentrations above regulatory levels preventing unlimited use or unrestricted exposure. Therefore, it is anticipated that one CERCLA Five-Year Review will be conducted to ensure effectiveness of the remedial action; however, continued CERCLA Five-Year Reviews will not be warranted. In the event that the RAOs are not achieved in the anticipated five-year time frame, per the requirements of Section 121 of CERCLA and the NCP, Five-Year Reviews will be continue until the COCs do not remain in concentrations above regulatory levels preventing unlimited use or unrestricted exposure.

2.14.1 Protection of Human Health and the Environment

The selected remedy would take an active, focused approach by targeting CCl_4 and TCE groundwater concentrations, thereby reducing the contaminant mass of the entire plume. The selected remedy would achieve the RAOs in a timely manner and would satisfy CERCLA Section 121. Short-term risks would be associated with activities involving the installation of groundwater wells and injection points. The chemical amendments; however, are naturally occurring elements, such as ZVI, and would pose little to no risk to on-site handlers or to the community.

Pursuant to CERCLA/NCP, protection of human health and the environment is a threshold requirement that a remedial alternative must meet in order to be eligible for selection.

2.14.2 Compliance with Applicable or Relevant and Appropriate Requirements

ARARs include federal and/or state promulgated standards, requirements, criteria, and limitations. ARARs have been identified for the site. Pursuant to CERCLA/NCP, compliance with ARARs is a threshold requirement that a remedial alternative must meet in order to be eligible for selection.

The ARAR analysis is directed at substantive, promulgated regulations with regard to on-site activities. Furthermore, CERCLA response actions, per CERCLA/NCP, are exempt from permits and similar procedural requirements with regard to on-site activities. As for off-site activities (e.g., transportation), compliance is required for applicable substantive and procedural requirements. Such off-site activities are not part of the ARAR analysis, but rather may be discussed under the implementability factor, to the extent that they pose challenges for certain alternatives.

Identified ARARs related to the selected remedy are presented in **Table 2-4**. The selected remedy would comply with the chemical-specific ARARs and be conducted in full compliance of the action-specific ARARs identified. There are no location-specific ARARs associated with the selected remedy.

Table 2-4. ARARs for the Selected Remedy			
Requirement	**Citations**	**ARAR Determination**	**Justification/Comments**
Federal Drinking Water Standards[1]	40 CFR 141	Chemical-specific ARAR	Groundwater and surface water are not currently used for drinking water purposes. However MCLs are relevant and appropriate because the State of Maryland considers all groundwater as potential drinking water and requires that groundwater meet MCLs.
Identification and Listing of Hazardous Waste	COMAR 26.13.02	Action-specific ARAR	Waste will be generated in the form of purge/development water and soil cuttings. Although historical site data suggests that soil and water generated during the remediation will not be considered hazardous waste, all waste will be characterized accordingly to meet State hazardous waste regulations.
Standards Applicable to Generators of Hazardous Waste	COMAR 26.13.03	Action-specific ARAR	If hazardous waste is identified during the remediation (e.g., soil and water), generator standards will be conducted in accordance with State hazardous waste regulations.
Land Disposal Restrictions	40 CFR 268		If hazardous waste is identified during the remediation (e.g., soil and water), concentrations or treatment technology based restrictions may apply. Wastes that meet treatment standards may be directly land disposed. Wastes that do not meet treatment standards must be treated to

			meet standards prior to land disposal.
Safe Drinking Water Act (Underground Injection Control Program)	40 CFR Parts 144-148	Action-specific ARAR	The selected remedy includes the installation of MWs and injection wells. Any class of injection well used at a CERCLA site is regulated under the Underground Injection Control including, well design, well operation, maintenance of injection pressure, analysis of injection fluids, demonstrations of integrity, and reporting requirements.

Legend:

ARAR	*Applicable, relevant and appropriate*
CFR	*Code of Federal Regulations*
COMAR	*Code of Maryland Regulations*
MCL	*maximum contaminant level*
NCP	*National Oil and Hazardous Substance Pollution Contingency Plan*
OSHA	*Occupational Safety and Health Administration*
1	*The Maryland groundwater standards, 26 COMAR 08.02, are identical to the Federal standards for the contaminants of concern. Technically, however, only State standards that are more stringent than the Federal standard can be ARARs, according to Federal law. NCP, 40 C.F.R. 300.5. Nevertheless, the selected remedy will comply with the State standards as well.*

2.14.3 Cost-Effectiveness

A cost-effective remedy is one whose costs are proportional to its overall effectiveness. Additionally, the overall effectiveness of a remedy is evaluated based on long-term effectiveness and permanence; reduction in toxicity, mobility and volume; and short-term effectiveness.

Based on these criteria, the selected remedial alternative is cost-effective. The selected remedial alternative has a relatively low total present worth cost of $425,000. The selected remedy also provides long-term and short-term effectiveness. The reduction of CCl_4 and TCE concentrations to the RAOs provide long-term effectiveness, addressing the potential risks to future receptors. In the short-term, potential risks would be associated with activities involving the installation of groundwater wells and injection points. The chemical amendments, however, are naturally occurring compounds and would pose little to no risk to on-site handlers or to the community. Chemical amendments will be used according to the manufacturer's instruction and under the purview of a site-specific health and safety plan that will further reduce potential risk to on-site handlers or the community. Additionally, during remedial activities, the use of personal protection equipment, health and safety monitoring, and compliance with the safety and health plan will greatly reduce the potential exposure risks to chemical amendments and COCs, and general construction risks to workers.

2.14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy represents the maximum extent to which permanent treatment technologies can be utilized in a practical manner at the site. ISCR will achieve reduction and elimination of COC within the groundwater plume entirely in situ, which would eliminate operations and maintenance energy usage throughout the life of the cleanup. Of those remedial alternatives that are protective of human health and the environment, and comply with ARARs, it has been determined based on the comparative analysis of potential remedial alternatives that ISCR provides the best balance of trade-offs in terms of the five balancing criteria (e.g., Long-term effectiveness and permanence, Reduction of toxicity, mobility, or volume through treatment, Short-term effectiveness, Implementability, and Cost), while also considering the preference for treatment as a principle element to extent practical and considering MDE and community acceptance. ISCR satisfies the CERCLA Section 121 (b) statutory preference for remedial actions that involve permanent and significant reductions in the volume, toxicity, and/or mobility of contamination.

The selected remedy treats the COCs CCl_4 and TCE, thereby achieving significant reductions in their concentrations in soil and groundwater and provides long-term effectiveness. Long-term effectiveness will be achieved through the reduction of COC concentrations into harmless compounds and groundwater monitoring until COCs in groundwater achieve the RAOs. Based on the comparative analysis of potential remedial alternatives, the selected remedy does not present substantially different short-term risks from other potential remedies. Potential risks to the community from the selected remedy would be minimized by taking appropriate measures prior to the execution of any work and complying with applicable state requirements. On-site workers will be protected during the site activities by following standard safety measures and complying with a site-specific health and safety plan. Therefore site activities would not present any danger to the surrounding community, workers or the environment. There are no special implementability issues that set the selected remedy apart from any of the other remedies evaluated.

2.14.5 Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for treatment as a principle element by reducing the COCs in groundwater through treatment technologies.

2.15 Documentation of Significant Changes

The PRAP was released for public comment on August 17, 2013 for public review and a public meeting was conducted on September 18, 2013. A public comment period was provided between August 17, 2013 and October 31, 2013. In compliance with the requirements of CERCLA and providing the opportunity for the public to review and comment on the proposed remedial action, USACE determined that there are no significant amendments to be made to the proposed remedial action as originally documented in the PRAP.

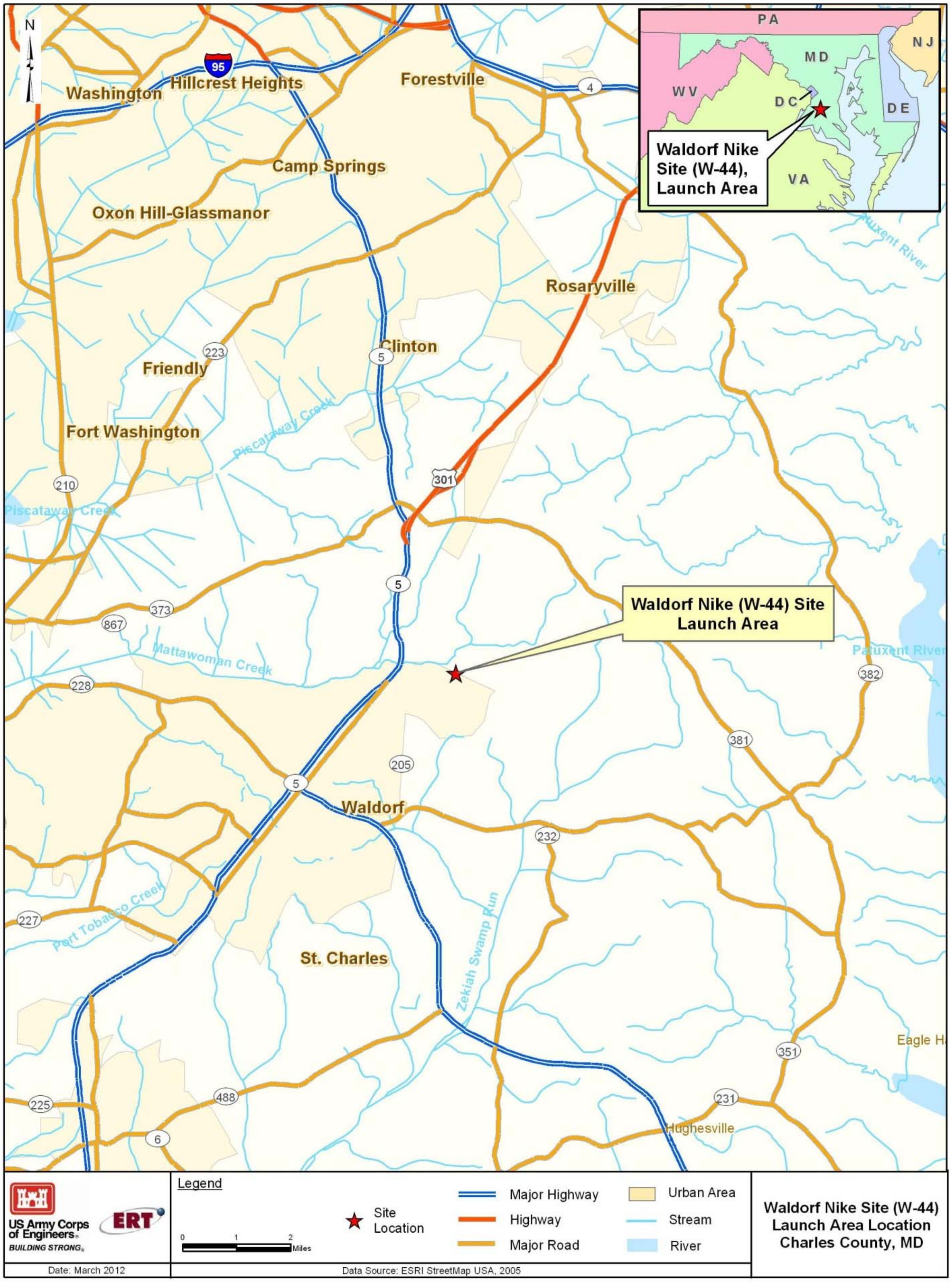

Figure 2-1. Site Location

Figure 2-2. Site Map Waldorf Nike (W-44) Site Launch Area

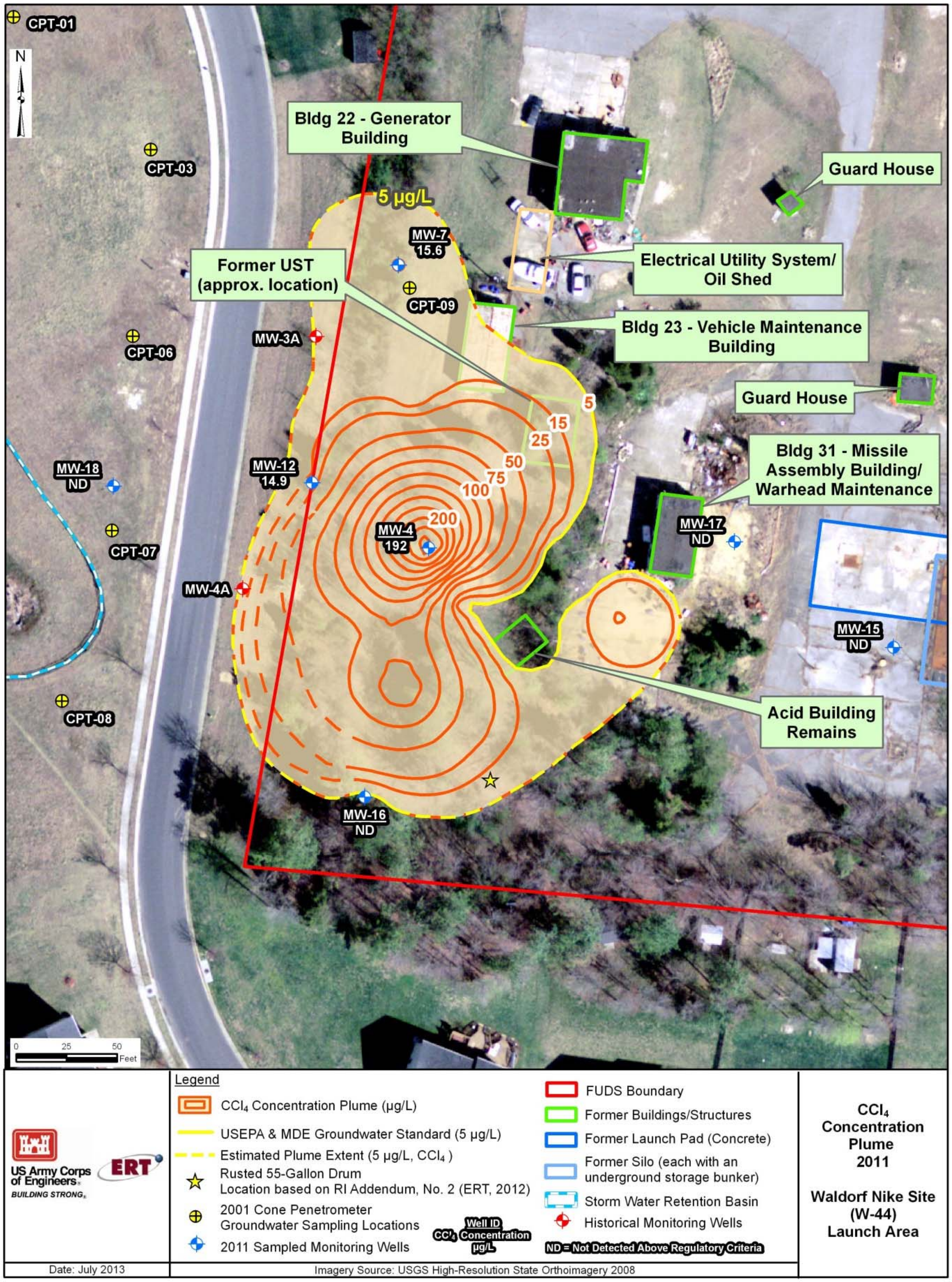

Figure 2-3. CCl_4 Concentration Plume, 2011

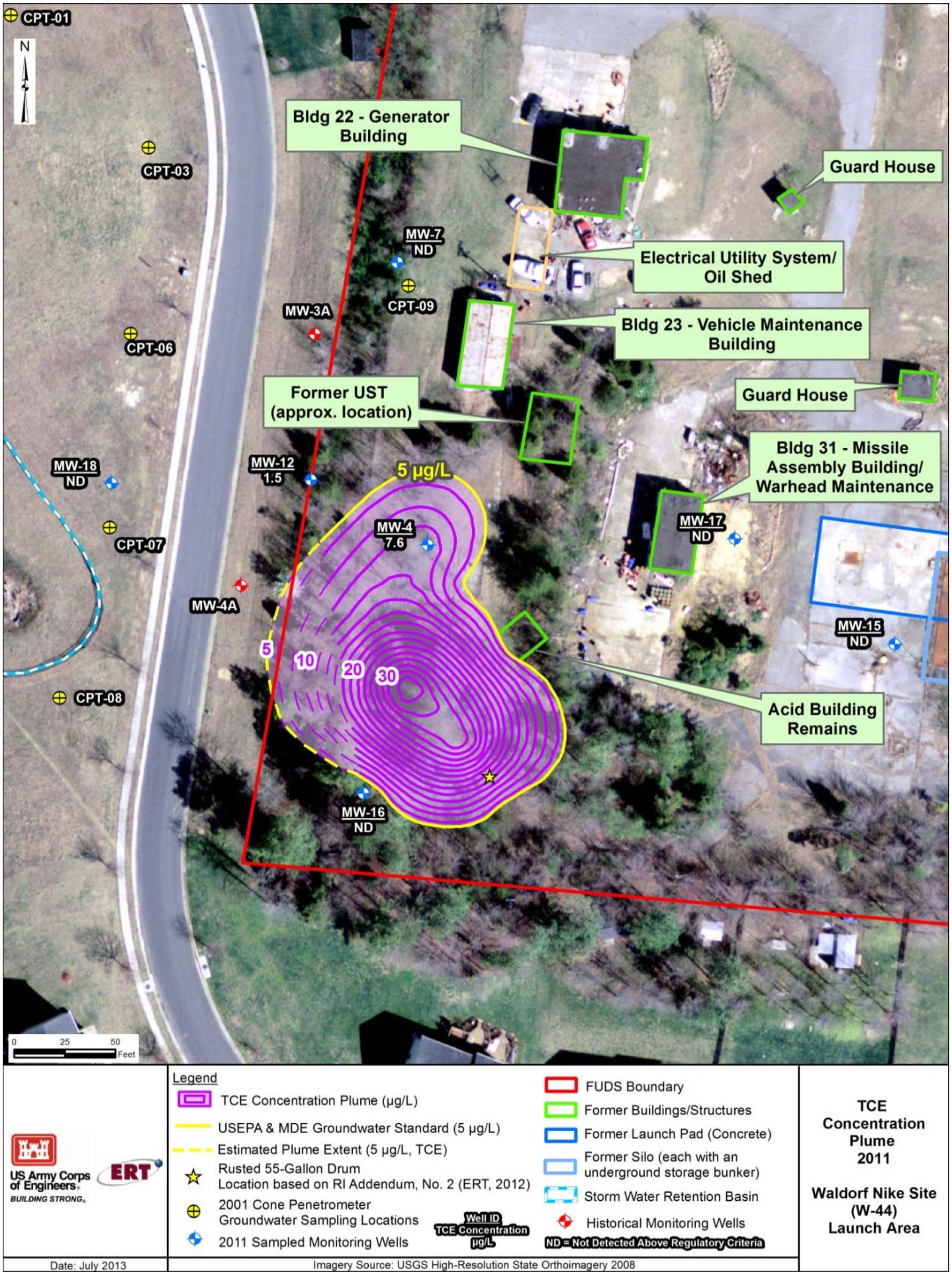

Figure 2-4. TCE Concentration Plume, 2011

3.0 RESPONSIVENESS SUMMARY

The USACE Baltimore District provided public notice and the opportunity to comment on the PRAP in accordance with requirements of CERCLA and the NCP. The NCP calls for a document that summarizes the proposed remedial action alternatives, including the agency-preferred alternative, and provides for public participation and comments in reviewing the proposed plans.

A Public Meeting Summary is included as Attachment 2 to this DD. It summarizes the materials USACE presented to community members and other attendees at the public meeting held on September 18, 2013.

The intent of the public meeting was to allow community attendees the opportunity to interact with the project delivery team and discuss the proposed remedial action. A public comment period was provided between August 17, 2013 (the date that the PRAP was made available to the public) and October 31, 2013.

Verbal comments were received from members of the public during the open forum at the public meeting.

During the public meeting, a brief history of remedial investigation efforts was imparted to community members. USACE explained that groundwater is not a source of drinking water in the area, and that remedial investigation efforts over the years have defined the boundaries of the contamination plume to the FUDS property only.

When discussing the selected remedial action, concerns were raised over the possibility of metals rising to the surface as a by-product of the chemical process. USACE explained that almost immediately after injection, the chemicals begin to break down the COCs and the only by-products will be inert carbon dioxide and manganese dioxide.

Additional comments were received by USACE during the comment period after the public meeting (comments and responses are provided in Attachment 2).

- Community members expressed interest in potential air quality degradation in the area associated with the groundwater contamination and requested to know if further testing will occur. USACE responded that, in all testing that has occurred since 1987, no negative air quality impacts were observed. USACE also explained that after the injection, groundwater monitoring would be conducted to ensure the effectiveness of the remedy.
- Community members expressed interest related to property sales and how property values would be affected while the remedial action is occurring. USACE has referred questions regarding property values to the site owner, Charles County (contact is Ms. Judy Michael, Michjh@charlescounty.org).
- Community members requested that homeowners be provided documentation when the restoration is complete and documentation that there is no danger of recurrence. USACE explained that a remedial after action report would be provided for public review that will explain in detail the work that occurred at the property and will outline the plan for long-term monitoring (to ensure effectiveness of the remedial action).
- Community members expressed interest in how often they would be updated on the status of remedial effort. USACE responded that homeowners would be updated during project

milestones. USACE will be posting project updates on the website: http://www.nab.usace.army.mil/Missions/Environmental/FormerlyUsedDefenseSites/WaldorfNikeMissileSite.aspx.

A letter prepared by MDE accepting the proposed remedial alternative as originally detailed in the PRAP is provided as Attachment 3.

No changes or amendments to the proposed remedial action as presented in the original PRAP have been made.

4.0 REFERENCES

Donohue & Associates, Inc., 1987. *Final Report for Confirmation Study at Former Nike Missile Battery (W-44), Waldorf, Maryland*. December.

ERT, Inc. (ERT), 2009. *Remedial Investigation Addendum for the Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland.* November.

ERT, 2012. *Final Remedial Investigation Report Addendum No. 2 for the Former Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland.* December.

ERT, 2013. *Final Proposed Remedial Action Plan for the Former Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland*. August.

ERT, 2014. *Technical Memorandum for Vapor Intrusion from Groundwater at the Former Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* December.

Halliburton NUS, 1991. *Site Screening Inspection, Former Nike (W-44) Site, Launch Area, Charles County, Maryland*.

Maryland Department of the Environment (MDE), 2001. *State of Maryland, Department of the Environment, Cleanup Standards for Soil and Groundwater*. August.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 1994. NCP; Final Rule, Environmental Protection Agency, 40 Code of Federal Regulations (CFR) Parts 9 and 300.

U.S. Army Corps of Engineers, HTRW-CX, 2003. *Nike Missile Battery Environmental Conditions Assessment Guide*. July.

U.S. Environmental Protection Agency (USEPA), 1986. *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) of 1980 as Amended by the *Superfund Amendments and Reauthorization Act* of 1986, and Title 40 of the Code of Federal Regulations Volume 19, Parts 300 to 309 (40 CFR Part 300).

USEPA, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*. October.

USEPA, 2007. Trichloroethylene (TCE), TEACH Chemical Summary, Toxicity and Exposure Assessment for Children's Health. Accessed 13 March 2012. http://www.epa.gov/teach/teachsummaries.html

USEPA, 2011. *Regional Screening Levels*. http://www.epa.gov/region9/superfund/prg/. May.

Weston Solutions (Weston), 1996. *Limited Risk Assessment for the Nike Battery W-44 Launch Area, Waldorf, Maryland.* Prepared for USACE, Baltimore District. September.

Weston, 2005. *Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland*. February.

Weston, 2011. *Final Focused Feasibility Study Nike Battery Launch Area (W-44), Formerly Used Defense Site, Waldorf, Maryland*. December.

This page intentionally left blank

Attachment 1

Summary of Groundwater Sampling Results Above Project Screening Criteria for CCl_4 and TCE between 1987 and 2011

This page intentionally left blank

Summary of Groundwater Sampling Results Above Project Screening Criteria for CCl_4 Between 1987 and 2011														
Well ID	**May 1987**	**Nov. 1991**	**Dec. 1993**	**Jun. 1995**	**Jun. 1999**	**Jul. 2001**	**Oct. 2001**	**Jun. 2003**	**Oct. 2003**	**Nov. 2004**	**May 2005**	**Dec. 2006**	**Apr. 2008**	**Dec. 2011**
	CCl_4 (µg/L)													
MW-4	**450**	**400**	NS	**180**	**314**	**180**	**240**	**34**	**110**	**97**	**190**	NS	**340**	**192**
MW-5	**9.0**	2.0 J	NS	ND	NS	ND	ND	ND	ND	NS	NS	NS	NS	NS
MW-7	-	-	-	**6**	**20**	**10**	**19**	**9**	**17**	**24**	**19**	NS	**11**	**15.6**
MW-12	-	-	-	-	**131**	**110**	**190**	**43**	**98**	**130**	**130**	NS	**98**	**14.9**
MW-18	-	-	-	-	-	-	-	-	-	-	-	**37**	ND	1.2 U
MW-3A[1]	NS	NS	**44**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-4A[1]	NS	NS	**210**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CPT-01[1]	NS	NS	NS	NS	NS	**8**	NS	NS	NS	NS	NS	NS	NS	NS
CPT-02[1]	NS	NS	NS	NS	NS	**18**	NS	NS	NS	NS	NS	NS	NS	NS
CPT-03[1]	NS	NS	NS	NS	NS	**8**	NS	NS	NS	NS	NS	NS	NS	NS
CPT-04[1]	NS	NS	NS	NS	NS	**40**	NS	NS	NS	NS	NS	NS	NS	NS
CPT-05[1]	NS	NS	NS	NS	NS	**58**	NS	NS	NS	NS	NS	NS	NS	NS
CPT-06[1]	NS	NS	NS	NS	NS	**73**	NS	NS	NS	NS	NS	NS	NS	NS

Summary of Groundwater Sampling Results Above Project Screening Criteria for CCl_4 Between 1987 and 2011

Well ID	May 1987	Nov. 1991	Dec. 1993	Jun. 1995	Jun. 1999	Jul. 2001	Oct. 2001	Jun. 2003	Oct. 2003	Nov. 2004	May 2005	Dec. 2006	Apr. 2008	Dec. 2011
	CCl_4 (µg/L)													
CPT-07[1]	NS	NS	NS	NS	NS	**180**	NS	NS	NS	NS	NS	NS	NS	NS
CPT-09[1]	NS	NS	NS	NS	NS	**10**	NS	NS	NS	NS	NS	NS	NS	NS

Legend:

1 *temporary well*
- *well not installed*
B *compound detected in laboratory method blank*
CCl_4 *carbon tetrachloride*
J *estimated, calculated value below method detection limit*
ND *not detected*
NS *MW not sampled*
U *not detected above limit indicated*
µg/L *microgram per liter*
Bold *Indicates concentration above the USEPA MCL (USEPA, 2011) of 5 micrograms per liter*
Source: *Final Focused Feasibility Study Nike Battery Launch Area (W-44) Formerly Used Defense Site, Waldorf, Maryland* (Weston, 2011)

Summary of Groundwater Sampling Results Above Project Screening Criteria for TCE Between 1987 and 2011														
Well ID	**May 1987**	**Nov. 1991**	**Dec. 1993**	**Jun. 1995**	**Jun. 1999**	**Jul. 2001**	**Oct. 2001**	**Jun. 2003**	**Oct. 2003**	**Nov. 2004**	**May 2005**	**Dec. 2006**	**Apr. 2008**	**Dec. 2011**
	TCE (µg/L)													
MW-4	**9.0**	**10**	NS	**9.0**	**13 J**	**9.0**	**14**	3.0	**6.0**	**7.0**	**11**	NS	**19**	**7.6**
MW-12	-	-	-	-	1.0 U	4.0	**12.0**	2.0	3.0	4.0 J	4.0 J	NS	3.2 J	1.5
MW-4A[1]	NS	NS	**11**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CPT-07[1]	NS	NS	NS	NS	NS	**7.0**	NS	NS	NS	NS	NS	NS	NS	NS

Legend:

1	*temporary well*
-	*well not installed*
B	*compound detected in laboratory method blank*
CCl_4	*carbon tetrachloride*
J	*estimated, calculated value below method detection limit*
ND	*not detected*
NS	*MW not sampled*
U	*not detected above limit indicated*
µg/L	*microgram per liter*
Bold	*Indicates concentration above the USEPA MCL (USEPA, 2011) of 5 micrograms per liter*
Source:	*Final Focused Feasibility Study Nike Battery Launch Area (W-44) Formerly Used Defense Site, Waldorf, Maryland* (Weston, 2011)

This page intentionally left blank

Attachment 2

Public Meeting Summary: Former Waldorf Nike (W-44) Site, Launch Area

This page intentionally left blank

Public Meeting Summary
Waldorf Nike Missile Battery W-44 – Launch Area
Formerly Used Defense Site
September 18, 2013
Waldorf West Branch Public Library
Waldorf, Maryland

Community Attendees (Alphabetically):
Cassandra Borden
Nadine Dangerhill
Joseph Harmon
Penny Hart
Leon Knight
Cynthia Makell
John Makell
Judy Michael, Charles County
Maurice Proctor
Steven Reed
Ren Snyder
Sharon Snyder
Larry Spencer
Patricia Spencer
Carol Thomas
Wendell Thomas
Whitney Thomas
Wayne Weaver

Federal, State, and Contractor Attendees:
Hamid Rafiee, Project Manager, U.S. Army Corps of Engineers, Baltimore District
Clem Gaines, Office of Public Affairs, U.S. Army Corps of Engineers, Baltimore District
Peg Nemoff, Federal Facilities Division, The Maryland Department of the Environment
Sean Carney, Project Manager, Environmental Services, ERT, Inc.
Michael Barsa, Deputy Project Manager, Environmental Services, ERT, Inc.

Handouts and Posters at the Meeting (Included):
1. Poster: Site History
2. Poster: Site Map
3. Poster: Soil and Groundwater Sampling Locations
4. Handout: A Citizen’s Guide to In-Situ Chemical Oxidation

Overview of Meeting Proceedings:
During the public meeting, a brief history of remedial investigation efforts was imparted to community members. Members of the community expressed concern over possible groundwater issues in their private properties. USACE explained that groundwater is not a source of drinking water in the area, and that remedial investigation efforts over the years have defined the boundaries of the contamination plume to the FUDS property only.

Concern was also expressed by community members that the nature and extent of the contamination plume may be currently known, but it is impossible to know for sure what conditions were like in the past. USACE explained that via the remedial investigation, modeling and risk assessment efforts have allowed past conditions to be simulated.

When discussing the selected remedial action, concerns were raised over the possibility of metals rising to surface as a by-product of the chemical process. USACE explained that almost immediately after injection, the chemicals begin to break down contaminants and the only by-product will be inert carbon dioxide.

The public comment period would end on October 31, 2013, approximately six weeks after the public meeting.

Waldorf W-44 Nike Missile Battery Site
September, 18, 2013 5:00 to 7:30 p.m.
Sign-In Sheet

Name	Affiliation	Address	City, State, Zip	Telephone	E-mail	Check box if you want to be placed on the project mailing list.
Maurice Proctor		11400 cadeville Rd	Brandywine	240.432.5446	PhillipProctor81@Gmail.com	
Judy Michael	Charles County Gov't	P.O. Box 2150	LAPLATA MD 20646	301-645-0516	Michjh@charlescounty.org	
Larry + Patricia Spencer		2160 Cedar Tree Ln	Waldorf MD 20601	301-645-2880	ltspls@yahoo.com	
Nadine Dangerfield					nadineyd@umd.edu	
Wendell & Whitney Thomas		2156 Cedar Tree Ln	Waldorf, Md. 20601	301-843-2789	I want a copy of the purposed plan	
Ken & Sharon Snyder	Home owner	2128 CEDAR TREE LANE	WALDORF MD 20601	301-645-1060	snyder1105@Verizon.net	
Steven Reed	HOME OWNER	2180 CEDAR TREE LN	Waldorf MD 20601	301-638-0398	checkpoin@aol.com	
John & Cynthia Makell		2164 Cedar Tree Lane	Waldorf, MD 20601 — Please send us detail information, including photos	301-893-2749	johnmakell@yahoo.com	✓
Penny Hart	Homeowner	2172 Cedar Tree Ln	Waldorf 20601	301.645.2760	phart@ccboe.com	

Waldorf W-44 Nike Missile Battery Site
September, 18, 2013 5:00 to 7:30 p.m.
Sign-In Sheet

Name	Affiliation	Address	City, State, Zip	Telephone	E-mail	Check box if you want to be placed on the project mailing list.
WAYNE WEAVER	HOME OWNER	2125 CEDAR TREE LANE	WALDORF, MD 20601	301-705-9897	ZAT007@NETZERO.NET	
PEG NEMOFF	MD DEPT of ENVIRON	1800 Washington Blvd	Baltimore 21230		~~Peg~~ Peg.Nemoff@	
Cassandra Borden	Home Owner	2153 Cedar Tree Lane	Waldorf, MD 20601	301.638.9757	CassandraBorden@verizon.net	✓
Joseph Hagman	Home Owner	2151 CEDER TREE LN	WAldorf, MD 2060[illegible]	202-520-2441	Jobose@COMCAST.NET I WANT Copy of PROPOSED PLAN	
LEON KNIGHT	Home Owner	2145 Cedar Tree Lane	Waldorf, MD 20601	301-645-4694	LLssfamily@comcast.net	
Carol Thomas	Homeowner	2156 Cedar Tree Lane	Waldorf, MD 20601	301-843-2789	thomascw@comcast.net	
Hamid Rafiee	PM CENAB					
Clem Gaines	CENAB Office of Public Affairs					
Sean Carney	Project Manager, ERT					

Mike Barsa
Deputy Project Manager, ERT

WALDORF NIKE BATTERY W-44 – LAUNCH AREA

Formerly Used Defense Site
Charles County, Maryland

Site History

The site is located on the boundary between the southern portion of Prince Georges County and the northern portion of Charles County, MD, approximately 15 miles southeast of the center of Washington, DC. Between 1955 and 1960, the government acquired a total of 31.40 acres, obtained easement on 39.77 acres, and leased 0.89 acre in 25 parcels from various owners to support the construction and operation of the Nike Battery. The site was developed as Nike Battery W-44 and included property for a missile Control Area, a missile Launch Area, and easements for access roads. Between June 1965 and February 1986, a total of 27.72 acquired acres, 35.98 acres of easement, and 0.89 acre lease were declared as excess by the Department of Defense (DoD) and subsequently conveyed to other owners. All structures, underground storage tanks, and electrical distribution system equipment constructed by DoD remained on the properties at the time of conveyance. The Launch Area is currently owned by Charles County and leased to the Maryland Indian Heritage Society for use as a cultural center. The former barracks are located adjacent to the missile silos at the Launch Area and also are being used by the Maryland Indian Heritage Society.

Nike Missile Silo Door

Metal Silo Elevator Door

Inside a Nike Silo

Corroded Drums in Berm Pit

Waldorf Nike Missile W-44 Launch Site

Drilling Crew using Direct Push Technology (DPT) to install Soil Boring (SB)-17 points

SB-03 is an example of the DPT groundwater sampling

Soil and Groundwater sampling Locations

A Citizen's Guide to In Situ Chemical Reduction

What Is In Situ Chemical Reduction?

In situ chemical reduction, or "ISCR," uses chemicals called "reducing agents" to help change contaminants into less toxic or less mobile forms. It is described as "in situ" because it is conducted in place, without having to excavate soil or pump groundwater above ground for cleanup. ISCR can clean up several types of contaminants dissolved in groundwater. It can also be used to clean up contaminants known as "dense non-aqueous phase liquids" or "DNAPLs," which do not dissolve easily in groundwater and can be a source of contamination for a long time. ISCR is most often used to clean up the metal chromium and the industrial solvent trichloroethene, or "TCE," which is a DNAPL.

How Does It Work?

When reducing agents are added to contaminated soil and groundwater, a chemical reaction occurs that changes contaminants into other forms. For example, a very toxic form of chromium called "hexavalent chromium," or "chrome 6," can be changed to chrome 3 when reducing agents are injected into contaminated groundwater. Chrome 3 is a much less toxic form of the metal. Chrome 3 is also less mobile because it does not dissolve as easily in water.

Common reducing agents include zero valent metals, which are metals in their pure form. The most common metal used in ISCR is zero valent iron, or "ZVI." ZVI must be ground up into small granules for use in ISCR. In some cases, micro- or nano-scale (extremely small) particles are used. The smaller particle size increases the amount of iron available to react with contaminants. Other common reducing agents include polysulfides, sodium dithionite, ferrous iron, and bimetallic materials, which are made up of two different metals. The most common bimetallic material used in ISCR is iron coated with a thin layer of palladium or silver.

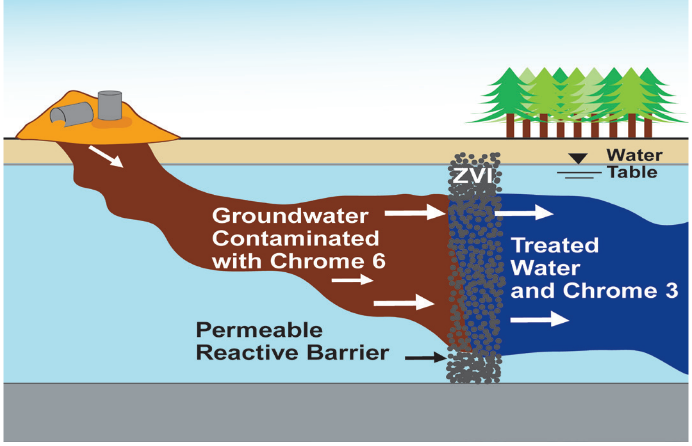

Illustration of the treatment of contaminated water with a PRB made of ZVI.

There are two ways of bringing reducing agents into contact with contaminated soil and groundwater: direct injection and construction of a permeable reactive barrier, or "PRB."

Direct injection involves mixing the reducing agent with water (or sometimes vegetable oil) to create a slurry, which is pumped down holes drilled directly into the contaminated soil and groundwater. This method is often used to treat highly contaminated source areas, including DNAPLs. Nano-scale ZVI is usually used when injecting iron underground, but micro-scale ZVI also is used.

A **PRB** is a wall built below ground, usually by digging a trench and filling it with a reducing agent. Iron filings, which are larger granules of ZVI, are commonly used. Because the wall is permeable, groundwater flows through the PRB allowing contaminants to react with the reducing agent; treated water flows out the other side. A PRB is used to treat contaminants dissolved in groundwater. It will only treat the water that flows through it. (See *A Citizen's Guide to Permeable Reactive Barriers* [EPA 542-12-015].)

How Long Will It Take?

ISCR may take as little as a few months to clean up a source area using direct injection, and PRBs may take several years. The actual cleanup time will depend on several factors that vary from site to site. For example, ISCR will take longer where:

- The source area is large, or contaminants are trapped in hard-to reach areas like fractures or clay.
- The soil or rock does not allow the reducing agent to spread quickly and evenly or reach contaminants easily.
- Groundwater flow is slow.

Is In Situ Chemical Reduction Safe?

The use of ISCR poses little risk to the surrounding community. Workers wear protective clothing while handling reducing agents, and when handled properly, these chemicals are not harmful to the environment or to people. Because contaminated soil and groundwater are cleaned up underground, ISCR does not expose workers or others at the site to contamination. If contaminated soil is encountered when digging the PRB trench, workers will need to wear protective clothing. They also cover any loose contaminated soil to keep dust and contaminants out of the air before disposing of it. Groundwater and soil are tested regularly to make sure ISCR is working.

How Might It Affect Me?

Residents and businesses near the site may see increased truck traffic when drilling rigs, earth-moving equipment, and reducing agents are delivered to the site. Residents also may hear the operation of equipment during injections or installation of PRBs. However, when injections and PRB installations are complete, ISCR requires no noisy equipment. Cleanup workers will occasionally visit the site to collect soil and groundwater samples to make sure ISCR is working.

Why Use In Situ Chemical Reduction?

ISCR can treat some types of contaminants including DNAPLs that are difficult to clean up using other methods. It can destroy most of the contamination in situ without having to pump groundwater for treatment or dig up soil for transport to a landfill or treatment facility. This can save time and money. In addition, no energy is needed to operate a PRB because it relies on the natural flow of groundwater. ISCR is a relatively new method for cleaning up hazardous waste sites, but is seeing increased use at Superfund sites across the country.

Injection of reducing agent into a hole drilled underground.

Example

ISCR was used to treat soil and groundwater contaminated with chrome 6 at the Macalloy Corporation Superfund site in South Carolina. Leaks and disposal of wastes at the former iron-chrome alloy manufacturing plant contaminated the groundwater, which flows into a nearby creek.

In December 2005, five PRBs (and later another four) were constructed to contain and treat groundwater before it could enter the creek. Soil excavated from trenches was mixed with gravel and a blend of ferrous iron and sodium dithionite. The mixture was placed back in the trenches to form the PRBs.

A 2010 review showed that concentrations of chrome 6 and the extent of contamination are decreasing at the site. Cleanup goals are being met in most of the wells sampled. The PRBs are expected to continue to reduce chrome 6 over the next five years.

For More Information

For more information about this and other technologies in the Citizen's Guide Series, visit::

www.cluin.org/remediation
www.cluin.org/products/citguide
www.cluin.org/ISCR

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response (5102G)

EPA 542-F-12-012
September 2012
www.epa.gov/superfund/sites
www.cluin.org

Community Member Commenter 1:

Thanks for mailing us a copy of the Proposed Remedial Action Plan for Waldorf Nike Missile (W-44) Site, Launch Area, Charles County, MD and extending the comment period to today's date.

I still have concerns about airborne contaminants/unforeseen chemicals that may affect the air quality in our homes and/or around our neighborhood. Please advise us if further testing for such contaminants, etc. will be conducted in 2014 or in near future, as we are very interested in reviewing your findings.

We sincerely appreciate the USACE's effort in keeping the community informed of all processes and decisions of the proposed remedial action plan, and ask that you keep our names on the USACE's mailing list for receiving any new developments on this project and if additional comments from the community are required on this issue.

CENAB Response to Commenter 1:

Thank you for the email. I understand your concerns.

Safety of the community is our number one priority. We have conducted multiple investigations at the Former Waldorf Nike Missile Site since 1987. None of these investigations showed chemicals affecting the air quality in the community.

However, during the Launch Area investigations, groundwater samples collected for volatile organic compounds from monitoring wells immediately adjacent to and down gradient of the Missile Assembly Building contained Carbon tetrachloride (CCl_4) and Trichloroethylene (TCE). This indicates that the source of the contaminants is likely a superficial spill or spills of solvents used to clean missile parts behind the Missile Assembly Building.

In 2014, we will perform remedial design followed by on-site chemical reduction and bioremediation combined with Land Use Controls and Long Term Monitoring to ensure the prevention of exposure to volatile organic compounds. We plan to monitor the site until concentrations of CC14 and TCE are below the EPA's and the Maryland Department of the Environment's groundwater standards. It is important to remember that groundwater is not a source of drinking water in the area.

We are committed to completing a thorough cleanup with the highest confidence level that can reasonably be achieved.

I will add your email to our list to receive updates on any new developments, including future comment periods. Also, please visit our website for the most up-to-date information: http://www.nab.usace.army.mil/Missions/Environmental/FormerlyUsedDefenseSites/WaldorfNikeMissileSite.aspx

If you have any questions, please let me know.

Community Member Commenter 2:

I attended the public meeting at the Waldorf West Library on September 18th, concerning the NIKE Missile Battery W-44. There were three areas of concern by the majority of the CTC Homeowners. The first is in reference to the property sale while the restoration is in progress, until the task is completed. Second, will the homeowners be provided documentation, that the restoration is complete and that there is no danger of recurrence. Third and may not be the last, how often will the homeowners be updated on the status of the restoration? Not speaking for all the homeowners, I would like to thank you and the others who provided a complete and detailed status of the restoration and a little of the history and facts about the site. Thank you again and look forward to hearing from you

CENAB Response to Commenter 2:

Thank you for your email. I will try to address your concerns and answer your questions as best as possible.

1) In reference to the property sale while the restoration is in progress, you will need to contact the property owner, Charles County. The point of contact is Ms. Judy Michael. Her email address is: Michjh@charlescounty.org

2) After we complete restoration, we will provide a remedial action report, which will outline the work that took place at the property and the plans for long term monitoring. We are confident that our thorough investigations and cleanup will greatly reduce any potential safety risk from remaining volatile organic compounds. The Corps is committed to completing a thorough cleanup with the highest confidence level that can reasonably be achieved.

3) We plan to update homeowners during various milestones in the restoration process, such as completion of the decision document, selection of a contractor, and start of work, just to name a few upcoming milestones. Also please feel free to visit our website for up-to-date information: http://www.nab.usace.army.mil/Missions/Environmental/FormerlyUsedDefenseSites/WaldorfNikeMissileSite.aspx

If you have any further concerns or questions, please email or call me.

This page intentionally left blank

Attachment 3

Letters from MDE and the U.S. Army Institute of Public Health
of Approval for Proposed Remedial Action

This page intentionally left blank

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101 • www.mde.maryland.gov

Lawrence J. Hogan, Jr.
Governor

Boyd K. Rutherford
Lieutenant Governor

Ben Grumbles
Acting Secretary

February 17, 2015

Mr. Hamid Rafiee
U.S. Army Corps of Engineers
10 South Howard Street
P.O. Box 1715
Baltimore, MD 22103

Re: Final Decision Document for former Waldorf Nike (W-44) Site, Launch Area Waldorf, Maryland, January 2015

Dear Mr. Rafiee:

The Federal Facilities Division (FFD) of the Maryland Department of the Environment's Land Restoration Program has completed review of the referenced document. This Decision Document (DD) documents the US Army Corps of Engineers (USACE) decision to take remedial action at the former Waldorf Nike Site which straddles the Maryland Prince Georges, and Charles County line.

A public meeting was held on September 18, 2013 to present the remedial action contained in this DD. Comments from the community were addressed and are documented in Attachment 2 of the DD. The DD documents the USACE's decision to address chlorinated volatile organic compounds, (CVOCs) in groundwater. The remedial action will include In Situ Chemical Reduction process utilizing Zero Valent Iron to remediate groundwater, performance monitoring of groundwater and land use controls.

These actions are conducted in compliance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). They are intended to prevent exposure of human and ecological receptors to the underlying material and thereby mitigate the CERCLA risks which were documented in the risk assessments. Based on the acceptable level of protection to human health and the environment provided by the remedy, the FFD concurs with the selected action.

Should you have any questions, please feel free to contact me at (410) 537-3418.

Sincerely,

Peg Nemoff

Peg Nemoff
Remedial Project Manager
Federal Facilities Division

PN:pn

cc: Mr. Joseph Vitello
Ms. Evelyn H. Hoblyn
Mr. Mark A. Williams
Mr. Horacio Tablada
Mr. James Carroll

DEPARTMENT OF THE ARMY
US ARMY INSTITUTE OF PUBLIC HEALTH
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MARYLAND 21010-5403

MCHB-IP-REH

MEMORANDUM FOR District Engineer, Baltimore District, U.S. Army Corps of Engineers (CENAB-EN-HN/Mr. Hamid Rafiee), 10 S. Howard Street, Baltimore, MD 21201-1715

SUBJECT: Final Decision Document, Former Waldorf Nike (W-44) Site, Waldorf, MD

1. The Army Institute of Public Health reviewed the subject document on behalf of the Office of The Surgeon General pursuant to Army Regulation 200-1 (Environmental Protection and Enhancement). We appreciate the opportunity to review the document.

2. We concur that the selected remedy is protective of human health and the environment. We have no additional comments.

3. Please help us find ways to improve the products and services we provide and take a few moments of your time to complete our survey, https://usaphcapps.amedd.army.mil/Survey/se.ashx?s=2511374518790C4B. To ensure we evaluate the proper project, for Question 3 "Product/Service provided by", please indicate: Location: Army Institute of Public Health, Portfolio/Staff: Health Risk Management, Program: Environmental Health Risk Assessment; for Question 5 "Type(s) of product or service received", please indicate: Document Review.

4. Our point of contact for this review is Mr. Jeffrey Leach, Environmental Health Risk Assessment Program. Mr. Leach can be reached at 410/436-2953 or jeffrey.g.leach.civ@mail.mil.

FOR THE DIRECTOR:

JEFFREY S. KIRKPATRICK
Portfolio Director, Health Risk Management

CF:
HQDA (DASG-PPM-NC/COL Ireland)
PHCR-North (HRMD/CPT Elyamani)

This page intentionally left blank