# FINAL

# PROPOSED REMEDIAL ACTION PLAN

## FORMER WALDORF NIKE (W-44) SITE, LAUNCH AREA
## WALDORF, MARYLAND

*Prepared for:*

US Army Corps of Engineers

BUILDING STRONG

**U.S. Army Corps of Engineers**
**Baltimore District**

**Contract No.: W912DR-09-D-0061**

**Delivery Order 003**

**FUDS Property: Former Waldorf Nike (W-44) Site in Charles County, Maryland**

**CERCLA Project Phase: Proposed Plan**

**Project Name: Waldorf Nike (W-44) Site**

*Prepared by:*


**ERT, Inc.**

**6100 Frost Place, Suite A**

**Laurel, Maryland 20707**

**301-361-0659**


**August 2013**

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Final

Proposed Remedial Action Plan

for

Former Waldorf Nike (W-44) Site, Launch Area

Waldorf, Maryland

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301-361-0659


25 July 2013

Sean M. Carney — Date

Project Manager, PMP

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## COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the ERT, Inc. (ERT) total quality management system. As such, a senior technical review has been conducted. This included review of the overall design addressed within the document, proposed or utilized technologies and alternatives, and their applications with respect to project objectives and framework of U.S. Army Corps of Engineers regulatory constraints. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

ELECTRONIC SIGNATURE

18 September 2012

Thomas Bachovchin, PG — Date
Senior Technical Reviewer

## COMPLETION OF INDEPENDENT TECHNICAL REVIEW

This document has been produced within the framework of ERT's total quality management system. As such, an independent technical review, appropriate to the level of risk and complexity inherent in the project, has been conducted. This included review of assumptions (methods, procedures, and material used in analyses), alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product accomplishes the stated project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

20 September 2012

Barry Millman, PE — Date
Independent Technical Reviewer

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## TABLE OF CONTENTS



## LIST OF TABLES



## LIST OF FIGURES

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ARAR | applicable or relevant and appropriate requirements |
| AS/SVE | air sparging with soil vapor extraction |
| $CCl_4$ | carbon tetrachloride |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COC | constituent of concern |
| DERP | Defense Environmental Restoration Program |
| DoD | U.S. Department of Defense |
| ERT | ERT, Inc. |
| FFS | Focused Feasibility Study |
| FS | Feasibility Study |
| FUDS | Formerly Used Defense Sites |
| GRA | general response action |
| GW CW with IW AS | groundwater circulation wells with in-well air stripping |
| ISCR | in situ chemical reduction |
| LTM | long-term monitoring |
| LUC | land use controls |
| MCL | maximum contaminant level |
| MDE | Maryland Department of the Environment |
| MNA | monitored natural attenuation |
| MW | monitoring well |
| NCP | National Contingency Plan |
| PRAP | Proposed Remedial Action Plan |
| PRB | permeable reactive barrier |
| RA | risk assessment |
| RAO | remedial action objective |
| RI | Remedial Investigation |
| TCE | trichloroethylene |
| USACE | U.S. Army Corp of Engineers |
| USEPA | U.S. Environmental Protection Agency |
| UST | Underground Storage Tank |
| VOC | volatile organic compound |
| Weston | Weston Solutions, Inc. |
| mg/L | milligrams per liter |
| µg/L | micrograms per liter |

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# GLOSSARY OF TERMS

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| Administrative Record | A collection of documents, containing all reports generated during the phases of environmental investigation at a site, which is used to make a decision on the selection of a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Administrative Record for the Waldorf Nike Site is located at the Upper Marlboro Branch Public Library. |
| Air Sparging | The process of injecting air or oxygen into an aquifer to flush contaminants trapped in air bubbles up through the groundwater and capturing with a vapor extraction system. |
| Applicable Requirements | Cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. |
| Cancer Risk | The likelihood that an individual will develop cancer from direct exposure to chemicals classified as carcinogens. U.S. Environmental Protection Agency (USEPA) defines acceptable cancer risk resulting from chemical exposure as no more than one additional cancer in a population of 10,000. Data indicating excess cancer risk above the threshold of one additional cancer in a population of 10,000 would indicate excess cancer risk. |
| Carcinogen | A substance having the potential to cause cancer. |
| Chlorinated Solvent | An organic compound containing chlorine atoms in its molecular structure. Chlorinated solvents are frequently used for degreasing or dry cleaning. Examples of chlorinated solvents include trichloroethylene (TCE) and carbon tetrachloride ($CCl_4$). |
| Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) | A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act authorizing response actions, including investigations and clean up, relating to hazardous substances, for sites with hazardous substances, pollutants, or contaminants for which a response is needed. Also referred to as the Superfund. |
| Contaminant Plume | A volume of hazardous substance with measurable dimensions that is mixed with and moves along with groundwater. |
| Decision Document | A legal public document that describes the cleanup action or remedy selected for a contaminated site, the basis for the choice of that remedy, and public comments on potential alternative remedies. The Decision Document legally bounds the preferred remedial alternative presented in the Proposed Remedial Action Plan (PRAP) and is based on information and technical analysis generated during the Remedial Investigation/Feasibility Study (RI/FS). |
| Defense Environmental Restoration Program (DERP) | Established law authorizing environmental investigation and cleanup at sites in the U.S. and its territories that the Department of Defense (DoD) either currently owns or owned in the past. |
| Downgradient | Flow towards lower elevations. |

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| Exposure Pathway | A route by which a person may come into contact with a hazardous substance. Three basic exposure pathways include: inhalation (breathing), ingestion (eating), or direct contact (touching). |
| Ex-Situ Treatment | Treatment conducted on a contaminated medium (e.g., water or soil) that has been removed from their original location. |
| Formerly Used Defense Sites (FUDS) | Properties that, prior to October 16, 1986, were owned, leased, or otherwise possessed by the U.S. government and were the responsibility of the U.S. Department of Defense (DoD).. |
| General Response Action (GRA) | A broad action that singly or in combination with other actions, will meet the remedial action objectives that established to protect human health and the environment. |
| Groundwater | Water found below the ground surface that fills the pores in soil or the openings/fractures in or between rocks. Groundwater is often the source of drinking water through municipal or domestic wells. |
| In Situ | Treatment conducted on contaminated medium (e.g., water or soil) that remains in its original location. |
| Land Use Control (LUC) | A measure that defines activities that are allowed on properties and in watersheds, restricting how water within the watershed may be utilized. |
| Maximum Contaminant Level (MCL) | The legal threshold limit established by the USEPA for the amount of a contaminant allowable in drinking water under the Safe Drinking Water Act. MCLs can be found in Title 40 of the Code of Federal Regulations (CFR) Part 140. |
| Monitoring | The act of collecting information about the environment over a period of time. For purposes of this plan, groundwater monitoring will be conducted in order to gauge the effectiveness of the remedial action on groundwater contamination. |
| Monitored Natural Attenuation (MNA) | A groundwater remedy that relies on natural processes to cleanup contamination and requires active monitoring of the process. |
| National Oil and Hazardous Substances Pollution Contingency Plan (NCP) | The federal regulation that implements CERCLA. The purpose of the NCP is to provide the organizational structure and procedures for preparing for and responding to discharges of oil and releases or threats of releases of hazardous substances, pollutants, or contaminants. |
| National Priorities List (NPL) | The USEPA list of hazardous waste sites, which are ranked in order of highest priority for cleanup based on the USEPA Hazard Ranking System. |
| Natural Attenuation | The method of reducing contaminant concentrations and/or the movement of contamination in groundwater by allowing natural forces in the environment to operate without human intervention. These processes include microbes that use the contaminants as food and the natural tendency of the contaminants to stick to soil particles. |
| No Further Action | A designation for a site that has been determined to require no further investigation or remedial action to address potential CERCLA hazardous substances, pollutants, or contaminants. |
| Permeability | The measure of the ability of a material to allow fluids to pass through it. |
| Permeable Reactive Barrier | A zone of reactive material that extends below the water table to intercept and treat contaminated groundwater. |

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| Petroleum Hydrocarbons | A group of chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products. Petroleum hydrocarbons are made primarily from hydrogen and carbon. |
| Proposed Remedial Action Plan (PRAP) | A plan that supplements the RI/FS and identifies the lead agency's proposed remedial alternative for a CERCLA site. The PRAP provides the public with a reasonable opportunity to comment on the alternatives for remedial action and to participate in the selection process before a final selection is made in the Decision Document. In the first step of the remedy selection process, the lead Agency identifies the alternative that best meets the requirements in the NCP and presents that alternative to the public in the PRAP. |
| Receptor | A human, animal species, plant species, or natural wildlife area that could be exposed to and/or be adversely affected by the introduction of a hazardous substance. |
| Relevant and Appropriate Requirements | Those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental laws or facility siting laws that, although not ''applicable'' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate. |
| Remedial Action | An action taken to address contamination of a medium (e.g., groundwater or soil) by preventing human and/or environmental exposure to the contamination or treating the contamination. |
| Remedial Investigation (RI) / Feasibility Study (FS) | An in-depth study designed to gather the data necessary to determine the nature and extent of known contamination at a site, assess risk to human health and/or the environment, and establish criteria for cleaning up the site. During the FS, the RI data are analyzed and remedial alternatives are identified. The FS serves as the mechanism for the development, screening, and detailed evaluation of alternative remedial actions |
| Risk Assessment (RA) | The identification, evaluation, and estimation of the level of risk based on known exposures to chemicals. Risk assessments take into account specific situational exposures, comparison against approved standards and determinations of acceptable risk. |
| Soil Gas | Vapors found within the small space between particles of earth and soil. |
| Semi-Volatile Organic Compounds | A group of chemicals composed primarily of carbon and hydrogen that have a slight tendency to evaporate (i.e., volatilize) into the air from water or soil. |
| Soil Vapor Extraction (SVE) | The process by which a vacuum is applied through extraction wells to remove volatile contamination (vapors) from soil through a medium such as air or steam. |
| Transmissivity | The rate at which groundwater flows through the subsurface. |

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| Type I Aquifer | An aquifer exhibiting slow flow rate conditions with a transmissivity greater than 1,000 gallons/day/foot, a permeability greater than 100 gallons/day/square foot, and natural water with a total dissolved solids concentration less than 500 milligrams/liter (mg/L). |
| Type II Aquifer | An aquifer that exhibits fast flow rate conditions, demonstrating either:<br>A) a transmissivity greater than 10,000 gallons/day/foot, a permeability greater than 100 gallons/day/square foot and natural water with a total dissolved solids concentration of between 500 and 6,000 mg/L; or<br>B) a transmissivity between 1,000 and 10,000 gallons/day/foot, a permeability greater than 100 gallons/day/square foot and natural water with a total dissolved solids concentration of between 500 and 1,500 mg/L. |
| Unsaturated Zone | The zone of soil and/or rock immediately above the groundwater table and below the surface of the ground where soil and/or rock is not fully saturated, although some water may be present. |
| Volatile Organic Compounds (VOCs) | Carbon compounds, such as solvents, that readily evaporates at room temperature and atmospheric pressure. VOCs are commonly found in industrial solvents used in dry cleaning, metal plating, and machinery degreasing operations. |
| Volatilization | The process by which an organic substance converts from a liquid or solid into a gaseous state or a vapor. |

## EXECUTIVE SUMMARY

This **Proposed Remedial Action Plan** (PRAP) summarizes the preferred alternative for remediating the identified potential contaminant source area and **groundwater contaminant plume** in the vicinity of the former Missile Assembly Building (Building 31) at the former Waldorf Nike Site (W-44), Launch Area. The objectives of this PRAP are to: (1) summarize the site history and the results of past **remedial investigations**, (2) summarize the remedial alternative evaluation process, (3) present the preferred remedial action alternative, and (4) provide the public an opportunity to review and comment on the proposed remedial action before final selection is made in the **Decision Document**.

This PRAP summarizes other remedial alternatives considered for addressing the identified contaminants that were previously evaluated during the development of a focused **feasibility study** (FFS) (Weston Solutions Inc. [Weston], 2011). In addition, this PRAP summarizes applicable information contained in the final remedial investigation reports (ERT, Inc., 2009 and 2012; and Weston 2005) and initial feasibility study report (Weston, 2004), that has led to the identification of the preferred remedial alternative. The United States Army Corps of Engineers (USACE) Baltimore District and the Maryland Department of the Environment (MDE) encourage the public to review these documents to gain a more comprehensive understanding of the site, the environmental investigation activities that have been conducted, and the various remedial action alternatives evaluated.

A potential contaminant source area has been identified in the southwest portion of the former Waldorf Nike Site (W-44), Launch Area, approximately 15 feet north-northwest of an observed empty, deteriorating steel 55-gallon drum. TCE was detected in one soil sample adjacent to the drum at a concentration below the USEPA Residential Screening Level for soil of 910 micrograms per kilogram.

The potential source area is situated adjacent to the former Missile Assembly Building (Building 31). Groundwater sample analysis has indicated concentrations of carbon tetrachloride ($CCl_4$) and trichloroethylene (TCE) above the United States Environmental Protection Agency (USEPA) drinking water **Maximum Contaminant Level** of 5 micrograms per liter (µg/L). Collectively, these standards are the ultimate project remedial objective used to ensure success of the remedial action. In general, a Type I Aquifer is slow moving groundwater with minimal soil particles, while a Type II Aquifer is fast moving groundwater with numerous soil particles. Groundwater data collected from the site has substantiated previous analytical data; however, the plume remains not fully characterized on the western side, in particular. During the upcoming preliminary design phase for the implementation of the preferred remedial alternative, additional groundwater sample collection outside of the existing sampling perimeter and estimated plume boundary will be conducted to fully characterize the boundary of the groundwater contaminant plume. In addition, if it is determined that the groundwater plume is underlying any current structures (i.e., residential homes), indoor air samples will be collected in order to determine if a complete vapor intrusion pathway exists.

Due to low contaminant concentrations detected in the potential source area and groundwater plume, the proposed remedial action alternative for the site is to treat the potential contaminant source area and groundwater plume via in situ chemical processes; perform long-term **monitoring** of the groundwater plume; and implement **land use controls** (LUCs). The objective of the LUCs is to restrict the installation and operation of drinking water wells until the concentrations of $CCl_4$ and TCE in groundwater are reduced to below the USEPA MCL of 5 µg/L.

A 30-day public comment period for this PRAP will be scheduled, after which a public meeting will be held. Comments and information provided during the 30-day public comment period will be evaluated by USACE Baltimore District and, if warranted, may result in the modification of the preferred remedial alternative or in the selection of a different remedial alternative. In consultation with MDE (the lead regulatory agency for this site), USACE Baltimore District will select a remedy (to be finalized via publication of a Decision Document) after the 30-day public comment period, public meeting, and consideration of received comments. This PRAP and supporting documents will be available for public review in the project **Administrative Record** located at:

Upper Marlboro Branch Public Library
14730 Main Street
Upper Marlboro, Prince Georges County,
Maryland 20772

In addition, the public is welcome to contact the MDE as an additional resource when reviewing this PRAP, and historical documents for the site. The MDE Project Manager may be contacted at:

Peg Nemoff
Federal Facilities Division
Land Restoration Program
Land Management Administration
Maryland Department of the Environment
1800 Washington Blvd, Suite 625
Baltimore, Maryland 21230

All written comments will be directed to the attention of the USACE Baltimore District Project Manager, Hamid Rafiee at:

Hamid Rafiee
USACE Baltimore District
P.O. Box 1715
Baltimore, Maryland 21201

# 1.0 INTRODUCTION

This Proposed Remedial Action Plan (PRAP) summarizes the preferred alternative for remediating the potential contaminant source area and groundwater contaminant plume within the vicinity of the former Missile Assembly Building (Building 31) at the former Waldorf Nike Site (W-44), Launch Area in Waldorf, Maryland, hereinafter referred to as "the site." ERT, Inc. (ERT) was contracted by the U.S. Army Corps of Engineers (USACE) Baltimore District to prepare this PRAP. This document details the proposed preferred remedial alternative developed by USACE Baltimore District to address **chlorinated solvent/volatile organic compound** (VOC) contamination at the former Waldorf Nike Site (W-44), Launch Area. USACE Baltimore District initiated environmental investigations at the site in 1986 in order to evaluate potential contamination associated with former Department of Defense (DoD) activities. The environmental investigations have resulted in the identification of a preferred remedial action alternative, as presented in this PRAP.

The environmental investigations at the site and this PRAP were conducted under the **Defense Environmental Restoration Program** (DERP) for **Formerly Used Defense Sites** (FUDS) in accordance with the **Comprehensive Environmental Response, Compensation, and Liability Act** (CERCLA) (United States Environmental Protection Agency [USEPA], 1986). The site is not listed on the **National Priorities List**. The lead regulatory agency is the Maryland Department of the Environment (MDE), Federal Facilities Division.

## 1.1 Purpose

The purpose of the PRAP is to: (1) summarize the site history and the results of past remedial investigations, (2) summarize the remedial alternative evaluation process, (3) present the preferred remedial action alternative, and (4) provide the public an opportunity to review and comment on the proposed remedial action.

This PRAP is designed to fulfill requirements of CERCLA Section 117(a)[1] and the **National Oil and Hazardous Substances Pollution Contingency Plan** (NCP), 40 Code of Federal Regulations (C.F.R.) § 300.430(f)(3), which require the issuance of a document that summarizes proposed remedial action alternatives and allows for public participation and review of the proposed remedial action. **Figure 1-1** summarizes the CERCLA process. CERCLA guidance provides for a phased process that considers the following goals:

- Identify contaminated sites possibly requiring further investigation (via Preliminary Assessment/Site Inspection);
- Characterize the nature and extent of identified contamination, as well as potential fate and transport/migration pathways for identified contamination (Remedial Investigation [RI]);
- Develop and evaluate potential remedial alternative(s) that will address site-specific contamination (Feasibility Study [FS]);
- Encourage public involvement for the selection of the preferred remedial action alternative(s) (PRAP);
- Document the selected remedial action (Decision Document); and
- Design and implement the selected remedial action (Remedial Design/Remedial Action).

The PRAP highlights key information from the RI/FS reports and the Administrative Record File, discusses the remedial alternatives considered, identifies the

[1] 42 U.S.C. § 9617(a).

preferred remedial action alternative, and explains the rationale for identifying the preferred remedial action alternative.

A 30-day public comment period and subsequent public meeting are being provided to comply with CERCLA §117(a) and NCP §300.430(f)(3). New information or recommendations that USACE Baltimore District receives during the public comment period and/or public meeting may result in a modification of the preferred remedial action alternative or the selection of a remedial action alternative that differs from the preferred remedial action alternative presented in this PRAP. This PRAP and other supporting documents will be available for public review in the Administrative Record located at:

Upper Marlboro Branch Public Library
14730 Main Street
Upper Marlboro, Prince Georges County,
Maryland 20772

Public comments should be submitted to the attention of the USACE Baltimore District Project Manager, Hamid Rafiee at:

Hamid Rafiee
USACE Baltimore District
P.O. Box 1715
Baltimore, Maryland 21201

## 1.2 Site Background

The following subsections provide a summary of the site description and history, previous investigations, identified constituents of concern (COCs), and the potential risks associated with the COCs.

### 1.2.1 <u>Site Description and History</u>

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 1-2**). The site was part of the Washington D.C. Defense Area Network that was established in 1955 and remained operational until 1971. The following facilities were present at the site: a former acid fueling building, personnel barracks, gate house, generator building, kennel, missile assembly and test building, oil shed, sand filter building, three underground storage tanks (one nearby the barracks and two in the vicinity of the vehicle maintenance building and missile assembly building) , two underground missile silos (A and B), and an electrical utility system. Between 1965 and 1986, the DoD declared 27.72 acquired acres, 35.98 acres of easement, and a 0.89 acre lease as property it no longer needed, and subsequently sold the property.

The site 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 1-3**).

### 1.2.2 <u>Previous Investigations</u>

Beginning in 1986, a series of investigation activities was conducted by USACE Baltimore District to address potential environmental concerns associated with previous DoD activities at the site.

In 2003, water samples collected from Silo A and Silo B were analyzed for VOCs, perchlorate and total metals. Perchlorate and VOCs were not detected in samples from either silo. Lead was detected in the water sample collected from Silo B at 64 micrograms per liter (µg/L), exceeding the Maryland maximum contaminant level (MCL) of 50 µg/L and the United States Environmental Protection Agency (EPA) MCL of 15 µg/L for groundwater (Weston, 2005).

Three down-gradient monitoring wells were installed specifically to address potential leaching of constituents within the silos. Groundwater samples collected from each of the three wells downgradient of the silos did not detect the presence of any constituents of concern, including lead. A dye tracer test was performed in order to determine if water within the silos was leaking into the local groundwater. The dye tracer test confirmed that the silos were not leaking. Based on the integrity of the silos, the lack of a complete receptor pathway for ingestion or dermal contact, and the non-presence of lead constituents in down-gradient groundwater samples, observed lead concentrations are not considered a hazard to human health or the environment (Weston, 2005). Also, no VOCs were detected in the groundwater samples collected from the wells just downgradient from the silos (MW-14, MW-15, and MW-17). Therefore, silos were also shown to not be contributing to the observed $CCl_4$/TCE groundwater plume.

The 1986 Confirmation Study recommended removal of the Underground Storage Tank (UST) near the vehicle maintenance building, due to one soil sample **total petroleum hydrocarbon**s concentration of 110 parts per million. This UST (Tank 6, an 8,000-gallon diesel UST) was removed in December 1994. The groundwater downgradient from 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 monitoring wells (MWs) at the site were analyzed for VOCs, **petroleum hydrocarbons**, metals, **semi-volatile organic compounds**, polychlorinated biphenyls, and pesticides. Results from each study consistently identified carbon tetrachloride ($CCl_4$) and trichloroethylene (TCE) in groundwater at concentrations above the USEPA maximum contaminant level (MCL) of 5 micrograms per liter (µg/L) The USEPA MCL of 5 µg/L was established as the project screening criteria (Haliburton NUS, 1991).

The following conclusions were presented in the 2005 RI report: (1) the two former missile silos at the site are not leaking any infiltrated water; (2) $CCl_4$ and TCE concentrations in groundwater remain above screening criteria; (3) the unnamed stream to the west of the site is not impacted and could be considered as unthreatened by contamination from the site; (4) potential future groundwater use and the inhalation of vapors associated with $CCl_4$ and TCE concentrations are the potential **exposure pathways**; and (5) concentrations of $CCl_4$ and TCE in groundwater are within the USEPA acceptable excess **cancer risk** range ($1 \times 10^{-4}$ and $1 \times 10^{-6}$, corresponding to incremental individual lifetime cancer risks).

Based on the **risk assessment** (RA) associated with the 2005 RI, concentrations of $CCl_4$ and TCE in groundwater remain above the USEPA MCL, but do not contribute to excess cancer risk above the acceptable USEPA cancer risk range (Weston Solutions [Weston], 2005).

In 2009, additional RI sampling was conducted to evaluate the potential risk of soil gas intrusion into future on-site and off-site buildings (ERT, 2009). The results of the additional sampling were presented in an RI Addendum. It was concluded in the Addendum that: (1) concentrations of $CCl_4$ 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 cover a wide range and continue to exceed the USEPA MCL (Weston, 2011).

In 2011, a second RI Addendum was completed to address data gaps related to the location of a potential source area and to better refine the extent of the groundwater plume (ERT, 2012).

TCE was detected in one soil sample at a concentration below the USEPA Residential Screening Level for soil of 910 micrograms per kilogram, but above the USEPA protection of groundwater SSL 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 discovered to be 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).

Attachment A provides the results for all groundwater samples with concentrations detected above project screening criteria collected during site investigations between 1987 and 2011, based on data presented in the Focused Feasibility Study (FFS), (Weston, 2011) and the RI Addendum No. 2 (ERT, 2012).

Prior to the FFS performed in 2011 (Weston, 2011), additional site data was collected. Based on these data, it was determined that concentrations of TCE remain in groundwater at levels above screening criteria (ERT, 2012).

The FFS established remedial action objectives (RAOs) and evaluated potential remedial alternatives for addressing the potential $CCl_4$ and TCE source area and associated groundwater plume (Weston, 2011). The FFS identified 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.

### 1.2.3 Constituents of Concern

Two COCs were identified during the development of the 2005 RI: $CCl_4$ and TCE (Weston, 2005).

Chlorinated organic compounds $CCl_4$ and TCE exhibit certain characteristics making both compounds more prone to **volatilization**. Carbon tetrachloride has many applications, such as in solvents, degreasers, dry cleaning materials, gasoline additives, refrigerants, and organic synthesis materials (Weston, 2011). Similarly, TCE has historically been used as an industrial solvent and degreaser and is commonly used to remove grease from metal parts and textiles (USEPA, 2007). Exposure to $CCl_4$ and TCE can be associated with negative health effects in humans and in the environment. Based on laboratory studies, both $CCl_4$ and TCE are considered by USEPA as potential human **carcinogens**, meaning that prolonged exposure to either could result in excess cancer risk in humans given sufficient time and exposure levels.

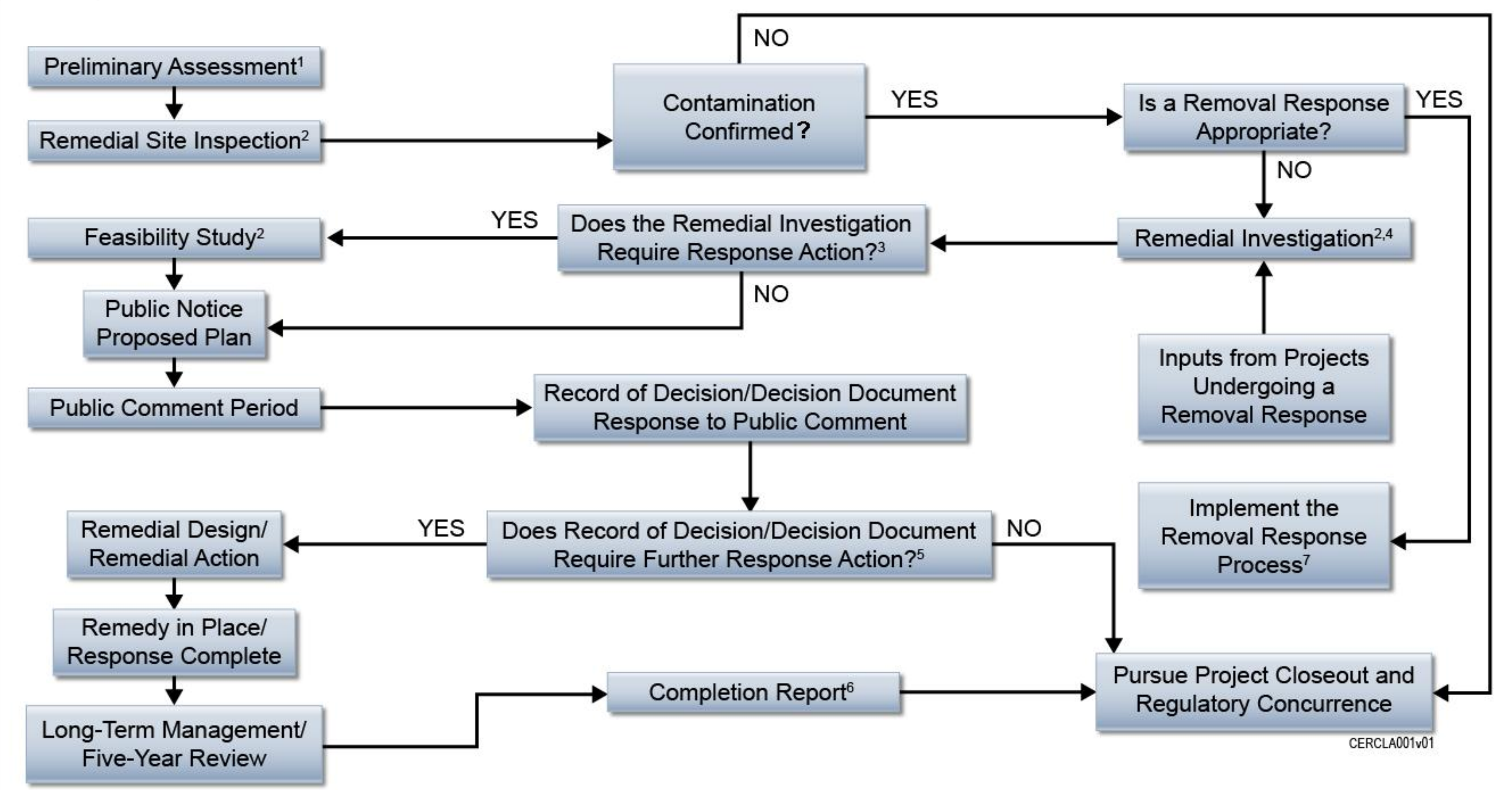
### 1.2.4 Summary of Risk Assessment Activities

An RA was initially conducted in 1996 and later updated in 2005 in order to determine the potential current and future effects of $CCl_4$ and TCE concentrations in groundwater on human health and the environment (Weston, 1996 and 2005). Considering the potential future land use of the site and the adjacent residential Cedar Tree Properties, the baseline RA was conducted assuming future residential use. The RA examined potential risks to future residents of the Cedar Tree Properties (adjacent to the western boundary of the site) and site personnel due to $CCl_4$ and TCE concentrations in groundwater.

The RA summarized the following:

- The detected concentrations of $CCl_4$ and TCE in groundwater;
- How $CCl_4$ and TCE contamination of groundwater can reach humans and the environment (i.e., exposure to **receptors**); and
- Potential human health or environmental effects associated with coming into contact with the contaminated groundwater (i.e., exposure effects).

Based on the RA, only $CCl_4$ could pose an excess cancer risk greater than $1 \times 10^{-6}$. The calculated excess cancer risk for TCE was found to be less than $1 \times 10^{-6}$.




Notes:

1 For new Inventory Project Reports, a Preliminary Assessment will be performed for eligible FUDS Properties. If no hazards are identified during the Preliminary Assessment, pursue property closeout and regulatory concurrence.

2 A removal response may be performed at any time during the process up until the Record of Decision/Decision Document signature.

3 Response action may include land use controls.

4 If the removal response taken adequately addresses the risk of safety concerns at the project, the Remedial Investigation may be abbreviated. If Land Use Control/5-Year Review/Long-Term Management are required, evaluate them in the Feasibility Study.

5 Land Use Control/5-Year Review/Long-Term Management are required to be documented in the Remedial Design.

6 Required by USACE FUDS policy.

7 Regardless of whether additional investigation/response is required following removal action, the projects will transition back to the remedial response process

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| ERT, Inc. | **CERCLA Process Flow Chart** | **Figure 1-1** |
| | | **September 2012** |

**Figure 1-1. CERCLA Process Flow Chart**

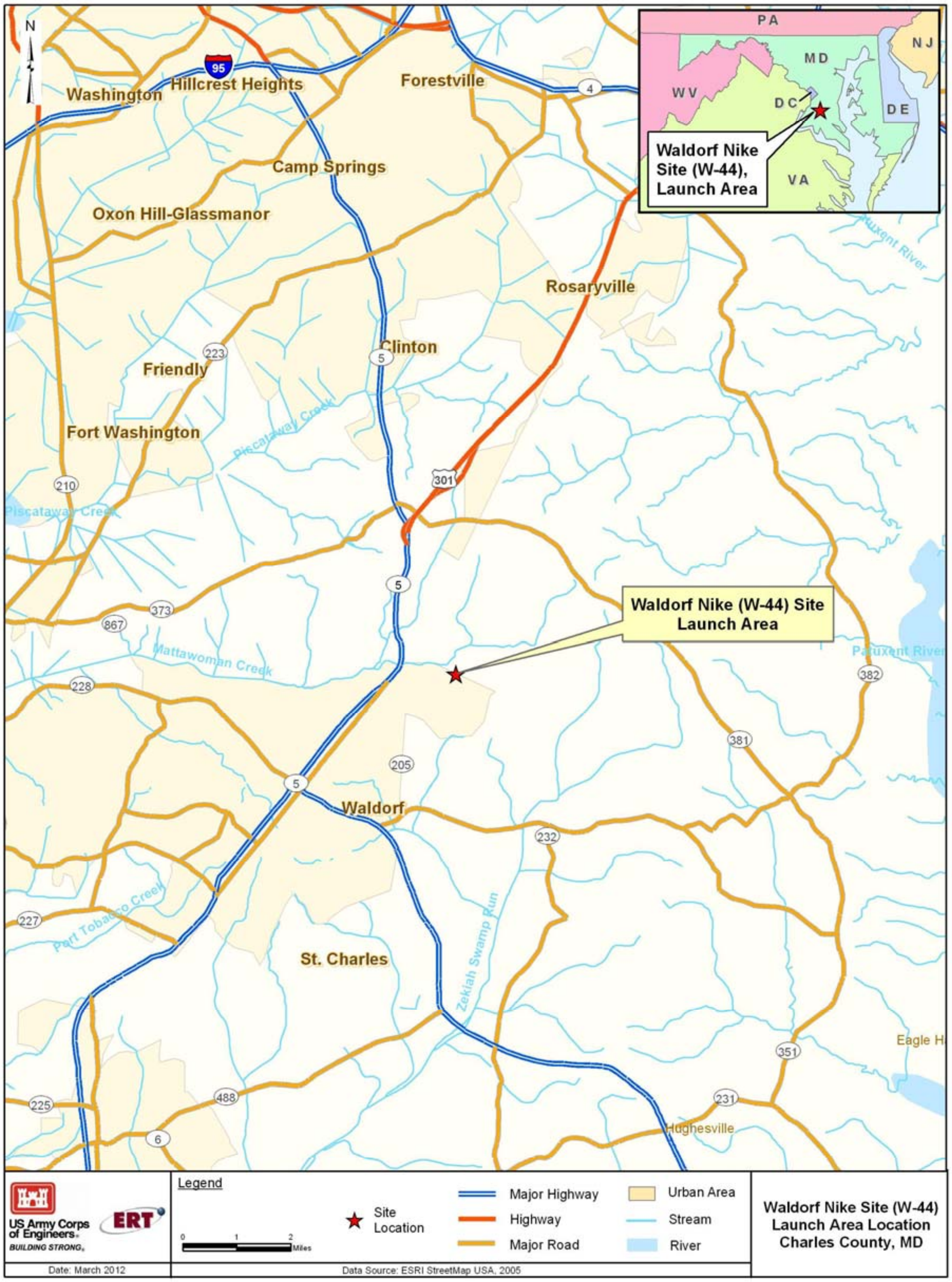


**Figure 1-2. Site Location**


**Figure 1-3. Site Map, Waldorf Nike Site (W-44) Launch Area**

## 2.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) describe the overall goals that the proposed remedial alternative is expected to accomplish. The RAOs for the site are medium-specific (i.e., groundwater-specific) and are based on USEPA MCLs for groundwater and site-specific, **applicable or relevant and appropriate requirements** (ARARs). The RAOs for the site are to:

- Prevent direct human exposure to site-related contaminants (i.e., $CCl_4$ and TCE) at concentrations above the USEPA MCL of 5 μg/L and MDE Groundwater Cleanup Standard for Type I and Type II aquifers of 5 μg/L, and
- Prevent the use of groundwater until the groundwater quality meets the USEPA and MDE groundwater standard of 5 μg/L for site-related contaminants (i.e., $CCl_4$ and TCE).

The proposed preferred remedial action alternative will reduce the carcinogenic risk associated with exposure by reducing the concentration in groundwater to below the USEPA and MDE groundwater standard of 5 μg/L (although the USEPA MCL is considered the applicable project screening criteria, the MDE standard has also been considered as a relevant and appropriate requirement; both standards are 5 μg/L). Additionally, the proposed preferred remedial action alternative will prevent the use of groundwater through Land Use Controls (LUCs) until the groundwater quality meets the USEPA MCL for $CCl_4$ and TCE of 5 μg/L, thus reducing the excess cancer risk associated with $CCl_4$ to below $1 \times 10^{-6}$. The proposed preferred remedial alternative will also include LUCs to restrict site personnel from conducting indoor activities at Buildings 23 (former vehicle maintenance) and 31 (former missile assembly). LUCs that restrict site access will require coordination and acceptance by the current occupants/site owners.

To further meet the RAOs, the proposed remedial alternative will provide for legal controls (e.g., permitting and deed restrictions), preventing the installation of drinking water wells (via permitting) until the concentrations of the $CCl_4$ and TCE are below the USEPA MCL. If individual property owners show no objections during the public comment period, these planned legal controls will include off-site legal controls, to be implemented through deed restrictions (Weston, 2011).

To ensure that the RAOs are met, after the remedial action has been implemented, long-term monitoring (LTM) of groundwater will be conducted until the groundwater quality meets USEPA MCLs for $CCl_4$ and TCE.

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## 3.0 SUMMARY OF POTENTIAL REMEDIAL ALTERNATIVES

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

- No Action
- LUCs
- Containment
- Recovery
- Treatment

Based on the initial consideration of various technologies and processes, six potential remedial alternatives were developed and analyzed against nine criteria developed by the USEPA. The six remedial alternatives analyzed were:

- ***No Further Action***;
- ***Monitored Natural Attenuation (MNA)*** – the process of relying on natural processes to reduce $CCl_4$ and TCE concentrations and carefully controlling and monitoring these processes.
- ***Air Sparging with Soil Vapor Extraction (AS/SVE)*** – the process of injecting air or oxygen into the groundwater to flush the $CCl_4$ and TCE as air bubbles up through the groundwater and capturing with a vapor extraction system.
- ***Groundwater Circulation Wells with In-Well Air Stripping (GW CW with IW AS)*** – the process of injecting pressurized air into a groundwater circulation well, aerating the water. The $CCl_4$ and TCE are collected as vapor within the well on top of the groundwater as the air bubbles out of the water.
- ***Permeable Reactive Barrier*** *(PRB)* – the process of digging a trench in front of the $CCl_4$ and TCE groundwater plume and filling the trench with reactive materials. The reactive materials in the wall trap the $CCl_4$ and TCE and/or change them into harmless products as the groundwater passes through.
- *In Situ Chemical Reduction (ISCR)* – the process of injecting environmentally-safe materials into the potential contaminant source area. Physical, chemical, and biological processes work together to change the $CCl_4$ and TCE in the soil and groundwater into harmless products.

Detailed analysis was performed for each remedial alternative by comparing each alternative against the following nine evaluation criteria identified by the NCP:

- *Protection of Human Health and the Environment* – used to determine whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls or treatment.
- *Compliance with ARARs* – used to evaluate whether the alternative meets federal and state environmental statutes, regulations, or other site-specific requirements.
- *Long-Term Effectiveness and Permanence* – used to determine the ability of the alternative to maintain the protection of human health and the environment over time.
- *Reduction in Toxicity, Mobility, or Volume through Treatment* – used to evaluate an alternative's use of treatment to reduce excessive risks, migration, or amount of contaminants of concern.

- *Short-Term Effectiveness* – used to evaluate the time required to implement the alternative and the risks posed to remedial workers, Cedar Tree Properties residents, and the environment during implementation.
- *Implementability* – used to evaluate the technical and administrative feasibility of implementing the alternative.
- *Cost* – used to estimate capital and annual costs in present dollars to implement the remedial alternative.
- *Regulatory Acceptance* – used to evaluate the acceptance of the alternative by MDE and USEPA.
- *Community Acceptance* – used to evaluate the acceptance of the alternative by the public.

A summary of the remedial alternatives screened during the FFS is presented in Section 3.1 of this PRAP. The relative rankings of the alternatives against each of the nine evaluation criteria are provided in **Table 3-1**. Details of the screening process and a comparison of the remedial alternatives against each other are available in the FFS (Weston, 2011).

The FFS (Weston, 2011) evaluated six remedial alternatives to identify the most appropriate action to address the localized potential contaminant source area and groundwater plume. The no action alternative was eliminated because it would not be protective of human health or the environment and, without a groundwater monitoring program, the fate of the $CCl_4$ and TCE in soil and groundwater would be unknown. Monitored natural attenuation, AS/SVE, GW CW with IW AS, PRB, and ISCR would all ultimately provide human health and environmental protection. AS/SVE, GW CW with IW AS, and ISCR would achieve this protection in a shorter time than monitored natural attenuation. The three active remedial actions of AS/SVE, GW CW with IW AS, and ISCR would focus on remediating the localized potential contaminant source zone, thereby ensuring the gradual reduction of $CCl_4$ and TCE concentrations in the entire plume. .The PRB would focus only on reducing the $CCl_4$ and TCE in the groundwater and would not address the localized potential contaminant source zone. The PRB would work by reducing the $CCl_4$ and TCE concentrations within the groundwater that pass through the barrier. . The total present worth cost of the ISCR alternative is less than the cost of either AS/SVE or GW CW with IW AS. 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 3-2**.

Based on the detailed analysis conducted in association with the FFS (Weston, 2011), one remedial alternative has been identified by USACE as the preferred remedial action alternative to address site-specific groundwater contamination. The preferred remedial alternative selected is summarized in Section 4.0.

## Table 3-1. Comparison of Remedial Alternatives for Groundwater at the Waldorf Nike Site, Launch Area

| Alternative | Protection of Human Health and Environment | Compliance with ARARs | Long-Term Effectiveness | Reduction in Toxicity, Mobility or Volume | Short-Term Effectiveness | Implement-ability | Cost | Regulatory Acceptance | Community Acceptance |
|---|---|---|---|---|---|---|---|---|---|
| No Action | LOW | LOW | MEDIUM | LOW | HIGH | HIGH | HIGH | TBD | TBD |
| MNA | HIGH | HIGH | HIGH | MEDIUM | HIGH | HIGH | MEDIUM | TBD | TBD |
| AS/SVE | HIGH | HIGH | HIGH | HIGH | HIGH | HIGH | LOW | TBD | TBD |
| GW CW with IW AS | HIGH | HIGH | HIGH | HIGH | HIGH | HIGH | LOW | TBD | TBD |
| PRB | HIGH | HIGH | HIGH | HIGH | HIGH | HIGH | HIGH | TBD | TBD |
| ISCR | HIGH | HIGH | HIGH | HIGH | HIGH | HIGH | HIGH | TBD | TBD |

*Legend:*

| | |
|---|---|
| *ARAR* | *applicable or relevant and appropriate requirement* |
| *AS/SVE* | *air sparging with soil vapor extraction* |
| *CW* | *circulation wells* |
| *ISCR* | *in situ chemical reduction* |
| *IW AS* | *in-well air stripping* |
| *MNA* | *monitored natural attenuation* |
| *PRB* | *permeable reactive barrier* |
| *TBD* | *to be determined* |
| (yellow) | *Outcome Moderate/Probable* |
| (red) | *Outcome Unlikely* |
| (green) | *Outcome Highly Probable* |
| (light blue) | *Outcome To Be Determined* |

*Note: Ranking system is based upon the screening of site-specific remedial alternatives presented in the Final Focused Feasibility Study Nike Battery Launch Area (W-44) Formerly Used Defense Site, Waldorf, Maryland (Weston, 2011).*

## Table 3-2. Groundwater Remedial Alternative Cost Estimates

| Cost | No Action | Monitored Natural Attenuation (MNA)[1] | | Air Sparging With Soil Vapor Extraction[1] | | Groundwater Circulation Wells With In-Well Air Stripping[1] | | Permeable Reactive Barrier[1] | | In Situ Chemical Reduction[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Present Worth Cost | $0 | Option A* | | Option A** | | Option A** | | Option A+ | | Option A++ | |
| | | *Capital:* | $52,000 | *Capital:* | $338,000 | *Capital:* | $350,000 | *Capital:* | $445,000 | *Capital:* | $216,000 |
| | | *Operations and Maintenance (O&M):* | $119,000 | *O&M:* | $493,000 | *O&M:* | $547,000 | *O&M:* | $223,000 | *O&M:* | $209,000 |
| | | **Total:** | **$171,000** | **Total:** | **$831,000** | **Total:** | **$897,000** | **Total:** | **$668,000** | **Total:** | **$425,000** |
| | | Option B*** | | Option B+ | | Option B+ | | | | Option B+++ | |
| | | *Capital* | $52,000 | *Capital* | $338,000 | *Capital* | $350,000 | | | *Capital* | $216,000 |
| | | *O&M* | $388,000 | *O&M* | $726,000 | *O&M* | $826,000 | | | *O&M* | $388,000 |
| | | **Total:** | **$440,000** | **Total:** | **$1,064,000** | **Total:** | **$1,176,000** | | | **Total:** | **$604,000** |

*MNA* *monitored natural attenuation*
*O&M* *operations and maintenance*
*1* *Includes semi-annual groundwater sampling at 5 monitoring wells; 5-Year Review included in all groundwater sampling costs*
*2* *Includes baseline, quarterly, and semi-annual groundwater sampling at 9 monitoring wells; 5-Year Review included in all groundwater sampling costs*
* *Based on 5 years of sampling and land use controls (LUCs)*
** *Based on 5 years of system operation and 10 years of annual MNA groundwater sampling and LUCs*
*** *Based on 20 years of sampling and LUCs*
\+ *Based on 10 years of system operation and 10 years of sampling and LUCs*
++ *Preferred alternative; includes baseline, 1 year of in situ treatment and 1 year of quarterly/2 years of semi-annual MNA groundwater sampling (4 years total)*
+++ *Preferred alternative; includes baseline, 1 year of in situ treatment and 1 year of quarterly/20 years of annual MNA groundwater sampling (22 years total)*
*Source:* *Data are based on the cost estimates for alternatives presented in the Final Focused Feasibility Study Nike Battery Launch Area (W-44) Formerly Used Defense Site, Waldorf, Maryland* (Weston, 2011).

## 4.0 PREFERRED ALTERNATIVE: IN SITU CHEMICAL REDUCTION

The ISCR alternative, as suggested by the conclusions of the FFS (Weston, 2011), has been chosen by USACE as the most appropriate remedial action alternative to address the localized potential contaminant source zone and groundwater plume. ISCR will be combined with LUCs, and LTM to ensure the prevention of exposure to the COCs until concentrations are below the USEPA MCL of 5 µg/L.

**In situ** chemical reduction refers to the use of environmentally-safe materials to promote the chemical break down contaminants. In situ chemical reduction technology creates conditions within the groundwater that promotes the breakdown of compounds such as $CCl_4$ and TCE in to harmless products. At the Waldorf site, the environmentally-safe materials would be injected as a liquid into the localized potential contaminant source zone.

Environmentally-safe materials will be injected into the localized potential contaminant source zone where physical, chemical, and biological processes will work together to change the $CCl_4$ and TCE in the soil and groundwater into harmless products. Following successful treatment of the $CCl_4$ and TCE localized potential contaminant source zone, the $CCl_4$ and TCE concentrations within the source zone would eventually decrease to within the USEPA and MDE groundwater standard of 5 µg/L. $CCl_4$ and TCE concentrations downgradient of the potential source area would also decrease.

Initially, $CCl_4$ and TCE concentrations in the existing groundwater downgradient from the injection site will remain above the USEPA and MDE groundwater standard of 5 µg/L. However, successful implementation of the ISCR/ISB alternative will result in treatment of the localized potential contaminant source zone will reduce $CCl_4$ and TCE concentrations in groundwater downgradient from the injection site to below the USEPA MCL of 5 µg/L. This alternative will eliminate potential future exposure risks to Cedar Tree Properties residents adjacent to the site.

According to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the remedial process is to include sampling until contaminant levels are consistently below regulatory limits. The NCP also states that any selected remedy where contaminants are left in place requires scheduling of a 5-Year Review. Based on the results of the LTM performance monitoring sampling rounds, the effectiveness of the remedy can be revisited at any time before the 5-Year Review, if monitoring results indicate that the selected remedy is not performing as expected.

Based on available information, the preferred remedial action alternative would be protective of human health and the environment; comply with ARARs and the USEPA MCL of 5 µg/L; be cost-effective; and result in a permanent solution.

## 5.0 SUMMARY OF THE PREFERRED REMEDIAL ALTERNATIVE

Based upon review of available historical site data, RI reports, the human health RA, FSs, and RAOs, a preferred remedial action alternative to address the $CCl_4$ and TCE at the Waldorf site of ISCR with LUCs and LTM is hereby proposed by USACE for the public record and for public review and comment This PRAP has been developed in compliance with requirements stipulated under CERCLA Section§117(a) and the NCP for public participation during response actions.

The goal of the remedial action is to reduce potential future exposure risk to Cedar Tree Properties residents and to reduce concentrations of $CCl_4$ (**Figure 5-1**) and TCE (**Figure 5-2**) in groundwater below the USEPA MCL of 5 µg/L. There is no indication by the landowners that current land use will change from residential homes to any other use. The USEPA MCL will be established in the Decision Document as a means to determine protectiveness of the remedy.

The preferred remedial action alternative will address concentrations of $CCl_4$ and TCE both in groundwater and in the localized potential contaminant source zone, eliminating any potential excess risk to human health and environmental receptors, and attaining the USEPA MCL standard of 5 µg/L.

Under the preferred remedial action alternative of ISCR with LUCs and LTM, an injection event will take place with environmentally-safe materials (Weston, 2011). Due to the low concentrations of $CCl_4$ and TCE, site-specific groundwater and soil chemistry, and the long-lasting effect of the injected environmentally-safe materials, only one injection event is estimated. Based on a pilot study and action field application, additional polishing event injections may be required in the event concentrations are not reduced to below the USEPA MCLs.

LTM performance monitoring will be conducted quarterly for the first year after the initial injection and subsequently, on a semi-annual basis for approximately 2-4 additional years. LUCs will be implemented on site and at areas downgradient of the site to prevent the use of groundwater until $CCl_4$ and TCE concentrations are reduced to the USEPA MCL of 5 µg/L. These LUCs will include: implementation of deed restrictions to prevent the use of groundwater as drinking water and issuance of groundwater monitoring well permits.

Once groundwater sampling results confirm $CCl_4$ and TCE concentrations are consistently below the USEPA MCL of 5 µg/L, or based on results of the 5-Year Review, LTM performance monitoring will be halted and LUCs will be lifted. The ISCR alternative will substantially reduce, if not completely eliminate, the potential risk to human health and the environment associated with the $CCl_4$ and TCE in groundwater and the localized potential contaminant source zone.

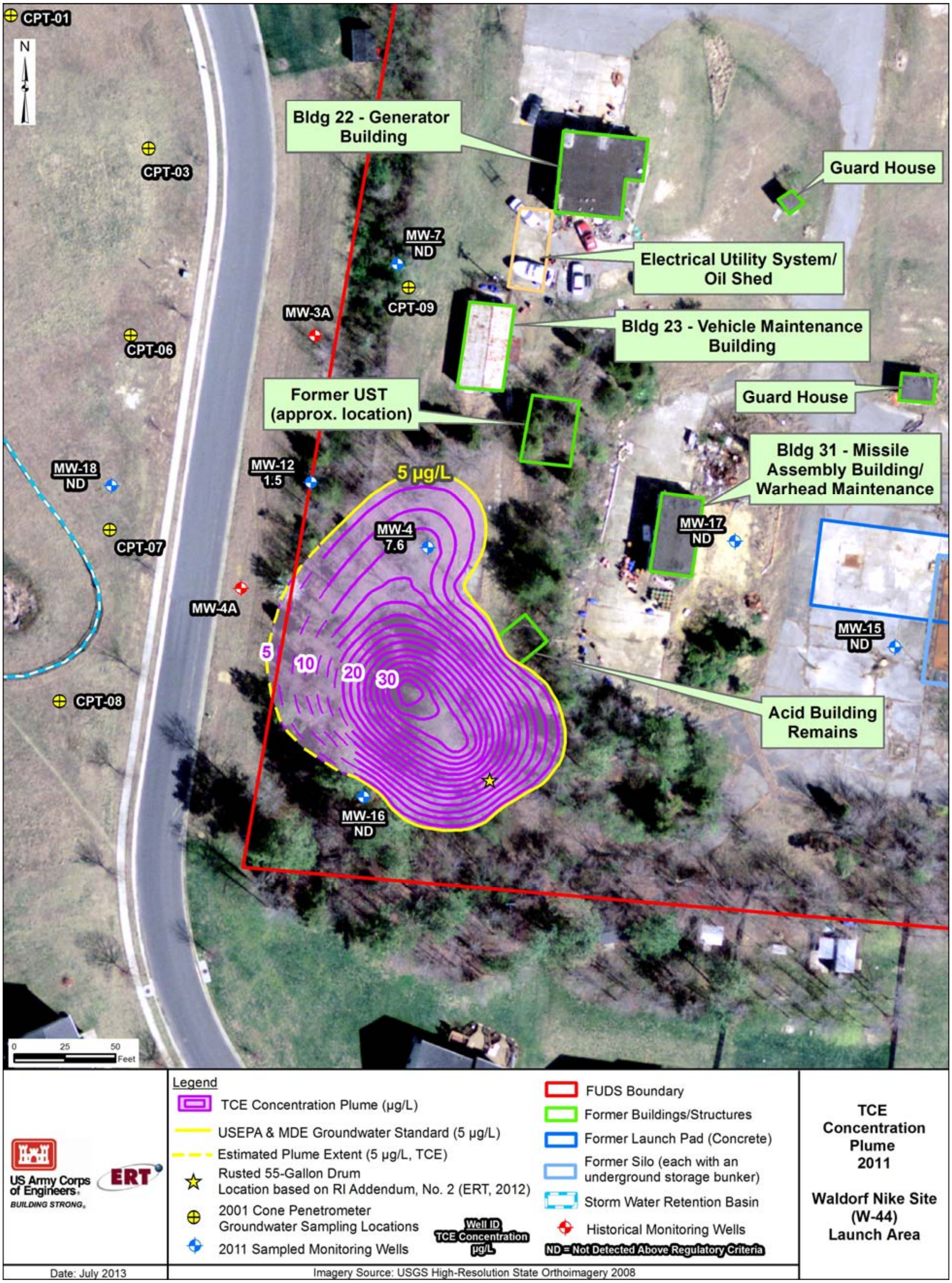


**Figure 5-1. $CCl_4$ Concentration Plume, 2011**

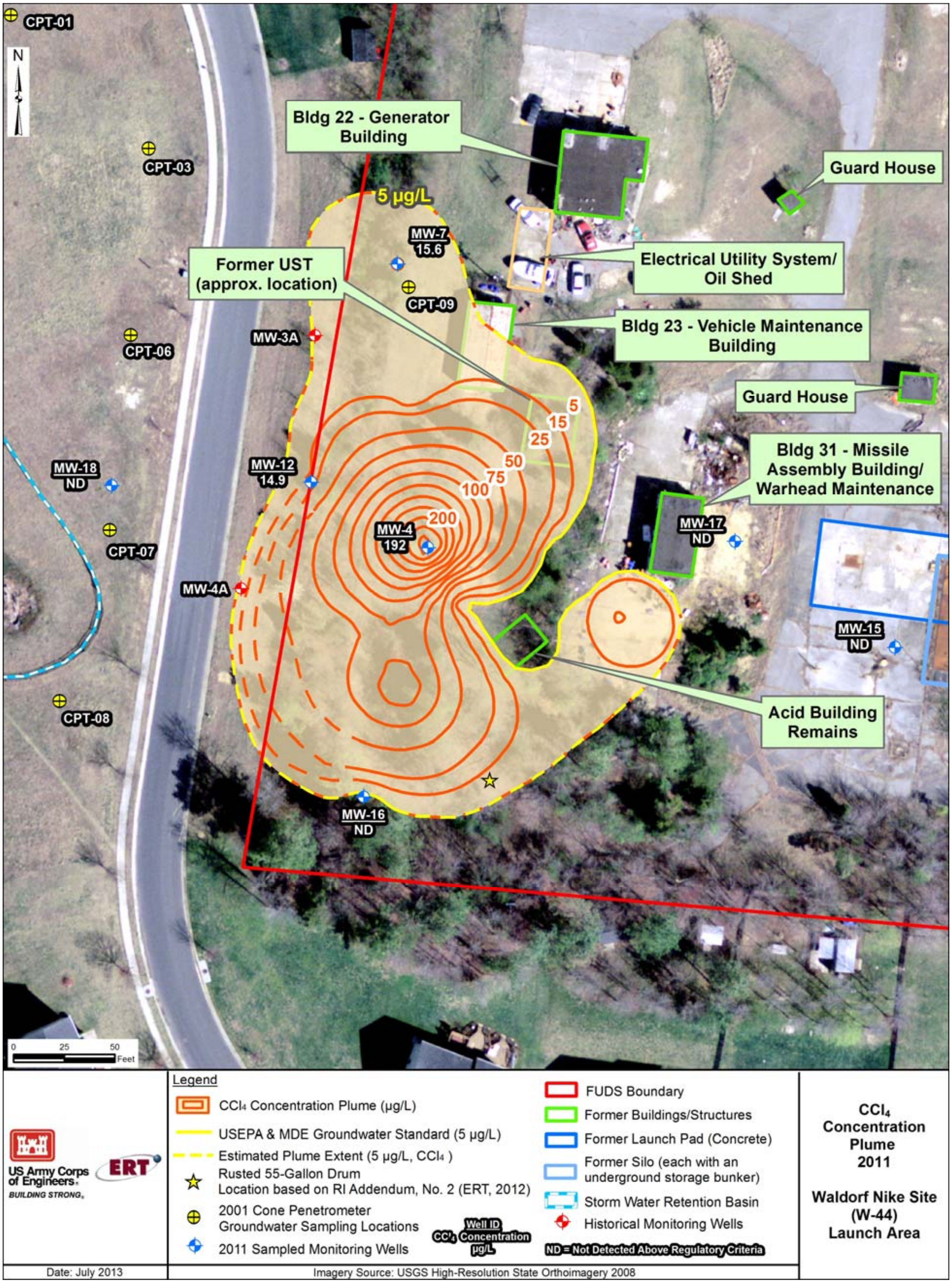


**Figure 5-2. TCE Concentration Plume, 2011**

## 6.0 COMMUNITY PARTICIPATION

Public input is important to the decision-making process. Nearby Cedar Tree Properties residents and other interested parties are encouraged by USACE and MDE to use the comment period to review the PRAP addressing the localized potential contaminant source zone and groundwater contaminant plume within the western portion of the site and to provide their comments to USACE.

Before selecting any plan for remedial action, a notice will be published via local news media to announce the availability of the PRAP. The PRAP and any supporting analysis and information will be made available to the public at the location of the Administrative Record located at:

Upper Marlboro Branch Public Library
14730 Main Street
Upper Marlboro, Prince Georges County,
Maryland 20772

As previously stated and in accordance with CERCLA Section 121(d)(4)[2], a 30-day public comment period for this proposed remedial action has been scheduled. A public meeting regarding the proposed remedial action will be held following the public comment period. The 30-day public comment period will commence on 23 August 2013 and end on 23 September 2013. A public meeting will be held on 29 September from 6:30 pm to 8:30 pm at:

P.D. Brown Memorial Branch Library
50 Village Street
Waldorf, Prince Georges County
Maryland 20602

All written comments should be submitted to the attention of the USACE Project Manager, Hamid Rafiee at:

Hamid Rafiee
USACE-Baltimore District
P.O. Box 1715
Baltimore, Maryland 21201

Community acceptance of the preferred remedial action alternative will be evaluated after the public comment period ends and the public meeting has been held. Following the public comment period and concurrence by USACE and MDE, a Decision Document will be prepared, which will detail the remedial alternative selected for the site and will include USACE's responses to comments received during the public comment period.

[2] 42 U.S.C. § 9621(d)(4).

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## 7.0 REFERENCES

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# Attachment A

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

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| 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* | *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* *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)