**Final**
19 August 2014

# Fourth Five-Year Review for NAS Whidbey Island Ault Field and Seaplane Base

**NAS Whidbey**
Oak Harbor, Washington

**Department of the Navy**
**Naval Facilities Engineering Command Northwest**
1101 Tautog Circle
Silverdale, WA  98315

# EXECUTIVE SUMMARY

As lead agency for environmental cleanup of Naval Air Station (NAS) Whidbey Island, Oak Harbor, Washington, the U.S. Navy has completed the fourth 5-year review of the remedial actions at Operable Units (OUs) 1 through 5 conducted pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act and National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300). The purpose of this 5-year review is to ensure that the remedial actions selected in the Records of Decision at NAS Whidbey Island remain protective of human health and the environment. A 5-year review is required for this site because the remedies allow contaminants to remain in place at concentrations that do not allow unlimited site use and unrestricted exposure. This fourth 5-year review was prepared in accordance with *Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Statutory Five-Year Reviews*, May 2004 and U.S. Environmental Protection Agency's (EPA's) *Comprehensive Five-Year Review Guidance* (OSWER 9355.7-03B-P, June 2001) and consultation with stakeholders during a kickoff meeting.

Remedy construction is complete at all five OUs. The remedies at OUs 2, 3, 4, and 5 remain protective of human health and the environment at this time. The remedial action is operating as expected at OU 1 Area 6 and remains protective of human health and the environment because of land use controls. The remedy at Area 6 will continue to require routine, regular maintenance and monitoring to ensure that protectiveness is maintained. Maintenance of sitewide land use controls is required to ensure protectiveness of the remedies. The recommendations presented in Section 8 will be implemented in order to maintain long-term protectiveness for all the OUs.

The Navy implemented 15 of the 16 recommendations from the third 5-year review. One recommendation, connecting well PW-10 to the extraction network, was not implemented with agreement between the Navy and EPA.

The Navy has made significant progress evaluating potential alternatives for addressing 1,4-dioxane in groundwater at OU 1 Area 6, including the development of a comprehensive, 3-dimensional, numeric groundwater model to use as an evaluation and remedy performance assessment tool. An amendment to the Record of Decision and a remedial system revision are expected during the next 5-year period. The current review recommends that monitoring programs be reduced at OU 2 Areas 2/3 and OU 5 Area 31 and that OU 2 Area 14, OU 5 Area 1, and OU 5 Area 52 be delisted.

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# Five-Year Review Summary Form

## SITE IDENTIFICATION

**Site name *(from WasteLAN)*:** Naval Air Station, Whidbey Island (Ault Field and Seaplane Base)

**EPA ID *(from WasteLAN)*:** WA5170090059 (Ault Field); WA6170090058 (Seaplane Base)

| | | |
|---|---|---|
| **Region:** 10 | **State:** WA | **City/County:** Oak Harbor/Island County |

## SITE STATUS

**NPL status:** ☐ Final ☐ Deleted ☒ Other (specify): OU 1, OU 2, OU 3, OU 5 Final; OU 4 Deleted

**Remediation status** (choose all that apply): ☐ Under Construction ☒ Operating ☒ Complete

| | |
|---|---|
| **Multiple OUs?*** ☒ YES ☐ NO | **Construction completion date:** 09/25/1997 |

**Has site been put into reuse?** ☒ YES ☐ NO

## REVIEW STATUS

**Lead agency:** ☐ EPA ☐ State ☐ Tribe ☒ Other Federal Agency: U.S. Navy

**Author name:** Sherry Rone

| | |
|---|---|
| **Author title:** Remedial Project Manager | **Author affiliation:** Naval Facilities Engineering Command Northwest, Navy |

**Review period:**** 05/08 to 12/2013

**Date(s) of site inspection:** 04/2013 and annual inspections

**Type of review:**

☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion

**Review number:** 1 (first) 2 (second) 3 (third) Other (specify) [✓ **Fourth**]

**Triggering action:**

Actual RA Onsite Construction at OU#____
~~Actual RA Start at OU ___~~
Construction Completion
[✓ Previous Five-Year Review Report]
Other (specify):____________

**Triggering action date *(from WasteLAN)*:** 9/29/2009

**Due date *(five years after triggering action date)*:** 7/31/2014

*[“OU” refers to operable unit.]

**[Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

## Five-Year Review Summary Form (Continued)

**Issues:**

*OU 1 Area 6*

- Based on groundwater results, residual vadose zone soil impacts could act as a continuing low-grade source to groundwater. Site 55 vadose zone data gap exists.
- The extraction system is not preventing the further spread of vinyl chloride in the shallow aquifer or reducing the potential risk to existing and future groundwater users downgradient of the site.
- 1,4-Dioxane was not identified in the Record of Decision (ROD) as a chemical of concern. However, this emergent contaminant has been identified by the U.S. Environmental Protection Agency (EPA) as a potential carcinogen. The current pump and treat system is unable to capture and treat the 1,4-dioxane plume. In addition, the full extent of the 1,4-dioxane plume remains uncertain.

*OU 2 Areas 2/3*

- It is not conclusively determined whether or not arsenic and manganese in groundwater pose a risk, because sitewide background levels may not be representative of the naturally occurring local site background level.

*OU 5 Area 31*

- Diesel-range organics (DRO), gasoline-range organics (GRO), benzene, and manganese do not appear to be attenuating in groundwater. DRO, GRO, benzene, vinyl chloride, and dissolved manganese remain above state and/or federal levels (remediation goals).

**Recommendations and Follow-Up Actions:**

*OU 1 Area 6*

- Complete Site 55 vadose zone data gap report to support optimization and treatability testing.
- Complete an alternative analysis and ROD amendment, if needed, to prevent the further spread of vinyl chloride downgradient and reduce the potential risk to existing and future groundwater users.
- Complete an alternative analysis and ROD amendment with a remedy to prevent the further spread of 1,4-dioxane downgradient and reduce the potential risk to existing and future groundwater users.

*OU 2 Areas 2/3*

- Determine if observed concentrations of arsenic and manganese in groundwater are representative of local site background. If concentrations exceed local site background, provide a path-forward recommendation to EPA.

*OU 5 Area 31*

- Continue monitoring for DRO, GRO, benzene, vinyl chloride, and dissolved manganese, and assume it may be some time before natural attenuation begins to reduce concentrations. Identify, or install if necessary, at least one downgradient well to evaluate plume stability. Discontinue residual-range organics and naphthalene monitoring. Monitor biannually for DRO, GRO, benzene, vinyl chloride, and dissolved and total manganese at wells MW31-9A and OWS-1 and an existing downgradient well, or new well if necessary, until the next 5-year review.

## Five-Year Review Summary Form (Continued)

**Protectiveness Statement(s):**

Remedy construction is complete at all five OUs. The remedies at OUs 2, 3, 4, and 5 remain protective of human health and the environment. The remedial action is operating as expected at OU 1 Area 6 and remains protective of human health and the environment because of land use controls. The remedy at Area 6 will continue to require routine, regular maintenance and monitoring to ensure that protectiveness is maintained. Maintenance of sitewide land use controls is required to ensure protectiveness of the remedies. The recommendations presented in Section 8 will be implemented in order to maintain long-term protectiveness for all the OUs.

**Other Comments:** None

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Signature sheet for the Naval Air Station Whidbey Island fourth five-year review for Operable Units 1 through 5

MK

M.K. NORTIER
Captain, U.S. Navy
Commanding Officer
Naval Air Station Whidbey Island

2 Sep 2014

Date

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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ARAR | applicable or relevant and appropriate requirement |
| ATSDR | Agency for Toxic Substances and Disease Control |
| AVGAS | aviation gasoline |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CESARS | Chemical Evaluation Search and Retrieval System |
| CFR | Code of Federal Regulations |
| COC | chemical of concern |
| cPAHs | carcinogenic polycyclic aromatic hydrocarbons |
| CSR | current situation report |
| CVOC | chlorinated volatile organic compound |
| DCA | dichloroethane |
| DCE | dichloroethene |
| DDD | dichlorodiphenyldichloroethane |
| DDE | dichlorodiphenyldichloroethene |
| DDT | dichlorodiphenyltrichloroethane |
| DNAPL | dense nonaqueous-phase liquid |
| DOH | Department of Health (Washington State) |
| DRO | diesel-range organics |
| EC | engineering control |
| Ecology | Washington State Department of Ecology |
| Eco-SSL | ecological soil screening level |
| EPA | U.S. Environmental Protection Agency |
| ESD | Explanation of Significant Differences |
| FAA | Federal Facilities Agreement |
| FS | feasibility study |
| GRO | gasoline-range organics |
| HDPE | high-density polyethylene |
| IC | institutional control |
| IRIS | Integrated Risk Information System |
| JP-4 | jet petroleum No. 4 |
| JP-5 | jet petroleum No. 5 |
| LOAEL | lowest observed adverse effect |
| LUC | land use control |
| MCL | maximum contaminant level |
| MCPP | 2-(2-methyl-4-chlorophenoxy)propanoic acid |
| MEK | methyl ethyl ketone |
| MFS | minimum functional standards |
| µg/L | microgram per liter |

# ABBREVIATIONS AND ACRONYMS (Continued)

| | |
|---|---|
| mg/kg | milligram per kilogram |
| mg/kg-day | milligram per kilogram per day |
| MSL | mean sea level |
| MTCA | Model Toxics Control Act |
| Navy | U.S. Navy |
| NAVFAC NW | Naval Facilities Engineering Command Northwest |
| NAS | Naval Air Station |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NPL | National Priorities List |
| NTCRA | non-time-critical removal action |
| O&M | operation and maintenance |
| OU | operable unit |
| PAH | polycyclic aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| PCP | pentachlorophenol |
| PM | Project Manager |
| ppb | parts per billion |
| ppm | parts per million |
| PQL | practical quantitation limit |
| RAB | Restoration Advisory Board |
| RAO | remedial action objective |
| RBSC | risk-based screening concentration |
| RCRA | Resource Conservation and Recovery Act |
| RfD | reference dose |
| RG | remediation goal |
| RI | remedial investigation |
| ROD | Record of Decision |
| RPM | Remedial Project Manager |
| RRO | residual-range organics |
| SARA | Superfund Amendments and Reauthorization Act |
| SIM | selected ion monitoring |
| SVOC | semivolatile organic compound |
| SVM | soil vapor monitoring |
| TCA | trichloroethane |
| TCDD | tetrachlorodibenzo-p-dioxin |
| TCE | trichloroethene |
| TCRA | time-critical removal action |
| TCLP | toxicity characteristics leaching procedure |

## ABBREVIATIONS AND ACRONYMS (Continued)

| | |
|---|---|
| TPH | total petroleum hydrocarbons |
| TPH-D | total petroleum hydrocarbons—diesel |
| TPH-Dx | total petroleum hydrocarbons as diesel and heavy oil |
| TRC | Technical Review Committee |
| TRV | toxicity reference value |
| UST | underground storage tank |
| VOC | volatile organic compound |
| WAC | Washington Administrative Code |
| $yd^3$ | cubic yard |

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# 1.0 INTRODUCTION

This report presents the results of the fourth 5-year review performed for Naval Air Station (NAS) Whidbey Island National Priorities List (NPL) sites, including both the Ault Field and Seaplane Base sites, which are listed separately on the NPL. NAS Whidbey Island is located along the shoreline of the Strait of Juan de Fuca in Oak Harbor, Washington (Figure 1-1).

The purpose of a 5-year review is to determine whether the remedies selected for implementation in the Record of Decision (ROD) for a site remain protective of human health and the environment. The methods, findings, and conclusions of 5-year reviews are documented in 5-year review reports, which identify any issues found during the review and recommendations to address them.

The U.S. Navy (Navy), the lead agency for NAS Whidbey Island, is preparing this 5-year review pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations [CFR] Part 300). CERCLA Section 121 states the following:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Navy's Naval Facilities Engineering Command Northwest (NAVFAC NW) has conducted this fourth 5-year review of the remedial actions implemented at NAS Whidbey Island in Oak Harbor, Washington. This review was initiated in March 2013 using analytical data generated between May 2008 and February 2014. The triggering action for this review was the third 5-year review, which was finalized in September 2009. The second 5-year review was completed in April 2004, and the first 5-year was executed in September 1998. Contaminants have been left at NAS Whidbey Island above levels that allow for unlimited use and unrestricted exposure. As a result, a statutory review is required under CERCLA. CERCLA requires 5-year reviews upon completion of the remedial action, when hazardous substances, pollutants, or contaminants will remain on site, the ROD for the site was signed on or after October 17, 1986 (the effective date of Superfund Amendments and Reauthorization Act [SARA]), and the remedial action was selected under CERCLA Section 121.

This report covers the remedies selected in the signed RODs for all five operable units (OUs) at NAS Whidbey Island (Figures 1-2 and 1-3) (U.S. Navy, Ecology, and USEPA 1993a, 1993b, 1994, 1995, and 1996). This report was prepared as part of the CERCLA 5-year review process using Navy and U.S. Environmental Protection Agency (EPA) guidance (U.S. Navy 2004a and USEPA 2001 and 2012a) and documents the results of the review, issues identified, and recommended actions. The data presented herein was collected between May 2008 and August 2013. Some August 2013 data are not included because of variations in data report generation.

This 5-year review has been streamlined to minimize information that has been presented in the previous three 5-year reviews. The intent is to focus on the actions, monitoring, and issues over the last 5 years and recommendations and protectiveness for the next 5 years. To facilitate this, references are provided in the appropriate sections of this document that will lead the reader to information for that section. In the PDF version of this document, these references will be hyperlinked to reference documents provided on the accompanying CD.

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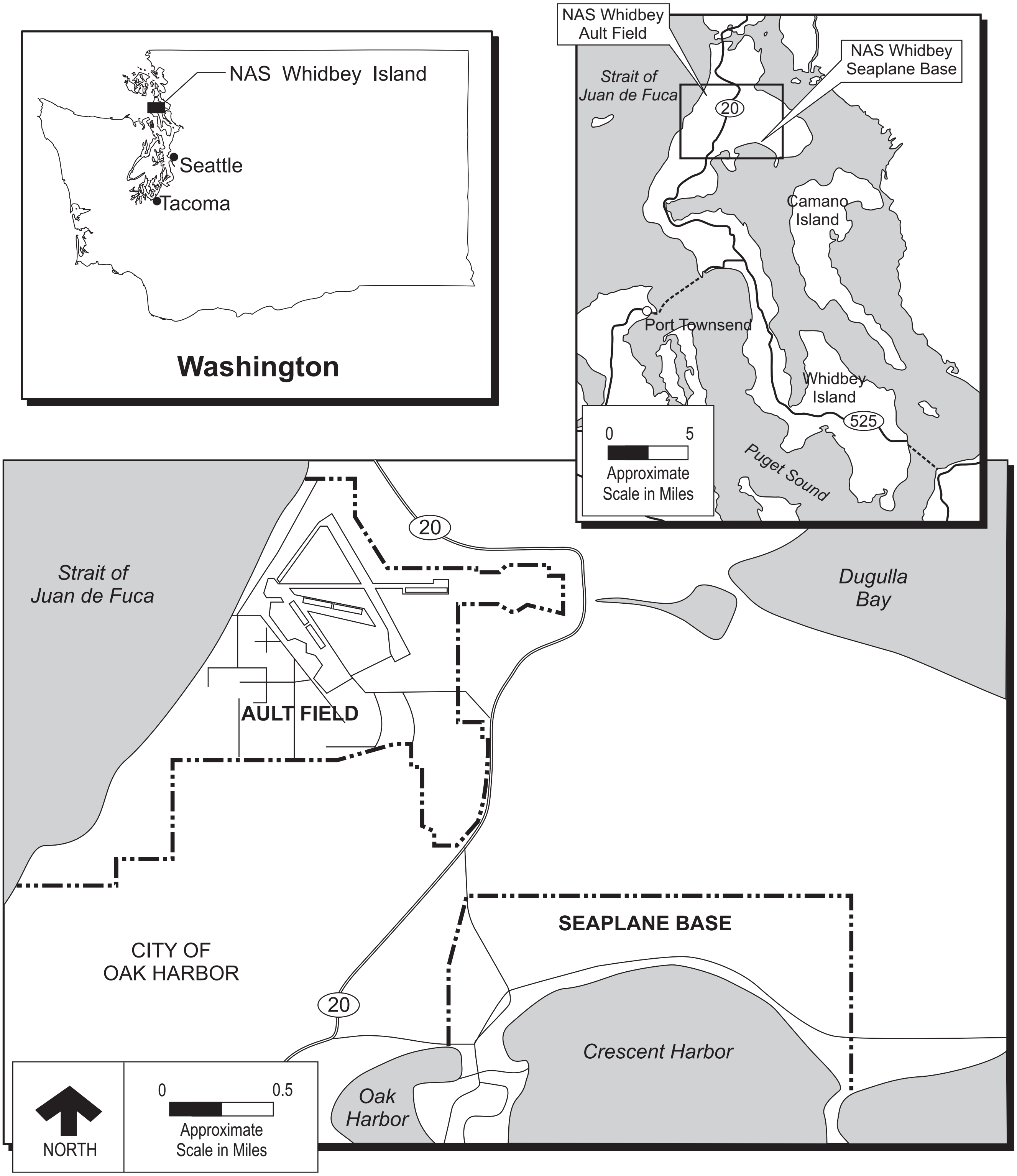

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Figure 1-1
Location Map for NAS Whidbey Island

NAS Whidbey Island
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Legend

| | |
|---|---|
| OU | Operable Unit |
| LUC | Land Use Control |
| ▪▪▪▪▪▪▪ | OU LUC Area/Site Boundary |

**Sources:**
**OU LUC Areas:** Boundary survey conducted using RTK GPS by Tetra Tech, Inc., June 2013.
**Aerial:** *Google Earth Pro*

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NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

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**Figure 1-2**
**Operable Units 1, 2, 3, and 5**

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Source of OU LUC Areas: Boundary survey conducted using RTK GPS by Tetra Tech, Inc., June 2013.

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NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

**Figure 1-3**
**Operable Unit 4**

J:\GIS\Projects\NAVY\WHIDBEY\DO 66\4th FYR\FIG 1-3 OU 4.dwg
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# 2.0 SITE CHRONOLOGY

This section summarizes dates of major events such as the initial discovery of contamination, NPL listing, decision and enforcement documents, start and completion of remedial and removal actions, construction completion, and prior 5-year reviews. Table 2-1 lists by OU the primary events in the chronology of NAS Whidbey Island related to site discovery, investigation, and remediation. Additional details regarding the site activities for individual OUs are provided in the narrative of this section.

The contents of this section that were presented in previous reviews are available in the third 5-year review. Readers of the hard copy version of this fourth 5-year review who want more information will find it in Section 2 of the third 5-year review (U.S. Navy 2009b). In the PDF version of this fourth 5-year review, the links below are to the U.S. Navy 2009b reference document on the CD provided.

Actions that occurred during the review are discussed by operable unit. A summary of the site chronology is presented in Table 2-1.

## 2.1 SITE DISCOVERY AND INITIAL INVESTIGATION

For pre-May 2008 information, please see Section 2.1 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 2.1 U.S. Navy 2009b**).

## 2.2 OPERABLE UNIT 1 CHRONOLOGY

For pre-May 2008 information, please see Section 2.2 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 2.2 U.S. Navy 2009b**).

## 2.3 OPERABLE UNIT 2 CHRONOLOGY

For pre-May 2008 information, please see Section 2.3 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 2.3 U.S. Navy 2009b**).

## 2.4 OPERABLE UNIT 3 CHRONOLOGY

For pre-May 2008 information, please see Section 2.4 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 2.4 U.S. Navy 2009b**).

## 2.5 OPERABLE UNIT 4 CHRONOLOGY

For pre-May 2008 information, please see Section 2.5 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 2.5 U.S. Navy 2009b**).

## 2.6 OPERABLE UNIT 5 CHRONOLOGY

For pre-May 2008 information, please see Section 2.6 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 2.6 U.S. Navy 2009b**).

A time-critical removal action (TCRA) was performed in January and February 2012 to mitigate and prevent further erosion of the Area 1 shoreline. The shoreline stabilization was performed in three of the most heavily eroded sections by placing riprap in place at the toe of the bluff. A total of 247 feet of shoreline was stabilized with 376 tons of temporary armor rock. A non-time-critical removal action (NTCRA) was conducted to construct a permanent coastal protection system along the Area 1 shoreline. Construction of the permanent system began in July 2012 and was completed in November 2012 (U.S. Navy 2013b).

## Table 2-1
## Chronology of Events

| Event | Date |
|---|---|
| **Sitewide** | |
| Initial assessment study | September 1984 |
| NAS Whidbey Island Ault Field and Seaplane Base proposed for NPL listing | September 18, 1985 |
| Current Situation Report | January 1988 |
| NAS Whidbey Island Ault Field and Seaplane Base listed separately on NPL | February 21, 1990 |
| Federal Facilities Agreement | October 1990 |
| First 5-year review | September 25, 1998 |
| Second 5-year review | April 15, 2004 |
| Third 5-year review | September 29, 2009 |
| **Operable Unit 1** | |
| Final RI/FS | 1993 |
| Interim action ROD for Area 6 | April 28, 1992 |
| Interim action construction start at Area 6 | July 26, 1993 |
| Interim action at Area 6 operation initiated | February 1995 |
| Proposed Plan | June 1993 |
| ROD | December 20, 1993 |
| Remedy design | February 1, 1995 |
| Remedy construction complete | August 22, 1997 |
| Interim removal action for Area 6, former liquid waste disposal area | November 21, 2001 |
| **Operable Unit 2** | |
| Final RI/FS | November 1993 |
| Proposed Plan | November 1993 |
| ROD | May 17, 1994 |
| Remedy design | January 18, 1995 |
| Remedy construction complete | August 22, 1997 |
| **Operable Unit 3** | |
| Final RI/FS | 1994 |
| Proposed Plan | July 1994 |
| ROD | April 20, 1995 |
| Remedy design | July 3, 1995 |
| Remedy construction complete | March 17, 1997 |
| **Operable Unit 4** | |
| Final RI/FS | August 1993 |
| Proposed Plan | August 1993 |
| ROD | December 20, 1993 |
| Remedy design | June 1, 1994 |
| Remedy construction complete | June 29, 1995 |
| Deleted from NPL | September 21, 1995 |
| **Operable Unit 5** | |
| Final RI/FS | September 1995 |
| Area 31 moved from OU 3 to OU 5, Proposed Plan | October 1995 |

## Table 2-1 (Continued)
## Chronology of Events

| Event | Date |
|---|---|
| ROD | July 10, 1996 |
| Remedy design | November 13, 1996 |
| Remedy construction | August 22, 1997 |
| Action Memorandum, Time-critical removal action for Area 1, shoreline stabilization | September 18, 2012 |
| Time-critical removal action for Area 1; shoreline stabilization completed | Completed February 2012 (phase 1) |
| Engineering Evaluation/Cost Analysis for Area 1;shoreline stabilization | September 18, 2012 |
| Non-time-critical removal action for Area 1; shoreline armoring completed | Completed January 2013 (phase 2) |

Notes:
FS - feasibility study
NAS - Naval Air Station
NPL - National Priorities List
OU - operable unit
RI - remedial investigation
ROD - Record of Decision

# 3.0 BACKGROUND

This section summarizes the physical characteristics of the sites that make up all five operable units at NAS Whidbey Island. These characteristics include land and resource use, history of contamination, initial responses, and the basis for taking action at each of the sites.

NAS Whidbey Island is located on Whidbey Island, Washington, at the northern end of Puget Sound and the eastern end of the Strait of Juan de Fuca (Figure 1-1).

NAS Whidbey Island comprises two separate complexes: Ault Field and Seaplane Base. The Ault Field site has been separated into four OUs (OUs 1, 2, 3, and 5). The Seaplane Base is OU 4.

The contents of this section that were presented in previous reviews are available in the third 5-year review. Readers of the hard copy version of this fourth 5-year review who want more information will find it in Section 3 of the third 5-year review (U.S. Navy 2009b). In the PDF version of this fourth 5-year review, the links below are to the reference document included on the CD provided.

## 3.1 OPERABLE UNIT 1

OU 1 consists of Areas 5 and 6 (Figure 3-1).

For pre-May 2008 information, please see Section 3.1 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 3.1 U.S. Navy 2009b**).

## 3.2 OPERABLE UNIT 2

OU 2 is composed of five areas located at Ault Field (Figure 3-2):

- Area 2, Former Western Highlands Landfill
- Area 3, Former 1969–1970 Landfill
- Area 4, Former Walker Barn Storage Area
- Area 14, Former Pesticide Rinsate Disposal Area
- Area 29, Former Clover Valley Fire School

Based upon their similar natures and close proximity, Areas 2 and 3 were considered together in the RI/FS and ROD and collectively identified as Areas 2/3 (U.S. Navy 2004b).

For pre-May 2008 information, please see Section 3.2 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 3.2 U.S. Navy 2009b**).

## 3.3 OPERABLE UNIT 3

OU 3 consists only of Area 16, also known as the Runway Ditches, located at Ault Field (Figure 3-3).

For pre-May 2008 information, please see Section 3.3 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 3.3 U.S. Navy 2009b**).

## 3.4 OPERABLE UNIT 4

OU 4 is composed of the following five areas and is the sole OU at the Seaplane Base (Figure 1-3):

- Area 39, Auto Repair and Paint Shop
- Area 41, Building 25/26 Disposal Area
- Area 44, Seaplane Base Nose Hangar
- Area 48, Salvage Yard
- Area 49, Seaplane Base Landfill

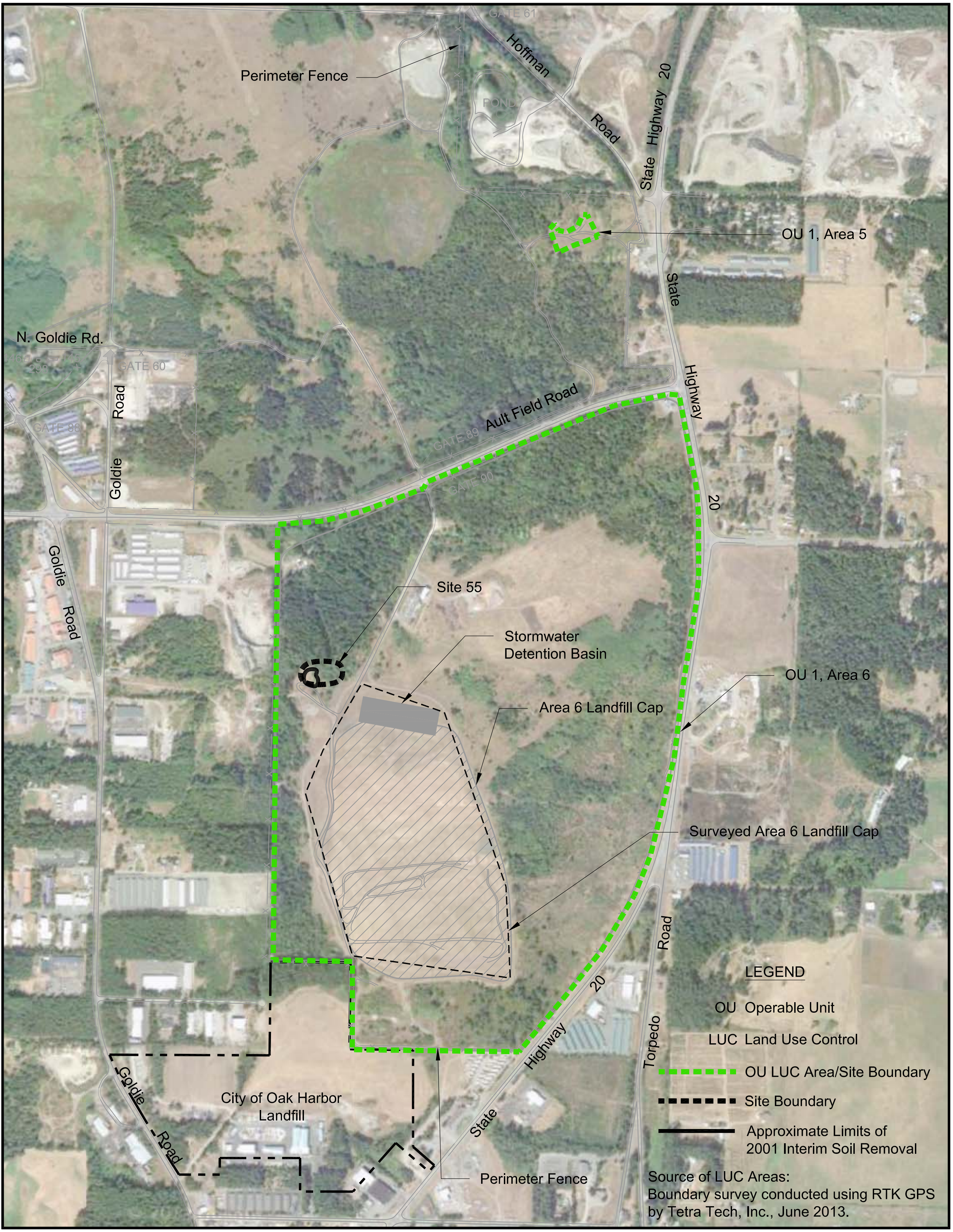
For pre-May 2008 information, please see Section 3.4 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 3.4 U.S. Navy 2009b**).

## 3.5 OPERABLE UNIT 5

OU 5 is composed of the following three areas located on Ault Field (Figure 3-4):

- Area 1, Former Beach Landfill
- Area 31, Former Runway Fire Training School
- Area 52, Jet Engine Test Cell

For pre-May 2008 information, please see Section 3.5 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 3.5 U.S. Navy 2009b**).



J:\GIS\Projects\NAVY\WHIDBEY\DO 66\4th FYR\FIG 3-1 OU 1_Areas 5,6.dwg
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**Figure 3-1**
**Operable Unit 1, Areas 5 and 6**

Source of LUC Areas:
Boundary survey conducted
using RTK GPS by Tetra
Tech, Inc., June 2013.

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## Figure 3-2
## Operable Unit 2

NAS Whidbey Island
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Source of LUC Area:
Boundary survey conducted
using RTK GPS by Tetra
Tech, Inc., June 2013.

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**Figure 3-3**
**Operable Unit 3, Area 16**

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LEGEND

OU Operable Unit

LUC Land Use Control

🟩 OU LUC Area/Site Boundary

Source of LUC Areas:
Boundary survey conducted
using RTK GPS by Tetra
Tech, Inc., June 2013.

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FOURTH FIVE-YEAR REVIEW

Figure 3-4
OU 5, Areas 1, 31, and 52

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# 4.0 REMEDIAL ACTIONS

The RODs for NAS Whidbey Island required remedial actions for OUs 1 through 5. This section summarizes the ROD-specified remedial action objectives (RAOs), ROD-specified remedies, remedy components and implementation, and current, ongoing, operation, maintenance, and monitoring requirements for each of the OUs.

The Navy completed an Explanation of Significant Differences (ESD) in October 2007 for these RODs (U.S. Navy 2007e), which clarified or amended the required land use control (LUC) actions for the listed sites. In response to this ESD, the Navy (U.S. Navy 2009d) completed an LUC Implementation Plan for NAS Whidbey Island. The LUC Implementation Plan was updated in March 2014 (U.S. Navy 2014b). As lead agency, the Navy is responsible for ensuring the effectiveness of the LUCs as long as the Navy controls the property or until LUCs are no longer needed. The results of the yearly LUC inspections are included in Section 6.5.

The contents of this section that were presented in previous reviews are available in the third 5-year review. Readers of the hard copy version of this fourth 5-year review who want more information will find it in Section 4 of the third 5-year review (U.S. Navy 2009b). In the PDF version of this fourth 5-year review, the links below are to the U.S. Navy 2009b reference document included on the CD provided.

Table 4-1 provides a remedial action summary by OU and Area. The table shows COCs, relevant media, remedial goals, remedial action objectives, remedy components, construction status, and site close strategy by area.

The actions, operation, maintenance, and monitoring conducted from 2009 to 2014 are described below.

## 4.1 OPERABLE UNIT 1

For a discussion of ROD-specified OU 1 remedial action objectives (RAOs), selected remedies, remedy components and implementation, and ongoing operation, maintenance, monitoring, and land use controls implemented prior to this review period (pre-2009), please see Section 4.1 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 4.1 U.S. Navy 2009b**).

The results of the yearly LUC inspections are included in Section 6.5.

### *Area 6 Operation and Maintenance, 2009 to 2014*

Operation of the extraction wells, treatment plant, and recharge system is currently performed in accordance with the operation and maintenance (O&M) manual (U.S. Navy 2002). Based on review of the Contractor Production Reports and treatment plant data, the treatment plant operated and performed generally at capacity from October 2007 through March 2013 (through March 31). However there were a few declines in performance in 2010 because of biofouling and clogged piping problems (U.S. Navy 2009a, 2010, 2011b, 2012c, and 2013e). Optimal operation of the extraction system was hampered by befouling of the extraction well pumps and piping systems, which causes declining flow rates in some wells. Periodic cleaning of the wells and piping systems is required to maintain operation. Biofouling has been an ongoing maintenance issue for the system since its startup and has required constant vigilance to maintain target flow rates. During May 2011 to address biofouling and improve system performance, the plant was taken offline to conduct repair and replacement activities (U.S. Navy 2011c), including the following:

- Replacement of scaled stripper tower packing media, demister fabric, and spray nozzle
- Removal of tree root-caused constrictions in the influent line connected to extraction well PW-1
- Cleaning of the effluent line connected to PW-8 and PW-9 to remove accumulated biofouling material
- Installation of five new aboveground cleanouts in the effluent line connected to wells PW-8 and PW-9
- Installation of flexible piping for extraction wells to facilitate easier biofouling removal and cleanout
- Excavation of existing underground cleanouts and removal of calcium carbonate and iron scaling constricting the treatment plant effluent line

On February 11, 2008, production well PW-5 quit discharging water. The pump was operating at normal amperage but showed no output. An electrician concluded that the wiring was in working order. The operator concluded that one or more pump stages had sheared or that the pump shaft was broken (U.S. Navy 2008). In June 2008, the pump in well PW-5 was extracted and found to have mechanical damage requiring replacement. The pump was replaced and PW-5 was back on line by December 3, 2008 (U.S. Navy 2012e). Pumping well PW-5 is critical for containment of the leading edge of the volatile organic compound (VOC) plume along the western edge of the landfill.

On June 19, 2012, well PW-9 experienced a failure of the 480-volt power supply line in a remote section of buried conduit. After significant trouble shooting to identify the precise location of the failure, PW-9 was put back on line October 22, 2013 (U.S. Navy 2013e and personal communication with Navy RPM). The entire treatment system was shut down September 18, 2013 due to failure of the air-stripping tower metal base. The failed tower base was original equipment installed in 1994. The tower base had degraded to the point where it was no longer capable of supporting the air stripper tower. As a result, the air-stripping tower was leaning and presented a risk to operation and maintenance personnel and posed a spill risk, so the system was taken out of service. A reinforced concrete pad was designed and constructed. The air-stripping tower was reset on the new base and was the system was back in operation on December 18, 2013 (U.S. Navy 2014a).

Inspection and maintenance for the low permeability cap covering the landfilled area are currently performed in accordance with the O&M manual (U.S. Navy 2002b) and LUC Implementation Plans (U.S. Navy 2009d and 2014c). The results of the landfill cap inspections over the last 5 years are provided in Section 6.5 based on the 2009 through 2013 LUC site inspections (U.S. Navy 2011a, 2011d, 2012a, and 2013b) and O&M technical memoranda (U.S. Navy 2012c and 2013e). The ongoing maintenance of the cap includes mowing and control of invasive plant species.

The 1993 OU 1 ROD required groundwater monitoring of Area 6 shallow wells to assess effectiveness of the groundwater treatment system. Monitoring wells in the intermediate and deep zones of the aquifer were to be monitored for VOCs and metals to assess the possibility of vertical migration. In addition, six private drinking water wells close to OU 1 were to be monitored every 18 months for VOCs and salinity.

Treatment plant system influent and effluent is monitored monthly for VOCs (since system startup in August 1995) and quarterly for 1,4-dioxane (since 2003). The first 5-year review (U.S. Navy 1998) states that up to 30 shallow monitoring wells and 9 production wells were sampled quarterly, 4 intermediate wells sampled annually, 4 deep wells monitored through October 1997, and 6 off-site private wells sampled. A revised monitoring schedule was implemented in February 2008 that included sampling 8 production wells, 28 monitoring wells, and 4 domestic wells on either a semiannual or annual basis and analyzed for VOCs and/or 1,4-dioxane (see Table 4-1 of the third 5-year review [U.S. Navy 2009b]; 4 wells were inadvertently excluded, including 6-S-40, -41, -42, -43. This revised schedule was completed during the April 2009 sampling event, and groundwater samples were collected from 20 wells (5 production and 15 monitoring) (U.S. Navy 2010).

The sampling schedule was revised again during fall 2009 to include sampling all wells on a semiannual basis. During the August 2009, August 2010, and February 2011 sampling events, groundwater samples were collected from 40 wells (29 monitoring, 8 production, and 3 domestic) (U.S. Navy 2010 and 2011b). During the August 2011, February 2012, August 2012, and February 2013 sampling events, groundwater samples were collected from 39 wells (8 production wells, 29 monitoring wells, and 2 domestic wells) (U.S. Navy 2012b and 2013c). Groundwater samples over the last 5 years have been analyzed for both VOCs by EPA Method 524.2 and for 1,4-dioxane by EPA Method 8270C selected ion monitoring (SIM) (U.S. Navy 2010, 2011b, 2012b, and 2013c). A groundwater data evaluation is included in Section 6.4.

1,4-Dioxane was not identified in the ROD as a COC in groundwater. As such, the treatment plant was not designed to treat extracted water containing this compound. Treated water with concentrations of 1,4-dioxane greater than the MTCA Method B cleanup level is being reinfiltrated into the subsurface. This also may extend site restoration time. A treatability study is underway to evaluate 1,4-dioxane treatment.

The Navy began evaluating alternatives to address the wide-spread, dilute (low concentration) 1,4-dioxane plume in 2009. Actions taken to date are:

- 2009 to 2011 – Bench-scale testing of microbial mats and advance oxidation
- 2010 to 2011 – Updating conceptual site model and evaluating residual source strength
- 2011 to 2012 – Follow-up advance oxidation bench-scale testing
- 2012 to 2013 - Developed a comprehensive, 3-dimensional, numeric groundwater model to use as an evaluation and remedy performance assessment tool
- 2012 to present – Optimization evaluation to select alternatives

During 2009, the Navy started an evaluation of microbial mats and advanced oxidation as potential alternatives for treating groundwater containing 1,4-dioxane. Bench-scale tests were conducted to evaluate both technologies. The results of the evaluation indicated that the microbial mats would need genetically engineered microbes and regular inoculations arranged in a large constructed wetland to provide the necessary residence time to remove 1,4-dioxane from the treatment system effluent. Advance oxidation showed a higher degree of potential and additional bench-scale testing was conducted to refine the process, optimize dosages, and estimate full-scale design parameters. A comprehensive, 3-dimensional groundwater model was developed to simulate site response to various in situ and ex situ alternatives. A field-scale, pilot study to evaluate in situ technologies is planned for 2014. The optimization evaluation is anticipated to be complete in 2015.

In 2001, six soil vapor monitoring (SVM) locations were installed in the former liquid waste disposal area at Area 6, including one location within Site 55 (U.S. Navy 2013f). This was the location of the 2001 interim soil removal action. The SVM probes were installed to monitor TCE in soil between 20 feet below ground surface (bgs), which is the approximate maximum impacted soil removal depth and the groundwater surface (approximately 80 feet bgs). A vertical characterization of soil was completed during the installation of these SVM locations. Vapor samples were collected in August 2001 and August 2003 to provide vertical characterization of chlorinated volatile organic compound (CVOC) concentrations. Sampling from the six SVM points (from multiple depths) was also conducted in September 2010 and February 2011. From these sampling events, the Navy determined that (1) additional soil concentration data at selected locations would be beneficial towards understanding the present site conditions, (2) these soil data would provide source soil concentration information for groundwater modeling, and (3) two existing soil vapor probes (SVM03-10 and SVM01-76.5) were compromised and that installation of new probes was necessary. Soil borings were drilled and soil samples were collected at four new locations (SVM-01A, SVM-03A, SVM-04A, and SVM-07) in October 2011. Replacement SVM probes were installed at SVM-01A and SVM-03A, while four new SVM probes were installed at location SVM-07. Soil and vapor monitoring results for 2010 and 2011 are presented in Section 6.4.

The third 5-year review recommended groundwater contouring and plume definition on an analyte basis compared to remediation goals (RGs) for Area 6. Trend analysis and contouring was conducted by the Navy on 37 wells using the source area (8 wells), midplume (11 wells), capture zone (11 wells), and downgradient (7 wells) monitoring wells in the recent Site 55 vadose zone investigation (U.S. Navy 2013f). In addition, the 2012 and 2013 monitoring reports provide groundwater contouring (U.S. Navy 2012b and 2013c). Summary information is provided in Section 6.4.

LUCs were formalized in the 2007 ESD for NAS Whidbey Island. Navy LUC inspection requirements for OU 1 Area 6 (U.S. Navy 2009d and 2014c) are as follows:

- Ensure that land use remains commercial and/or industrial.
- No downgradient well drilling, except for monitoring wells and/or remediation system wells authorized by EPA and Ecology in approved plans.
- Protect existing monitoring wells.

- No use of groundwater from, or downgradient of, the area, except for monitoring and remediation as approved by EPA and Ecology.

- Prevent any disturbance to the landfill cap, except as necessary for authorized cap maintenance activities.

The results of the yearly LUC inspections are included in Section 6.5.

Washington State has established a 1,000-foot drilling restriction all landfills Figure 4-1. The Navy contacts the County annually during the LUC inspection and confirms that the restriction is still in place and no additional wells have been installed.

## 4.2 OPERABLE UNIT 2

For a discussion of ROD-specified OU 2 RAOs, selected remedies, remedy components and implementation, and ongoing operation, maintenance, monitoring, and land use controls implemented prior to this review period (pre-2009), please see Section 4.2 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 4.2 U.S. Navy 2009b**).

The results of the yearly LUC inspections are included in Section 6.5.

### *OU 2 Operation, Maintenance, Monitoring, and Land Use Controls 2009 - 2014*

Post-ROD groundwater monitoring indicated the need for additional groundwater monitoring at the time of the second 5-year review at Areas 2/3 (inorganics and VOCs), Area 4 (inorganics), and Area 29 (inorganics). Groundwater monitoring has been conducted at Areas 2/3, 4, and 29 in 5-year cycles. No additional action was required for Area 14 (U.S. Navy 1998).

Based on the third 5-year review recommendations, current groundwater monitoring conducted as part of the fourth 5-year review includes the following (U.S. Navy 2013a), and results are reported in Section 6.4:

- Areas 2/3 – Collect groundwater samples from seven monitoring wells and analyze for vinyl chloride, arsenic, and manganese.

- Area 4 – Collect groundwater samples from two monitoring wells and analyze for arsenic.

- Area 29 – Collect groundwater samples from three monitoring wells and analyze for arsenic.

LUCs were formalized in the 2007 ESD for NAS Whidbey Island. Navy LUC inspection requirements for OU 2 (U.S. Navy 2009d and 2014c) follow.

***Areas 2/3***

- Ensure that land use remains commercial and/or industrial.
- No use of groundwater from, or downgradient of, the area except for monitoring and remediation, except as approved by EPA and Ecology.
- No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by EPA and Ecology in approved plans.
- Protect existing monitoring wells.
- Use restrictions to prevent ground disturbance via digging and/or construction activities in the area of former construction debris landfill.

An LUC failure was identified at Areas 2/3 and 29 in December 2013. A contractor conducted trenching across these sites to install a communication line. The work was assigned by a tenant contracting entity at NAS Whidbey Island. This resulted in exposed landfill debris. The Navy met with EPA on January 22, 2014 to discuss the Navy's investigation into the failure causes, actions taken or to be taken to prevent future occurrences, and response to the exposed debris and damage caused by trenching. The incident was caused by the contracting entity not requesting site approval for the project, as required by the *NAS Whidbey Island Instruction for Site Approval*. Had this procedure been followed, the trench would have been redirected around the landfilled area.

The contracting entity was required to fund all response and repair work to restore these sites to pre-excavation conditions. The cap restoration along the trench at Area 2 will be conducted according to current standards, which is a significant upgrade to standards required at the time of closure. This meeting was followed up by Navy formal written response regarding the incident to EPA (February 3, 2014 Letter from NAVFAC NW to EPA). The Navy described a plan to reinforce site approval process requirements, broaden LUC awareness and knowledge through quarterly and annual training for all facilities and building managers, revise existing signage at all LUC sites with stronger language, and increase the number of signs and visibility of the signs identifying LUC sites. EPA responded positively to Navy's swift response, thorough investigation, and comprehensive plan to strengthen LUC management at NAS Whidbey Island.

To prevent future land use control issues, NAS Whidbey Island will perform additional outreach education with tenant commands at the installation. The outreach will consist of the following: 1) conduct CERCLA training at both bimonthly and quarterly Activity Environmental Coordinator and Manager meetings; 2) conduct CERCLA training at each of the Building Manager meetings; 3) add land use control slides to web-based training for all base personnel and their contractors. Additional signs will be installed at each of the LUC sites including at points of entry facing vehicle drivers. Also, the site approval instruction will be modified as necessary.

### *Area 4*

- Ensure that land use remains commercial and/or industrial.
- No use of groundwater from, or downgradient of, the area except for monitoring and remediation, except as approved by EPA and Ecology.
- No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by EPA and Ecology in approved plans.
- Protect existing monitoring wells.

### *Area 14*

No LUC was specified for this site in the 2007 ESD (U.S. Navy 2007). In previous years, the site was inspected to determine if there had been any land disturbance or land use change since the last inspection. The Navy requested and EPA approved removal of the inspection requirement in the 2013 inspection report (U.S. Navy 2013b).

### *Area 29*

- No use of groundwater from, or downgradient of, the area except for monitoring and remediation, except as approved by EPA and Ecology.
- No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by EPA and Ecology in approved plans.
- Protect existing monitoring wells.
- Prevent ground disturbance or construction activities.

The results of the yearly LUC inspections are included in Section 6.5.

## 4.3 OPERABLE UNIT 3

For a discussion of ROD-specified OU 3 RAOs, selected remedies, remedy components and implementation, and ongoing operation, maintenance, monitoring, and land use controls implemented prior to this review period (pre-2009), please see Section 4.3 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 4.3 U.S. Navy 2009b**).

The results of the yearly LUC inspections are included in Section 6.5.

### *OU 3 Operation, Maintenance, Monitoring, and Land Use Controls*

Catch-basin cleanout and sediment sampling (at two locations) was completed in January 2014 (TetraTech personal communication, 5 March 2014).

LUCs were formalized in the 2007 ESD for NAS Whidbey Island. Navy LUC inspection requirements for OU 3, Area 16 (U.S. Navy 2009d and 2014c) are as follows:

- Ensure that land use remains commercial and/or industrial.
- Limit adjoining ditch banks to disposal of dredged sediments meeting MTCA industrial soils criteria and/or industrial use.

The results of the yearly LUC inspections are included in Section 6.5.

## 4.4 OPERABLE UNIT 4

For a discussion of ROD-specified OU 4 RAOs, selected remedies, remedy components and implementation, and ongoing operation, m6aintenance, monitoring, and land use controls implemented prior to this review period (pre-2009), please see Section 4.4 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 4.4 U.S. Navy 2009b**).

The results of the yearly LUC inspections are included in Section 6.5.

### *OU 4 Operation, Maintenance, Monitoring, and Land Use Controls 2009 - 2014*

Except for LUC inspections, there are no maintenance or monitoring requirements for the sites in OU 4 Areas 39, 41, 44, and 48/49. LUCs were formalized in the 2007 ESD for NAS Whidbey Island. Navy LUC inspection requirements for OU 4 Areas 48/49 (U.S. Navy 2009d and 2014c) are as follows:

- Ensure that land use remains commercial and/or industrial.
- Use restrictions to prevent ground disturbance via excavation or other ground-disturbing activities in the area of former construction debris landfill.

The results of the yearly LUC inspections are included in Section 6.5.

## 4.5 OPERABLE UNIT 5

For a discussion of ROD-specified OU 5 RAOs, selected remedies, remedy components and implementation, and ongoing operation, maintenance, monitoring, and land use controls implemented prior to this review period (pre-2009), please see Section 4.5 of U.S. Navy 2009b, *Third Five-Year Review of Records of Decision, Naval Air Station Whidbey Island, Washington* (**link to Section 4.5 U.S. Navy 2009b**).

The results of the yearly LUC inspections are included in Section 6.5.

### *OU 5 Area 1 Operation, Maintenance, Monitoring, and Land Use Controls 2009 - 2014*

Annual visual monitoring of shoreline stability was required at Area 1 for a period of 5 years beginning in calendar year 1998. This shoreline stability monitoring was conducted by NAS Whidbey Island Environmental Affairs Office personnel and properly documented. The final shoreline stability monitoring event was completed in July 2002**.** This monitoring indicated that relatively minor shoreline erosion is occurring along the coastline of Area 1 (U.S. Navy 2004b).

Post-ROD groundwater monitoring was performed in 1996 to determine whether cyanide was present at concentrations that could adversely affect the marine environment (ecological risk from cyanide in groundwater was the only identified risk associated with Area 1). Two inland groundwater monitoring wells and six intertidal groundwater seeps along the shoreline were sampled and analyzed for cyanide and inorganics (total and dissolved metals). Inorganics were not detected sufficiently in excess of the ROD cleanup levels to require annual monitoring of groundwater or groundwater seeps. However, because detectable concentrations of copper and nickel were identified (coupled with the previous identification of elevated detectable concentrations of cyanide), the initial 5-year review recommended that monitoring for inorganics and cyanide at Area 1 groundwater seeps be conducted at the time of the second 5-year review.

The recommended second groundwater seep sampling event was conducted in December 2002. A total of five seep samples were collected from Area 1. All samples were analyzed for cyanide and inorganic compounds (total and dissolved metals). Documentation of this seep sampling is provided in the second 5-year review (U.S. Navy 2004b). Results showed only trace concentrations of arsenic and low levels of manganese. There was no detection of cyanide in any of the seep samples.

No specific recommendation was made in the second 5-year review relative to additional groundwater monitoring at Area 1. The third 5-year review recommended that seep sampling be discontinued at OU 5 Area 1. Therefore, no sampling was planned for Area 1 prior to the fourth 5-year review (U.S. Navy 2013a).

During the LUC inspection in September 2009, the Navy identified that erosion along the 3,300-foot long shoreline had exposed the fill and historical landfill in several areas. Timbers, refuse, metal, and concrete were identified in the exposed shoreline bluff. The Navy implemented shoreline erosion monitoring under the LUC starting in December 2010 and continuing into 2012 in order to understand the severity of the erosion issue (U.S. Navy 2011a and 2012a). The first set of erosion monitoring events were conducted by Tetra Tech and APS Survey and Mapping in December 2010 and February, April, and June 2011 (U.S. Navy 2011a).

Monitoring events indicated up to 5.4 feet of erosion along the bluff in certain areas (U.S. Navy 2011a). A TCRA was performed in January and February 2012 to mitigate and prevent further erosion of the Area 1 shoreline (U.S. Navy 2012a). The shoreline stabilization was performed in three of the most heavily eroded sections by placing riprap in place at the toe of the bluff. A total of 247 feet of shoreline was stabilized with 376 tons of temporary armor rock. An NTCRA was conducted to construct a permanent coastal protection system along the Area 1 shoreline (Figure 4-2). Construction of the permanent system began in July 2012 and was completed in November 2012. Shoreline monitoring events were conducted by Tetra Tech and APS Survey and Mapping in February, April, and November 2013. The survey showed the effectiveness of the shoreline stabilization activities, as evidenced by the absence of erosion between February and April 2012 and the final location of the permanent coastal protection system in November 2012. The 2013 LUC inspections continued the shoreline monitoring task at the Area 1 Former Beach Landfill seawall to determine the continued rate of erosion and seawall deterioration. It was recommended that additional shoreline protection be implemented south of the new seawall at OU 5 Area 1 (U.S. Navy 2013b).

### *OU 5 Area 31 Operation, Maintenance, Monitoring, and Land Use Controls 2009 - 2014*

The soil venting and product recovery system operations were terminated in the spring of 2000 after the EPA agreed that the RAOs had been successfully met and the recovery system had removed fuel to the practicable endpoint. EPA concurrence with the termination of soil venting was provided in a letter dated May 19, 2000. In this letter, EPA requested final confirmation sampling around Area 31. Confirmation sampling results were reported to EPA on November 21, 2000. Data collected at that time were compared to chemical-specific ARARs. Sampling has been continued as a good management practice and to confirm that chemicals are not migrating off site.

Groundwater monitoring was conducted on a quarterly basis at seven Area 31 wells during the second 5-year review period to demonstrate that contaminants in groundwater are attenuating over time and are not migrating off site (U.S. Navy 2007b).

The 2007 third quarter monitoring report (U.S. Navy 2007f) recommended reducing sampling frequency to once every 5 years. The third 5-year review recommended that residual-range organics (RRO), styrene, and toluene monitoring should be discontinued; monitoring annually for diesel-range organics (DRO), gasoline-range organics (GRO), benzene, naphthalene, and vinyl chloride at wells MW31-9A and OWS-1 until the next 5-year review; and monitoring well MW31-11 annually for total and dissolved manganese only. Currently, Area 31 is monitored annually for total and dissolved manganese, DRO, GRO, benzene, naphthalene, and vinyl chloride at MW31-9A and OWS-1. MW31-11 is abandoned, and manganese has been added to the analyte list for site wells MW31-9A and OWS-1. Sampling results are reported in Section 6.4.

### *OU 5 Area 52 Operation, Maintenance, Monitoring, and Land Use Controls 2009 - 2014*

Passive product recovery continued at the site using either canisters or absorbent socks through June 2007. Product recovery volume, product thickness, and depth to water are currently monitored and reported on a quarterly basis (U.S. Navy 2007c). Product recovery was terminated in June 2007 with EPA concurrence. Shoreline groundwater sampling was conducted in July 2007 to confirm that petroleum constituents have not migrated to the adjacent marine environment.

Based on third 5-year review recommendations, six seep samples were collected and analyzed for DRO and RRO as part of the fourth 5-year review (U.S. Navy 2013a). In addition, sediment pore water monitoring at all six previously established locations was conducted in December 2013 using a push probe. Results for seep and sediment samples are reported in Section 6.4.

### *OU 5 Land Use Controls*

LUCs were formalized in the 2007 ESD for NAS Whidbey Island. Navy LUC inspection requirements for OU 5 (U.S. Navy 2009d and 2014c) are as follows:

#### *Area 1*

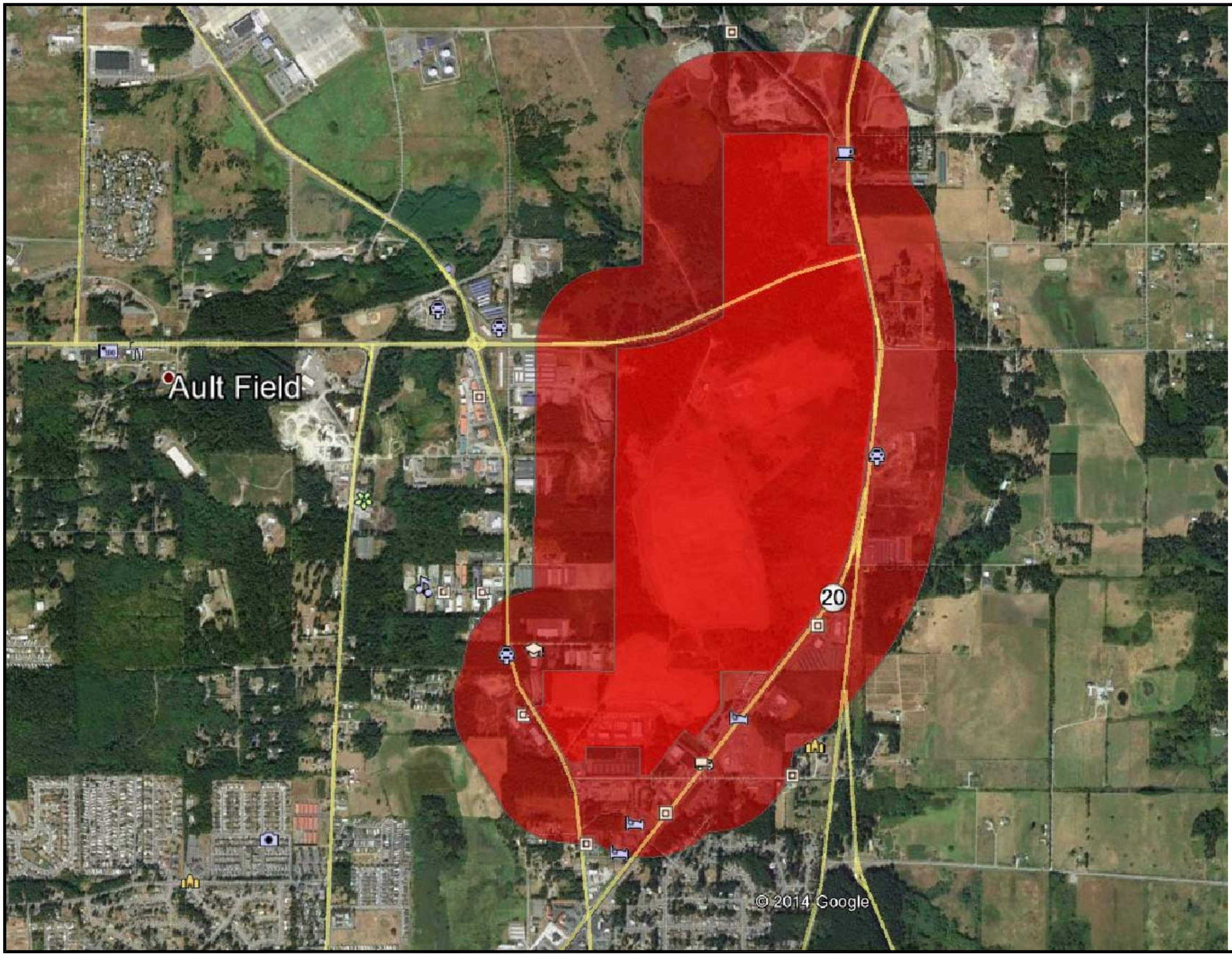
- Ensure that land use remains commercial and/or industrial.
- No use of groundwater from, or downgradient of, the area except for monitoring and remediation, except as approved by EPA and Ecology.

- No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by EPA and Ecology in approved plans.
- Protect existing monitoring wells.
- Land use restrictions to prevent ground disturbance via digging and/or construction activities in the area of former construction debris landfill.
- Ensure that shoreline armoring is in place and functioning as intended.

***Areas 31 and 52***

- Ensure that land use remains commercial and/or industrial.
- No use of groundwater from, or downgradient of, the area except for monitoring and remediation, except as approved by EPA and Ecology.
- No downgradient well drilling except for monitoring wells and/or remediation system wells authorized by EPA and Ecology in approved plans.
- Protect existing monitoring wells.

The results of the yearly LUC inspections are included in Section 6.5.



LEGEND

🟥 1,000-Foot Well Installation Restriction Zone

**U.S. NAVY**

NOT TO SCALE

**Figure 4-1**
**Island County Map Showing 1,000-Foot Well Installation Restriction Zone**

NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

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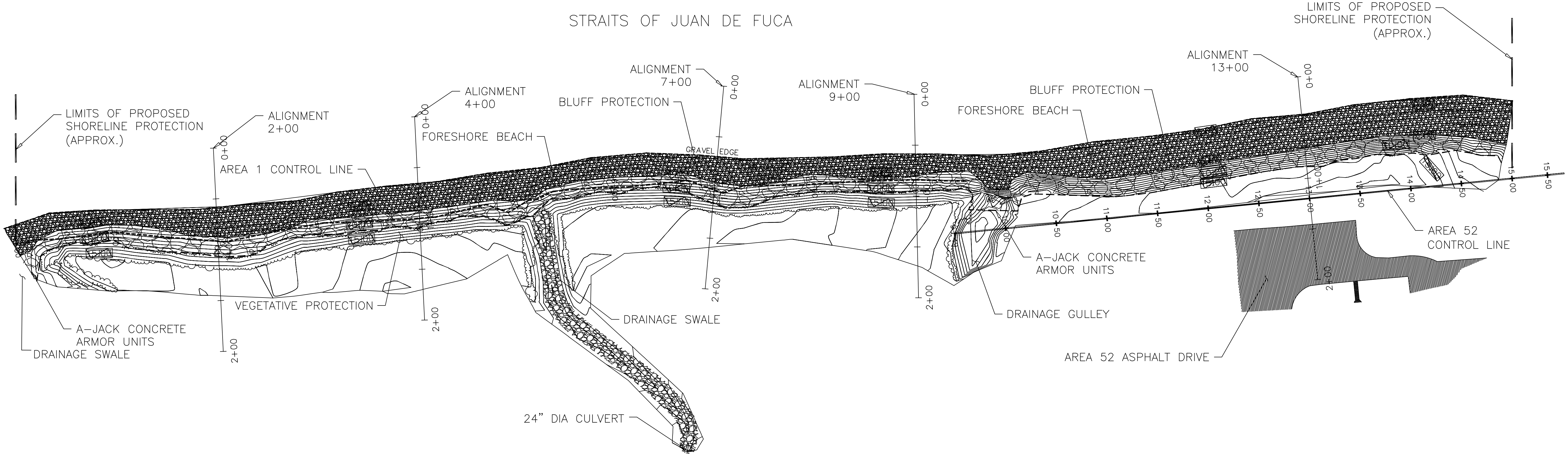

Source: SES-Tech Remediation (U.S. Navy 2013d)

**U.S. NAVY**

NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

0 50 100
SCALE IN FEET

**Figure 4-2**
**Area 1 Seawall**

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## Table 4-1
## Summary of Remedial Actions, OUs 1 through 5, NAS Whidbey Island

| OU | Site | Reasonably Anticipated Land Use | COC Requiring Action | Media | RGs | RAOs | Remedy Component | Remedy Construction Complete | Site Closeout Strategy |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Area 5 | Continue as naval installation | None | None | None | No RAO was established for OU 1 Area 5 | LUCs | Yes | None |
| | Area 6 | | TCE<br>1,1,1-TCA<br>1,1-DCA<br>1,1-DCE<br>cis-1,2-DCE<br>VC<br>New COC identified after ROD, RG not established<br>1,4-Dioxane | GW | 5 µg/L<br>200 µg/L<br>800 µg/L<br>0.07 µg/L<br>70 µg/L<br>0.02 µg/L<br>0.44 µg/L (MTCA B) | Reduce concentrations of contaminants . . . in shallow aquifer to state and federal drinking water standards.<br>Prevent the further spread of VOCs in the shallow aquifer.<br>Treat extracted water to meet state and federal standards prior to discharge.<br>Reduce the potential risk to existing and future groundwater users downgradient of the site.<br>Minimize infiltration of rainwater in the landfill.<br>Prevent stormwater erosion of the surface soils at the Area 6 landfill operations area.<br>Prevent exposure to contaminants in the landfill. | GW extraction system<br>Air stripping system<br>Engineered landfill cap<br>LUCs | Yes | Ongoing system optimization and treatability study to evaluate ISCO, eventually move to MNA<br>Ongoing LUC maintenance<br>ROD amendment to add 1,4-dioxane as a COC and remove any COC that has reached RG |
| 2 | Multiple Areas | | | | | Minimize the potential for migration of contaminants from surface soils to surface water or other media at Areas 4, 14, and 29. | See area specific lines | | |
| | Areas 2/3 | | Antimony<br>Arsenic<br>Manganese<br>VC | GW | 6 µg/L/BK[a]<br>0.05 µg/L/BK[a]<br>80 µg/L/BK[a]<br>0.023 µg/L/PQL[a] | Reduce risks to hypothetical future residents from groundwater contaminants at Areas 2/3. | LUCs, 6-month GW monitoring, monitoring continues in 5- year cycles | Yes | Determine if COC concentrations are background<br>Ongoing LUC maintenance |
| | Area 4 | | MCPP<br>PCBs<br>PCP<br>Arsenic<br>Manganese | Soil<br>GW | 80 mg/kg<br>1 mg/kg<br>8.33 mg/kg<br>0.05/BK[a] µg/L<br>80/BK[a] µg/L | Reduce the health risk to hypothetical future residents and the environmental risk to small mammals by removing surface and near-surface soil. | Excavation of 1,750 yd$^3$ of PCB-impacted soil, GW monitoring<br>LUCs | Yes | None<br>This 5-year review recommends terminating 5-year review support GW monitoring.<br>Ongoing LUC maintenance |

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## Table 4-1 (Continued)
## Summary of Remedial Actions, OUs 1 through 5, NAS Whidbey Island

| OU | Site | Reasonably Anticipated Land Use | COC Requiring Action | Media | RGs | RAOs | Remedy Component | Remedy Construction Complete | Site Closeout Strategy |
|---|---|---|---|---|---|---|---|---|---|
| OU 2 (cont.) | Area 14 | | Bromacil<br>2,3,7,8-TCDD<br>2,4-Dichlorophenol<br>Bromacil<br>2,4-Dichlorophenol | Soil<br>GW | 7 mg/kg<br>$6.67x10^{-6}$ mg/kg<br>4.8 mg/kg<br>70 µg/L<br>48 µg/L | Reduce risks to hypothetical future residents by removing the sources of organic contamination (i.e., the dry well and surrounding soils) at Area 14. | Pump out dry well and well 14-MW-1, treat extracted, dispose of the treated water to POTW<br>Excavate dry well, monitoring well, and approximately 420 yd$^3$ of surrounding contaminated soil, dispose of the excavated soils and decontaminated well casings<br>Well 14-MW-1 reinstalled to support 5-year reviews<br>LUCs | Yes | None<br>This 5-year review recommends terminating 5-year review support GW monitoring.<br>Ongoing LUC maintenance |
| | Area 29 | Continue as naval installation | PCP<br>PAHs<br>Arsenic<br>Manganese | Soil<br>GW | 8.33 mg/kg<br>1 mg/kg<br>0.05/BK[a] µg/L<br>80/BK[a] µg/L | Reduce risks to hypothetical future residents from inorganic groundwater contaminants at Areas 4 and 29. | Excavate and dispose of approximately 1,400 yd$^3$ of PCP- and PAH-impacted soil locations surrounding the burn pad.<br>Conduct GW to support 5-year reviews<br>LUCs | Yes | None<br>This 5-year review recommends terminating 5-year review support GW monitoring.<br>Ongoing LUC maintenance |
| 3 | Area 16 | | Arsenic<br>Lead<br>2-Methylnaphthalene<br>Benzo(k)fluoranthene<br>Dibenz(a,h)anthracene<br>Phenanthrene<br>TPH | Sed | 16[b] mg/kg (Eco)<br>18[c] mg/kg (BK)<br>0.8[b] mg/kg (Eco)<br>18 mg/kg<br>1.1[b] mg/kg (Eco)<br>13[b] mg/kg (Eco)<br>200 mg/kg | Reduce current ecological risks posed by COCs in the ditch sediments.<br>Reduce potential future human health risks should contaminated sediments be dredged during ditch maintenance and placed on the ditch banks. | Sample and analyze sediments in the ditch segments identified during the RI to determine the extent of contamination that needs to be removed.<br>Compare the sample results to RCRA criteria for toxicity characteristic wastes to determine whether the dredged sediments would need to be treated and disposed of as hazardous waste or dangerous waste.<br>Dredge the sediments from those portions of the ditch segments determined by the sampling to be contaminated above the selected cleanup levels.<br>For those sediments determined to be nonhazardous waste, haul and place the dredged sediments at the Area 6 landfill so they will be incorporated under the final cover.<br>For any sediment determined to be hazardous waste, haul the dredged sediments to a permitted off-area facility for appropriate treatment and disposal.<br>LUCs | Yes | None<br>This 5-year review recommends conducting sediment sampling once during the next 5-year review period.<br>Ongoing LUC maintenance |

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## Table 4-1 (Continued)
## Summary of Remedial Actions, OUs 1 through 5, NAS Whidbey Island

| OU | Site | Reasonably Anticipated Land Use | COC Requiring Action | Media | RGs | RAOs | Remedy Component | Remedy Construction Complete | Site Closeout Strategy |
|---|---|---|---|---|---|---|---|---|---|
| 4 | Areas 39, 41, 44, and 48, 49 | | 4,4'-DDD<br>4,4'-DDE<br>4,4'-DDT<br>Arsenic<br>Chromium (VI)<br>Lead<br>cPAHs[d] | Soil | 4.17 mg/kg<br>2.94 mg/kg<br>2.94 mg/kg<br>20 mg/kg<br>400 mg/kg<br>250 mg/kg<br>1 mg/kg | Minimize contamination of surface soil.<br>Minimize direct contact of humans and animals with COCs in soil/sediment.<br>Reduce concentrations of contaminants in the surface soil and Area 44 storm drain system sediments to comply with applicable state and federal regulations.<br>Prevent further migration of the contaminants. | The selected remedy for Areas 39, 41, and 48 was excavation of contaminated soils and on-station disposal at the NAS Whidbey Island Ault Field Area 6 landfill. The soil removal from Areas 39, 41, and 48 was intended to meet regulatory soil cleanup standards established under the MTCA for the COCs (U.S. Navy, Ecology, and USEPA 1993b).<br>The remedy for Area 44 was excavation, treatment if needed, and off-area disposal at an approved landfill of 1 yd$^3$ of sediment and approximately 30 yd$^3$ of surface soil and catch basin cleaning.<br>The remedy for Area 49 is inclusion of notification regarding the existence of a historical construction and demolition debris landfill on the deed when and if the Navy disposes of the property.<br>LUCs | Yes | None<br>Remedy complete<br>Ongoing LUC maintenance |
| 5 | Area 1 | | Zinc<br>Cyanide<br>Bis(2-ethylhexyl) phthalate<br>1,1-Dichloroethene | SW | 76.6 µg/L<br>1 µg/L<br>3.56 µg/L<br>1.93 µg/L | Confirm protection of ecological receptors in the marine environment by determining compliance with the water quality standards for marine surface waters at the point of groundwater discharge | LUCs to prevent human exposure to landfill contents or groundwater by preventing future development that may disturb the landfill and to prevent the installation of drinking water wells.<br>Establish an environmental monitoring program that includes groundwater sampling and biological surveys of the beach.<br>Conduct visual inspections of the physical condition of the landfill bluff annually for the first 5 years and document the results. | Yes | None<br>Third 5-year review recommended the seep monitoring be discontinued.<br>Ongoing LUC maintenance |
| | Area 31 | | Beryllium<br>Lead<br>Manganese<br>Mercury<br>Aroclor 1260<br>Benzene<br>Naphthalene<br>Pentachlorophenol<br>Styrene<br>Toluene | GW | 0.0203 µg/L<br>9.7 µg/L<br>142 µg/L<br>2 µg/L<br>1 µg/L<br>5 µg/L<br>320 µg/L<br>1 µg/L<br>1.46 µg/L<br>1,000 µg/L | Reduce the sources of petroleum hydrocarbons in subsurface soils that may cause groundwater contamination<br>Prevent migration of floating petroleum product and dissolved COCs that are present above ARARs in groundwater.<br>Prevent human exposure under the future residential | Removal of the oil/water separator, bioventing, and oil skimming were the selected remedy components at Area 31.<br>LUCs to prevent human exposure to surface soil, subsurface soil, and groundwater containing COCs above cleanup levels.<br>Removed the ash piles at Area 31 and disposed of them in accordance with state and federal regulations. | Yes | Monitoring analyte list has been reduced over time.<br>This 5-year review recommends further reduction with biannual monitoring for dissolved and total manganese, DRO, |

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## Table 4-1 (Continued)
## Summary of Remedial Actions, OUs 1 through 5, NAS Whidbey Island

| OU | Site | Reasonably Anticipated Land Use | COC Requiring Action | Media | RGs | RAOs | Remedy Component | Remedy Construction Complete | Site Closeout Strategy |
|---|---|---|---|---|---|---|---|---|---|
| OU 5 (cont.) | | | Vinyl chloride<br>2,3,7,8-TCDD<br>TPH | | 0.1 µg/L<br>$0.58\times10^{-6}$ µg/L<br>1,000 µg/L | scenario to the COCs in groundwater that are present at concentrations above state and federal cleanup levels. | GW monitoring<br>LUCs | | GRO, benzene, and vinyl chloride at wells MW31-9A and OWS-1 until the next 5-year review.<br>Ongoing LUC maintenance |
| | Area 52 | | Vinyl chloride<br>Benzo(a)anthracene<br>Benzo(a)pyrene<br>Benzo(b)fluoranthene<br>Chrysene<br>Indeno(1,2,3-cd)pyrene<br>TPH | SW | 2.92 µg/L<br>0.0296 µg/L<br>0.0296 µg/L<br>0.0296 µg/L<br>0.0296 µg/L<br>0.0296 µg/L<br>1,000 µg/L | Prevent the migration of floating petroleum product from groundwater to marine surface water.<br>Confirm protection of ecological receptors in the marine environment by determining compliance with the water quality standards for marine surface waters at the point of groundwater discharge. | Oil skimming was selected as the Area 52 remedy, together with institutional controls and environmental monitoring. Removal of free product was intended to meet the RAO of preventing migration of floating petroleum product from groundwater to marine surface water.<br>Shoreline seep monitoring | Yes | None<br>This 5-year review recommends terminating seep monitoring. |

[a] Cleanup level was based on the higher of the two values.
[b] ROD cleanup level is based on ecological risks.
[c] ROD cleanup level is based on background.
[d] Based on benzo(a)pyrene

Notes:
BK - background
COC - chemical of concern
cPAHs - carcinogenic polycyclic aromatic hydrocarbons
cis-1,2-DCE - 1,2-dichloroethene (cis)
1,1-DCA - 1,1-dichloroethane
1,1-DCE - 1,1-dichloroethene
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
Eco - ecological
GW - groundwater
ISCO - in situ chemical oxidation
LUCs - land use controls
MCPP - propionic acid (2-[2-methyl-4-chlorophenoxy])
µg/L - microgram per liter
mg/kg - milligram per kilogram
MTCA B - Washington State Model Toxics Control Act Method B groundwater cleanup level
OU - operable unit
PAHs - polycyclic aromatic hydrocarbons
PCBs - polychlorinated biphenyls
PCP - pentachlorophenol
POTW - publicly owned treatment work
PQL - practical quantitation limit
RAO - remedial action objective
RCRA - Resource Conservation and Recovery Act
RG - remedial goal
Sed - sediment
SW - surface water
1,1,1-TCA - 1,1,1-trichloroethane
TCDD - tetrachlorodibenzo-p-dioxin
TCE - Trichloroethene
TPH - total petroleum hydrocarbons
VC - vinyl chloride
VOC - volatile organic compound

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# 5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

This section summarizes the status of recommendations and follow-up actions from the last review, the results of implemented actions, including whether they achieved the intended purpose, and the status of any other prior issues. The Navy implemented 15 of the 16 recommendations from the third 5-year review. One recommendation, connecting well PW-10 to the extraction network, was not implemented with agreement between the Navy and EPA. The recommended actions and notes regarding their completion are summarized in Table 5-1, and notable listed items are discussed further below. The EPA's database for tracking 5-year review recommendations and their completion was evaluated during this 5-year review period.

## 5.1 NOTABLE RECOMMENDATIONS IMPLEMENTED

### *Item No. 1, Practical Quantitation Limit Evaluation*

As listed under Item No. 1 in Table 5-1, an evaluation of practical quantitation (PQL)-based groundwater cleanup levels was recommended in the third 5-year review. The groundwater cleanup levels that are based on PQLs include vinyl chloride at:

- OU 1 (Area 6)
- OU 2 (Areas 2/3)
- OU 5 (Area 31)

The vinyl chloride practical quantitation limits (PQLs) at Area 6 were evaluated in the vadose zone investigation report (U.S. Navy 2013f). The ROD RG at OU 1 Area 6 for vinyl chloride is 0.02 µg/L, based on the former MTCA B level. For a period, the 0.1 µg/L ROD PQL value was used for groundwater compliance monitoring. Current laboratory limits of quantitation (roughly equivalent to reporting limits) range from 0.02 to 0.05 µg/L for vinyl chloride in water, depending on the laboratory. To achieve a 0.02 to 0.05 µg/L reporting limit, most laboratories perform the analysis using SIM techniques, which is a separate analysis from a standard Method 8260/524.2 gas chromatograph/mass spectrometer analysis. Currently, most laboratories can achieve the 0.02 µg/L as a reporting limit. This does not provide for a reporting limit that is "below" the ROD RG of 0.02 µg/L, but is equivalent to the ROD RG. However, the current MTCA B vinyl chloride value is 0.029 µg/L, which is higher than 0.02 µg/L. In summary, the ROD RG of 0.02 µg/L for OU 1 Area 6 can now be achieved through current laboratory analysis methods, and this value is health-protective of residents and also achievable for OU 2 Areas 2/3 and OU 5 Area 31. As a result, vinyl chloride results can now be compared to the ROD-specified RGs.

The groundwater cleanup level for Aroclor 1260 at OU 5 (Area 31) is also PQL based. The Aroclor 1260 regulatory level has decreased from 1 to 0.2 µg/L, based on the PQL. Monitoring of groundwater wells for Aroclor 1260 was not specified in the OU 5 ROD for Area 31. The source of PCBs was soil, and it has been removed (U.S. Navy 2004b). PCBs tend to partition strongly to soils and the potential for PCB leaching to groundwater is usually low. Therefore, this decrease in the regulatory level does not affect the protectiveness of the remedy.

### *Item No. 5, Cost Effectiveness of Treating Extraction System Effluent for 1,4-Dioxane*

The chemical 1,4-dioxane was not identified as a COC, and a cleanup level was not established in the OU 1 ROD. Currently groundwater is extracted and treated for VOCs, and discharged to the surface. The Navy has made substantial progress in evaluating various alternatives for treating groundwater containing 1,4-dioxane both in situ and ex situ during the review period and has worked closely with EPA. During 2010, the Navy evaluated biomats and advanced oxidation. The conclusion from that study indicated that biomats would not be effective without genetically engineered microbes and would require a very large engineered wetland to provide the needed residence time to reduce 1,4-dioxane to acceptable levels. As a result, the Navy decided to focus on advanced oxidation (U.S. Navy 2011e). The Navy completed a second bench-scale evaluation of advanced oxidation for ex situ treatment of 1,4-dioxane to refine the process, optimize dosages, and estimate design parameters for a large-scale system.

A comprehensive groundwater model has been developed to predict and evaluate results of various in situ and pumping scenarios. An optimization team was established in December 2012 which comprises Navy (NAVFAC Northwest, NAVFAC Headquarters, Expeditionary Warfare Center), EPA Region 10, and EPA Headquarters representatives. The Navy has met multiple times with the EPA and many of the optimization team members since its inception. The Navy is currently evaluating treatment options for 1,4-dioxane in groundwater. The Navy is moving forward with a significant in situ treatability study to support the optimization effort. The treatability study will evaluate the effectiveness of in situ chemical oxidation using activated persulfate and activated hydrogen peroxide, and the expected optimization report completion date is 2015. The intended end result of the optimization evaluation is to support preparation of a ROD amendment that identifies an alternative to address 1,4-dioxane and the residual VOCs at the site.

### *Item No. 7, Establishing Cleanup Level for 1,4-Dioxane*

A ROD amendment timeline to establish a cleanup level for 1,4-dioxane is to be determined and will be based on the results of the treatment alternatives evaluation (item No. 6 of this section) expected to be completed during 2015. In February 2013, 1,4-dioxane was monitored in 31 monitoring wells and compared to the MTCA B value of 0.44 µg/L where 24 of 31 wells exceeded this value (U.S. Navy 2013c). The MTCA B value is based on protection of residential drinking water.

## 5.2 OTHER COMPLETED ACTIONS

In addition to addressing the recommendations from the last 5-year review, the Navy completed the actions discussed below.

### *OU 1 Area 6 Updates to the GERT Equipment*

The Navy and EPA concluded during the May 7, 2013 meeting that pumping from PW-5 was adequately containing the groundwater plume and connection of PW-10 to the extraction network was unnecessary. As an alternative, the Navy agreed to maintain an adequate inventory of spare parts and equipment to quickly respond to any operating issues at PW-5.

### *OU 5 Area 1 TCRA Shore Stabilization*

In addition to annual monitoring, shoreline stabilization action at Area 1 was completed. A TCRA was performed in January and February 2012 to mitigate and prevent further erosion of the shoreline. The shoreline stabilization was performed in three of the most heavily eroded sections by placing riprap in place at the toe of the bluff. A total of 247 feet of shoreline was stabilized with 376 tons of armor rock. An NTCRA was conducted to construct a permanent coastal protection system along the Area 1 shoreline. Construction of the permanent system began in July 2012 and completed in November 2012 (U.S. Navy 2013b).

## Table 5-1
## Summary of Progress Since Last 5-Year Review

| Item No. | Recommendation/Follow-up Action From Third 5-Year Review (September 2009) | Completion Date | Notes Regarding Completion | Reference |
|---|---|---|---|---|
| 1 | **General**<br>PQL-based cleanup levels specified in the RODs need to be evaluated against current quantitation capabilities**.** | January 31, 2013 | Laboratory vinyl chloride PQLs have approached regulatory levels. | U.S. Navy 2013f |
| **Operable Unit 1** | | | | |
| 2 | **OU 1 Area 6**<br>Repair the fence along the southwestern portion of site boundary. Have on-site personnel inform NAS Whidbey Island Security of trespassers. | Spring 2011 | The fencing at Area 6 was repaired and vegetation was cleared to prevent future damage. | U.S. Navy 2011a |
| 3 | **OU 1 Area 6**<br>Conduct vadose zone vapor monitoring for VOCs to evaluate stability of vadose zone impacts. | January 31, 2013 | Soil vapor sampling conducted in 2010 and 2011 indicates that soil vapor concentrations increase with depth, but are, overall, decreasing over time compared to the 2003 data. | U.S. Navy 2013f |
| | If groundwater COC concentrations in samples from wells near the former industrial waste disposal area stabilize or begin to increase during pumping conditions or once pumping is suspended, develop a criterion for additional source area work and agree on how to evaluate it. | Initiated 2010, Ongoing | Groundwater COC concentrations continue to decrease, although rate of decreased has slowed in last five years | U.S. Navy 2010, 2011b, 2012b, and 2013c |
| 4 | **OU 1 Area 6**<br>Maintain target pumping rate and drawdown at PW-5 to control the plume in the southwestern corner and along the western boundary of the site. | Ongoing | Maintained target pumping rate over past 5 years | NA |
| | Install infrastructure for pumping from PW-10 in the event that PW-5 production is compromised. | 2009 flexible piping added to pumping wells in to facilitate easier cleanout, spare pumps on site | It was determined at the May 7, 2013 meeting with EPA that maintaining consistent operation at PW-5 was sufficient. | NA |

## Table 5-1 (Continued)
## Summary of Progress Since Last 5-Year Review

| Item No. | Recommendation/Follow-up Action From Third 5-Year Review (September 2009) | Completion Date | Notes Regarding Completion | Reference |
|---|---|---|---|---|
| 5 | **OU 1 Area 6**<br>Evaluate applicability and cost effectiveness of treating extraction system effluent for 1,4-dioxane. | Ongoing<br>Initial bench-scale testing August 2010<br>Follow up bench-scale testing initiated November 2012<br>Field testing of in situ technologies planned for 2014 | Treatability study in progress; discussed in text. Biomats were considered but required a large wetland area, engineered microbes, and long residence time to address 1,4-dioxane. Ex situ advance oxidation to treat extracted water is currently being considered along with in situ oxidation. | U.S. Navy 2011e |
| 6 | **OU 1 Area 6**<br>Future contouring should be conducted by hand, out to the analyte-specific RG or cleanup level. This will ensure that the plume definition reflects the RG values. Results should be documented on the appropriate figure at locations where target analytes were measured below the analyte-specific RG or cleanup level. This will allow for assessment of potential containment problems. | Hand contouring began with the 2010 annual report and continues | Contouring is included in the 2011–2012 and 2012–2013 monitoring reports and vadose zone investigation and conceptual site model update. | U.S. Navy 2012b, 2013c, and 2013f |
| 7 | **OU 1 Area 6**<br>Assess the need for a ROD amendment to establish a 1,4-dioxane cleanup level. | In 2011 EPA and Navy determined that a ROD amendment is needed. | The due date for the ROD amendment was originally December 2013. In July 2013, the EPA and Navy decided that the ROD amendment will be deferred until completion of the ISCO treatability study. | NA |

## Table 5-1 (Continued)
## Summary of Progress Since Last 5-Year Review

| Item No. | Recommendation/Follow-up Action From Third 5-Year Review (September 2009) | Completion Date | Notes Regarding Completion | Reference |
|---|---|---|---|---|
| 8 | Contact Island County annually during the institutional controls inspection and confirm that the restriction is still in place and no additional wells have been installed. | Complete, annual inspections initiated 2009 | Island County is contacted annually during land use control site inspections. | U.S. Navy 2011a, 2011d, 2012a, and 2013b |
| **Operable Unit 2** | | | | |
| 9 | **OU 2 Area 2**<br>Take steps to remove the two drums observed at this area. | June 2007 | Drums removed by NAS Whidbey | U.S. Navy 2013b |
| 10 | **OU 2 Areas 2/3**<br>Maintain land use controls, update LUC Implementation Plan and update maps. | LUC maintenance ongoing, LUC Implementation Plan and maps updated | NA | U.S. Navy 2011a, 2011d, 2012a, and 2013b |
| | Discontinue monitoring for 1,1-dichloroethene and 1,4-dichlorobenzene. Conduct groundwater monitoring during the next 5-year-review period for total and dissolved arsenic, total and dissolved manganese, and vinyl chloride. | December 2013 | Results discussed in Section 6.4 | Pending |
| 11 | **OU 2 Area 4**<br>Maintain land use controls. | Complete, annual inspections initiated 2009 | NA | U.S. Navy 2011a, 2011d, 2012a, and 2013b |
| | Discontinue monitoring for 1,1-dichloroethene and 1,4-dichlorobenzene. Conduct groundwater monitoring during the next 5-year-review period for total and dissolved arsenic. | December 2013 | Results discussed in Section 6.4 | Pending |
| 12 | **OU 2 Area 29**<br>Maintain land use controls. | Complete, annual inspections initiated 2009 | NA | U.S. Navy 2011a, 2011d, 2012a, and 2013b |
| | Conduct groundwater monitoring during the next 5-year-review period for total and dissolved arsenic. | December 2013 | Results discussed in Section 6.4 | Pending |

## Table 5-1 (Continued)
## Summary of Progress Since Last 5-Year Review

| Item No. | Recommendation/Follow-up Action From Third 5-Year Review (September 2009) | Completion Date | Notes Regarding Completion | Reference |
|---|---|---|---|---|
| 13 | **OU 3 Area 16**<br>Maintain land use controls. | Complete, annual inspections initiated 2009 | NA | U.S. Navy 2011a, 2011d, 2012a, and 2013b |
| | Clean out the catch basin associated with the 2006 sampling location 16-2 to remove sediment containing elevated total petroleum hydrocarbon concentrations. | February 2014 | Catch basin cleanout and sediment sampling completed. | Document pending |
| | Collect sediment samples from previous locations during the next 5-year review period for the same COCs as the 2006 event. | February 2014 | TPH was identified above RG. No other COC identified at a concentration greater than RG. | Document pending |
| 14 | **OU 5 Area 1**<br>Conduct annual inspection of the shoreline side of the landfill. | 2009, 2010, 2011, 2012, and 2013 | Annual erosion monitoring is occurring during LUC inspection. During 2012 and 2013 time-critical and non-time critical removal actions were completed. See Section 6.5. | U.S. Navy 2011a, 2011d, 2012a, 2013b, and 2013d |
| 15 | **OU 5 Area 31**<br>RRO, styrene, and toluene monitoring should be discontinued. Monitor annually for DRO, GRO, benzene, naphthalene, and vinyl chloride at wells MW31-9A and OWS-1 until the next 5-year review. Monitor annually well MW31-11 for total and dissolved manganese only. | Complete | MW31-11 is abandoned and manganese has been added to the analyte list for site wells MW31-9A and OWS-1. Results discussed in Section 6.4 | U.S. Navy 2013c (August 2012 data) |
| 16 | **OU 5 Area 52**<br>Conduct sediment pore water monitoring at all 6 previously established locations using push probe. It was determined that the shoreline erosion control was also needed at Area 52. | December 2013 | Results discussed in Section 6.4, during 2012 and 2013 time-critical and non-time critical removal actions were completed in 2012. | Pending |

## Table 5-1 (Continued)
## Summary of Progress Since Last 5-Year Review

Notes:
COCs - chemical of concern
DRO - diesel-range organics
EPA - U.S. Environmental Protection Agency
GRO - gasoline-range organics
ISCO - in situ chemical oxidation
NA - not applicable
NAVFAC NW - Naval Facilities Engineering Command Northwest
OU - operable unit
PQL - practical quantitation limit
RG - remediation goal
ROD - Record of Decision
RRO - residual-range organics
TBD - to be determined
VOCs - volatile organic compounds

# 6.0 FIVE-YEAR REVIEW PROCESS

This section identifies 5-year review team members, community notification and involvement in the 5-year review process, and documents reviewed. An evaluation is presented of data generated during the past 5 years, together with the results of site inspections and site interviews.

## 6.1 FIVE-YEAR REVIEW TEAM

The Navy is the lead agency for this 5-year review. Personnel from NAVFAC NW and NAS Whidbey Island represented the Navy in this 5-year review. Project managers and other staff from the EPA and other stakeholder groups have also participated in the review process. Both the EPA and Ecology are cosignatories of the RODs for NAS Whidbey Island.

## 6.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

There are specific requirements pursuant to CERCLA Section 117(a), as amended, for certain reports to be released to the public and for the public to be notified of proposed cleanup plans and remedial actions. The Navy's community notification and involvement activities related to NAS Whidbey Island are described in the sections that follow.

### 6.2.1 History of Community Involvement

Community relations activities have established communication between the citizens living near the site, other interested organizations, the Navy, EPA, and Ecology. The actions taken to satisfy the statutory community involvement requirements have also provided a forum for citizen involvement and input to site remedial activities. The community involvement activities at the site have included the following:

- Development of a community relations plan
- Periodic meetings of the Technical Review Committee (TRC) and later the Restoration Advisory Board (RAB) that replaced the TRC in February 1994
- Public meetings
- Newspaper advertisements

The RAB (or its predecessor, the TRC) was involved in the review and comment process for all project documents. The RAB included representatives from the Navy and regulatory agencies, as well as civic, private, city government, and environmental activist groups.

The Navy has generally conducted semiannual RAB meetings in April and October every year during this review period. Members of the community were invited to these meetings. Meeting times and locations were announced in the *Whidbey News – Times* approximately two weeks prior to each meeting. Meeting topics included status of CERCLA sites at NAS Whidbey and planned activities.

### 6.2.2 Community Involvement During the Five-Year Review

A notice of intent was published by the Navy on March 18, 2014, in the *Whidbey News – Times* informing the public of the Navy's intent to perform the fourth 5-year review, when, where, and how they could receive information, and how to provide comments on the protectiveness of the remedy.

A notice of availability was published in the *Whidbey News – Times* on July 5, 2014, informing the public of the availability of the Draft Final Fourth 5-Year Review, establishing a 30-day public comment period, and providing direction as to how to provide comments on the protectiveness of the remedy. At the conclusion of the 5-year review process, a notice of completion will be published in the *Whidbey News – Times*.

## 6.3 DOCUMENT REVIEW

Documents reviewed during this 5-year review were primarily those that established the remedies and those describing the progress on construction and monitoring of the selected remedies during the time period January 2008 to December 2013 or February 2014, where available. Earlier documents were reviewed as needed to establish a complete summary of the site history. The primary documents that were reviewed were:

- The RODs (U.S. Navy, Ecology, and USEPA 1992, 1993a, 1993b, 1994, 1995, and 1996)
- The first, second, and third 5-year review reports (U.S. Navy 1998, 2004b, and 2009b)
- LUC inspection work plan (U.S. Navy 2012d)

- The recent monitoring reports 2008 to early 2013 (U.S. Navy 2009a, 2009c, 2010, 2011b, 2012b, and 2013c)
- The previous and current LUC implementation plans (U.S. Navy 2009d and 2014c)
- The recent LUC site inspection reports for 2009, 2010, 2011, and 2012 (U.S. Navy 2011d, 2011a, 2012a, and 2013b)
- O&M manual for Area 6 (U.S. Navy 2002b)
- O&M technical memoranda Area 6 (U.S. Navy 2012c and 2013e)
- Fourth 5-year review sampling and analysis plan (U.S. Navy 2013a)
- Fourth 5-year review sampling results (reference pending completion)
- Other relevant reports, such as, technical memoranda (U.S. Navy 2011c) and vadose zone investigation (U.S. Navy 2013f)

## 6.4 DATA REVIEW

This section summarizes trends in chemical data collected through the various monitoring programs at NAS Whidbey Island from January 2008 through February 2014, where available. The monitoring programs are described in Section 4, and the implications of the data regarding the functionality and protectiveness of the remedies are discussed in Section 7. Site inspection results are discussed separately in Section 6.5.

### 6.4.1 OU 1 Area 6 Monitoring Data

#### *Groundwater*

The groundwater monitoring schedule comprises sampling of approximately 40 wells on a semiannual basis. The current monitoring program was adopted during August 2009 and available data results are through February 2013. Groundwater monitoring locations are shown on Figure A-1 (Appendix A). Surface water and production well sampling locations are shown on Figure A-2. The distribution of VOCs has generally been described as comprising two plumes: the western plume located along the western property boundary, which consists primarily of TCE, 1,1,1-TCA, 1,1-DCA, cis-1,2-DCE, and 1,1-DCE, and the southern plume located in the southern and southeastern portion of the site, which consists primarily of vinyl chloride and 1,4-dioxane.

Figure A-3 (Appendix A) depicts the potentiometric surface of the shallow aquifer for the February 4 to 14, 2013, sampling period. The groundwater flow direction and gradient observed are similar to observations made during the course of the treatment system operation. The primary groundwater flow direction in the shallow aquifer is to the south beneath the landfill and to the south-southeast south of the landfill. The average horizontal hydraulic gradient is approximately 0.005 foot, per foot which is similar to observations made over the lifetime of operation (U.S. Navy 2013c).

To summarize the detailed discussion that follows, VOC concentrations in groundwater have generally decreased over the past 5 years, and overall, VOC concentrations have decreased an order of magnitude since installation of the extraction and treatment system. Some VOCs have migrated beyond the western and southern boundaries of the site, but do not currently threaten potential groundwater users. It is expected that the hydraulic gradient induced by pumping groundwater from extraction well PW-5 will capture those VOCs that have migrated across the western property boundary as they migrate south in groundwater. The southern boundary infringement is slowed by pumping at well PW-5, and the target drawdown in this area must be carefully maintained to ensure upgradient plume capture.

Cumulative summaries of analytical results for influent, effluent, production well, swale surface water, and monitoring well samples are provided in Tables A-1 through A-4 (Appendix A). Cumulative summaries of concentration trends for TCE, 1,1,1-TCA, and 1,4-dioxane in production and monitoring well samples are provided in Tables A-5 through A-7.

***Treatment Plant Data***

VOC concentrations in the treatment plant effluent and swale samples are monitored for:

- TCE
- 1,1,1-TCA
- 1,1-DCA
- cis-1,2-DCE
- 1,1-DCE
- Vinyl chloride

None of these compounds were measured at concentrations that exceeded the effluent limits specified in the sampling and analysis plan and ROD during the third 5-year review (U.S. Navy 2007a) or the fourth 5-year review period (U.S. Navy 2013c). These results indicate that the treatment plant is operating as intended. 1,4-Dioxane is currently cycling through the system untreated. Some of the 1,4-dioxane effluent and surface water results exceed the MTCA Method B level of 0.44 μg/L. Concentration trends for TCE, 1,1,1-TCA, 1,1-DCE, vinyl chloride, and 1,4-dioxane treatment plant influent samples are plotted on Figure A-4. The plots show that influent concentrations been relatively consistent during this review period.

Treatment system effluent was also monitored for 1,4-dioxane during the review period. Since the treatment system was not designed to address 1,4-dioxane, the effluent contained 1,4-dioxane at concentrations greater than the MTCA Method B cleanup level of 0.44 µg/L.

### *COC Distribution and Plume Definition*

The 1997 and February 2013 distributions of monitored VOCs and 1,4-dioxane in groundwater are shown on Figures A-5 through A-10 (Appendix A). The 1997 to 2013 data show that there is a general decrease in concentrations and a reduction in plume area for:

- TCE
- 1,1,1-TCA
- 1,1-DCE
- cis-1,2-DCE
- Vinyl chloride

Data for 1,4-dioxane (Figure A-10) indicate that distributions of this contaminant in groundwater have increased to the south of the site and are moving beyond the existing monitoring network. 1,1-DCA data were not included in this evaluation because reported concentrations have not exceeded the established groundwater cleanup level of 800 µg/L in any sample collected at the site.

The RG for TCE in groundwater is 5 µg/L. As shown on Figure A-5 (Appendix A), TCE is present in groundwater along the western site boundary. Concentrations of TCE within the central core of the plume have decreased from over 400 µg/L in 1997 to less than 100 µg/L in 2013. The southern extent of the TCE plume containing measured concentrations above the RG no longer extend beyond the southwest corner of the Area 6 boundary onto the Oak Harbor Landfill (Figure A-5).

TCE data obtained from groundwater samples collected in February 2013 show an order of magnitude reduction in concentrations within the central core of the plume since 1997. In addition, the site area containing TCE concentrations above the 5 µg/L cleanup level has been reduced. These data indicate that the TCE plume has been captured by the extraction wells located at the southern site boundary. The only well along the southern property boundary to yield water containing TCE at a concentration greater than the RG is extraction well PW-5, which is positioned to intercept the groundwater plume at the southern property boundary. TCE does extend off property to the west, as indicated by samples collected from monitoring wells 6-S-21, MW-07, and 6-S-6 (Figure A-5), at a concentration above the RG. However, the interpolated data indicate that the western extent of the TCE plume has shrunk and is retreating back to the western Area 6 property boundary under pumping conditions.

The RG for 1,1,1-TCA in groundwater is 200 μg/L. The May 1997 distribution of 1,1,1-TCA in groundwater (Appendix A, Figure A-6) is similar to the TCE distribution. As such, the central core of the 1,1,1-TCA plume also migrated south to locations just beyond the southern site boundary. Concentration data from February 2013 indicate a reduction in area where 1,1,1-TCA was reported above the RG. This area no longer extends beyond the southern boundary of the site. A tongue of the 1,1,1-TCA plume extends beyond the southern Area 6 boundary onto the Oak Harbor Landfill (Figure A-6) at concentrations below the RG. The 2013 data indicate that 1,1,1-TCA also extends across the site boundary to the west at a concentration above the RG. However, there is no evidence that the plume is expanding in that direction.

The compliance level for 1,1-DCE was increased to the MCL of 7 μg/L "as agreed by EPA in the June 6, 2006 meeting." Subsequent discussion will use this as the cleanup level. The May 1997 distribution of 1,1-DCE in groundwater (Appendix A, Figure A-7) is generally similar to the TCE and 1,1,1-TCA distributions. The central core of the 1,1-DCE plume has migrated south with the highest measured concentration (130 μg/L) in extraction well PW-5 located at the southern site boundary. Similar to TCE and 1,1,1-TCA, a tongue of the 1,1-DCE plume extends beyond the southwest corner of the Area 6 boundary onto the Oak Harbor Landfill (Figure A-7) at a concentration above the cleanup level. The 1997 data indicate that 1,1-DCE also extended across the site boundary to the west at a concentration above the cleanup level. Concentration data from February 2013 indicate a reduced area where 1,1-DCE was reported above the established cleanup level, with no concentration above 72 μg/L (well PW-5). A tongue of the 1,1-DCE plume extends a short distance beyond the southern Area 6 boundary onto the Oak Harbor Landfill (Figure A-7) at concentrations above the cleanup level. The 2013 data indicate that 1,1-DCE also extends across the site boundary to the west at a concentration above the cleanup level, but these data suggest that the plume is not expanding or continuing to migrate in that direction.

The RG for cis-1,2-DCE in groundwater is 70 μg/L. In 1997, cis-1,2-DCE was present in groundwater along the western site boundary at concentrations above the RG within the north central core of the contaminant plume (Appendix A, Figure A-8). Concentrations of cis-1,2-DCE were not measured above the RG in any of the February 2013 groundwater samples (Figure A-8). The last groundwater sample from the site to contain cis-1,2-DCE at a concentration greater than the RG was collected from source area well PW-1 on February 22, 2008.

The OU 1 ROD RG for vinyl chloride was identified as the PQL at the time the ROD was executed. The cleanup level for vinyl chloride in groundwater is 0.029 μg/L, which is now considered to be the PQL for vinyl chloride analyses in groundwater. The distribution of vinyl chloride in groundwater is shown on Figure A-9 (Appendix A). In 1997, vinyl chloride was present in groundwater along the south-central site boundary, with a reported maximum concentration of 4.4 µg/L in well 6-S-29 located at the site boundary. Interpolation of data in 1997 was limited by the PQL at the time. February 2013 data indicate that vinyl chloride in groundwater at concentrations greater than the cleanup level still extend beyond the southern property site boundary, with a maximum reported concentration of 3.1 µg/L in downgradient well 6-S-43. The February 2014 sample from well 6-S-43 contained 2.9 µg/L vinyl chloride. From August 2010 to February 2014, vinyl chloride has increased from 2.7 to 2.9 µg/L in samples from well 6-S-43. During this time, vinyl chloride has fluctuated from a low of 1.8 µg/L in the August 2011 sample to a high of 3.7 µg/L in the August 2012 sample.

A cleanup level for 1,4-dioxane was not established in the ROD. The MTCA Method B groundwater cleanup level for 1,4-dioxane was previously established at 4 µg/L. However, the MTCA Method B cleanup level for 1,4-dioxane in groundwater was lowered an order of magnitude to 0.44 µg/L in 2011. The 2003 distribution of 1,4-dioxane in groundwater, shown on Figure A-10 (Appendix A), extends off site to the south at a concentration greater than the former MTCA Method B groundwater cleanup level of 4 µg/L. 1,4-Dioxane was not detected at concentrations greater than the MTCA Method B groundwater cleanup level in samples collected quarterly between May 2005 and November 2006 from approximately a dozen private wells off site to the south and east. However, 1,4-dioxane was reported at concentrations above the revised cleanup level in February 2013 groundwater samples collected from downgradient wells 6-S-41 (0.82 µg/L), 6-S-42 (12 µg/L), 6-S-43 (4.6 µg/L), MW-03B (0.94 µg/L), and 6-DW-38 (6.2 µg/L). These data suggest that 1,4-dioxane has migrated beyond the downgradient extent of the groundwater monitoring network at concentrations above the revised cleanup level (0.44 µg/L).

### *COC Concentration Trends in Monitoring Wells*

Monitoring well data results for the fourth 5-year review period (2008 to 2013) are summarized as follows (from U.S. Navy 2013f):

- Eight source area wells located within the identified contaminant release area, immediately upgradient from the release area, or immediately downgradient from the release area

- Eleven midplume wells located along the contaminant plume between the source area and the capture zone: Three are situated along the centerline of the plume, three along the western plume margin, and five along the eastern plume margin.

- Eleven capture zone wells located within the portion of the site where active groundwater pumping occurs at multiple, closely spaced locations: Five are static monitoring wells and the remaining six wells are active pumping wells.

- Seven downgradient wells: Four are on-site monitoring wells located downgradient from the capture zone wells, and three are situated off site along Washington State Highway 20.

Of the wells listed above, nine that were sampled between 1991 and 2007 were not sampled between 2008 and 2013. Trends could not be estimated for seven wells because results at these locations were reported as not detected, or there were not enough results to provide meaningful trends.

The data trends of the four study areas are summarized below. Table 6-1 shows the decision criteria and interpretation of the statistical analysis. Concentration trend analysis summaries are presented for TCE, 1,1,1-TCA, vinyl chloride, and 1,4-dioxane in Tables 6-2, , 6-3, 6-4, and 6-5, respectively. The trend graphs for these four chemicals are presented in Appendix A. Trends are discussed by location at the site: source area wells, midplume wells, capture zone wells, and downgradient wells. Trends for vinyl chloride are limited to downgradient wells. Data through August 2013 were used for all analytes except vinyl chloride, which included February 2014 data. The daughter products 1,1-DCE, cis-1,2-DCE, 1,1-DCA, and vinyl chloride were not analyzed by trends analysis. For well locations where trends were analyzed but the locations were outside the study areas, results are presented under “Wells Located Outside Study Areas.” The rationale for determining concentrations are decreasing over time (U.S. Navy 2013f) is summarized in Table 6.1.

**Source Area Wells.** In general, the trend analyses for source area well groundwater results from 2008 through 2013 indicate that concentration trends for TCE, 1,1,1-TCA, and 1,4-dioxane are decreasing. The concentration trends at greater than 95 percent confidence level are as follows:

- Decreasing for TCE in five of the six wells
- Decreasing for 1,1,1-TCA in five of the six wells
- Decreasing for 1,4-dioxane in six of the six wells. Two wells (6-S-21 and 6-S-22) were not sampled during this time period.

TCE results from source area wells for the period 2008 through 2013 indicate that concentrations are trending downward in the following wells:

- 6-S-30, N6-38
- PW-1 (pumping well)
- N6-37
- 6-S-31

No trend could be estimated for well 6-S-10 because results were below the detection level. The following wells had detections above the TCE cleanup level:

- N6-38 (1 out of 10)
- PW-1 (10 out of 10)
- N6-37 (9 out of 10)
- 6-S-31 (10 out of 10)

Concentrations of TCE have consistently decreased from 130 µg/L (February 2008) to 65 µg/L (February 2013) in groundwater samples from pumping well PW-1 (Appendix A, Table A-4) during this review period. Concentrations of TCE have decreased from 97 µg/L (August 2008) to 13 µg/L (February 2013) in groundwater samples from monitoring well N6-37 (Appendix A, Table A-4) during this review period. Monitoring well N6-37 is located approximately 120 feet east (cross gradient) of PW-1.

1,1,1-TCA results from source area wells for the period 2008 through 2013 indicate that concentrations are trending downward in the following wells:

- 6-S-30
- N6-38
- PW-1
- N6-37
- 6-S-31

The trend is flat to increasing in well 6-S-10, however the average concentration over the review period was 0.52 µg/L. No source area well had detections above the 1,1,1-TCA cleanup level.

1,4-Dioxane results from source area wells for the period 2008 through 2013 indicate that concentrations are trending downward in all six wells, 6-S-30, 6-S-10, N6-38, PW-1, N6-37, and 6-S-31. All six wells had detections above the 1,4-dioxane MTCA B level.

**Midplume Wells.** In general, the trend analyses for midplume well groundwater results from 2008 through 2013 indicate that concentration trends for TCE are decreasing, for 1,1,1-TCA are flat to decreasing, and for 1,4-dioxane are flat to decreasing. The concentration trends at greater than 95 percent confidence level are decreasing for TCE in 5 of the 6 wells, for 1,1,1-TCA in 2 of the 6 wells, and for 1,4-dioxane in 2 of the 6 wells. Four wells (6-S-11, 6-S-12, 6-S-23, and MW-8) were not sampled during this time period. No trend could be estimated for well 6-S-15 because either it was not sampled, or limited data are available (not enough to provide meaningful trend information) for this review period.

TCE results from midplume wells for the period 2008 through 2013 indicate that concentrations are trending downward in the following wells:

- MW-7
- PW-3 (pumping well)
- 6-S-6
- 6-S-24
- MW-10

No trend could be estimated for well 6-S-14 because results were below the detection level. The following wells had detections above the TCE cleanup level:

- MW-7 (10 out of 10)
- PW-3 (11 out of 11)
- 6-S-6 (8 out of 8)

Concentrations of TCE have consistently decreased from 110 µg/L (February 2008) to 55 µg/L (February 2013) in groundwater samples from pumping well PW-3 (Appendix A, Table A-4) during this review period. Pumping well PW-3 is located along the plume centerline approximately 750 feet downgradient of PW-1. Concentrations of TCE have decreased from 80 µg/L (February 2008) to 46 µg/L (February 2013) in groundwater samples from monitoring well MW-7 (Appendix A, Table A-4) during this review period. Monitoring well MW-7 is located approximately 400 feet downgradient of PW-1 and 350 feet upgradient of PW-3.

1,1,1-TCA results from midplume wells for the period 2008 through 2013 indicate that concentrations are trending downward in wells MW-7 and 6-S-24. Data from wells PW-3, 6-S-6, and MW-10 indicate flat to decreasing concentrations. No trend could be estimated for well 6-S-14 because most of the results were below the detection level. Only well 6-S-06 had results (8 out of 8) that exceed the 1,1,1-TCA cleanup level. Concentrations of 1,1,1-TCA have fluctuated in groundwater samples from 6-S-6 with concentrations ranging from 220 µg/L (February 2013) to 890 µg/L (August 2009). The average concentration of samples from 6-S-6 was 533 µg/L during the review period (Appendix A, Table A-6).

1,4-Dioxane results for the midplume wells during the period 2008 through 2013 indicate that concentrations are trending downward in wells MW-7 and 6-S-6. Data from PW-3, 6-S-14, and MW-10 indicate flat to decreasing concentrations. Data from well 6-S-24 indicate a flat to increasing concentration trend. All six wells had most detections above the 1,4-dioxane MTCA Method B level.

**Capture Zone Wells.** In general, the trend analyses for capture zone well groundwater results from 2008 through 2013 indicate that concentration trends are decreasing for TCE in 7 of the 9 wells, for 1,1,1-TCA in 6 of 9 wells, and for 1,4-dioxane in 5 of 9 wells (includes three wells with flat to decreasing trends). Flat to increasing concentration trends were identified for TCE in well PW-9, for 1,1,1-TCA in wells PW-6 and PW-4, and for 1,4-dioxane in wells 6-S-25 and PW-5. Increasing concentration trends were found for TCE in well 6-S-25, for 1,1,1-TCA in well MW-5, and for 1,4-dioxane in well PW-8. Wells 6-S-13 and 6-S-28 were not sampled during this time period.

TCE results from the capture zone wells for the period 2008 through 2013 indicate that concentrations are trending downward in the following wells:

- MW-5
- 6-S-27
- PW-4 through PW-8

Data from PW-9 indicate a flat to increasing concentration trend. Data from well 6-S-25 identified increasing concentrations. It should be noted that TCE concentrations measured from wells 6-S-25 and PW-9 during this review period were below the MCL of 5 µg/L. Only well PW-5 had results (8 out of 8) that exceed the TCE cleanup level. Concentrations of TCE in groundwater samples from pumping well PW-5 decreased from 110 µg/L (April 2009) to 68 µg/L (February 2013) (Appendix A, Table A-4).

1,1,1-TCA results from the capture zone wells for the period 2008 through 2013 indicate that concentrations are trending downward in the following wells:

- PW-5
- PW-7
- PW-8
- PW-9
- 6-S-25
- 6-S-27

Data from pumping wells PW-4 and PW-6 identified flat to increasing concentration trends. It should be noted that 1,1,1-TCA concentrations measured from wells PW-4 and PW-6 during this review period were below the RG (MCL) of 200 µg/L. The following wells had detections above the 1,1,1-TCA cleanup level:

- 6-S-25 (4 out of 10)
- PW-5 (2 out of 8)

- MW-5 (4 out of 10)

Data from well MW-5 indicate increasing concentration trends. However, pumping was not occurring from PW-5 between February 2008 and December 2008. Pumping well PW-5 is approximately 300 feet northwest (up- and somewhat crossgradient) of MW-5. 1,1,1-TCA concentrations in groundwater samples from MW-5 varied as shown in the following bullets:

- 2/25/08 – 16 µg/L
- 8/26/08 – 13 µg/L
- 4/28/09 – 12 µg/L
- 8/19/09 – 8.1 µg/L
- 8/4/10 – 5.5 µg/L
- 2/20/11 – 600 µg/L
- 8/9/2011 – 790 µg/L
- 2/7/12 – 750 µg/L
- 8/8/12 – 310 µg/L
- 2/7/13 - 170 µg/L

Concentrations of 1,1,1-TCA decreased in MW-5 groundwater samples from February 2008 through August 2010. However, 1,1,1-TCA concentrations jumped two orders of magnitude in the February 2011 sample and increased again in the August 2011 sample. Concentrations of 1,1,1-TCA then decreased to a level below the RG of 200 µg/L in February 2013 sample from MW-5 (U.S. Navy 2013c), indicating restoration of the capture zone. This pattern is likely the result of the February 2008 to December 2008 suspension of pumping from PW-5 due to pump failure. A similar pattern is observed for 1,1-DCE concentrations in groundwater samples from MW-5. However, the magnitude of the increase is far lower than for 1,1,1-TCA and 1,1-DCE concentrations were never measured above the MCL of 7 g/L (U.S. Navy 2013c). This pattern was not observed for TCE, 1,1-DCA, cis-1,2-DCE, vinyl chloride, or 1,4-dioxane in groundwater samples from MW-5.

1,4-Dioxane results from the capture zone wells for the period 2008 through 2013 indicate that concentrations are trending downward in wells MW-5 and PW-4. Data from wells PW-6, PW-7 and PW-9 indicate flat to decreasing concentration trends. Data from wells 6-S-25 and PW-5 indicate a flat to increasing concentration trend. Data from pumping well PW-8 indicates an increasing concentration trend. No 1,4-dioxane trend could be estimated for well 6-S-27 because all of the results were below the detection level. Six wells had all detections above the 1,4-dioxane MTCA Method B level:

- PW-4
- PW-5

- PW-6
- PW-8
- PW-9
- MW-5

**Downgradient Wells.** In general, the trend analyses for downgradient well groundwater results from 2008 through 2013 indicate concentration trends are decreasing for TCE in 4 of the 7 wells, for 1,1,1-TCA in 5 of 7 wells (count includes well 6-S-19, with flat to decreasing trends), and for 1,4-dioxane in 4 of 7 wells (count includes well 6-S-19, with flat to decreasing trends). Flat to increasing concentration trends were identified for 1,1,1-TCA in wells MW-9 and 6-S-43 and for 1,4-dioxane in well 6-S-41. Increasing concentration trends were found for 1,4-dioxane in two off-site wells:

- 6-S-42
- 6-S-43

TCE results from downgradient wells for the period 2008 through 2013 show that concentrations are trending downward at the four on-site downgradient wells:

- 6-S-29
- MW-9
- 6-S-19
- 6-S-3

Data for the three off-site downgradient wells 6-S-41, 6-S-42, and 6-S-43 were not detected for this review period, and therefore no trend analysis could be estimated. No result exceeded the TCE cleanup level.

1,1,1-TCA results from downgradient wells for the period 2008 through 2013 indicate that concentrations are trending downward in the following wells:

- 6-S-29
- 6-S-3
- 6-S-41
- 6-S-42

Data from well 6-S-19 indicate flat to decreasing concentrations. Data from wells MW-9 and 6-S-43 indicate flat to increasing concentrations. No result exceeded the 1,1,1-TCA cleanup level.

Vinyl chloride results from downgradient wells for the period of 2008 through 2013 show that concentrations are trending downward in the following wells:

- 6-S-03
- 6-S-19
- 6-S-29

Data from wells MW-9 and 6-S-42 indicate flat to decreasing trends. Data from well 6-S-43 indicate a flat to increasing trend. Trends in vinyl chloride concentrations were also evaluated for pumping wells PW-4, PW-8, and PW-9 along the southern boundary of Area 6. The trend in data from PW-8 is decreasing. The trend in data from PW-4 and PW-9 is flat to decreasing.

1,4-Dioxane results from downgradient wells for the period 2008 through 2013 indicate that concentrations are trending downward in on-site wells 6-S-29, 6-S-03, and MW-9. Results obtained for on-site downgradient well 6-S-19 indicate a flat to decreasing concentration trend. Data from off-site downgradient well 6-S-41 indicate flat to increasing concentration trends. Data from off-site downgradient wells 6-S-42 and 6-S-43 indicate increasing concentration trends. The majority of detections for all seven wells were above the 1,4-dioxane MTCA B level of 0.44 µg/L. Groundwater monitoring data indicate that the 1,4-dioxane plume is not hydraulically captured. Groundwater modeling conducted as part of the ongoing treatability study/optimization suggests that current pumping is marginally slowing the migration rate of the off-site portion of the plume.

**Wells Located Outside Study Areas.** Wells 6-S-7 and 6-S-26 are located north of the source area wells. Well 6-S-7 results indicated no detection or no trend for VOCs and stable concentrations for 1,4-dioxane. Well 6-S-26 VOC results from 2008 through 2013 indicate no detection except for 1,1-DCA and 1,4-dioxane, and 1,4-dioxane concentrations indicated decreasing trends (U.S. Navy 2013c).

Wells 6-S-16 and 6-S-17 are located in the southeast corner of the Area 6 landfill. Well 6-S-16 is located to the east of the lower midplume study area and well 6-S-17 to the east of the upper capture zone study area. Results for the period 2008 through 2013 indicate that VOC concentrations for wells 6-S-16 and 6-S-17 are stable or increasing, and 1,4-dioxane concentrations are decreasing for both wells (U.S. Navy 2013c).

Wells 6-S-1, 6-S-2, and 6-S-40 are located on the far east of Area 6, parallel to the Navy fence line. However, well 6-S-2 is located much farther north than wells 6-S-1 and 6-S-40, which are located close to each another. VOC and 1,4-dioxane results were mostly not detected for the period 2008 through 2013 from well 6-S-2. All results were not detected for the period 2008 through 2013 for wells 6-S-1 and 6-S-40 (U.S. Navy 2013c).

Wells MW-3B and 6-DW-38 are located southwest and southeast of the downgradient wells. VOC concentrations from well MW-3B for the period 2008 through 2013 indicated both decreasing and increasing trends for VOCs and stable concentrations for 1,4-dioxane. Well 6-DW-38 is located southeast of the site. Results for both VOCs and 1,4-dioxane are mostly not detected and at low concentrations for samples from MW-3B. Groundwater samples from well 6-DW-38 have not contained detectable VOC concentrations. Concentrations of 1,4-dioxane in groundwater have increased from less than 0.16 µg/L in the August 2009 sample to 7.7 µg/L in the February 2014 sample.

**Soil Vapor Survey Results.** In 2001, six SVM locations were installed in and around Area 6 source zone, including one location within Site 55 (U.S. Navy 2013f). Vapor samples were collected in August 2001 and August 2003 in order to provide vertical characterization of CVOC concentrations. When compared to results of soil vapor surveys conducted in 1991 and 2000, it was concluded that deeper vadose zone soil VOC concentrations were not decreasing at Area 6. However, VOC vapor concentrations dropped sharply at shallow monitoring locations in the area in which the 2001 hotspot removal was conducted. Sampling from the six SVM points (from multiple depths) was also conducted in September 2010 and February 2011. An evaluation of 2001, 2003, 2010, and 2011 SVM results indicates that soil vapor concentrations increase with depth, but are, overall, decreasing over time. SESOIL modeling (U.S. Navy 2013f) suggests that the 2011 soil vapor concentrations are not indicative of soil that poses a significant, ongoing source of CVOCs to groundwater (U.S. Navy 2013f).

**Soil Concentrations in Source Area Results.** In 2001, a vertical characterization of soil was completed during the installation of the six SVM locations (U.S. Navy 2013f). An evaluation of the 2001 soil results compared to soil samples collected from proximal locations in 2011 indicate that concentrations have decreased to varying degrees (U.S. Navy 2013f). SESOIL modeling suggests that 2011 soil concentrations are not indicative of soil that poses a significant, ongoing source of TCE to groundwater. This conclusion is based on the available data. Given the observed groundwater concentrations in the source area, it is possible that vadose zone soil in areas not yet sampled could pose an ongoing source to groundwater. However, TCE and 1,4-dioxane concentrations in groundwater samples from source area monitoring wells and the pumping continue to decrease. Results of future groundwater monitoring conducted as part of remedy implementation and assessment will determine if the SESOIL model results are accurate (U.S. Navy 2013f).

### *Area 6 Monitoring Recommendations*

The monitoring program implemented in February 2008 and all changes made through 2013 (Table 4-1) should be maintained and amended, with EPA concurrence, as deemed appropriate by subsequent data. Since four of the VOC COCs continue to exceed the RGs and 1,4-dioxane continues to exceed the cleanup level, groundwater monitoring of the 8 production wells, 31 monitoring wells, and domestic wells 6-DW-48 for both VOCs and 1,4-dioxane should continue on a semiannual schedule. The following recommendations were made in the most recent 2012–2013 groundwater long-term monitoring report for OU 1 Area 6 (U.S. Navy 2013c) and should be appropriately followed through the 5-year review process:

- Since well 6-DW-38B is screened in the deep aquifer, the chance of well contamination is low. Well 6-DW-38B has been sampled sufficiently to prove that no contamination has entered the well. It should, therefore, be removed from future sampling events. If well 6-DW-38B is sampled in future sampling events, it should only be sampled once per 5-year review period to confirm that no contamination has entered the well (continued semiannual sampling is not necessary).

- Sampling at wells 6-S-11, MW-11, P-3, and P-4 was initiated in August 2013 to better define the 1,4-dioxane plume. Located west of the Area 6 boundary northwest of well PW-3, well 6-S-11 improves delineation at that location. Monitoring wells MW-11 and MW-15 are located east of the landfill cap in the area close to a previous effluent recharge well and downgradient of the older reinjection well field. These wells help determine the persistence of 1,4-dioxane in this area. Monitoring wells P-3 and P-4 located north of Area 6 across Ault Field Road on Navy property evaluate 1,4-dioxane concentrations in groundwater from the discharge swale in this area. This sampling should continue.

- To better define the 1,4-dioxane plume off site, additional monitoring wells should be considered to the southeast and southwest on the leading edge of the plume.

- If after the 2013 to 2014 year, samples collected at well 6-S-9 have not detected 1,4-dioxane, it should be dropped from the sampling schedule (see page 5-3 of U.S. Navy 2013c).

In addition to the above recommendations, the recommendations following the most recent 2011 soil vapor monitoring of Area 6 Site 55 and reported in the vadose zone investigation report (U.S. Navy 2013f) should also be followed through the 5-year review process and are listed below:

- Conduct vapor monitoring for CVOCs at Site 55 in 5 years to confirm decreasing concentration trends.

- Although the vadose zone sampling satisfied the requirement of the third 5-year review, a data gap exists to the east and southeast and should be appropriately addressed.
- Continue evaluating groundwater monitoring results for decreasing CVOC concentration trends in the source area (Site 55).

### 6.4.2 OU 2 Monitoring Data

#### *OU 2 Areas 2/3 Groundwater Monitoring*

Post-ROD groundwater sampling was conducted at Areas 2/3 in 1995, 2002, 2007, and most recently in December 2013 (U.S. Navy 2013a). Seven groundwater monitoring wells were sampled in July 2007: wells 3-MW-2, N2-3, N2-6C, N2-7S, N2-8, N2-9, and N3-12. Of these seven wells, N2-7S was dropped in the 2013 sampling because it appeared to be screened in a perched zone. It is not clear whether the ROD-specified decision criteria (cleanup levels) apply to the perched zone. Furthermore, the EPA suggested that it is likely not a usable aquifer. Well locations are shown on Figure 6-1. Groundwater samples collected in 2013 were analyzed for vinyl chloride according to EPA Method 8260B SIM, and total/dissolved arsenic and manganese were analyzed by EPA Method 6020A. Post-ROD results for analytes and wells sampled in 2013 are summarized in Table 6-6.

Prior to the 2013 sampling, 1,1-DCE and 1,4-dichlorobenzene results were not measured at concentrations greater than their cleanup levels in the 1995, 2002, or 2007 groundwater samples collected from the seven monitoring wells. Based upon these results, the third 5-year review recommended that monitoring of 1,1-DCE and 1,4-dichlorobenzene be discontinued at Areas 2/3. Vinyl chloride was measured in the samples from well N3-12 at decreasing concentrations over the same time period (1995 through 2007). Total arsenic was measured at concentrations greater than the cleanup level in the 2007 samples from four of the monitored wells (N2-3, N2-7S, N2-8, and N3-12). Total arsenic increased from 2002 to 2007 in samples from wells N2-3, N2-7S, and N2-8 and decreased in samples from well N3-12. Total manganese was measured at concentrations greater than the cleanup level in the 2007 samples from three of the monitoring wells (N2-6C, N2-7S, and N3-12). Total manganese decreased from 1995 through 2007 in samples from these three wells. The results of the 2013 sampling are summarized by chemical below.

The RG for vinyl chloride in groundwater at Areas 2/3 is 1 µg/L. In 2013, vinyl chloride was only detected at well N3-12 with a groundwater concentration of 2.5 µg/L, which exceeds the RG. Using SIM analysis, vinyl chloride concentrations were reported at less than the reporting limit of 0.02 µg/L in samples from the following wells:

- 3-MW-2
- N2-3
- N2-6C
- N2-8
- N2-9

None of these five wells has had detected vinyl chloride concentrations above the RG (1 µg/L) during the four sampling events (1995, 2002, 2007, and 2013). Vinyl chloride was measured in the 1995, 2002, and 2007 samples from well N3-12 at 12, 11 and 5.84 µg/L, respectively, all of which are greater than the cleanup level. However, these results together with the 2013 results show a decrease of vinyl chloride concentrations in this well since 1995.

The total arsenic RG in groundwater at Areas 2/3 is 7.7 µg/L. In 2013, total arsenic groundwater concentrations at all six wells (3-MW-2, N2-3, N2-6C, N2-8, N2-9, and N3-12) exceeded the cleanup level, with a maximum concentration of 190 µg/L at well N2-3. Total arsenic concentrations have increased at all six wells when compared to 2007 data. Total arsenic concentrations remained relatively consistent from 2002 to 2013 in samples from well N2-6C (8.9 to 5.92 to 8.3 µg/L). However, dissolved arsenic groundwater concentrations at wells 3-MW-2 and N2-8 did not exceed the cleanup level, and wells N2-3, N2-6C, and N2-9 only slightly exceeded the cleanup level at sampling locations correlated with totals analysis. The dissolved arsenic concentration of 40 µg/L at well N3-12 was the maximum concentration of the three wells that exceeded the cleanup level.

The total manganese RG in groundwater at Areas 2/3 is 125 µg/L. In 2013, total manganese groundwater concentrations at wells 3-MW-2, N2-6C, and N3-12 exceeded the cleanup level, with a maximum concentration of 4,300 µg/L at N3-12. For those well locations above the RG, total manganese concentrations have increased at wells 3-MW-2, N2-6C, and N3-12 when compared to 2007 and 2013 data. Dissolved manganese groundwater concentrations at wells 3-MW-2, N2-3, N2-8, and N2-9 did not exceed the RG and wells N2-6C (190 µg/L) and N3-12 (4,000 µg/L) exceeded the RG at sampling locations correlated with totals analysis.

The ROD remedy description also stipulated that Navy, U.S. EPA, and Ecology would evaluate the results and jointly determine what additional actions may be necessary if levels exceed ROD decision criteria (U.S. Navy, Ecology, and USEPA 1994).

### *OU 2 Areas 2/3 Monitoring Recommendations*

It is recommended based on its location and usability that well N2-7S be decommissioned. Groundwater monitoring should be conducted during the next 5-year review period at locations 3-MW-2, N2-3, N2-6C, N2-8, N2-9, and N3-12 for total and dissolved arsenic and manganese. Based on the 5 years of monitoring data, monitoring for vinyl chloride should be terminated at all locations except well N3-12. Monitoring for vinyl chloride should be conducted during the next 5-year review period at well N3-12. Vinyl chloride analysis should be conducted using SIM or other analytical method capable of producing a reporting limit less than the RG of 1 µg/L.

It is not conclusively determined whether or not arsenic and manganese in groundwater pose a risk. Therefore, it is recommended that an analysis of existing data be performed to determine if observed concentrations of arsenic and manganese in groundwater are background or pose an unacceptable risk. If necessary, additional data may be collected. If it is determined that the observed arsenic and manganese groundwater concentrations are background, monitoring will be terminated.

### *OU 2 Area 4 Groundwater Monitoring*

Post-ROD groundwater sampling was conducted at two monitoring wells at Area 4 in 1995, 2002, 2007, and December 2013. The two well locations 4MW-1 and 4-MW-3 are shown on Figure 6-1. Groundwater samples collected in 2013 were analyzed for total and dissolved arsenic according to EPA Method 6020A. Post-ROD arsenic results for wells sampled during 2013 are summarized in Table 6-7.

Prior to 2013, total arsenic was measured in the 1995, 2002, and 2007 samples from both wells at concentrations greater than the RG of 7.7 µg/L. Total arsenic decreased from 1995 to 2007 in groundwater from well 4-MW-1 (11 to 9.04 µg/L) and increased from 1995 to 2007 in groundwater from well 4-MW-3 (11.2 to 19.1 µg/L). In 2013, total arsenic groundwater concentrations at both wells exceeded the cleanup level of 7.7 µg/L, with a maximum concentration of 370 µg/L at well 4-MW-3. At well 4-MW-1, total arsenic results ranging from 8.8 to 11 µg/L demonstrate concentrations are consistent for the four sampling events (1995, 2002, 2007, and 2013). Total arsenic concentrations have increased from 1995 to 2013 in samples from well 4-MW-3 (11.2 to 10.6 to 19.1 to 370 µg/L). However, the dissolved arsenic groundwater concentration at well 4-MW-3 of 12 µg/L only slightly exceeds the cleanup level (correlated with totals analysis result of 370 µg/L). The dissolved arsenic concentration of 11 µg/L at well 4-MW-1 also slightly exceeds the cleanup level.

### *OU 2 Area 4 Groundwater Monitoring Recommendations*

The OU 2 ROD does not specify a groundwater remedy for Area 4. Dissolved arsenic in groundwater remains at concentrations slightly above decision criteria and concentrations appear stable. Given that LUCs are in place that include groundwater use prohibition and well installation, the EPA and Navy have agreed to discontinue groundwater monitoring at OU 2 Area 4.

### *OU 2 Area 29 Groundwater Monitoring*

Post-ROD groundwater sampling was conducted at Area 29 in 1995, 2002, 2007 and December 2013. The following three groundwater monitoring wells were sampled during the first three sampling years: 29-MW-4, N29-20, and N29-22D. Well N29-22d was dropped from the 2013 sampling program, because it was screened more than 10 feet below the aquifer of interest, down in the underlying metamorphic rocks, which are a natural source of arsenic unrelated to the source area. Well locations are shown on Figure 6-1. Groundwater samples collected in 2013 were analyzed for total and dissolved arsenic according EPA Method 6020A. Post-ROD arsenic results for wells sampled during 2013 are summarized in Table 6-8.

Total arsenic was measured in the 1995, 2002, and 2007 samples from all three wells (29-MW-4, N29-20, and N29-22D ) at concentrations greater than the cleanup level of 7.7 µg/L. In 2013, sampling was conducted only at well 29-MW-4, and the total arsenic result of 9.1 µg/L slightly exceeds the cleanup level. Total arsenic concentrations from well 29-MW-4 remain relatively consistent for the four sampling events. One dissolved arsenic groundwater concentration collected in 2013 at well 29-MW-4 of 8.3 µg/L only slightly exceeds the cleanup level (correlated with totals analysis result of 9.1 µg/L). Well N29-20 could not be sampled in 2013 because of an obstruction blocking the sampling equipment. Well N29-22D was not included in the 2013 field sampling event.

### *OU 2 Area 29 Groundwater Monitoring Recommendations*

It is recommended that well N29-22D be decommissioned because of its screening location within a naturally occurring arsenic area.

The OU 2 ROD does not specify a groundwater remedy for Area 29. Dissolved arsenic in groundwater remains at concentrations slightly above decision criteria, however, arsenic was not identified as a COC for the completed remedy at the site. Dissolved arsenic concentrations were very low in shallow wells and increase with depth. It is the Navy and EPA opinion that the arsenic is naturally occurring. LUCs that include a groundwater use prohibition and well installation are in place. Based on these conditions, EPA and Navy have agreed to discontinue groundwater monitoring at OU 2 Area 29.

### 6.4.3 OU 3 Catch Basin Sediment Sampling Data

Two sediment samples were collected from catch basin at Location 16-2 at OU 3 Area 16. Sediment sampling was conducted on January 27, 2014 (U.S. Navy 2014d). Location 16-2 is a catch basin that appears to be a confluence for multiple surface drainage areas of the airfield and is downgradient of Site 31, Fire Fighting School. Sediment samples were analyzed for arsenic, lead, 2-methylnaphthalene, benzo(k)fluoranthene, dibenz(a,h)anthracene, phenanthrene, and total petroleum hydrocarbons (TPH) in the diesel range and the residual range.

Results are summarized in Table 6-9. Diesel-range TPH was measured using the NWTPH-Dx method at concentrations of 1,600 and 2,000 milligrams per kilogram (mg/kg) in the catch basin sediment samples. These results are above the ROD RG of 200 mg/kg. The second result is above the Washington MTCA Method A cleanup level for soil of 2,000 mg/kg. Residual-range TPH (or motor-oil range) was also measured using the NWTPH-Dx method. Residual-range TPH was measured at concentrations of 3,300 and 4,600 mg/kg in the catch basin sediment samples. These results are above the ROD RG of 200 mg/kg and the Washington MTCA Method A cleanup level for soil (reference to come from TetraTech).

Arsenic was measured at estimated concentrations of 14 and 15 mg/kg in the sampled sediment, which is below the ecological-based ROD RG of 16 mg/kg. Lead was measured at concentrations of 72 and 79 mg/kg, which exceeds the background-based ROD RG of 18 mg/kg (reference to come from TetraTech).

The sediment samples contained 2-methylnaphthalene at concentrations of 270 and 360 mg/kg. These concentrations exceed the ecological-based ROD RG of 80. Benzo(k)fluoranthene, dibenz(a,h)anthracene, and phenanthrene were not measured at concentrations greater than their respective ROD RGs (Table 6-9) (reference to come from TetraTech).

#### *OU 3 Monitoring Recommendations*

Based on the results summarized in Table 6-9, it is recommended that sediment in the catch basin at location 16-2 be sampled once during the next five years for TPH in the diesel and residual ranges, lead, and 2-methylnaphthalene. This will enable the Navy to determine if additional catch basin cleanout is warranted. Sediment monitoring should be discontinued for TPH in the gasoline range, arsenic, phenanthrene, benzo[k]fluoranthene, and dibenz(a,h)anthracene.

### 6.4.4 OU 4 Monitoring Data

No monitoring was required for OU 4 during this review period.

### 6.4.5 OU 5 Monitoring Data

#### *OU 5 Area 1 Monitoring*

Seep sampling was conducted during January 2013 to evaluate if the seawall repair had enabled migration of petroleum hydrocarbons (U.S. Navy 2013d) along the Area 1 shoreline. Samples were collected at five seep locations for 1,1-dichloroethene, bis-2-ethylhexylphthalate, cyanide, and dissolved zinc. Dissolved zinc was measured in one of the five samples at a concentration of 100 µg/L, which is greater than the ROD RG of 76.6 µg/L. No other analyte was measured at a concentration greater than the ROD RG in the January 2013 seep samples.

Area 1 was used for disposal of demolition and construction debris from the construction of Seaplane Base between the 1940s and 1970s. The landfilled material is not expected to contain hazardous material that could pose a risk to human health or the environment. During ongoing erosion of the landfill over time, no hazardous material has been observed. This conclusion is also supported by seep/sediment pore water monitoring conducted in 2002, 2007, and 2013. The third 5-year review recommended that seep monitoring be discontinued. No further monitoring is recommended.

### *OU 5 Area 31 Groundwater Monitoring*

From years 2002 to 2007, groundwater samples at Area 31 were collected from six wells (OWS-1, OWS-3, OWS-4, MW31-9A, MW31-34, and MW31-35) on a quarterly basis (Note that no fourth quarter monitoring was performed in 2007). Prior to 2008, samples were analyzed for DRO, GRO, and RRO on a quarterly basis and for benzene, manganese, naphthalene, styrene, toluene, and vinyl chloride on an annual basis. Sampling was not performed in 2008 at Area 31, and thereafter monitoring was performed yearly. As stated in the third 5-year review, RRO, styrene, and toluene monitoring were discontinued, and limited sampling for manganese was resumed at well 31-09A in 2009 monitoring. In 2010, sampling was expanded to include GRO, DRO, benzene, naphthalene, toluene, and vinyl chloride only for wells MW31-9A and OWS-1.

The most recent available monitoring data was collected in August of 2012. Sampling locations are shown on Figure B-1 (Appendix B). A cumulative summary of laboratory-reported analytical results is provided in Table B-1 in Appendix B (U.S. Navy 2013c). During the 2012 annual sampling event, analytical results for DRO, GRO, benzene, and dissolved manganese concentrations exceeded their respective ROD RGs in monitoring wells 31-09A and OWS-1. These wells are located in the center of the area where the former free-product plume had been located.

The 2012 data indicate that no free product is present in any of the monitored wells. In addition, the residual fuel contaminants are contained in the vicinity of wells OWS-1 and MW31-9A and are not migrating downgradient off site. Field parameters continue to indicate that natural attenuation is occurring at the site (U.S. Navy 2013c). Water quality parameters of 2012 indicate that natural attenuation is likely occurring in groundwater at the two wells based on the observed anaerobic conditions and reducing environment.

DRO concentrations have remained consistently above the cleanup level in samples from wells OWS-1 and MW31-9A over the review period. DRO concentrations have fluctuated over this time period. However, in more recent sampling, DRO concentrations appear to be increasing at both wells. DRO concentrations in samples from well OWS-1 have increased from 8,700 µg/L in the March 2007 sample to 11,000 µg/L in the August 2012 sample. DRO concentrations in samples from MW31-9A have increased from 1,300 µg/L in the March 2007 sample to 5,100 µg/L in the August 2012 sample.

The distribution of GRO has been similar to DRO at this site, in that it has been measured at concentrations greater than the cleanup level of 1,000 µg/L in wells OWS-1 and MW31-9A. However, results from sampling from the last five sampling years (2007 to 2012) appear to be generally stable at both wells.

RRO concentrations have continued to remain below the cleanup level of 1,000 µg/L in all samples collected during the review period. RRO has not been measured at a concentration greater than the cleanup level in any of the samples collected over the last six monitoring events.

Benzene concentrations remain above the RG and appear to show a decreasing trend in well MW31-9A, but appear to be increasing in well OWS-1. Benzene concentrations have decreased in MW31-9A samples from 190 µg/L in May 2007 to 70 µg/L in 2012. Benzene in samples from well OWS-1 increased from 11 µg/L in May 2007 to 78 µg/L in 2012.

Dissolved manganese concentrations have remained consistently above the RG of 142 µg/L in annual samples collected from wells OWS-1 and MW31-9A during this review period. However, total and dissolved manganese concentrations appear generally stable in both wells. During this review, dissolved manganese concentrations have decreased in MW31-9A samples from 9,670 µg/L in May 2007 to 5,700 µg/L in 2012. The dissolved manganese concentration in the May 2007 well OWS-1 sample was 3,400 µg/L, slightly increasing to 4,130 µg/L in 2012.

Since the onset of monitoring in 2007, concentrations of naphthalene have never exceeded the RG in either well. Naphthalene concentrations have increased in both wells since May 2007. However, concentrations remain below the RG and appear stable. Vinyl chloride has remained below the RG in well MW31-9A for the last 2 years, and vinyl chloride concentrations appear to be decreasing in well OWS-1. Vinyl chloride concentrations have generally decreased in well MW31-9A groundwater samples from 0.61 µg/L in May 2007 to 0.09 µg/L in 2012. Vinyl chloride has also generally decreased in well OWS-1 samples from an estimated 0.42 µg/L in May 2007 to an estimated 0.19 µg/L in 2012.

### *OU 5 Area 31 Groundwater Monitoring Recommendations*

Based on the most recent 2012 observations and trends, it is recommended that annual monitoring continue for GRO, DRO, benzene, vinyl chloride, and manganese at wells 31-9A and OWS-1 as prescribed to allow time for the remedy of natural attenuation to effect a change. However, because naphthalene and RRO have remained below cleanup levels since 2007, it is recommended that monitoring for these COCs be discontinued at wells MW31-9A and OWS-1.

### *OU 5 Area 52 Groundwater Monitoring*

Prior to 2013 sampling, water samples were collected periodically at two Area 52 seep locations. Samples were collected at SP-4 in 1997, 1998, 1999, and 2007 and at SP-6 in 1997 and 2007. Sampled locations are shown on Figure 6-2. During 2007, sediment pore water samples were collected from approximately 36 inches below the ground surface at both sampled locations using PushPoint equipment. The purpose of the 2007 sampling was to confirm that dissolved petroleum hydrocarbons were not migrating to the marine environment at concentrations greater than groundwater cleanup levels following closure of the product recovery system at Area 52 in June 2007. Samples were collected in 2007 using an “MHE probe sampler” at two locations (SP-4 and SP-6) where surface materials were soft enough to allow probe penetration. Samples were not collected at the other four locations since flowing water was not observed. The probe was inserted approximately 12 inches below the surface for pore water sample collection.

Seep sampling was conducted during January 2013 to evaluate if the seawall repair had enabled migration of petroleum hydrocarbons (U.S. Navy 2013d) along the Area 52 shoreline. Samples were collected from six seep locations which were analyzed for DRO, GRO, RRO, vinyl chloride, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene. None of these analytes were measured at concentrations greater than their respective ROD cleanup level in the January 2013 seep samples.

In 2013, all 6 seep sampling locations (SP-1 through 6) we reoccupied using a hand held GPS. Seep sampling was conducted at low tide on December 16, 2013. Sampling was conducted as specified in U.S Navy 2013b. Samples were analyzed for TPH-D and TPH-heavy oil range hydrocarbons.

None of the 2013 seep samples contained TPH-D or TPH-heavy oil at concentrations greater than the RG of 1,000 µg/L. In 2013, SP-4 and SP-6 were resampled together with four other locations (SP-1, SP-2, SP-3, and SP-5) previously identified in the initial monitoring required by the OU 5 ROD. Analytical results for Area 52 seep sampling are provided in Table 6-10 and summarized below.

The six seep samples were analyzed for TPH in the diesel range (TPH-D) and heavy oil range (TPH-Dx). The RG is 1,000 µg/L for both ranges. In 2013, none of the TPH-D or TPH-Dx results exceeded the cleanup level. Historically, only one water sample from location SP-4 in 1999 resulted in a TPH-D concentration of 1,100 µg/L, exceeding the cleanup level. Also at location SP-4, two TPH-Dx results were reported as not detected with elevated reporting limits of 1,000 and 720 µg/L in the 1998 and 1999 samples, respectively. These reporting limits were equal to or below the cleanup level.

#### *OU 5 Area 52 Groundwater Monitoring Recommendations*

Based on the 1997 through 2013 seep sampling results, it is recommended that seep sampling be terminated at Area 52.

## 6.5 RESULTS OF SITE INSPECTIONS

Site inspections were conducted yearly from 2009 to 2013 to ensure the effectiveness of LUCs for CERCLA sites located throughout five OUs at NAS Whidbey Island. Inspections were performed in accordance with the LUC Implementation Plan (U.S. Navy 2009d). The results of the inspections are summarized here, and details are included in the 2009, 2010, 2012, and 2013 LUC site inspection reports (U.S. Navy 2011a, 2011d, 2012a, and 2013b) for the five OUs. At each of the OUs, visual site inspections documented the conditions of the institutional controls (ICs) and engineering controls (ECs) in place and verified whether they remain protective of human health and the environment. From 2009 through 2013, all ICs and ECs were functioning as intended, with the exception of OU 2, erosion issues at OU 5, and site well deficiencies. Corrective actions are discussed below. A summary of the last 5 years of LUC site inspections is presented in Table 6-11. Site checklists for inspections conducted in 2013 are provided in Appendix C.

In 2010, there was evidence of soil excavations at OU 2 Area 29 from construction activities associated with underground water lines. As a result of the underground utility construction activities that occurred in Area 29, it was also reported that vegetation was cleared, site fencing was removed, and wells were damaged. The following corrective actions were made to ensure that the ICs and ECs would function properly at Area 29:

- NAS Whidbey Island reviewed the communication protocol with Public Works regarding excavations at the various CERCLA sites.

- Fencing at Area 29 was reinstalled by NAS Whidbey Island.

- The broken well and cover at Area 29 were repaired by NAS Whidbey Island in September 2011.
- The broken well monument at Area 29 was repaired by NAS Whidbey Island on November 14, 2011.

The third 5-year review recommended annual inspections of the shoreline side of OU 5 Area 1 landfill based on erosion issues first identified during the September 2007 site inspection. The LUC inspection in September 2009 noted that erosion along the 3,300-foot-long shoreline had exposed the fill and historical landfill in several areas. The Navy implemented shoreline erosion monitoring under the LUC starting in December 2010 and continuing into 2012 and took action to stabilize the shoreline (U.S. Navy 2011a and 2012a).

The first set of erosion monitoring events were conducted by Tetra Tech and APS Survey and Mapping on December 29, 2010 and February 8, April 20, and June 2011 (U.S. Navy 2011a). The shoreline stabilization TCRA phase 1 was performed in January and February 2012. Construction of the permanent erosion control system, under an NTCRA, began in July and was completed in November 2012 (U.S. Navy 2012a). Additional shoreline monitoring events were conducted by Tetra Tech and APS Survey and Mapping on February 21, April 24, and November 7, 2012 (U.S. Navy 2012a). Annual shoreline erosion monitoring continues during LUC site inspections.

The 2013 LUC inspection report documents the most recent conditions at the NAS Whidbey Island LUC areas (U.S. Navy 2013b). Inspectors determined that the landfill boundaries did not conform to the boundaries shown in the ESD and LUC Implementation Plan for OU 1 Area 5, OU 2 Areas 2 and 3, and OU 5 Area 1. Based upon these discrepancies, it was recommended that the boundaries of each LUC area be researched, surveyed, and legally described. The boundary surveys were completed in June 2013. With the exception of Area 14, it was recommended that the LUC site inspections at all sites should continue on an annual basis. It was recommended that inspections at OU 2 Area 14 be discontinued because LUCs were not specified for the site. It was also recommended that the monitoring well at OU 2 Area 14 be properly abandoned. A summary of the well deficiencies and well recommendations from the 2013 LUC Inspection report is presented as Table 6-12. Typical well maintenance, such as painting and labeling, was recommended.

Between 2009 and 2013, the OU 1 Area 6 landfill cap was inspected annually during the LUC site inspections that the soil cover was intact, and there was no visual or administrative evidence that the landfill cap integrity had been compromised (U.S. Navy 2011a, 2011d, 2012a, and 2013b). Landfill cap inspections at Area 6 were also performed in accordance with the O&M manual (U.S. Navy 2002b). The results of the monthly cap inspections are detailed in the 2012 and 2013 O&M technical memoranda (U.S. Navy 2012c and 2013e). In summary, the landfill cap was noted to be in good condition from April 2011 to March 2013, and ongoing maintenance included mowing and control of invasive plant species.

## 6.6 RESULTS OF INTERVIEWS

As part of the 5-year review, interviews were conducted with persons familiar with the CERCLA actions at NAS Whidbey Island. Interview candidates were identified from a variety of organizations and groups, including the Navy (NAVFAC NW and NAS Whidbey Island), EPA, Island County Health Department, City of Oak Harbor, TetraTech, and community RAB members. A set of interview questions and instructions were transmitted to interview candidates by e-mail or post. Not all interview candidates chose to respond to the interview request.

The interview responses are included in Appendix D. Highlights of the interviews are summarized below.

### 6.6.1 Navy Personnel

The Navy's Remedial Project Manager (RPM) provided responses to interview questions. Her overall impression is that the remedies are in place and functioning as intended. Specific interview questions and responses are provided in Appendix D.

A TetraTech contractor representative who supports the Navy also provided responses to interview questions. He also believes that the remedies are in place and functioning as intended at NAS Whidbey Island. He stated that all ROD goals are effectively being met at OU 1, with the exception of emerging contaminants, which the Navy is currently working with the EPA and stakeholders to address. He believed that groundwater monitoring at OU 2 Areas 2/3, 4, and 29 and sediment monitoring at OU 3 Area 16 were adequate and sufficient to demonstrate that remedies remain protective. The following sites north of Ault Field were recommended for delisting by the TetraTech representative:

- OU 1 Area 5
- OU 2 Areas 2/3, 4, 14, and 29 (after one more additional long-term monitoring groundwater sampling)
- OU 3 Area 16 (unless additional environmental concerns are identified in recent LUC inspections or sampling determines additional upgradient sources of contamination)
- OU 4 Areas 48/49

- OU 5 Areas 1, 31, and 52

There was no awareness from the representative of groundwater being used inconsistently with current land use, but a suggestion was made for a compliance review of the gravel quarry operations adjacent to Area 6 to ensure they are compliant with their approved permitting.

### 6.6.2 Environmental Protection Agency Personnel

The EPA Project Manager (PM) for NAS Whidbey Island and the EPA hydrogeologist familiar with NAS Whidbey Island provided responses to interview questions (Appendix D).

The EPA PM's overall assessment was that the remedies continue to be protective and are successful. She felt that the Navy's biggest accomplishment was the repair work at the OU 5 Area 1 landfill. However, there are concerns about the repair work that has been done to the Area 6 pump and treat system and the length of time the system was not operational. The biggest recommendation from the previous 5-year review was also in regards to the 1,4 dioxane concentrations at Area 6 Landfill. In response, the Navy has been working closely with the EPA to determine the best cleanup approach, but options have been limited. Therefore, the EPA and Navy have reached an agreement to conduct a treatability study that will be implemented in 2014. The Area 6 pump and treat system has been an operational challenge, but has been containing the plume.

The EPA was not aware of any new scientific findings that could affect the protectiveness of the remedy, except for the already known concern of 1,4 dioxane. However, the EPA PM noted that the vapor intrusion pathway is a more recent pathway of concern that was not addressed in the ROD.

The Navy has determined that the vapor intrusion pathway at OU 1 Area 6, is not a health concern at this time for the following reasons: 1,4-dioxane is not considered volatile, 1,4-dioxane concentrations are too deep in relation to groundwater depth, and there is a lack of significant building structures located over the 1,4-dioxane plume.

The EPA PM felt that the Navy has made great strides in ensuring that LUCs are maintained and enforced. There have been some problems relating to the LUCs, but the Navy is aware and is now paying more attention to the LUC plan and its reporting requirements. However, the EPA PM recommended that communication strategies within the Navy be addressed.

Recently, the EPA was informed about another LUC issue that involved unauthorized digging at Areas 2/3 and 29. The Navy RPM followed appropriate notification. However, the Navy is looking into preventative measures to prevent a repeat occurrence. The EPA PM did express her concern for the long-term implementation of LUCs because of this occurrence. The EPA was aware of one notice of violation and one issue regarding community concerns during the last 5 years. In 2011, EPA issued a notice of violation to NAS Whidbey Island relating to not reporting a LUC violation. The Navy responded appropriately to the notice and changed procedures. There were also complaints from nearby residents about the Navy's plan to use groundwater to water the golf course. The EPA's hydrologeogist responded appropriately to community questions and concerns.

The EPA hydrogeologist felt that remedy operation, maintenance, and monitoring have been revised in accordance with recommendations made in the third 5-year review and that the remedies continue to be effective. However, the aging pump and treat system at OU 1, Area 6 could compromise the effectiveness of the remedy. At times, the Area 6 western VOC plume appears to cross the base property boundary to the west and even to the south, most recently because of the extended shutdown of well PW-5 because of a broken pump. Currently, there has been no development of the private property to the west or south of the western VOC plume for residential use, nor any drilling of wells. The VOC plume "footprint" has also likely remained within the 1,000-foot well drilling buffer around the landfill portion of OU 1 in the last 5-years.

As long as Island County enforces the buffer that prevents well drilling, the EPA hydrogeologist felt that the remedy should remain protective. The EPA hydrogeologist also noted that there are still migration issues at OU 1 Area 6 with the 1,4-dioxane plume, which is clearly expanding south because the extraction system in place was not designed to capture 1,4- dioxane. The 1,4-dioxane plume may eventually expand beyond the 1,000-foot well drilling buffer south of the adjacent Oak Harbor landfill. She commented that there are also older wells that were drilled before the buffer was established that may be impacted, even if the plume does not expand past the 1,000-foot well drilling buffer.

The EPA hydrogeologist also mentioned the complaints from local residents about the Navy's plan to use groundwater to water the golf course near OU 2, particularly near Area 29. The concerns by the local residents were that residential wells would be impacted because of lower water levels and that contamination from Area 29 could be mobilized in such a way that it could flow off site. The EPA hydrogeologist responded by sending the Island County her evaluation of Area 29, which concluded that impacts were unlikely. There have been no further inquiries since, suggesting that drawdown impacts on local wells have not been significant as had been feared by local residents.

The EPA hydrogeologist was aware of two scientific findings that may question the protective of the remedy at NAS Whidbey Island during this 5-year period. The first new finding is that EPA recently revised the slope factor for 1,4-dioxane, which lowered the MTCA Method B value. Because of the more conservative MTCA Method B cleanup level, one domestic well's concentrations exceeded the new cleanup level. The Navy appropriately replaced the domestic well, which was located at the south end of the 1,4-dioxane plume. However, there are also significant 1,4-dioxane concentrations that have exceeded the new MTCA Method B cleanup level in new monitoring wells that were installed along Highway 20 between the landfills and domestic wells to the south and southeast. The concern expressed by the EPA hydrogeologist was that it is unclear whether additional domestic wells may eventually be impacted.

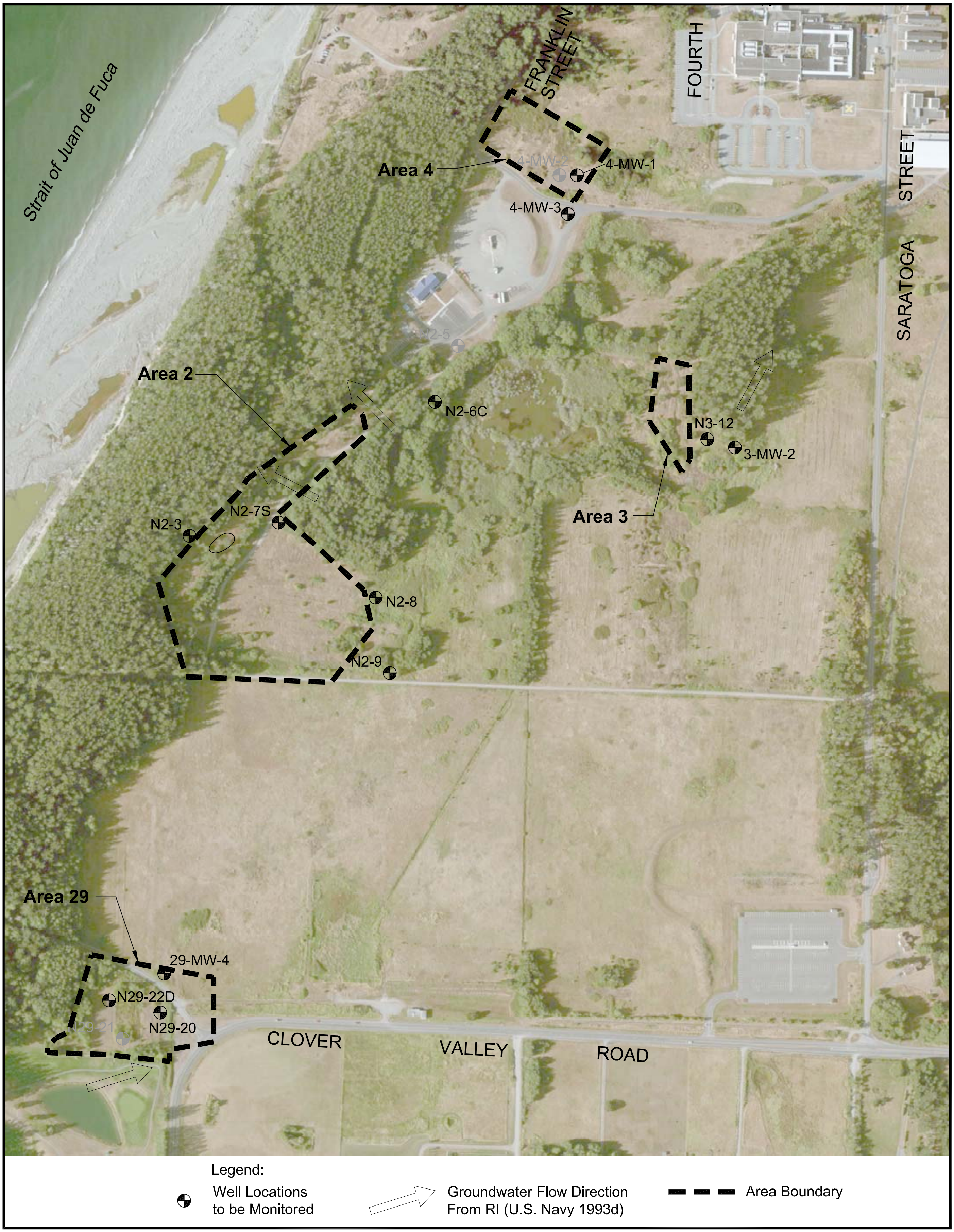
The second new finding is that the current situation report noted that aqueous film forming foams were used at Area 31. The U.S. Air Force has recently recognized that their use of aqueous film forming foams at fire training areas can result in soil and groundwater contamination with perfluorinated compounds far above the EPA's provisional health advisory levels. No toxicity information is available in the EPA's Integrated Risk Information System (IRIS) database. However, the EPA hydrogeologist is confident that there will be soon. Therefore, the Navy should be prepared to respond with the appropriate risk-based levels (as soon as they are available).

The EPA hydrogeologist felt that the ongoing monitoring program meets the goals of the ROD, with the exception of Area 29. She felt that the groundwater monitoring at Area 29 was sparse and possibly not adequate to evaluate plume extent or trends effectively at some areas. Some wells sampled at Area 29 are not related to the study plumes, thus giving the possibility of misleading data. Some wells may have been decommissioned too early, as there should have been more thought given to utilizing existing well networks. The EPA hydrogeologist felt that in order to improve the quality of data, the existing well network may need to be improved at Area 29.

The EPA hydrogeologist stated that overall the ICs and O&M procedures used at NAS Whidbey Island were consistent with the ROD and recommendations from the third 5-year review. Although there were some glitches, the Navy has responded well and kept the EPA informed. There was an issue regarding differences in maps boundaries for some areas between the LUC ESD and RI maps. The Navy has responded appropriately by resurveying the map boundaries of all OUs (U.S. Navy 2014c).

The EPA hydrogeologist stated there were two major accomplishments for the Navy. First the Navy has made good progress on reevaluating the vadose zone source area for the western VOC plume at Area 6. They have also begun optimization efforts to address both the western VOC plume and the southern 1,4-dioxane plume, with an agreement that in situ plume treatments be seriously evaluated through a treatability study. Secondly, the Navy has also implemented robust measures to mitigate beach erosion at the Area 1 landfill. The EPA hydrogeologist also recommended that the bluff armoring at Area 1 may need to be extended southward to address the entire landfill. This extension is because of one of the waste areas is not fully delineated in the old LUC maps.

An additional concern from the EPA hydrogeologist is that 1,4-dioxane is simply being recycled through the groundwater system and not remediated. She emphasized the need to develop an ex situ treatment system to remediate 1,4-dioxane levels.



**U.S. NAVY**

NAS Whidbey Island
FOURTH FIVE-YEAR
REVIEW

0 250 500
SCALE IN FEET

**Figure 6-1**
**Groundwater Sampling Locations,**
**OU 2 Areas 2, 3, 4, and 29**

J:\GIS\Projects\NAVY\WHIDBEY\DO 66\4th FYR\FIG 6-1 GW Areas 2,3,4,29.dwg
Mod: 01/13/2014, 10:18 | Plotted: 07/08/2014, 11:31 | john_knobbs

J:\GIS\Projects\NAVY\WHIDBEY\DO 66\4th FYR\Fig 6-2 Seep Area 52.dwg
Mod: 07/08/2014, 13:35 | Plotted: 07/08/2014, 13:35 | john_knobbs

**U.S. NAVY**

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FOURTH FIVE-YEAR
REVIEW

0 100 200
SCALE IN FEET

## Figure 6-2
## Seep Sampling Locations
## OU 5 Area 52

## Table 6-1
## Rationale for Determination That Concentrations of Volatile Organic Compounds Are Decreasing With Time

| Slope of 95% UCL | Slope of Decay Rate | Slope of 95% LCL | Confidence That Trend Is Downward | Interpretation of Results |
|---|---|---|---|---|
| Negative | Negative | Negative | >95% | Decreasing trend |
| Positive | Negative | Negative | <95% but >50% | Flat to decreasing |
| Positive | Positive | Negative | <50% but >5% | Flat to increasing |
| Positive | Positive | Positive | <5% | Increasing trend |

Notes:
LCL - lower confidence limit
UCL - upper confidence limit

## Table 6-2
## Concentration Trends Analysis Summary for Trichloroethene in Groundwater Samples 2008–2013 at OU 1 Area 6

| Well | Number of Results | Number of Detects | Number of Detects Above CUL | Average Conc. (µg/L) | Minimum Conc. (µg/L) | Maximum Conc. (µg/L) | Slope of 95% UCL | Slope of Decay Rate | Slope of 95% LCL | Confidence That Trend Is Downward |
|---|---|---|---|---|---|---|---|---|---|---|
| **Source Area Wells** | | | | | | | | | | |
| 6-S-30 | 8 | 0 | 0 | 0.04 | 0.03 | 0.07 | -0.018 | -0.134 | -0.250 | >95% |
| 6-S-10 | 6 | 0 | 0 | 0.03 | 0.03 | 0.03 | NA | NA | NA | NA |
| 6-S-21 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| N6-38 | 10 | 10 | 1 | 3.1 | 1.8 | 5.5 | -0.019 | -0.130 | -0.242 | >95% |
| PW-1 | 10 | 10 | 10 | 92 | 65 | 130 | -0.092 | -0.129 | -0.165 | >95% |
| 6-S-22 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| N6-37 | 10 | 10 | 9 | 34.2 | 4 | 97 | -0.180 | -0.445 | -0.711 | >95% |
| 6-S-31 | 10 | 10 | 10 | 12.9 | 8.3 | 17 | -0.066 | -0.118 | -0.170 | >95% |
| **Midplume Wells** | | | | | | | | | | |
| MW-7 | 10 | 10 | 10 | 62.9 | 46 | 80 | -0.064 | -0.100 | -0.137 | >95% |
| 6-S-11 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-15 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| PW-3 | 11 | 11 | 11 | 81.9 | 55 | 110 | -0.125 | -0.150 | -0.174 | >95% |
| 6-S-23 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-14 | 7 | 0 | 0 | 0.03 | 0.03 | 0.03 | NA | NA | NA | NA |
| 6-S-06 | 8 | 8 | 8 | 72.8 | 57 | 110 | -0.077 | -0.126 | -0.176 | >95% |
| 6-S-12 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-24 | 10 | 1 | 0 | 0.15 | 0.03 | 0.5 | -0.188 | -0.521 | -0.855 | >95% |
| MW-10 | 10 | 1 | 0 | 0.20 | 0.03 | 0.5 | -0.189 | -0.552 | -0.915 | >95% |
| MW-8 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| **Capture Zone Wells** | | | | | | | | | | |
| 6-S-13 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-25 | 10 | 6 | 0 | 0.11 | 0.03 | 0.24 | 0.495 | 0.271 | 0.046 | <5% |
| PW-5 | 8 | 8 | 8 | 81.8 | 68 | 110 | -0.093 | -0.129 | -0.166 | >95% |

## Table 6-2 (Continued)
## Concentration Trends Analysis Summary for Trichloroethene in Groundwater Samples 2008–2013 at OU 1 Area 6

| Well | Number of Results | Number of Detects | Number of Detects Above CUL | Average Conc. (µg/L) | Minimum Conc. (µg/L) | Maximum Conc. (µg/L) | Slope of 95% UCL | Slope of Decay Rate | Slope of 95% LCL | Confidence That Trend Is Downward |
|---|---|---|---|---|---|---|---|---|---|---|
| PW-6 | 8 | 3 | 0 | 0.17 | 0.03 | 0.5 | -0.586 | -0.752 | -0.919 | >95% |
| PW-7 | 8 | 0 | 0 | 0.09 | 0.027 | 0.5 | -0.039 | -0.438 | -0.837 | >95% |
| MW-5 | 10 | 0 | 0 | 0.04 | 0.03 | 0.07 | -0.085 | -0.178 | -0.271 | >95% |
| 6-S-27 | 8 | 0 | 0 | 0.04 | 0.03 | 0.07 | -0.018 | -0.135 | -0.251 | >95% |
| 6-S-28 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| PW-8 | 8 | 1 | 0 | 0.09 | 0.027 | 0.5 | -0.093 | -0.475 | -0.856 | >95% |
| PW-4 | 8 | 0 | 0 | 0.09 | 0.027 | 0.5 | -0.039 | -0.438 | -0.837 | >95% |
| PW-9 | 7 | 1 | 0 | 0.03 | 0.027 | 0.06 | 0.289 | 0.111 | -0.067 | <50% but >5% |
| **Downgradient Wells** | | | | | | | | | | |
| 6-S-29 | 10 | 0 | 0 | 0.04 | 0.03 | 0.07 | -0.084 | -0.177 | -0.270 | >95% |
| MW-9 | 8 | 1 | 0 | 0.04 | 0.03 | 0.07 | -0.031 | -0.152 | -0.274 | >95% |
| 6-S-19 | 8 | 0 | 0 | 0.09 | 0.027 | 0.5 | -0.036 | -0.433 | -0.830 | >95% |
| 6-S-03 | 8 | 0 | 0 | 0.09 | 0.03 | 0.5 | -0.058 | -0.443 | -0.829 | >95% |
| 6-S-41 | 6 | 0 | 0 | 0.03 | 0.03 | 0.03 | NA | NA | NA | NA |
| 6-S-42 | 6 | 0 | 0 | 0.03 | 0.03 | 0.03 | NA | NA | NA | NA |
| 6-S-43 | 6 | 0 | 0 | 0.03 | 0.03 | 0.03 | NA | NA | NA | NA |

Notes:
Conc - concentration
CUL - cleanup level
LCL - lower confidence limit
µg/L - microgram per liter
NA - not available
UCL - upper confidence limit

## Table 6-3
## Concentration Trend Analyses Summary for 1,1,1-Trichloroethane in Groundwater Samples 2008–2013 at OU 1 Area 6

| Well | Number of Results | Number of Detects | Number of Detects Above CUL | Average Conc. (µg/L) | Minimum Conc. (µg/L) | Maximum Conc. (µg/L) | Slope of 95% UCL | Slope of Decay Rate | Slope of 95% LCL | Confidence That Trend Is Downward |
|---|---|---|---|---|---|---|---|---|---|---|
| **Source Area Wells** | | | | | | | | | | |
| 6-S-30 | 8 | 8 | 0 | 17.4 | 5 | 31 | -0.083 | -0.314 | -0.546 | >95% |
| 6-S-10 | 6 | 6 | 0 | 0.52 | 0.27 | 1.1 | 0.818 | 0.189 | -0.439 | <50% but >5% |
| 6-S-21 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| N6-38 | 10 | 10 | 0 | 36.9 | 15 | 63 | -0.022 | -0.430 | -0.301 | >95% |
| PW-1 | 10 | 10 | 0 | 43.0 | 33 | 59 | -0.080 | -0.120 | -0.160 | >95% |
| 6-S-22 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| N6-37 | 10 | 10 | 0 | 8.36 | 0.87 | 25 | -0.171 | -0.430 | -0.690 | >95% |
| 6-S-31 | 10 | 10 | 0 | 46.1 | 30 | 68 | -0.008 | -0.095 | -0.182 | >95% |
| **Midplume Wells** | | | | | | | | | | |
| MW-7 | 10 | 10 | 0 | 31.9 | 25 | 37 | -0.032 | -0.084 | -0.135 | >95% |
| 6-S-11 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-15 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| PW-3 | 10 | 10 | 0 | 123 | 99 | 160 | 0.018 | -0.050 | -0.119 | <95% but >50% |
| 6-S-23 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-14 | 6 | 2 | 0 | 0.03 | 0.03 | 0.03 | NA | NA | NA | NA |
| 6-S-06 | 8 | 8 | 8 | 533 | 220 | 890 | 0.015 | -0.238 | -0.490 | <95% but >50% |
| 6-S-12 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-24 | 10 | 10 | 0 | 129 | 89 | 170 | -0.058 | -0.105 | -0.153 | >95% |
| MW-10 | 10 | 4 | 0 | 0.13 | 0.03 | 0.5 | 0.030 | -0.331 | -0.692 | <95% but >50% |
| MW-8 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| **Capture Zone Wells** | | | | | | | | | | |
| 6-S-13 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-25 | 10 | 10 | 4 | 231 | 88 | 760 | -0.180 | -0.350 | -0.520 | >95% |

## Table 6-3 (Continued)
## Concentration Trend Analyses Summary for 1,1,1-Trichloroethane in Groundwater Samples 2008–2013 at OU 1 Area 6

| Well | Number of Results | Number of Detects | Number of Detects Above CUL | Average Conc. (µg/L) | Minimum Conc. (µg/L) | Maximum Conc. (µg/L) | Slope of 95% UCL | Slope of Decay Rate | Slope of 95% LCL | Confidence That Trend Is Downward |
|---|---|---|---|---|---|---|---|---|---|---|
| PW-5 | 8 | 8 | 2 | 195 | 130 | 350 | -0.152 | -0.245 | -0.339 | >95% |
| PW-6 | 8 | 8 | 0 | 4.69 | 1.3 | 14 | 0.439 | 0.091 | -0.257 | <50% but >5% |
| PW-7 | 8 | 8 | 0 | 0.51 | 0.38 | 0.73 | -0.067 | -0.128 | -0.188 | >95% |
| MW-5 | 10 | 10 | 4 | 267 | 5.5 | 790 | 1.435 | 0.904 | 0.372 | <5% |
| 6-S-27 | 8 | 8 | 0 | 1.18 | 0.67 | 2.2 | -0.080 | -0.186 | -0.292 | >95% |
| 6-S-28 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| PW-8 | 8 | 7 | 0 | 0.34 | 0.18 | 0.50 | -0.002 | -0.135 | -0.269 | >95% |
| PW-4 | 8 | 8 | 0 | 6.6 | 4.9 | 8.6 | 0.120 | 0.031 | -0.057 | <50% but >5% |
| PW-9 | 7 | 7 | 0 | 0.39 | 0.16 | 0.63 | -0.261 | -0.374 | -0.488 | >95% |
| **Downgradient Wells** | | | | | | | | | | |
| 6-S-29 | 10 | 10 | 0 | 1.04 | 0.75 | 1.7 | -0.024 | -0.093 | -0.162 | >95% |
| MW-9 | 8 | 6 | 0 | 0.15 | 0.03 | 0.5 | 0.509 | 0.027 | -0.456 | <50% but >5% |
| 6-S-19 | 8 | 8 | 0 | 1.39 | 0.98 | 1.9 | 0. 095 | -0.024 | -0.144 | <95% but >50% |
| 6-S-03 | 8 | 8 | 0 | 2.96 | 2.6 | 4.0 | -0.017 | -0.070 | -0.123 | >95% |
| 6-S-41 | 6 | 6 | 0 | 0.04 | 0.03 | 0.04 | -0.063 | -0.148 | -0.234 | >95% |
| 6-S-42 | 6 | 6 | 0 | 3.78 | 3.4 | 4.4 | -0.052 | -0.100 | -0.147 | >95% |
| 6-S-43 | 6 | 6 | 0 | 0.26 | 0.22 | 0.39 | 0.326 | 0.114 | -0.098 | <50% but >5% |

Notes:
Conc - concentration
CUL - cleanup level
LCL - lower confidence limit
µg/L - microgram per liter
UCL - upper confidence limit

## Table 6-4
## Concentration Trend Analyses Summary for Vinyl Chloride in Groundwater Samples 2008–2013 at OU 1 Area 6

| Well | Number of Results | Number of Detects | Number of Detects Above CUL | Average Conc. (µg/L) | Minimum Conc. (µg/L) | Maximum Conc. (µg/L) | Slope of 95% UCL | Slope of Decay Rate | Slope of 95% LCL | Confidence That Trend Is Downward |
|---|---|---|---|---|---|---|---|---|---|---|
| **Downgradient Wells** | | | | | | | | | | |
| 6-S-03 | 10 | 10 | 10 | 0.24 | 0.13 | 0.39 | -0.185 | -0.217 | -0.249 | >95% |
| 6-S-19 | 10 | 10 | 10 | 1.04 | 0.63 | 1.5 | -0.006 | -0.088 | -0.170 | >95% |
| 6-S-29 | 12 | 12 | 12 | 0.9 | 0.51 | 1.4 | -0.095 | -0.135 | -0.175 | >95% |
| MW-9 | 10 | 10 | 10 | 0.45 | 0.34 | 0.66 | 0.028 | -0.040 | -0.107 | <95% but > 50% |
| PW-4 | 10 | 10 | 10 | 0.27 | 0.17 | 0.43 | 0.015 | -0.071 | -0.157 | <95% but > 50% |
| 6-S-42 | 8 | 8 | 8 | 0.20 | 0.15 | 0 | 0.025 | -0.099 | -0.223 | <95% but > 50% |
| 6-S-43 | 8 | 8 | 8 | 2.76 | 1.80 | 3.70 | 0.211 | 0.091 | -0.028 | <50% but >5% |
| PW-8 | 10 | 10 | 10 | 0.49 | 0.37 | 0.70 | -0.026 | -0.076 | -0.126 | >95% |
| PW-9 | 9 | 9 | 9 | 0.52 | 0.38 | 0.75 | 0.039 | -0.060 | -0.158 | <95% but > 50% |

Notes:
Conc - concentration
CUL - cleanup level
LCL - lower confidence limit
µg/L - microgram per liter
UCL - upper confidence limit

# Table 6-5
# Concentration Trend Analyses Summary for 1,4-Dioxane in Groundwater Samples 2008–2013 at OU 1 Area 6

| Well | Number of Results | Number of Detects | Number of Detects Above CUL | Average Conc. (µg/L) | Minimum Conc. (µg/L) | Maximum Conc. (µg/L) | Slope of 95% UCL | Slope of Decay Rate | Slope of 95% LCL | Confidence That Trend Is Downward |
|---|---|---|---|---|---|---|---|---|---|---|
| **Source Area Wells** | | | | | | | | | | |
| 6-S-30 | 8 | 8 | 8 | 3.88 | 2.7 | 6.0 | -0.004 | -0.099 | -0.194 | >95% |
| 6-S-10 | 8 | 8 | 8 | 4.61 | 2.9 | 7.2 | -0.011 | -0.110 | -0.209 | >95% |
| 6-S-21 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| N6-38 | 7 | 7 | 7 | 3.83 | 2.5 | 8.2 | -0.087 | -0.262 | -0.436 | >95% |
| PW-1 | 8 | 8 | 8 | 8.21 | 4.8 | 14 | -0.050 | -0.154 | -0.257 | >95% |
| 6-S-22 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| N6-37 | 7 | 7 | 7 | 3.36 | 2.2 | 5.6 | -0.162 | -0.250 | -0.338 | >95% |
| 6-S-31 | 10 | 10 | 10 | 4.76 | 3.2 | 6.7 | -0.048 | -0.103 | -0.157 | >95% |
| **Midplume Wells** | | | | | | | | | | |
| MW-7 | 10 | 10 | 10 | 5.50 | 3.9 | 8.1 | -0.015 | -0.081 | -0.146 | >95% |
| 6-S-11 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-15 | 2 | 2 | 2 | 3.25 | 2.8 | 3.7 | NA | -0.559 | NA | NA |
| PW-3 | 10 | 10 | 10 | 5.49 | 3.7 | 7.5 | 0.035 | -0.034 | -0.103 | <95% but >50% |
| 6-S-23 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-14 | 10 | 10 | 10 | 9.58 | 7.6 | 13 | 0.010 | -0.045 | -0.100 | <95% but >50% |
| 6-S-06 | 8 | 8 | 7 | 2.54 | 0.4 | 9.1 | -0.102 | -0.480 | -0.858 | >95% |
| 6-S-12 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-24 | 6 | 4 | 2 | 0.41 | 0.16 | 0.8 | 1.032 | 0.481 | -0.069 | <50% but >5% |
| MW-10 | 8 | 8 | 8 | 2.10 | 0.53 | 4.7 | 0.001 | -0.338 | -0.678 | <95% but >50% |
| MW-8 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| **Capture Zone Wells** | | | | | | | | | | |
| 6-S-13 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| 6-S-25 | 6 | 1 | 0 | 0.20 | 0.16 | 0.42 | 0.610 | 0.273 | -0.065 | <50% but >5% |

## Table 6-5 (Continued)
## Concentration Trend Analyses Summary for 1,4-Dioxane in Groundwater Samples 2008–2013 at OU 1 Area 6

| Well | Number of Results | Number of Detects | Number of Detects Above CUL | Average Conc. (µg/L) | Minimum Conc. (µg/L) | Maximum Conc. (µg/L) | Slope of 95% UCL | Slope of Decay Rate | Slope of 95% LCL | Confidence That Trend Is Downward |
|---|---|---|---|---|---|---|---|---|---|---|
| PW-5 | 7 | 7 | 7 | 3.86 | 2.6 | 5.0 | 0.229 | 0.047 | -0.135 | <50% but >5% |
| PW-6 | 10 | 10 | 10 | 3.93 | 2.8 | 5.7 | 0.006 | -0.067 | -0.141 | <95% but >50% |
| PW-7 | 8 | 8 | 0 | 3.11 | 2.4 | 4.0 | 0.049 | -0.046 | -0.142 | <95% but >50% |
| MW-5 | 8 | 3 | 3 | 0.86 | 0.16 | 3.9 | -0.185 | -0.601 | -1.016 | >95% |
| 6-S-27 | 6 | 0 | 0 | 0.16 | 0.16 | 0.16 | NA | NA | NA | NA |
| 6-S-28 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA |
| PW-8 | 8 | 8 | 8 | 4.75 | 2.2 | 6.3 | 0.285 | 0.152 | 0.019 | <5% |
| PW-4 | 10 | 10 | 10 | 6.09 | 3.3 | 8.7 | -0.114 | -0.170 | -0.226 | >95% |
| PW-9 | 7 | 7 | 7 | 3.47 | 2.3 | 5.2 | 0.085 | -0.123 | -0.331 | <95% but >50% |
| **Downgradient Wells** | | | | | | | | | | |
| 6-S-29 | 10 | 10 | 10 | 9.8 | 7 | 16 | -0.024 | -0.100 | -0.175 | >95% |
| MW-9 | 8 | 7 | 8 | 1.86 | 1.1 | 3.0 | -0.119 | -0.221 | -0.323 | >95% |
| 6-S-19 | 8 | 8 | 8 | 6.63 | 3.2 | 10 | 0.081 | -0.104 | -0.289 | <95% but >50% |
| 6-S-03 | 10 | 10 | 10 | 4.81 | 2.8 | 7.6 | -0.037 | -0.115 | -0.194 | >95% |
| 6-S-41 | 9 | 8 | 7 | 0.82 | 0.16 | 1.8 | 0.447 | 0.177 | -0.093 | <50% but >5% |
| 6-S-42 | 9 | 9 | 9 | 13.2 | 5.3 | 18 | 0.286 | 0.177 | 0.068 | <5% |
| 6-S-43 | 9 | 9 | 9 | 3.67 | 1.8 | 8.4 | 0.337 | 0.180 | 0.023 | <5% |

Notes:
Conc - concentration
CUL - cleanup level
LCL - lower confidence limit
µg/L - microgram per liter
NA - not available
UCL - upper confidence limit

## Table 6-6
## Summary of Post-ROD Groundwater Analytical Results for OU 2 Areas 2/3

| | | Volatile Organic Compounds | | | | Inorganics | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location ID/Area** | **Date** | **1,1-Dichloroethene (µg/L)** | **1,4-Dichlorobenzene (µg/L)** | **Vinyl Chloride (µg/L)** | **Vinyl Chloride SIM/Low Level (µg/L)** | **Total Arsenic (µg/L)** | **Dissolved Arsenic (µg/L)** | **Total Manganese (µg/L)** | **Dissolved Manganese (µg/L)** |
| N2-3/Area 2 | 1995 | NS | NS | NS | NS | **8.8** | NA | 50.6 | NA |
| | 2002 | 0.12U | 0.098U | 0.22U | NA | **31.6** | NA | 61.8 | NA |
| | 2007 | 0.2U | 0.2U | 0.2U | 0.02UR[a] | **38.6** | NA | 84.9 | NA |
| | 2013 | 0.06U | 0.1U | NA | 0.02U | **190** | **11** | 80 | 50 |
| N2-6C/Area 2 | 1995 | NS | NS | NS | NS | NS | NA | NS | NA |
| | 2002 | 0.12U | 0.098U | 0.22U | NA | **8.9** | NA | **318** | NA |
| | 2007 | 0.2U | 0.2U | 0.2U | 0.02U | 5.92 | NA | **250** | NA |
| | 2013 | 0.06U | 0.1U | NA | 0.02U | **8.3** | **8.4** | **470** | **190** |
| N2-7S/Area 2 | 1995 | 1U | 1U | 1U | NA | **25.2** | NA | **4,590** | NA |
| | 2002 | 0.12U | 0.46J | 0.22U | NA | **25.6** | NA | **4,250** | NA |
| | 2007 | 0.2U | 0.55 | 0.2U | 0.021 | **80.5** | NA | **3,510** | NA |
| | 2013 | NS | NS | NS | NS | NS | NS | NS | NS |
| N2-8/Area 2 | 1995 | NS | NS | NS | NS | 5J | NA | 118 | NA |
| | 2002 | 0.12U | 0.098U | 0.22U | NA | 5U | NA | 2.5 | NA |
| | 2007 | 0.2U | 0.2U | 0.2U | 0.02R[a] | **9.86** | NA | 55.2 | NA |
| | 2013 | 0.06U | 0.1U | NA | 0.02U | **44** | 5.4 | 60 | 3.7J |
| N2-9/Area 2 | 1995 | NS | NS | NS | NS | 6.4 | NA | 44.8 | NA |
| | 2002 | 0.12U | 0.098U | 0.22U | NA | 4.9U | NA | 2.1 | NA |
| | 2007 | 0.2U | 0.2U | 0.2U | 0.02R[a] | 7.55 | NA | 40.5 | NA |
| | 2013 | 0.06U | 0.1U | NA | 0.02U | **11** | **8.1** | 34J | 26J |

## Table 6-6 (Continued)
## Summary of Post-ROD Groundwater Analytical Results for OU 2 Areas 2/3

| Location ID/Area | Date | Volatile Organic Compounds | | | | Inorganics | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1,1-Dichloroethene (µg/L) | 1,4-Dichlorobenzene (µg/L) | Vinyl Chloride (µg/L) | Vinyl Chloride SIM/Low Level (µg/L) | Total Arsenic (µg/L) | Dissolved Arsenic (µg/L) | Total Manganese (µg/L) | Dissolved Manganese (µg/L) |
| 3-MW-2/Area 3 | 1995 | 1U | 1U | 1U | NA | 6.4 | NA | **153** | NA |
| | 2002 | 0.12U | 0.098U | 0.22U | NA | **8.9U** | NA | 65.7 | NA |
| | 2007 | 0.2U | 0.2U | NA | 0.02U | 6.56 | NA | 121 | NA |
| | 2013 | 0.06U | 0.1U | NA | 0.02U | **11** | 4.3J | **170** | 66 |
| N3-12/Area 3 | 1995 | 1U | 1U | **12** | NA | **71.5** | NA | **8,270** | NA |
| | 2002 | 0.12U | 0.098U | **11** | NA | **55.6** | NA | **5,270** | NA |
| | 2007 | 0.2U | 0.2U | NA | **5.84** | **47.9** | NA | **3,670** | NA |
| | 2013 | 0.06U | 0.1U | NA | **2.5** | **100** | **40** | **4,300** | **4,000** |
| Remediation goal | | 7[b] | 63 | 1 | 1 | 7.7 | 7.7 | 125 | 125 |

[a] Vinyl chloride was not detected but result was "R" qualified during validation.
[b] Maximum contaminant level

Notes:
**Bold** value exceeds the remediation goal.
J - associated results considered an estimate
µg/L - microgram per liter
NA - not analyzed
NS - not sampled
R - result rejected by data validator
ROD - Record of Decision
U - analyte not detected above specified reporting limit

## Table 6-7
## Summary of Post-ROD Groundwater Analytical Results for OU 2 Area 4

| Location ID | Date | Dissolved Arsenic (µg/L) | Total Arsenic (µg/L) |
|---|---|---|---|
| 4-MW-1 | 1995 | NA | **11** |
| | 2002 | NA | **8.8** |
| | 2007 | NA | **9.04** |
| | 2013 | **11** | **11** |
| 4-MW-3 | 1995 | NA | **11.2** |
| | 2002 | NA | **10.6** |
| | 2007 | NA | **19.1** |
| | 2013 | **12** | **370** |
| Remediation goal | | 7.7 | 7.7 |

Notes:
**Bold** value exceeds the remediation goal.
µg/L - microgram per liter
NA - not analyzed
ROD - Record of Decision

## Table 6-8
## Summary of Post-ROD Groundwater Analytical Results for OU 2 Area 29

| Location ID | Date | Dissolved Arsenic (µg/L) | Total Arsenic (µg/L) |
|---|---|---|---|
| 29-MW-4 | 1995 | NA | **10** |
| | 2002 | NA | **10.4** |
| | 2007 | NA | **8.72** |
| | 2013 | **8.3** | **9.1** |
| N29-20 | 1995 | NA | **12** |
| | 2002 | NA | **12** |
| | 2007 | NA | **17.4** |
| | 2013 | NS | NS |
| N29-22D | 1995 | NA | **19.4** |
| | 2002 | NA | **20.6** |
| | 2007 | NA | **23.5** |
| | 2013 | NS | NS |
| Remediation goal | | 7.7 | 7.7 |

Notes:
**Bold** value exceeds the remediation goal.
µg/L - microgram per liter
NA - not analyzed
NS - not sampled
ROD - Record of Decision

## Table 6-9
## Results of 2014 Catch Basin Sediment Sampling, OU 3 Area 16

| | Sample ID/Date | | | Soil Cleanup Level[a] | | |
|---|---|---|---|---|---|---|
| | **CB 16/2-SD-01** | **CB 16/2-SD-02** | | | | |
| **Chemical** | **1/27/2014** | **1/27/2014** | **ROD RG** | **MTCA Method A** | **MTCA Method B** | **MTCA Method C** |
| **NWTPH-Gx (mg/kg)** | | | | | | |
| Gasoline | 27 J | 31 J | 200 | 2000 | NA | NA |
| **NWTPH-Dx (mg/kg)** | | | | | | |
| #2 Diesel (C10-C24) | **1,600** | **2,000** | 200 | 2000 | NE | NE |
| Motor oil (>C24-C36) | **3,300** | **4,600** | 200 | 2000 | NE | NE |
| **Metals (mg/kg)** | | | | | | |
| Arsenic | 14 J | 15 J | 16 | NE | NE | NE |
| Lead | **79** | **72** | 18 | NE | NE | NE |
| **SVOCs (µg/kg)** | | | | | | |
| 2-Methtylnaphthalene | **270 J** | **360** | 80 | NE | NE | NA |
| Phenanthrene | 360 J | 450 | 13,000 | NE | NE | NE |
| Benzo(k)fluoranthene | 64 U J | 97 U | 18,000 | NE | NE | NE |
| Dibenz(a,h)anthracene | 64 U J | 97 U | 1,100 | NE | NE | NE |

[a]Downloaded from CLARC March 12, 2014

Notes:
**Bold** value is greater than ROD RG.
**Bold** and highlighted value is greater than ROD RG and MTCA Method A.
J - The analyte was positively identified; the quantitation is an estimation.
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
MTCA - Model Toxics Control Act
NE - not established
RG - remediation goal
ROD - Record of decision
SVOCs – semivolatile organic compounds
U - The analyte was analyzed for, but was not detected above the sample quantitation limit.

# Table 6-10
# Summary of Post-ROD Surface Water Analytical Results for OU 5 Area 52

| Location ID | Date | TPH-Diesel (µg/L) | TPH-Heavy Oil (µg/L) |
|---|---|---|---|
| SP-1 | 2013 | 120U | 240U |
| SP-2 | 2013 | 120U | 240U |
| SP-3 | 2013 | 120U | 240U |
| SP-4 | 1997 | 270 | NA |
| | 1998 | 250U | 1,000U |
| | 1999 | **1,100** | 720U |
| | 2007 | 306 | 154J |
| | 2013 | 120U | 240U |
| SP-5 | 2013 | 120U | 240U |
| SP-6 | 1997 | 250U | NA |
| | 2007 | 91.9J | 127J |
| | 2013 | 120U | 240U |
| Remediation goal | | 1,000 | 1,000 |

Notes:
**Bold** value exceeds the remediation goal.
J - associated results considered an estimate
µg/L - microgram per liter
NA - not analyzed
TPH - total petroleum hydrocarbons
U - analyte not detected above specified reporting limit

## Table 6-11
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| **Operable Unit 1** | | | | | | |
| Area 5, Hoffman Road Landfill | • Ensure that site is used for industrial or commercial purposes only.<br>• Ensure that all soil excavated from the site is properly characterized and disposed of and that on-site workers are protected. | No ECs are required for Area 5. However, the site is located inside the main Ault Field perimeter fence and therefore secured from the public. | The ICs are functioning as intended to protect human receptors from exposure to soil and groundwater. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. Construction activities were observed adjacent to the site (along the road for gravel staging/borrow area). However, there was no indication of excavation activities at this site.<br>**Recommendation:** Post a sign at the boundary that identifies Area 5 as a CERCLA site with excavation restrictions.<br>**Follow-up action:** A work order was submitted by NAS Whidbey Island to post a sign at Area 5. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. | The ICs are functioning as intended to protect human receptors from exposure to soil and groundwater.<br>During site visit, inspectors determined that the landfill boundaries do not conform to the boundaries shown in the ESD and LUC Implementation Plan.<br>**Recommendation:** Review and revise site boundaries as necessary.<br>**Follow-up action:** Site boundaries at all OUs were surveyed and are reported in the new LUC Implementation plan (U.S. Navy 2014c). |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 6, Former Municipal Landfill | • Ensure that site is used for industrial or commercial purposes only.<br>• Protect existing monitoring wells and landfill cap from unauthorized disturbances.<br>• No on-site or downgradient well drilling or use of groundwater, except as approved by EPA or Ecology.<br>• Maintain access restrictions, including fences and signs. | • Landfill caps/soil covers<br>• Groundwater monitor wells<br>• Signage, fencing, and gates<br>• Remediation treatment systems | The ICs are functioning as intended to protect human receptors from exposure to soil and groundwater.<br>**Recommendation:** The fence along the southwest perimeter should be repaired.<br>**Follow-up action**: The fencing at Area 6 was repaired and vegetation was cleared by NAS Whidbey Island in spring of 2011. | Overall, ICs and ECs are functioning as intended.<br>Although no indication of well installation, there was no mechanism in place to confirm that no drinking water wells were installed within the 1,000-foot zone of Area 6 boundary.<br>Several sections of fencing along the western and southern boundaries were identified as being damaged and overgrown with vegetation.<br>One sign needed to be resecured to the fencing along the southwestern boundary.<br>No well deficiency was noted, but some were not labeled, and some bollards were damaged. | The ICs and ECs appear to be functioning as intended. | The ICs and ECs are functioning as intended.<br>Site inspectors observed old garbage dumpsters and a destroyed vessel dock immediately north of the composting facility.<br>All fencing and signs in good condition.<br>No significant deficiency noted with the on-site wells. Concrete surface seal is compromised at P-3. Typical maintenance, such as painting and labeling of wells, should be performed.<br>**Recommendations:** Remove discarded dock and dumpsters.<br>Perform painting and labeling of wells. Repair concrete surface seal at P-3. |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 6, Former Municipal Landfill<br>(Cont.) | | | | Repair fencing around perimeter and clear vegetation.<br>**Follow-up actions:**<br>The fencing at Area 6 was repaired, and vegetation was cleared by NAS Whidbey Island in spring 2011. | | |
| **Operable Unit 2** | | | | | | |
| Area 2, Former Western Highlands Landfill/Area 3, 1969–1970 Landfill | • Ensure that site is used for industrial or commercial purposes only.<br>• No on-site or downgradient well drilling or use of groundwater, except as approved by EPA or Ecology.<br>• Protect existing monitoring wells.<br>• Prevent ground disturbance or construction activities. | Signs and soil cover with drainage swales. | The ICs are functioning as intended to protect human receptors from exposure to soil and groundwater.<br>**Recommendation**: The two drums at Areas 2 and 3 should be removed and properly disposed of.<br>**Follow-up action**:<br>Drums identified at the site to be removed | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. The ECs appeared to be functioning to prevent environmental exposures. | The ICs and ECs appear to be functioning as intended. Drums identified in 2009 were not identified during the 2011 inspection. It is assumed that these drums were removed in 2010 or 2011. | The ICs and ECs are functioning as intended at Areas 2/3.<br>Typical maintenance, such as painting and labeling, should be performed at Areas 2/3.<br>Area 2: Landfill boundaries do not conform to the boundaries shown in the ESD and LUC.<br>No significant deficiency with the on-site wells were identified; however, polyvinyl chloride slip cap on well N2-6B says the well is damaged.<br>Area 3: No significant deficiencies with the on-site wells were identified. |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 2, Former Western Highlands Landfill/Area 3, 1969–1970 Landfill (Cont.) | | | | | | **Recommendation:** Review and revise site boundaries as necessary for Areas 2/3.<br>Perform painting and labeling of wells. Repair well N2-6B.<br>**Follow-up action:** Site boundaries at all OUs were surveyed and are reported in the new LUC Implementation Plan (U.S. Navy 2014c).<br>Well N2-6B to be repaired. |
| Area 4, Walker Barn Storage Area | • Ensure that site is used for industrial or commercial purposes only.<br>• Protect existing monitoring wells.<br>• No on-site or downgradient well drilling or use of groundwater, except as approved by EPA or Ecology. | ECs for this site include groundwater monitoring wells and signs. No fencing is required because the site is located within the main perimeter fence for Ault Field. | The ICS were functioning as intended to protect human receptors from exposure to soil and groundwater. Wells and fencing/gate installed were in good condition.<br>**Recommendation:** Additional signs should be placed around the perimeter (similar to those posted at Area 1).<br>**Follow-up action**:<br>Completed | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater.<br>The ECs appeared to be functioning to prevent environmental exposures. Well heads and casings were found in good condition and locked. | The ICs and ECs appear to be functioning as intended.<br>Well heads and casings were found to be in good condition and locked. | The ICs and ECs are functioning as intended.<br>No significant deficiency with the on-site wells was identified. However typical maintenance, such as painting and labeling, should be performed.<br>**Recommendation:** Perform painting and labeling of wells. |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 14, Pesticide Rinsate Disposal Area | • Ensure that site is used for industrial or commercial purposes only.<br>• No on-site or downgradient well drilling or use of groundwater, except as approved by EPA or Ecology. | None. | No LUC was required per the 2009 implementation plan. | Although, no LUC was required per the 2009 implementation plan, the site was inspected. No evidence of land disturbance or change was found since the previous inspection. | No evidence of land disturbance or change was found since the previous inspection.<br>Well 14-MW-1 was found in good condition. | No evidence of land disturbance or change was found since the previous inspection.<br>**Recommendation:** Discontinue LUC inspections.<br>Proper monitoring of well 14-MW-1 abandonment recommended.<br>**Follow-up action:** LUC inspections are not included in the new LUC Implementation Plan (U.S. Navy 2014c). |
| Area 29, Clover Valley Fire School | • Protect existing monitoring wells.<br>• No on-site or downgradient well drilling or use of groundwater, except as approved by EPA or Ecology. | ECs include signs, a gate, perimeter fence, and groundwater network. | The ICSs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater.<br>Well heads and casings were all found in good condition.<br>**Recommendation**: Install perimeter signage.<br>**Follow-up action**: Signage noted in 2012 inspection report. | ICs and ECs were not functioning optimally at Area 29. There was evidence of construction (underground utility): excavations, fencing removed, and wells damaged.<br>**Recommendations:**<br>• Reinstall perimeter fencing. | No evidence of land disturbance or change was found since the previous inspection.<br>Wells 29-MW-4, N29-22D, N29-22S, N29-20 were found in good condition.<br>Signs, fencing, and a gate were in place. | The ICs and ECs are functioning as intended.<br>Signs, fencing, and a gate were in place.<br>No significant deficiency with the on-site wells were identified. However, typical maintenance, such as painting and labeling, should be performed and well N29-20 monument ears were bent and unable to open. Replace |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 29, Clover Valley Fire School (Cont.) | | | | • NAS Whidbey Island to review procedures and communicate with Public Works regarding the excavation disturbance.<br>• Replace broken well covers and verify integrity of wells impacted by construction.<br>• Verify bolts are in place during the next groundwater monitoring event.<br>**Follow-up actions:**<br>• NAS Whidbey Island reviewed the communication protocol with Public Works regarding excavations at the various CERCLA sites.<br>• The fencing was reinstalled by NAS Whidbey Island. | | monument. Five monitoring wells were not located.<br>**Recommendation:** Review and revise site boundaries as necessary.<br>Perform painting and labeling of wells. Repair N29-20.<br>**Follow-up action:** LUC inspections are not included in the new LUC Implementation Plan (U.S. Navy 2014c). |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 29, Clover Valley Fire School (Cont.) | | | | • The broken well and cover were repaired September 2011. Broken monument was repaired on November 14, 2011.<br>• Bolts to be replaced during the next long-term monitoring | | |
| **Operable Unit 3** | | | | | | |
| Area 16, Runway Ditches | • Limit adjoining ditch banks to disposal of dredged sediments meeting Model Toxics Control Act industrial soils criteria and/or industrial use.<br>• Ensure that site is used for industrial or commercial purposes only. | No EC is required at Area 16. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. | ICs are functioning as intended to protect human receptors from exposure to soil and groundwater.<br>The Navy's stormwater pollution prevention measures include minimizing waste runoff into the ditches.<br>An extremely faint sheen (a couple square feet in extent) was noted in a small branch of the runway ditch that discharges towards Dugualla Bay. Sheen was not observed in any other surface water inspected in the ditches. |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| **Operable Unit 4** | | | | | | |
| Areas 48/49, Seaplane Base Landfill | • Prevent ground disturbance in landfilled area.<br>• Ensure that site is used for industrial or commercial purposes only. | No EC is required.<br>**Note**: Site now has no further action status. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater. | ICs are functioning as intended to protect human receptors from exposure to soil and groundwater. |
| **Operable Unit 5** | | | | | | |
| Area 1, Former Beach Landfill | • Ensure that site is used for industrial or commercial purposes only.<br>• Ensure that shoreline armoring is in place and functioning as intended.<br>• No on-site or downgradient well drilling or use of groundwater, except as approved by EPA or Ecology.<br>• Protect existing monitoring wells.<br>• Prevent ground | Signs, soil cover, and an armored seawall. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater.<br>**Recommendation:** A monitoring action should be implemented along the shoreline of Areas 1 and 52 to determine erosion rate. Currently, no debris or contaminant was identified or exposed along the bluff or beach. However, it appears from the inspection that the potential exists for exposed landfill debris if the seawall erosion is significant over the next years.<br>**Follow-up action:** A survey | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater.<br>Due to erosion, the Navy implemented a shoreline monitoring action at the end of 2010 through 2011.<br>**Recommendation:** Immediate interim protection measures at Areas 1 and 52, which are currently insufficient. A new seawall design and subsequent construction is | The ICs and ECs appeared to be functioning as intended.<br>There was no indication of a change in land use.<br>A change in conditions of placement of riprap in three sections as a temporary erosion control measure.<br>Sink hole noted in landfill cap.<br>Site monitoring wells were in good condition, other than one corroded well cover. | ICs are functioning as intended to protect human receptors from exposure to soil and groundwater. The soil cover appeared to be intact and undisturbed.<br>Additional shoreline protection is needed south of the new seawall.<br>Wells in good condition except MW-103, where it was noted the monument was completely rusted through and can be removed from the well. Typical maintenance, such as painting and labeling, should also be performed.<br>**Recommendations:** Review and revise site boundaries as necessary. |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 1, Former Beach Landfill (Cont.) | disturbance or construction activities. | | of the shoreline to determine the actual rate of seawall erosion was implemented in the 2010 LUC inspection. | suggested to prevent further erosion.<br>**Follow-up action**: A TCRA and follow-on permanent design and construction of coastal protection was implemented at the end of 2011 through 2012. | A TCRA shoreline stabilization was performed in January and February 2012 and a NTCRA from July to November 2012.<br>Survey results in April and November 2012 indicate reduction in erosion rate. | Armoring is recommended south of the new seawall.<br>Perform repair of well MW-103, and paint and label other monitoring wells.<br>**Follow-up action:** LUC inspections are not included in the new LUC Implementation Plan (U.S. Navy 2014c). |
| Area 31, Former Runway Fire Training School | • Ensure that site is used for industrial or commercial purposes only.<br>• Protect existing monitoring wells.<br>• No on-site or downgradient well drilling or use of groundwater, except as approved by EPA or Ecology. | ECs include a groundwater monitoring network and signage. Because the site is located within the active secured area adjacent to the main runways, this site does not have a specific security fencing system. However, the site is monitored by base security. | The ICS were functioning as intended to protect human receptors from exposure to soil and groundwater.<br>The well head of the repaired well OWS-2 needed to be concreted.<br>**Recommendation**: Install perimeter signage.<br>**Follow-up action**: Signage noted in 2010 and 2012 inspections. | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater.<br>All well heads and casings were in good condition. However, some of the flush-mount wells were missing cover bolts, and well PRW-5 had a deteriorated concrete pad.<br>Note: No recommendation was made in 2010 LUC | The ICs and ECs appeared to be functioning as intended.<br>All well heads and casings were in good condition. However, some of the flush-mount wells were missing cover bolts, and well PRW-5 had a deteriorated concrete pad.<br>Note: No recommendation was made in 2012 LUC inspection report to replace bolts and | ICs are functioning as intended to protect human receptors from exposure to soil and groundwater.<br>Well OWS-2 identified as destroyed and requires proper abandonment. Typical maintenance, such as painting and labeling, should be performed.<br>Previous LUC reports document that all remedial systems have been removed. However, two sheds housing remedial systems and associated piping were observed. |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 31, Former Runway Fire Training School (Cont.) | | | | inspection report to replace bolts and repair well. | repair well. | **Recommendation:** Properly abandon well OWS-2. Perform painting and labeling of wells.<br>Remove treatment system equipment. |
| Area 52, Jet Engine Test Cell | • Ensure that site is used for industrial or commercial purposes only.<br>• No on-site or downgradient well drilling or use of groundwater, except as approved by EPA or Ecology.<br>• Protect existing monitoring wells. | ECs include a groundwater monitoring network and signage. Because the site is located within the active secured area adjacent to the main runways, this site does not have a specific security fencing system. However, the site is monitored by base security. | The ICS were functioning as intended to protect human receptors from exposure to soil and groundwater.<br>Well heads and casings were all found in good condition.<br>**Recommendation:** A monitoring action should be implemented along the shoreline of Areas 1 and 52 to determine whether the seawall is eroding at an accelerated rate. Currently, no debris or contaminant was identified or exposed along the bluff or beach. However, it appears from the inspection that the potential exists for exposed landfill debris if the seawall erosion is significant over the next years.<br>**Follow-up action**:<br>Completed | The ICs appeared to be functioning as intended to protect human receptors from exposure to soil and groundwater.<br>One sign was found bent, and some of the flush mount well covers were missing bolts. One cover was broken at well MW-11. Several wells were not located and therefore not inspected.<br>**Recommendations:** Replace broken well cover and missing bolts. Also verify the integrity of the well head at these wells.<br>**Follow-up action:** Work order submitted | The ICs and ECs appeared to be functioning as intended.<br>One sign was found bent.<br>All well heads and casings were in good condition. However, some of the flush-mount well covers were missing bolts. One cover was broken at MW-11. Three wells were not located and therefore not inspected.<br>Note: **Recommendation:** from 2010 inspection report did not appear to be completed as noted during 2012 | ICs are functioning as intended to protect human receptors from exposure to soil and groundwater.<br>One sign was found bent.<br>Wells in good condition except well MW-6, which is missing both the cap and monument cover. Seven wells were not located. Typical maintenance, such as painting and labeling, should be performed.<br>MW-11 noted in good condition during this inspection.<br>**Recommendations:** Properly abandon well MW-6.<br>Perform painting and labeling of wells. |

## Table 6-11 (Continued)
## Land Use Control Inspection Summary, 2009 Through 2013

| Site Name | Land Use Controls Inspected | Engineering Controls | 2009 | 2010 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Area 52, Jet Engine Test Cell (Cont.) | | | | to repair wells. | inspection. No recommendation was made in the 2012 LUC inspection report to replace bolts and repair well cover. | |

Notes:
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
EC - engineering control
Ecology - Washington State Department of Ecology
EPA - U.S. Environmental Protection Agency
ESD - Explanation of Significant Differences
LUC - land use control
NTCRA - non-time-critical removal action
OU - operable unit
TCRA - time-critical removal action

## Table 6-12
## 2013 Groundwater Monitoring Well Issues and Recommendations Summary

| Well ID | Notes |
|---|---|
| **OU 1 Area 6, Former Municipal Landfill** | |
| P-3 | Concrete surface seal is compromised. |
| **OU 2 Area 2, Former Western Highlands Landfill** | |
| N2-6B | Polyvinyl chloride cap was damaged. |
| **OU 2 Area 14, Pesticide Rinsate Disposal Area** | |
| 14-MW-1 | Abandonment is recommended |
| **OU 2 Area 29, Clover Valley Fire School** | |
| N29-20 | Monument ears are bent and unable to open. Replace monument. |
| **OU 5 Area 1, Former Beach Landfill** | |
| TP-101 | Mice are living in monument. |
| MW-103 | Replace monument |
| **OU 5 Area 31, Former Runway Fire Training School** | |
| OWS-2 | Destroyed; properly abandon. |
| **OU 5 Area 52, Jet Engine Test Cell** | |
| EW-1 | Flooded. |
| MW-6 | Properly abandon. |
| MW-25 | Coordinates off. |

Note: OU - operable unit

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# 7.0 TECHNICAL ASSESSMENT

This section answers three questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Based on the answers to these questions discussed in this section, a technical assessment of the remedies is summarized. The following table provides a quick reference to questions A, B, and C answers by OU and area.

| **OU** | **Area** | **Question A:** Is the remedy functioning as intended by the decision documents? | **Question B:** Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid? | **Question C:** Has any other information come to light that could call into question the protectiveness of the remedy? |
|---|---|---|---|---|
| 1 | 5 | Yes | Yes | No |
| 1 | 6 | Yes | No | No |
| 2 | 2/3 | Yes | Yes | No |
| 2 | 4 | Yes | Yes | No |
| 2 | 14 | Yes | Yes | No |
| 2 | 29 | Yes | Yes | No |
| 3 | 16 | Yes | Yes | No |
| 4 | 48/49 | Yes | Yes | No |
| 5 | 1 | Yes | Yes | No |
| 5 | 31 | Yes | Yes | No |
| 5 | 52 | Yes | Yes | No |

## 7.1 ANSWERS TO QUESTIONS A, B, AND C FOR OU 1

This section answers questions A, B, and C for OU 1, which comprises Areas 5 and 6.

### 7.1.1 Area 5

For OU 1 Area 5 the answer to question A is “yes,” the remedy is functioning as intended by the OU 1 ROD. ICs are effectively enforced basewide.

No action was the selected remedy for OU 1 Area 5. The Navy decided to conduct a one-time sampling and monitoring event to assess whether metals concentrations in groundwater were consistent with background levels, or elevated above levels of concern for human health (U.S. Navy, Ecology, and USEPA 1992). Groundwater use restrictions were implemented because of the potential presence of landfilled material at this site.

For OU 1 Area 5, the answer to question B is “yes,” the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 1 Area 5, the answer to question C is “no.” No other information reviewed during this 5-year review affects the protectiveness of the remedy.

### 7.1.2 Area 6

For OU 1 Area 6 the answer to question A is “yes,” the remedy is functioning as intended by the OU 1 ROD. Based on the observed site conditions and remedy performance data, the remedy is functioning as intended by the OU 1 ROD. Continued operation of the groundwater extraction and treatment system is required.

The landfill cap is functioning as intended by the OU 1 ROD at Area 6. The landfill cap is intact and is well maintained.

The groundwater extraction and treatment system has been successful at reducing COC concentrations in groundwater as evidenced by an order of magnitude decrease in COC concentrations in the highest concentration areas. The lateral extent of volatile organic COCs in the shallow groundwater is decreasing in the western plume area. Volatile organic COCs in groundwater continue to extend off site to the west and the southwest (Figures A-5 and A-9). The system has successfully reduced concentrations in these areas, but continued reliable extraction system operation is necessary to maintain control of the plume extending off site to the south and southwest. Operation of well PW-5 is important for capturing COCs that have extended across the western border as they migrate south with groundwater flow. Target flow rates must be carefully maintained at PW-5 in order to maintain remedy functionality. Groundwater modeling conducted as part of the ongoing optimization evaluation shows that pumping has slowed the off-site vinyl chloride and 1,4-dioxane plumes expansion.

Vinyl chloride has migrated south of the Area 6 boundary onto the adjacent City of Oak Harbor landfill property. However, Washington State law (Washington Administrative Code [WAC] 173-160-171[3bvi]) prohibits the drilling of wells within 1,000 feet of a landfill. Vinyl chloride in groundwater has not migrated beyond the 1,000-foot restriction relative to the City of Oak Harbor landfill. Therefore, exposure to this groundwater via wells is prevented by WAC 173-

160-171(3bvi). The remedy for OU 1 Area 6 will no longer be functioning as intended if vinyl chloride migrates farther than 1,000 feet from the City of Oak Harbor landfill boundary.

For OU 1 Area 6, the answer to question B is “no.” The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6. The answer to this question is no because the ROD did not consider 1,4-dioxane in the exposure assumptions. The downgradient extent of 1,4-dioxane is still within the 1,000-foot groundwater well installation restriction zone of the Oak Harbor landfill. However, the current treatment system does not treat groundwater for 1,4-dioxane, and the existing extraction system is not capable of capturing it. 1,4-Dioxane was identified in groundwater at the site prior to the preceding 5-year review, and the Navy has been actively evaluating alternatives to address it during this review period.

It should be noted that the MCL for 1,1-DCE is 7 µg/L and the ROD RG is 0.07 µg/L. The ROD RG was risk based assuming that 1,1-DCE was a carcinogen. Groundwater 1,1-DCE concentrations at OU 1 Area 6 are currently being evaluated against the MCL of 7 µg/L.

For OU 1 Area 6, the answer to question C is “no.” No new information has come to light that “could” call into question the protectiveness of the remedy at OU 1 Area 6

1,4-Dioxane was not identified as a COC in the OU 1 ROD. However, it is present in groundwater at concentrations greater than the MTCA Method B cleanup level of 0.44 µg/L. The existing groundwater capture and treatment system was not designed to address 1,4-dioxane in groundwater at OU 1 Area 6. However, the 1,4-dioxane distribution is similar to vinyl chloride in that it has not migrated beyond the 1,000-foot restriction relative to the City of Oak Harbor landfill. Therefore, exposure to this groundwater via wells is prevented by WAC 173-160-171(3bvi). At this time, the presence of 1,4-dioxane does not call into question the protectiveness of the remedy. The Navy has isolated water users where 1,4-dioxane was identified in domestic wells by redrilling deeper wells into the lower unimpacted aquifer. The remedy for OU 1 Area 6 will no longer be functioning as intended if 1,4-dioxane migrates farther than 1,000 feet from the City of Oak Harbor landfill boundary. It has been identified as a chemical to be addressed, and the Navy continues to actively evaluate alternatives.

The Navy has completed bench-scale evaluation of biomats and advanced oxidation for ex situ treatment of groundwater containing 1,4-dioxane (U.S. Navy 2011e). A second bench-scale evaluation of ex situ advanced oxidation has been completed to refine methods and dosages and to estimate large-scale system design parameters. Results of this second evaluation will be presented in the ongoing optimization evaluation, once complete. A field-scale pilot study is planned for 2014 to evaluate in situ chemical oxidation at the site. Results of this field study will also be presented in the ongoing optimization evaluation. A comprehensive groundwater model has been constructed to predict and evaluate results of various in situ and pumping scenarios.

These results, combined with the bench-scale ex situ and field-scale in situ studies, will be used by the optimization team (NAVFAC NW, NAVFAC Headquarters, Expeditionary Warfare Center, EPA Region 10, and EPA Headquarters) to optimize the remedy. The conclusions of the optimization will be used to develop a ROD amendment that will address 1,4-dioxane in groundwater at the site.

## 7.2 ANSWERS TO QUESTIONS A, B, AND C FOR OU 2

### 7.2.1 Areas 2/3

For OU 2 Areas 2/3 the answer to question A is "yes," the remedy is functioning as intended by the OU 2 ROD.

A combination of ICs and a groundwater monitoring program for the first 5 years was selected as the remedy for Areas 2/3. The intent of the groundwater monitoring program was to confirm that concentrations of inorganics in groundwater were within background levels and below risk-based levels. Based on results of the four rounds of 5-year reviews sampling (1995, 2002, 2007, and 2013), groundwater monitoring continues on a 5-year basis, and the need for continued monitoring is assessed on the same cycle.

The 2013 LUC failure was the result of a tenant contracting entity at NAS Whidbey Island not following the Naval Air Station Whidbey Island "site approval process." The Navy is strongly reinforcing its LUC program communication and signage as described in Section 4.2.4. The EPA was very satisfied with the Navy's prompt response to the occurrence, the thoroughness of the investigation, revisions to the communication program, and accountability.

In light of the strengthened LUC implementation program, ICs are effectively enforced through Navy instruction, communications, signage, and accountability.

For OU 2 Area 2/3, the answer to question B is "yes," the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

However, it is recommended that an analysis on existing data be performed to determine if observed concentrations of arsenic and manganese in groundwater are background or pose an unacceptable risk. If necessary, additional data may be collected. If it is determined that the observed arsenic and manganese groundwater concentrations are background, monitoring will be terminated.

For OU 2 Areas 2/3, the answer to question C is "no." No other information reviewed during this 5-year review affects the protectiveness of the remedy.

### 7.2.2 Area 4

For OU 2 Area 4, the answer to question A is “yes,” the remedy is functioning as intended by the OU 2 ROD.

Excavation and off-site disposal of approximately 1,750 $yd^3$ of PCB-contaminated soil has been completed at Area 4. Low-stress groundwater monitoring has been conducted to determine the level of inorganics in the groundwater for both on-area and background wells. ICs (groundwater use restrictions) and continued groundwater monitoring were implemented based on the results of the initial groundwater monitoring. Groundwater monitoring continues on a 5-year basis, and the need for continued monitoring is assessed on the same cycle. ICs are effectively enforced through Navy instruction.

For OU 2 Area 4, the answer to question B is “yes,” the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 2 Area 4, the answer to question C is “no.” No other information reviewed during this 5-year review affects the protectiveness of the remedy.

### 7.2.3 Area 14

For OU 2 Area 14, the answer to question A is “yes,” the remedy is functioning as intended by the OU 2 ROD.

The dry well and monitoring well 14-MW-1 were pumped out, and approximately 1,000 gallons of water was treated and disposed of. The dry well and monitoring well were removed and approximately 420 $yd^3$ of surrounding contaminated soil was excavated and disposed of. Well 14-MW-1 was reinstalled downgradient of its original location and groundwater sampled during the wet season to confirm the effectiveness of the remediation effort. The EPA confirmed, via letter, that all cleanup actions required by the ROD have been implemented and the remedy was complete (U.S. Navy 1998).

For OU 2 Area 14, the answer to question B is “yes,” the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 2 Area 14, the answer to question C is “no.” No other information reviewed during this 5-year review affects the protectiveness of the remedy.

### 7.2.4 Area 29

For OU 2 Area 14, the answer to question A is "yes," the remedy is functioning as intended by the OU 2 ROD.

Excavation and disposal of approximately 1,400 yd$^3$ of PCP- and PAH-contaminated soil from several locations surrounding the burn pad has been completed at Area 29. Low-stress groundwater monitoring has been conducted to determine the level of inorganics in the groundwater for both on-site and background wells. ICs (groundwater use restriction) and continued groundwater monitoring were implemented based on results of the initial monitoring event. Groundwater monitoring continues on a 5-year basis, and the need for continued monitoring is assessed on the same cycle. The LUC failure at this site, discussed in section4.2.4 resulted in a strengthened communication and signage program. With the strengthened program, ICs are effectively enforced through Navy instruction.

For OU 2 Area 29, the answer to question B is "yes," the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 2 Area 29, the answer to question C is "no." No other information reviewed during this 5-year review affects the protectiveness of the remedy.

## 7.3 ANSWERS TO QUESTIONS A, B, AND C FOR OU 3

Area 16 makes up OU 3. For OU 3, the answer to question A is "yes," the remedy is functioning as intended by the OU 3 ROD.

The initial 5-year review noted that remediation was completed in April 1996 as designed, and no modifications were required. The OU 3 remedies were considered complete, and the initial 5-year review concluded that OU 3 would not be subject to future 5-year reviews because no hazardous substances, pollutants, or contaminants remained on site above levels that would not allow for unlimited use and unrestricted exposure (U.S. Navy, 1998).

Current EPA guidance (USEPA 2001) requires that 5-year reviews at NAS Whidbey Island include OU 3 because of ICs encompassing Area 16 that do not allow for the unlimited use of Area 16. The IC for this area consists of an industrial land use designation for areas 50 feet from either side of the ditch centerlines to allow the Navy to place material dredged from ditches on the ditch banks during routine maintenance.

Results from the 2002 and 2006 sediment monitoring indicate that the removal action was successful in achieving cleanup levels. The third 5-year review recommended resampling sediments at the same 2006 locations. This sampling was conducted in February 2014. No COCs were identified at concentrations greater than RGs in the 2013 sediment samples. ICs are effectively enforced by Navy instruction. For OU 3 the answer to Question A is "yes," the remedy functioning at as intended by the OU 3 ROD.

For OU 3, the answer to question B is "yes," the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 3, the answer to question C is "no." No other information reviewed during this 5-year review affects the protectiveness of the remedy.

## 7.4 ANSWERS TO QUESTIONS A, B, AND C FOR OU 4

For OU 4, the answer to question A is "yes," the remedy is functioning as intended by the OU 4 ROD.

Excavation and on-station or off-area disposal of contaminated soil at Areas 39, 41, 44, and 48 have been completed. OU 4 was deleted from the NPL on September 21, 1995. A notification regarding the existence of a historical construction and demolition debris landfill will be placed on the deed for Area 49 when and if the Navy disposes of the property. Transfer of any Navy property is conducted through a Finding of Suitability for Transfer process, during which the notification would be placed on the deed. As such, the remedy is functioning as intended by the OU 4 ROD. For OU 4 the answer to Question A is "yes," the remedy functioning at as intended by the OU 2 ROD.

For OU 4, the answer to question B is "yes," the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 4, the answer to question C is "no." No other information reviewed during this 5-year review affects the protectiveness of the remedy.

## 7.5 ANSWERS TO QUESTIONS A, B, AND C FOR OU 5

### 7.5.1 Area 1

For OU 5 Area 1 the answer to question A is "yes," the remedy is functioning as intended by the OU 5 ROD.

ICs and monitoring, including annual visual inspections of the landfill bluff, were implemented as prescribed in the ROD. Annual inspections were performed prior to the initial 5-year review and then discontinued after satisfying the ROD requirement. Construction debris from the Area 1 landfill was exposed along the western bluff as a result of shoreline erosion. Annual inspections were resumed in 2009. The shoreline was repaired and a seawall was constructed in 2012 to mitigate future erosion at Area 1. Seep monitoring conducted in 2007 showed COC concentrations in sediment pore water did not exceed ROD cleanup levels. ICs are effectively enforced through Navy instruction. Based on site observations and the 2007 seep monitoring data, the remedy for Area 1 OU 5 is currently functioning as intended by the ROD. However, regular inspections of the bluff area should be conducted to monitor the condition of the newly constructed seawall.

For OU 5 Area 1, the answer to question B is “yes,” the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 5 Area 1, the answer to question C is “yes.” Slight erosion had been observed at the south end of the seawall in 2013. However, some deposition in this same area was observed in 2014. So the need for additional armoring should be evaluated during the next 5-year review period.

### 7.5.2 Area 31

For OU 5 Area 31, the answer to question A is “yes,” the remedy is functioning as intended by the OU 5 ROD. However, the existing data do not indicate that natural attenuation is occurring relative to dissolved petroleum constituents in groundwater. The remedy of product recovery and vadose zone bioventing was to remove free product on the groundwater surface and adsorbed petroleum constituents from vadose zone soil. The remedy was not intended to address residual petroleum in groundwater. An extended period of time may be required to exhaust the residual petroleum in groundwater and accumulate data that demonstrates natural attenuation. Land use controls, current land use, and restricted site access preclude potential exposures to groundwater at this time. Therefore, it is recommended that monitoring be continued and additional data be collected to evaluate dissolved plume stability.

Removal of the oil/water separator and the ash pile was completed in April 1996. Oil skimming and bioventing was conducted from 1996 through June 2007. Semiannual groundwater monitoring was conducted to confirm system performance (FWEC 1997d, U.S. Navy 2013c). Annual groundwater monitoring has been conducted during this review period. The 2012 data indicate that no free product is present in any of the monitored wells, residual fuel constituents are not migrating downgradient off site, natural attenuation is occurring (U.S. Navy 2013c). ICs limiting site access and prohibiting groundwater use are effectively enforced through Navy instructions.

For OU 5 Area 31, the answer to question B is “yes,” the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 5 Area 31, the answer to question C is “no.” No other information reviewed during this 5-year review affects the protectiveness of the remedy.

### 7.5.3 Area 52

For OU 5 Area 52, the answer to question A is “yes,” the remedy is functioning as intended by the OU 5 ROD.

A suspected dry well was removed from the site in 1996 as part of the remedy. Based on the removal and analytical results, it was concluded that the casing was not a dry well used for disposal purposes (U.S. Navy 2004b). The dry well removal component of the remedy is complete.

The product recovery system was operated from 1996 through June 2007. Based on product recovery rates, operation of the system was discontinued in June 2007 with EPA concurrence. Sediment pore water sampling was conducted in July 2007 at two of six previously established seep sampling locations and all six locations in 2013. Results of the 2007 and 2013 seep sampling events demonstrate that petroleum hydrocarbons have not migrated in groundwater from the site to the marine environment at concentrations greater than cleanup levels at the sampled locations.

The remedy at Area 52 is considered complete, and ICs are effectively enforced through Navy instruction. It is recommended that sediment pore water sampling be terminated. The remedy for OU 5 Area 52 has functioned as intended.

For OU 5 Area 52, the answer to question B is “yes,” the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. A discussion of the changes in toxicity data and cleanup levels is provided in Section 7.6.

For OU 5 Area 52, the answer to question C is “no.” No other information reviewed during this 5-year review affects the protectiveness of the remedy.

## 7.6 CONTINUED VALIDITY OF ROD ASSUMPTIONS

This section answers question B, "Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?" Therefore, this section reviews any changes to ARARs used to establish cleanup levels in the RODs and reviews any changes to risk assessment assumptions (exposure and toxicity) to evaluate the protectiveness of the remedy.

The findings documented in this section are that changes in the exposure and toxicity assumptions of ARARs that have occurred since the RODs were signed do not affect the protectiveness of the remedies at the following:

- OU 1 (Areas 5 and 6)
- OU 2 (Areas 2/3, 4, 14, and 29)
- OU 3 (Area 16)
- OU 4 (Areas 39, 41, 44, 48, and 49)
- OU 5 (Areas 1, 31, and 52)

Therefore the answer to question B is "yes," the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid for OUs 1 through 5.

Concentrations of chemicals in groundwater remain above the cleanup levels at some locations in OUs 1, 2, 3, 4, and 5, resulting in the need for continued ICs to prevent exposure and the need for ongoing monitoring. Although some of the cleanup levels might be lower if calculated today, the remedy components continue to protect against exposures, just as they did at the time the RODs were signed. ICs preventing exposure and ongoing monitoring will need to continue until COC concentrations in groundwater and surface water are below the cleanup levels.

### 7.6.1 Review of Applicable or Relevant and Appropriate Requirements

In the preamble to the NCP, EPA states that ARARs are generally "frozen" at the time of ROD signature, unless new or modified requirements call into question the protectiveness of the selected remedy. Five-year review guidance (USEPA 2001) indicates that the question of interest in developing the 5-year review is not whether a standard identified as an ARAR in the ROD has changed in the intervening period, but whether such a change to a regulation calls into question the protectiveness of the remedy. If the change in the standard would be more stringent, the next stage is to evaluate and compare the old and the new standards and their associated risk. This comparison is done to assess whether the currently calculated risk associated with the standard identified in the ROD is still within EPA's acceptable excess cancer risk range of $10^{-4}$ to $10^{-6}$, or below a hazard index of 1 for noncancer effects. If the old standard is not considered protective, a new cleanup standard may need to be adopted after the 5-year review through

CERCLA's processes for modifying a remedy. The risk comparison is provided in Section 7.2.2 where the risk assessment assumptions are discussed.

The first 5-year review for OU 1 (Areas 5 and 6), OU 2 (Areas 2/3, 4, and 29), and OU 5 (Areas 1, 31, and 52) reported that there was no substantive change to ARARs that would call into question the protectiveness of the remedies (U.S. Navy 1998). It is presumed that during the second 5-year review for OU 1 (Areas 5 and 6), OU 2 (Areas 2/3, 4, 14, and 29), OU 3 (Area 16), OU 4 (Areas 39, 41, 44, 48, and 49), and OU 5 (Areas 1, 31, and 52), no substantive change was found to ARARs that would call into question the protectiveness of the remedies (U.S. Navy 2004b). However, ARARs were not explicitly discussed in the second 5-year review report. During the third 5-year review for OU 1 (Areas 5 and 6), OU 2 (Areas 2/3, 4, 14, and 29), OU 3 (Area 16), OU 4 (Areas 39, 41, 44, 48, and 49), and OU 5 (Areas 1, 31, and 52), no substantive change was found to ARARs that would call into question the protectiveness of the remedies (U.S. Navy 2009b).

As part of this fourth 5-year review, all of the ARARs identified in the RODs were reviewed for changes that could affect the assessment of whether the remedy is protective. Based on this review, it was concluded that the following regulations listed as ARARs have changed since the RODs:

- Washington State MTCA regulations
- Washington State marine surface water quality standards for protection of aquatic life

In addition to establishing risk-based cleanup levels, MTCA also allows for use of background or the laboratory PQL as a cleanup level when the MTCA cleanup level is lower than these values. Based on new analytical techniques, laboratories now are able to readily achieve lower PQLs for some COCs. When cleanup levels are established as PQLs and the PQLs decrease with improved technology, the 5-year review process does not typically recommend revising the cleanup levels during every 5-year review. Instead, the 5-year review includes an assessment of whether the latest PQLs are being used for monitoring and decision making.

The result of the amendments to the regulations is sometimes the lowering of a numeric ARAR. In these instances, the revised ARAR must be evaluated to determine whether there is a negative effect on the protectiveness of the remedy. This evaluation is discussed below. In other instances, the ARAR remains unchanged or has increased. In these instances, a detailed evaluation is not provided, because the protectiveness of the remedy is not affected.

### *Operable Unit 1*

OU 1 consists of Areas 5 and 6. No cleanup levels were established for Area 5. For Area 6, the cleanup levels are based on future residential land use. These areas were reviewed separately for potential revisions to ARAR values that could affect the protectiveness of the remedies.

**Area 5.** ICs, including groundwater use restrictions, remain in place at Area 5. No ARAR review was conducted for Area 5, because there were no ROD cleanup levels identified. All exposure assumptions and RAOs used at the time of the remedy selection are still valid. No other information has come to light since the last 5-year review that could call into question the protectiveness of the remedy.

**Area 6.** For Area 6, no cleanup levels were established for soil. Groundwater cleanup levels were based on the protection of human health, assuming groundwater is used as drinking water. For the COCs in groundwater listed in the OU 1 ROD, no revision to the ARARs was found that would affect the protectiveness of the remedy.

The selected cleanup levels for Area 6 are generally based on MTCA Method B potable groundwater cleanup levels. The compliance levels for vinyl chloride listed in Table 17 of the ROD (U.S. Navy 1993a) take into account analytical considerations and were evaluated during this 5-year review. Table 7-1 compares current ARAR values with those presented in the OU 1 ROD (U.S. Navy 1993a, Table 17).

The ARAR values have changed since the signing of the ROD for:

- TCE
- 1,1-DCA
- 1,1-DCE
- cis-1,2-DCE

For TCE, the ROD cleanup level of 5 µg/L was based on the Federal MCL. However, the MTCA Method B groundwater cleanup level is currently 4 µg/L (based on revised toxicity criteria; see Section 7.2.2) and is slightly lower than the MCL. The ROD cleanup level of 800 µg/L for 1,1-DCA was based on MTCA Method B and has increased to 1,600 µg/L (see Section 7.2.2).

The MTCA Method B value for 1,1-DCE increased from 0.07 to 400 µg/L, because the EPA (USEPA 2013) no longer considers this chemical a carcinogen (see Section 7.2.2). However, the Federal MCL of 7 µg/L is lower and listed as the current regulatory level.

The current ARAR value for cis-1,2-DCE has decreased therefore calling into question the protectiveness of the remedy**.** The MCL based cleanup value of 70 µg/L for cis-1,2-DCE is no longer considered protective by either the EPA or Ecology. The revised MTCA B cleanup level of 16 µg/L is considered protective because it is based on revised toxicity factors (see section 7.2.2). Currently, only well PW-1 exceeds the current MTCA B cleanup level of 16 µg/L. Well PW-1 is an extraction well in the capture zone, where active pump and treat occur. The February 2013 sample from PW-1 contained cis-1,2-DCE at 26 µg/L. All concentrations of COCs at PW-1 show a decreasing trend in the last 5 years and concentrations are expected to decrease in the future per this trend. ICs are in place to prevent use of groundwater as drinking water source. Therefore, the remedy is still protective of human health.

The vinyl chloride MTCA Method B value increased from 0.02 to 0.029 µg/L. The compliance level, however, is based on the PQL, which was listed as 0.1 µg/L in the ROD and is currently 0.03 µg/L based on the recent February 2013 long-term monitoring at OU 1 Area 6 (U.S. Navy 2013c). The ROD cleanup levels for TCE, 1,1-DCA, and 1,1-DCE remain protective of human health based on ICs in place and/or risks between $10^{-4}$ and $10^{-6}$ and hazards below 1. Further discussion is provided in Section 7.2.2.

The second 5-year review identified a new chemical, 1,4-dioxane, in the influent to the groundwater treatment system at Area 6 in 2003. Although 1,4-dioxane is not specified in the ROD or the second 5-year review for Area 6 as a COC, it has become a COC at other sites that are similar to Area 6 (U.S. Navy 2004b). Because this chemical was identified after the completion of the ROD, no cleanup level was established. Therefore, during the third 5-year review, the MTCA Method B groundwater cleanup value of 4 µg/L was included as the current regulatory level. The current MTCA Method B value has been revised to 0.44 µg/L for 1,4-dioxane (based on toxicity criteria updated in 2010) and is included in Table 7-1.

### *Operable Unit 2*

For OU 2, soil and groundwater cleanup levels for Areas 2/3, 4, 14, and 29 were based on future residential use. For the COCs in soil and groundwater listed in the OU 2 ROD, no revision to the ARAR values was found that would affect the protectiveness of the remedy.

**Soil.** The selected cleanup levels for Areas 4, 14, and 29 are based on MTCA Methods A and B unrestricted land use. Table 7-2 compares current soil ARAR values with those documented in the OU 2 ROD (U.S. Navy, Ecology, and USEPA 1994, Table 12). In Area 4, the MTCA Method A unrestricted land use value is currently 1 mg/kg for PCBs. However, the MTCA Method B unrestricted land use value is 0.5 mg/kg. In Areas 4 and 29, PCP's MTCA Method B value decreased from 8.33 to 2.5 mg/kg. In Area 14, the MTCA Method B cleanup level for 2,3,7,8-TCDD has increased from $6.67 \times 10^{-6}$ to $1.1 \times 10^{-5}$ mg/kg and 2,4-dichlorophenol has increased from 4.8 to 240 mg/kg. In Area 29, the MTCA Method A cleanup level for PAHs (based on benzo[a]pyrene) decreased from 1 to 0.1 mg/kg.

EPA conducted an inspection on July 11, 1996 and confirmed by letter on July 24, 1996 that all cleanup actions required by the OU 2 ROD had been completed for Areas 4, 14, and 29 (U.S. Navy 1998). Contaminated soil has been excavated, and confirmatory sampling was conducted to verify concentrations of PCBs, PAHs, and PCP of less than or equal to ROD cleanup levels (U.S. Navy 2004b). It is unknown if PCB concentrations between 0.5 to 1 mg/kg, PAH concentrations between 0.1 to 1 mg/kg, and PCP concentrations between 2.5 to 8.33 mg/kg remain in soil on site. However, for these chemicals that now have lower cleanup levels, the ROD RGs remain protective of human health based on risks between $10^{-4}$ and $10^{-6}$, as discussed further in Section 7.2.2. In addition, the current land use in these areas is industrial and the MTCA Method A industrial cleanup level for PCBs is 10 mg/kg and for PAHs, 2 mg/kg. The MTCA Method C industrial value for PCP is 328 mg/kg and TCDD is 0.0015 mg/kg. If remaining concentrations of contaminants in soil are above the current ARARs, ICs are in place to prevent residential land use. Therefore, the lowering of these ARAR values does not affect the protectiveness of the remedy, and the ROD cleanup levels remain protective of human health.

**Groundwater.** The selected final cleanup levels for Areas 2/3, 4, 14, and 29 are based on a variety of sources, including MCLs, background values, PQLs, and MTCA Method B potable groundwater cleanup levels. Table 7-3 compares current groundwater ARAR values with those presented in the OU 2 ROD (U.S. Navy, Ecology, and USEPA 1994, Table 13) and the post-ROD levels. Background values for arsenic and manganese and a PQL for vinyl chloride were established after the ROD during groundwater monitoring (U.S. Navy 1997e).

In Areas 2/3, 4, and 29, the final cleanup level selected for manganese was based on background. The MTCA Method B groundwater cleanup level for manganese increased from 80 to 747 µg/L. The actual MTCA B cleanup level listed in Ecology's CLARC website is 2,240 µg/L, however EPA recommends a modification factor of 3 when assessing exposure from drinking water or soil. This modification factor is based on the increased exposure of children to manganese-contaminated water and soil (USEPA 2014). Therefore, the current adjusted MTCA Method B ARAR value of 747 µg/L could now be used as a cleanup standard, because it is larger than the background value of 125 µg/L. Because this is an increase in the regulatory level, the ROD cleanup level remains protective of human health.

In Areas 2/3, the vinyl chloride ROD cleanup level is based on the PQL of 1 µg/L. Based on the lowest attained detection limits in recent long term groundwater sampling, the PQL for vinyl chloride has decreased from 1 to 0.03 µg/L. The current MTCA Method B value for vinyl chloride is 0.029 µg/L, and laboratory analytical techniques are getting closer to attaining this cleanup level. Current and historical groundwater monitoring results at Areas 2/3 for vinyl chloride did not exceed the ROD cleanup level of 1 µg/L, except at location N3-12 (see

Table 6-2). Although vinyl chloride currently has a lower ARAR value than the established cleanup level and site concentrations at one location exceed the cleanup level, ICs restrict groundwater use as a drinking water source, and the remedy is still protective of human health. If ICs were to be removed from this area in the future, any remaining concentrations of vinyl chloride would have to be reviewed in terms of current toxicological information and analytical methods.

In Area 14, the MTCA B cleanup level for 2,4-dichlorophenol decreased from 48 to 24 µg/L. Although remediation has occurred at Area 14 based on the higher ROD cleanup level of 48 µg/L, groundwater sampling conducted in 1996 (U.S. Navy 1997e) confirms that 2,4-dichlorophenol levels are well below 24 µg/L. As a result, groundwater sampling is not conducted or required at Area 14 (U.S. Navy 2004b). Currently, ICs restrict groundwater use as a drinking water source. However, sampling has demonstrated that site concentrations of 2,4-dichlorophenol are not a human health concern. Therefore, the remedy is still protective of human health.

### *Operable Unit 3*

Sediment cleanup levels for OU 3 Area 16 were based on ecological receptors and industrial land use. No cleanup levels were established for surface water or groundwater. ARAR values were not available for ecological risk in sediment. Therefore, to establish cleanup levels, ecological receptor modeling (based on the muskrat) was conducted for four chemicals (arsenic, 2-methylnaphthalene, dibenz[a,h]anthracene, and phenanthrene), background was used for lead, and MTCA Methods A and C soil cleanup levels based on industrial land use were selected for the remaining chemicals (benzo[k]fluoranthene and TPH). Table 7-4 compares current soil ARAR values with those documented in the OU 3 ROD (U.S. Navy, Ecology, and USEPA 1995, Table 8-1). The table includes ROD and current regulatory levels based on human health (i.e., MTCA Methods A and C) for comparative purposes. Although there have been changes to the regulatory levels based on human health, the selected cleanup levels based on ecological modeling are lower and therefore protective.

A review of the muskrat modeling toxicity values was conducted for arsenic, lead, and 2-methylnaphthalene, because the 2002 and 2006 sediment data for Area 16 indicated that these chemicals had concentrations above the ROD cleanup levels (Section 6.4). Current arsenic, lead, and 2-methylnaphthalene levels in sediments were reviewed. Maximum arsenic concentrations are below current MTCA Method A levels and are presumed to be protective of the environment on that basis. While the ROD cleanup level for lead was based on background, ecological risk-based concentrations for lead are often lower than background because toxicity studies are based on a highly bioavailable form of lead. If cleanup levels based on ecological risks for arsenic and 2-methylnaphthalene were calculated today, higher cleanup levels would result, based on current toxicological studies available (see Section 7.2.3). Therefore, the ROD cleanup levels for arsenic, lead, and 2-methylnaphthalene are protective of human health and the environment, and no change to the remedy is required.

The current cleanup levels for the remaining PAHs (dibenz[a,h]anthracene and phenanthrene) if calculated today are unlikely to change from the ROD cleanup levels, based on no revisions to the ecological toxicity criteria (see Section 7.2.3). Therefore, site concentrations of these two PAHs, which are currently below the ROD cleanup levels, are likely acceptable and protective of the environment.

The ROD selected cleanup level of 200 mg/kg for TPH in soil is based on the MTCA Method A industrial or unrestricted cleanup level. MTCA Method A values are currently available for each of the specific fuel type fraction ranges of diesel, heavy oil, mineral oil, gasoline with benzene, and gasoline without benzene. Therefore, a straight comparison of present and past MTCA Method A levels cannot be made for TPH. As shown in Table 7-4, the ROD-selected cleanup level of 200 mg/kg is protective for all of the individual TPH compounds with the potential exception of gasoline. However, the residual TPH in sediment is more likely attributable to the diesel range rather than the gasoline range, because the source is JP-5, and benzene was not identified as a COPC in the risk assessment. In addition, the MTCA Method A values are intended to be protective of unrestricted land use, and ICs are in place that will prevent residential use of the site. Therefore, the ROD-selected cleanup level for TPH remains protective of human health.

### *Operable Unit 4*

For OU 4, no groundwater cleanup levels were established, and the same soil cleanup levels were used for Areas 39, 41, 44, 48, and 49 to achieve RAOs. Soil ARAR values were based on residential land use. For the COCs in soil and sediment listed in the OU 4 ROD, no revision to the ARAR values were found that would affect the protectiveness of the remedy.

The selected soil cleanup levels were based on MTCA Methods A and B unrestricted land use cleanup levels. Table 7-5 compares current soil ARAR values with those documented in the OU 4 ROD (U.S. Navy, Ecology, and USEPA 1993b, Table 13). The current ARAR values for chromium and carcinogenic PAHs (cPAHs) have decreased and, therefore, these changes call into question the protectiveness of the remedy. The chromium cleanup level of 400 mg/kg (based on chromium VI; MTCA Method B) has decreased to 240 mg/kg (based on a change in toxicity criteria; see Section 7.2.2). The cPAH cleanup level of 1 mg/kg based on MTCA Method A has decreased to 0.14 mg/kg (based on benzo[a]pyrene).

Contaminated soil has been excavated and confirmatory sampling was conducted to verify a chromium cleanup level of 400 mg/kg and a cPAH cleanup level of less than or equal to 1 ppm (U.S. Navy 2004b). It is unknown if chromium concentrations between 240 to 400 mg/kg and cPAH concentrations between 1 to 0.1 mg/kg remain in soil on site. However, OU 4 is currently industrial, and the Method A industrial cleanup level for cPAHs based on benzo(a)pyrene is 2 mg/kg, and the Method C industrial cleanup level for chromium VI is 11,000 mg/kg. If remaining concentrations of chromium and PAHs in soil are above current ARAR values (240 and 0.14 mg/kg, respectively), LUCs are effectively enforced through Navy instruction for deed notification on transfer. Therefore, the decrease in these ARAR values does not affect the protectiveness of the remedy.

### *Operable Unit 5*

OU 5 consists of Areas 1, 31, and 52. Each of these areas was reviewed separately for potential revisions to the ARARs that could affect the protectiveness of the remedies.

**Area 1.** For Area 1, the human health and ecological risk assessments concluded that under the assumed industrial and recreational land use scenarios, no human or ecological risk was present at the site, and no RAO was developed for the protection of human health and the environment for exposures to soil, freshwater sediments, or surface water. In addition, groundwater at Area 1 is not a drinking water source, and no human health or ecological risk was identified for exposure to groundwater. However, cleanup levels were established for groundwater to address potential adverse impacts to marine life because of groundwater discharges to the Strait of Juan de Fuca. No revision to the groundwater ARARs was found that would affect the protectiveness of the remedy.

Table 7-6 compares current groundwater ARAR values for the protection of surface water with those presented in the OU 5 ROD (U.S. Navy, Ecology, and USEPA 1996, Table 12). Since the ROD, the marine ambient water quality criterion (Washington Administrative Code 173-201A, and 40 CFR Part 131) for zinc increased slightly, from 76.6 to 81 µg/L. However, this change does not affect the protectiveness of the remedy.

As discussed for OU 1 Area 6, 1,1-DCE is no longer considered a carcinogen (see Section 7.2.2). Therefore, if calculated today, the MTCA B cleanup level for 1,1-DCE at OU 5 Area 1 would increase from 1.9 to 23,100 µg/L.

**Area 31.** For Area 31, no chemical-specific cleanup levels were established for soil, sediment, or ash. Chemical-specific cleanup levels were established for groundwater used as a drinking water source. No revision to the groundwater ARARs was found that would affect the protectiveness of the remedy.

***Soil.*** The human health risk assessment concluded that under the assumed industrial and future residential land use scenarios, no unacceptable human health risk is present from exposure to chemicals in soil, sediment, or ash, with the potential exception of lead in isolated areas of ash and adjacent ditch sediments. In addition, petroleum in soil found near the oil/water separator was identified as a source of TPH contamination in groundwater. The ecological risk assessment identified lead and dioxin in surface soil as COCs that may cause potential adverse effects to the masked shrew. The ecological risk assessment concluded that the potential risks to the shrew are highly uncertain and, thus, RAOs based on protecting the shrew were not developed.

Because the human health risk assessment determined that no target health goals were exceeded and the ecological risk assessment identified potential unacceptable risk as highly uncertain, no chemical-specific cleanup levels were developed in soil. The selected remedy to address potential human and ecological health concerns regarding TPH in soil (source of contamination to groundwater; human exposure only) and lead in ash and sediment included removal of the ash, the oil/water separator, surrounding soils, and ditch sediments (U.S. Navy 2004b). Based on the lack of definitive health risks and the subsequent removal action, the remedy is considered to remain protective at this site.

***Groundwater.*** The selected cleanup levels for Area 31 are generally based on MTCA Methods A and B potable groundwater cleanup levels. Table 7-7 compares current groundwater ARAR values with those presented in the OU 5 ROD (U.S. Navy, Ecology, and USEPA 1996, Table 14). The MTCA Method B cleanup level for beryllium has increased from 0.0203 to 32 µg/L. However, the federal MCL of 4 µg/L is considered the current regulatory level. This change does not affect the protectiveness of the remedy.

As shown in Table 7-7, the MTCA Method B cleanup levels have decreased for benzene, naphthalene, and PCP as have the PQLs for Aroclor 1260 and vinyl chloride. It should also be noted that since the third 5-year review, the MTCA Method A value for mineral oil has decreased from 1,000 to 500 µg /L. However, in no case does the decrease call into question the protectiveness of the remedy. If ICs were to be removed in the future, any remaining concentrations of chemicals with lower ARAR values than ROD cleanup levels may have to be reviewed in terms of current toxicological information and analytical methods (see also risk level discussion for these chemicals in Section 7.2.2). These ARARs are further evaluated below:

- The Aroclor 1260 regulatory level has decreased from 1 to 0.2 µg/L based on the PQL. Monitoring of groundwater wells for Aroclor 1260 was not specified in the OU 5 ROD for Area 31. The source of PCBs was soil, and it has been removed (U.S. Navy 2004b). PCBs tend to partition strongly to soils, and the potential for PCB leaching to groundwater is usually low. Therefore, this decrease in the regulatory level does not affect the protectiveness of the remedy.

- The MTCA Method B level for TCE has decreased from 5 to 0.8 µg/L. Current and historical groundwater monitoring results (2007, 2010, 2011, and 2012) for benzene exceed the ROD cleanup level of 5 µg/L (see Table B-1 in Appendix B).

The current TCE MCL is 5 µg/L. Although benzene has a lower MTCA Method B cleanup value than the established cleanup level, the MCL is less than the MTCA 10-5 cancer risk level for benzene (8 µg/L), so Ecology would consider the MCL to be protective. Site concentrations TCE exceed the MCL, but because ICs restrict groundwater use as a drinking water source and the pump and treat system is actively containing the plume and reduce TCE mass in groundwater, the remedy is still protective of human health.

- The naphthalene cleanup level has decreased from 320 to 160 µg/L. Current and historical groundwater monitoring results (2007, 2010, 2011, and 2012) for naphthalene do not exceed the ROD cleanup level of 320 µg/L (see Table B-1 in Appendix B) or the current ARAR of 160 µg/L. Although naphthalene has a lower ARAR value than the established cleanup level because ICs restrict groundwater use as a drinking water source, the remedy is still protective of human health.

- The PCP cleanup level has decreased from 1 to 0.22 µg/L. Monitoring of groundwater wells for PCP, an SVOC, was not specified in the OU 5 ROD for Area 31. PCP was not analyzed for in groundwater wells MW31-9A or OWS-1 between 2007 and 2012. ICs restrict groundwater use as a drinking water source. Therefore, this decrease in the regulatory level does not affect the protectiveness of the remedy.

- The vinyl chloride cleanup level has decreased from 0.1 to 0.03 µg/L based on the PQL. Current and historical groundwater monitoring results (2007, 2010, 2011, and 2012) for vinyl chloride exceed the ROD cleanup level of 0.1 µg/L (see Table B-1 in Appendix B). In addition, because the current MTCA Method B value for vinyl chloride (0.029 µg/L) is almost equal to the current PQL (0.03 µg/L, based on current laboratory analytical techniques), it could now be used as a cleanup standard instead of the ROD PQL (0.1 µg/L). Although vinyl chloride has a lower current ARAR value than the established cleanup level and site concentrations exceed this cleanup level, because ICs restrict groundwater use as a drinking water source, the remedy is still protective of human health.

- The ROD-selected Method A cleanup level of TPH is no longer calculated, because MTCA Method A values are currently available for each of the specific fuel type fraction ranges of diesel, heavy oil, mineral oil, gasoline with benzene, and gasoline without benzene. Therefore, a straight comparison of present and past MTCA Method A levels cannot be made for TPH. As shown in Table 7-7, the ROD-selected cleanup level of 1,000 µg/L is only protective of the individual TPH compound of gasoline without benzene, as the current MTCA Method A levels for diesel, heavy oil, and gasoline with benzene are all lower than 1,000 µg/L. The MTCA Method A value for mineral oil has decreased since the last 5-year review from 1,000 µg/L to 500 µg/L. Although the individual fraction ranges of TPH compounds are all lower than the established cleanup level of TPH (with the exception of gasoline without benzene), and site concentrations are still exceeded for DRO, GRO) ICs restrict groundwater use as a drinking water source. Therefore, the ROD-selected cleanup level for TPH of 1,000 µg/L is considered to be protective of human health.

**Area 52.** For Area 52, no chemical-specific cleanup levels were established for soil or sediment. Chemical-specific cleanup levels were established for groundwater for the protection of marine surface water. No revision to the groundwater cleanup levels was found that would affect the protectiveness of the remedy.

***Soil.*** The human health risk assessment assumed future industrial land use. Cleanup levels were not developed because soils at Area 52 did not pose current or potential future human health risks exceeding the CERCLA risk range, and no clear ecological risk was present.

***Groundwater.*** Groundwater at Area 52 is neither a current nor potential future drinking water source. Therefore, remedial action was not needed to protected human health. However, as groundwater discharges to the Strait of Juan de Fuca, RAOs for groundwater were established to address potential adverse impacts to marine life. Cleanup levels are based on compliance with the water quality standards for marine surface waters at the point of groundwater discharge.

The selected cleanup levels are based on MTCA Method A groundwater and MTCA Method B surface water cleanup levels. Table 7-8 compares current surface water and groundwater ARAR values with those presented in the OU 5 ROD (U.S. Navy, Ecology, and USEPA 1996, Table 13). The MTCA Method B cleanup level for vinyl chloride increased from 2.92 to 3.7 µg/L. The lower cleanup level selected in the ROD (2.92 µg/L) based on surface water quality remains protective of human health and the environment. The ROD-selected MTCA Method B cleanup level for the individual PAHs listed in Table 7-8 were all based on benzo(a)pyrene. However, there are now calculated MTCA Method B cleanup levels for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. The ROD-selected cleanup level based on benzo(a)pyrene (0.0296 µg/L) is lower than the current MTCA B levels for all other PAHs listed. Therefore, based on an increase in the surface water quality ARARs for all PAHs (excluding benzo[a]pyrene), the ROD cleanup levels remain protective of human health and the environment.

In addition, the ROD-selected cleanup level of 1,000 µg/L for TPH in groundwater is based on the MTCA Method A cleanup levels. MTCA Method A values are currently available for each of the specific fuel type fraction ranges of diesel, heavy oil, mineral oil, gasoline with benzene, and gasoline without benzene. Therefore, a straight comparison of present and past MTCA Method A levels cannot be made for TPH. As shown in Table 7-8, the ROD-selected cleanup level of 1,000 µg/L is higher than all the other TPH fractions (i.e., diesel, heavy oil, mineral oil, gasoline with benzene) and is only protective of gasoline without benzene. However, MTCA Method A values are intended to be protective of unrestricted land use (i.e., drinking groundwater), rather than industrial use and protection of surface water. Therefore, these MTCA Method A values are overly protective for Area 52, where groundwater is not considered a drinking water source. There are no MTCA Method B surface water quality values for TPH. Therefore, the ROD-selected cleanup level for TPH of 1,000 µg/L is considered protective of human health and the environment.

### 7.6.2 Review of Human Health Risk Assessment Assumptions

Risk assessment assumptions were also reviewed as part of the requirement to assess protectiveness of the remedy. For human health, there are potentially two areas where changes could have occurred since the signing of the RODs: toxicity values for select chemicals and assumptions regarding human activity (i.e., exposure assumptions). How these changes to toxicity and exposure parameters might affect the protectiveness of the remedy is discussed below.

#### *Toxicity Criteria*

For those ARAR values that are based on a human health risk-based number (e.g., MTCA Method B groundwater cleanup level), changes to toxicity criteria may raise or lower the current regulatory level. Changes to toxicity criteria have occurred for 13 chemical-specific cleanup levels: benzene, beryllium, chromium VI, 1,1-DCA, 1,1-DCE, 2,4-dichlorophenol, manganese, naphthalene, PCBs, PCP, 2,3,7,8-TCDD, TCE, and vinyl chloride, identified at OUs 1, 2, 4, and 5 since the signing of the five RODs discussed in this 5-year review. In addition, changes to the 1,4-dioxane (the chemical identified post-ROD in groundwater) toxicity criteria are discussed.

Chemicals with values that have changed are discussed below and identified in Table 7-9. Seven chemicals (benzene, chromium VI, 2,4-dichlorophenol [groundwater only], naphthalene, PCBs, PCP, and TCE) have lower current regulatory levels, and if the RGs were calculated today, would be lower (i.e., more stringent). For these chemicals, the health risks of the ROD RG are compared with today's currently regulatory level. This comparison is done to assess whether the currently calculated risks associated with the ROD RG are still within EPA's acceptable excess cancer risk range of $10^{-4}$ to $10^{-6}$, or below a hazard index of 1 for noncancer effects. Seven chemicals (beryllium, 1,1-DCA, 1,1-DCE, 2,4-dichlorophenol [soil only], manganese, TCDD, and vinyl chloride) have higher current regulatory levels, and if the RGs were calculated today, would be higher (i.e., less stringent). For these chemicals, an explicit comparison of risk levels is unnecessary, because RGs were based on an assumption that the chemicals are more toxic (i.e., lower RGs) than would be assumed today.

**Benzene.** This chemical is a COC at OU 5 Area 31 groundwater. The oral slope factor for benzene, as reported in EPA's IRIS (USEPA 2013), changed to 0.055 $(mg/kg\text{-}day)^{-1}$ in 2000. This change in toxicity is reflected in the current MTCA Method B formula value level of 0.8 µg/L, a decrease from the ROD cleanup level of 5 µg/L. Using this new slope factor, the cancer risk of the cleanup level of 5 µg/L is $6 \times 10^{-6}$, below the ROD cancer risk goal of $1 \times 10^{-5}$. Therefore, the remedy remains protective because: (1) cancer risks at the ROD RG still meet ROD goals, and (2) the remedy (ICs) prevents use of the water for drinking. Although the ROD RG still meets ROD target cancer risk goals, despite new toxicity information, the ROD RG should be reviewed at the time when monitoring indicates that concentrations are below the cleanup level, and a proposal is put forward to remove the ICs. The ROD RG may need to be recalculated based on ARARs and toxicity criteria at that time, to ensure that conditions at the subject site would be protective in the absence of ICs.

**Beryllium.** This chemical is a COC at OU 5 Area 31 groundwater. The reference dose (RfD) for beryllium (USEPA 2013) changed to 0.002 mg/kg-day in 1998. This change in toxicity increases the MTCA Method B groundwater cleanup level to 32 µg/L from the ROD cleanup level of 0.0203 µg/L. The federal MCL of 4 µg/L is considered the current regulatory value, because it is lower than 32 µg/L. Using the new RfD, the noncancer hazard of 0.0203 µg/L would be well below the ROD target health goal of 1. Because the ROD noncancer goal is still being met, the remedy designed to achieve the cleanup level is protective, and no cleanup level change is recommended.

**Chromium VI.** Chromium VI is a COC in soil at OU 4. The soil cleanup level of 400 mg/kg is based on the MTCA Method B value at the time the ROD was signed. In 1998, the RfD for chromium VI was lowered to 0.003 mg/kg-day in IRIS (USEPA 2013). This change in toxicity is reflected in the current regulatory soil cleanup level of 240 mg/kg. Using the new RfD, the noncancer hazard of the cleanup level of 400 mg/kg is 2, which is above the ROD target health goal of 1. However, as described in the OU 4 ROD, the speciation of chromium was not identified in site soil samples. Also, toxicity criteria values used in the cleanup level were based on chromium VI, the carcinogenic form of chromium, and it is unlikely that all the chromium on the site is in its carcinogenic form. Therefore, using the chromium VI toxicity criteria is likely an overestimate of risks. In addition, as stated previously in Section 7.2.1, ICs are in place to prevent residential use of the site. Therefore, the remedy is still protective of human health. At the time when monitoring indicates that concentrations are below the ROD RG and a proposal is put forward to remove the ICs, the cleanup levels would then need to be recalculated based on ARARs and toxicity criteria at that time to ensure that conditions at the subject site would be protective in the absence of ICs.

**1,1-Dichloroethane.** This chemical is a COC in groundwater at OU 1 Area 6. Since the oral RfD was revised from 0.1 to 0.2 mg/kg-day, the MTCA Method B groundwater value increased from 800 µg/L established in the ROD to 1,600 µg/L. Because the ARAR value has increased, the protectiveness of the remedy is not affected by this change.

**1,1-Dichloroethene.** This chemical is a COC in groundwater at OU 1 Area 6. 1,1-DCE is no longer considered a carcinogen by the EPA (USEPA 2013). Therefore, the MTCA Method B carcinogen value of 0.07 µg/L established in the ROD is no longer current. The current MTCA Method B value of 400 µg/L is based on noncarcinogenic effects using the oral RfD of $5 \times 10^{-2}$ mg/kg-day. The federal MCL of 7 µg/L is considered the current regulatory value because it is lower than 400 µg/L. Because the value has increased, noncancer hazards of the ROD RG are less than 1, and the protectiveness of the remedy is not affected by this change.

1,1-DCE is being monitored in groundwater for protection of surface water at OU 5 Area 1. Since this chemical is no longer considered a carcinogen, the MTCA Method B surface water value increased from 1.93 µg/L established in the ROD to 23,100 µg/L. Because the value has increased, the protectiveness of the remedy is not affected by this change.

**cis-1,2-Dichloroethene.** This chemical is a COC in groundwater at OU 1 Area 6. A new RfD was established in EPA's database (IRIS) on September 30, 2010. Due to the new RfD value, the MCL value of 70 µg/L is no longer protective, because there would be unacceptable risk levels. The hazard would be greater than 1. However, the remedies in place for OU 1 Area 6 are protective, because the only portion of the site where cis-1,2-DCE is greater than the revised cleanup level (28 µg/L) is within the conditional point of compliance area. In addition, ICs are in place to prevent the use of groundwater as drinking water source. Therefore, the remedy is still protective of human health.

**2,4-Dichlorophenol.** This chemical is a COC in soil at OU 2 Areas 4 and 29 and for groundwater at OU 5 Area 31. The MTCA Method B soil value of 4.8 mg/kg established in the ROD has increased to 240 mg/kg, based on currently being considered a volatile chemical. Because the value has increased, the protectiveness of the remedy is not affected by this change.

The current MTCA Method B groundwater value for this chemical has decreased from 48 µg/L established in the ROD to 24 µg/L. Based on conducting risk calculations it appears that this chemical is currently considered volatile by Ecology, where at the time of the ROD, it was not considered volatile. The ROD RG of 48 mg/kg results in a hazard quotient of 2, which is greater than the ROD target health goal of 1. However, ICs are in place to prevent residential use of the site. Therefore, the remedy is still protective of human health. At the time when monitoring indicates that concentrations are below the ROD RG and a proposal is put forward to remove the ICs, the cleanup levels would then need to be recalculated based on ARARs and toxicity criteria at that time to ensure that conditions and the subject site would be protective in the absence of ICs.

**Manganese.** This chemical is a COC in groundwater at OU 2. The ROD RGs for this chemical were listed as 80 µg/L based on the MTCA Method B value and 125 µg/L based on background. The MTCA Method B value has increased to 747 µg/L, with the modifying factor, and is the current regulatory level. The current MTCA Method B value is based on noncarcinogenic effects using the oral RfD of 0.14 mg/kg-day revised in 1996 (USEPA 2013). Because the value has increased, the protectiveness of the remedy is not affected by this change.

**Naphthalene.** This chemical is a COC at OU 5 Area 31 groundwater. The RfD for naphthalene, as reported in IRIS (USEPA 2013), changed to 0.02 mg/kg-day in 1998. This change in toxicity is reflected in the current regulatory groundwater cleanup level of 160 µg/L, a decrease from the ROD cleanup level of 320 µg/L. Using the new RfD, the noncancer hazard of the cleanup level of 320 mg/kg is 2, which is above the ROD target health goal of 1. However, as stated previously in Section 7.2.1, ICs are in place to prevent residential use of the site. Therefore, the remedy is still protective of human health. At the time when monitoring indicates that concentrations are below the ROD RG and a proposal is put forward to remove the ICs, the cleanup levels would then need to be recalculated based on ARARs and toxicity criteria at that time to ensure that conditions and the subject site would be protective in the absence of ICs.

**PCBs.** This chemical is a COC in soil at OU 2 Area 4. The ROD RG was based on the MTCA Method A value of 1 mg/kg, which has not changed. However, the unrestricted MTCA Method B value is 0.5 mg/kg, and because it is lower, the current regulatory value based on a $1 \times 10^{-6}$ risk and oral slope factor of 2 $(\text{mg/kg-day})^{-1}$. The risk level based on the ROD RG is a $2 \times 10^{-6}$ risk, which is within the CERCLA acceptable range of $10^{-4}$ to $10^{-6}$. Therefore, the remedy is still protective of human health.

**Pentachlorophenol.** This chemical is a COC at OU 2 Areas 4 and 29 for soil and at OU 5 Area 31 for groundwater. The soil ROD RG was 8.33 mg/kg, and the current regulatory value of 2.5 mg/kg is based on a $1 \times 10^{-6}$ risk and oral slope factor of 0.2 $(\text{mg/kg-day})^{-1}$, which was revised in 2010 (USEPA 2013). The risk level based on the soil ROD RG is $4 \times 10^{-6}$. The groundwater ROD RG was 1 µg/L, and the revised value is 0.22 µg/L. The risk level based on the groundwater ROD RG is $5 \times 10^{-5}$. Therefore, the remedy is still protective of human health based on the ROD RG risk calculations being within the CERCLA acceptable range of $10^{-4}$ to $10^{-6}$.

**2,3,7,8-TCDD.** This chemical is a COC in soil at OU 2 Area 14. The RfD for this chemical (USEPA 2013) changed to $7 \times 10^{-10}$ mg/kg-day in 2012. This change in toxicity increases the MTCA Method B groundwater cleanup level to $1.1 \times 10^{-5}$ mg/kg from the ROD cleanup level of $6.67 \times 10^{-6}$ mg/kg. Using the new RfD, the noncancer hazard is well below the ROD target health goal of 1. The current oral slope factor is 1.3 x $10^{-5}$ (mg/kg-day)$^{-1}$ and results in a risk level below the target goal of 1 x $10^{-6}$. Starting in 2012, the carcinogenicity of this chemical is being evaluated by the EPA (2013). Because the ROD goals are still being met, the remedy designed to achieve the cleanup level is protective, and no cleanup level change is recommended.

**Trichloroethene.** This chemical is a COC in groundwater at OU 1 Area 6. The ROD RG was based on the federal/state MCL of 5 µg/L. However, the lower MTCA Method B value of 4 µg/L is the current regulatory value, based on a hazard quotient of 1 and the revised 2012 oral RfD of 0.0005 mg/kg-day. The ROD RG of 5 µg/L results in a risk level of 5 x $10^{-6}$ and HQ of 1. Therefore, the remedy is still protective of human health, based on the ROD RG risk calculations being within the CERCLA acceptable range of $10^{-4}$ to $10^{-6}$.

**Vinyl Chloride.** This chemical is a COC at OU 1 Area 6 groundwater and OU 5 Area 52 surface water. The oral slope factor for vinyl chloride, as reported in IRIS (USEPA 2013), changed to 1.5 (mg/kg-day)$^{-1}$ in 2000. For OU 1, this change in toxicity is reflected in the current regulatory groundwater cleanup level of 0.029 µg/L, a decrease from the ROD cleanup compliance level of 0.1, based on the PQL and an increase from the ROD cleanup level of 0.02 µg/L (former MTCA Method B value). Using this new slope factor, the cancer risk of the cleanup level of 0.02 is 1 x $10^{-6}$, below the ROD cancer risk goal of 1 x $10^{-4}$. For OU 5, this change in toxicity is reflected in the current regulatory surface water cleanup level of 3.7 µg/L, an increase from the ROD cleanup level of 2.92 µg/L, and risks would be less than 1 x $10^{-6}$. Therefore, the protectiveness of the remedy is not affected by these changes, because the values have increased.

**1,4-Dioxane**. This chemical was identified post-ROD in groundwater at OU 1 Area 6. A cleanup level for this chemical has not been established. If a cleanup level were to be established in the future, it would likely be based on the chemical's two most sensitive toxic endpoints: adverse noncancer effects on the liver and kidneys and its potential to cause liver cancer (ATSDR 2012). The EPA updated the toxicological profile in 2010, establishing a cancer slope factor for 1,4-dioxane in IRIS of 0.1 (mg/kg-day)$^{-1}$ and a noncancer RfD of 0.03 mg/kg-day (USEPA 2013). If a risk-based cleanup level for 1,4-dioxane were to be established in the future, the latest EPA information should be taken into account.

### *Exposure Parameters*

The expected land use on or near all five OUs as stated in the RODs have not changed. Since the signing of the five RODs, no human health or ecological route of exposure or receptor has changed or been newly identified at any of the five OUs. However, a new potential COC has been found at OU 1, and physical site conditions have changed at OU 5. Therefore, the assumptions upon which the remedy was based have changed for OU 1 and OU 5.

In the third 5-year review, the new contaminant 1,4-dioxane was reported for OU 1 Area 6. It was concluded that 1,4-dioxane concentrations in groundwater were not a health concern according to an ATSDR (2005) study, and therefore the remedy was still protective. However, since the last 5-year review, more groundwater sampling and analysis have been conducted for 1,4-dioxane. Concentrations of 1,4-dioxane in the shallow aquifer are widespread beneath the site, with the MTCA Method B groundwater cleanup level exceeded in 22 of 29 monitoring wells and in and all 8 production wells sampled during 2011 through 2012 sampling events (U.S. Navy 2012a).

The monitoring results show that the 1,4-dioxane plume extends off base in the southeast direction. Trend analysis of 1,4-dioxane concentrations generally show either a stable or declining trend. However, well 6-S-41 located southeast of the site (off site) exhibits a flat to increasing trend for 1,4-dioxane, and well 6-S-42 located south of the site (off site), well 6-S-6 on the west side of the landfill, well 6-S-7 at the north end of the plume area, and well 6-DW-38 exhibit increasing trends. Well 6-DW-38 is a domestic well that has been taken out of service and replaced with a deeper well (6-DW-38B). 1,4-Dioxane was not measured above the reporting limit in well 6-DW-38B since 2009 or in the other two private wells regularly sampled since 2006. Sediment sample results for 1,4-dioxane were also below the MTCA Method B sediment carcinogen level and surface water sample results were above the MTCA Method B value of 0.44 µg/L. The existing pump and treat system on site was not designed to remediate 1,4-dioxane. Therefore, the Navy is currently evaluating alternatives for treating 1,4-dioxane at this site (U.S. Navy 2012a). Although 1,4-dioxane concentrations are above MTCA Method B levels, current land use and ICs protect human health, and groundwater modeling results (to be published with the optimization evaluation) suggests operation of the groundwater extraction system serves to mildly suppress the offsite, downgradient migration rate. The remedy at Area 6 needs to be enhanced to address 1,4-dioxane in groundwater.

As a result of LUC inspections at OU 5 in 2009, a monitoring action was recommended along the shoreline of Areas 1 and 52 to determine whether the seawall was eroding at an accelerated rate. Storms displaced the concrete riprap that supported the beachfront, and the beachfront had subsequently eroded. Timber, refuse, metal, and concrete blocks were present in the exposed areas along the shoreline bluff, and there was concern that chemical wastes could be exposed because of erosion.

TCRA was performed in January and February 2012 to mitigate and prevent further erosion of the Area 1 shoreline. The shoreline stabilization was performed in three of the most heavily eroded sections by placing riprap in place at the toe of the bluff. A total of 247 feet of shoreline was stabilized with 376 tons of temporary armor rock. An NTCRA was conducted to construct a permanent coastal protection system along the Area 1 shoreline. Construction of the permanent system began in July 2012 and was completed in November 2012 (U.S. Navy 2013b).

### 7.6.3 Review of Ecological Risk Assessment Assumptions

Ecological health risk assessment assumptions were also reviewed as part of the requirement to assess protectiveness of the remedy. As described in Section 7.2.1, only OU 3 had soil cleanup levels for the runway ditch sediments based on ecological risk. The focus of ecological health is on toxicity and selected species, rather than exposure assumptions as with human health. Therefore, the ecological health discussion describes current toxicological information and its effect on the protectiveness of the remedy.

Table 7-4 summarizes the soil cleanup levels for the runway ditch sediments from the ROD (U.S. Navy, Ecology, and USEPA 1995). Soil cleanup levels were calculated based on muskrat modeling, as described in the OU 3 RI and OU 3 ROD (U.S. Navy 1994a and U.S. Navy, Ecology, and USEPA 1995) for arsenic, 2-methylnaphthalene, dibenz(a,h)anthracene, and phenanthrene, as discussed below. In addition, lead is also evaluated, even though the ROD cleanup level was based on background. Although it is not possible to reproduce the muskrat modeling results, a discussion of the likely toxicity reference values (TRVs) used in the modeling and whether or not the value has increased, decreased, or has remained the same is provided.

**Metals.** In the OU 3 RI, the arsenic risk-based screening concentration (RBSC) used a toxicity reference value (TRV) of 0.380 mg/kg-day, which is the chronic lowest observed adverse effect level (LOAEL) from the Chemical Evaluation Search and Retrieval System (CESARS) and based on a mouse study with effect of decreased survival. The CESARS database is developed and provided by the Michigan Department of Natural Resources and Ontario [Canada] Ministry of the Environment that contains profiles on chemicals of environmental concern. In 2005, the EPA released an interim final ecological soil screening levels (eco-SSLs) document for arsenic that included a comprehensive review of the available mammal toxicity data for arsenic and derived a mammalian TRV of 1.04 mg/kg-day (USEPA 2005a).

Based on review of current literature, recent arsenic toxicity studies (e.g., Gyasi et al. 2012, Ghandi et al. 2012, and Wang et al. 2006) were not directly relevant to environmental exposure conditions of arsenic (e.g., exposure via injection or in water). However, based on the EPA’s use of a mammalian TRV of 1.04 mg/kg-day during the development of their soil screening levels, the TRV for arsenic and the RBSC used in the OU 3 RI could potentially be increased. However, because the ROD remains protective, no change in the ROD cleanup level for this chemical is proposed.

In the OU 3 RI, the lead RBSC used a TRV of 0.32 mg/kg-day, which is the chronic LOAEL from Eisler (1988) and based on a dog study effect on survival. In 2005, the EPA released an interim final eco-SSL for lead that included a comprehensive review of the available mammal toxicity data (USEPA 2005b). The EPA derived a TRV of 4.7 mg/kg-day as the basis for their

TRV, which is higher and less conservative than the value used in the OU 3 RI to derive the RBSC. ASTDR updated their lead chemical profile in 2007, and while the focus of the report is in terms of public health, the toxicity data section was reviewed.

No new mammalian study was identified that would affect the TRV. Based on a further review of current literature, new rodent lead toxicity studies were found (e.g., Suradkar et al. 2009, Conti et al. 2012 and Ibrahim et al. 2012), but either the route of exposure (drinking water or injection), the measurement endpoint (changes in blood chemistry), or the report details (data reported in terms of a fraction of the median lethal dose without defining it) precluded the use of the data for derivation of a TRV. Nonetheless, background was used as the ROD cleanup level and remains protective of environmental health. However, if the TRV value based on the eco-SSL lead document was used in the OU 3 RI calculations, it could potentially increase the cleanup level.

**PAHs.** In the OU 3 RI, the dibenz(a,h)anthracene and phenanthrene RBSCs used a TRV of 10 mg/kg-day, which is the LOAEL from ATSDR (1990) and based on a mouse study indicating developmental effects. The study used benzo(a)pyrene and is applied to all heavy molecular weight PAHs. No new toxicity data was located for dibenz(a,h)anthracene, and the use of benzo(a)pyrene as a surrogate remains appropriate for this PAH. For phenanthrene, the U.S. Army Center for Health Promotion and Preventive Medicine (2006) performed a wildlife toxicity evaluation of phenanthrene to identify TRVs for inhalation, ingestion, and dermal exposure pathways in mammals and concluded that toxicity data were insufficient for phenanthrene to derive TRVs for mammals. No new toxicity data was located for phenanthrene, based on a review of current literature. Therefore, the use of benzo(a)pyrene as a surrogate for phenanthrene remains appropriate. The ATSDR (1990) document for PAHs evaluated in the last 5-year review has not been updated. Thus, the TRV remains unchanged from 10 mg/kg-day and remains protective of the environment, and no change in the ROD cleanup levels for these two chemicals is proposed.

**2-Methylnaphthalene.** In the OU 3 RI, the 2-methylnaphthalene RBSC used a TRV of 0.024 mg/kg-day, which is the median lethal dose from Eisler (1987) and based on a rat study. In 2007, the EPA released an interim final eco-SSL document for PAHs that included a comprehensive review of the available mammal toxicity data for low molecular weight PAHs (USEPA 2007, Appendix 6.1). It identified a mouse study that evaluated the effects of 2-methylnaphthalene at dietary dose levels of 54.3 and 113.8 mg/kg, with the lower dose level identified as a no observed adverse effect level (NOAEL) for pulmonary alveolar proteinosis. This NOAEL was converted to a dose of 52.7 mg/kg-day, which is much higher than the TRV used as the basis for the derivation of the RBSC. Based on review of current literature, no additional dietary toxicity study was located for 2-methylnaphthalene. Therefore, the TRV for this chemical used as the basis for the RBSC derivation in the ROD is protective of the environment.

## 7.7 NEW INFORMATION

This section is a response to question C, Has any other information come to light that could call into question the protectiveness of the remedy?

The answer to question C is “no.” No other information reviewed during this 5-year review, apart from what is included previously in this document, affects the protectiveness of the remedy.

## 7.8 TECHNICAL ASSESSMENT SUMMARY

The findings documented in this section are that changes in the exposure and toxicity assumptions of ARARs that have occurred since the RODs were signed do not affect the protectiveness of the remedies at OU 1 (Areas 5 and 6), OU 2 (Areas 2/3, 4, 14, and 29), OU 3 (Area 16), OU 4 (Areas 39, 41, 44, 48, and 49), and OU 5 (Areas 1, 31, and 52).

Concentrations of chemicals in groundwater remain above the cleanup levels at some locations in OU 1, OU 2, and OU 5, resulting in the need for continued ICs to prevent exposure and the need for ongoing monitoring. Although some of the cleanup levels might be lower if calculated today, the remedy components continue to protect against exposures, as intended by the RODs. ICs preventing exposure and ongoing monitoring will need to continue until COC concentrations in groundwater and surface water are below the cleanup levels.

The remedies are functioning as intended at all OUs and will continue to function with implementation of recommendations made herein.

## 7.9 ISSUES

Table 7-10 lists the issues identified as a result of this 5-year review that appear to have the potential to affect the protectiveness of the remedies at NAS Whidbey Island.

## Table 7-1
## Groundwater Cleanup Levels for OU 1 Area 6

| Chemical | ROD Cleanup Level (µg/L) | Current Regulatory Level (µg/L) | ROD Basis |
|---|---|---|---|
| **Trichloroethene** | **5** | **4[a] (MTCA B)** | **MCL** |
| 1,1,1-Trichloroethane | 200 | 200 | MCL |
| **1,1-Dichloroethane** | **800** | **1,600** | **MTCA B[b]** |
| **1,1-Dichloroethene** | **0.07** | **7[c] (MCL)** | **MTCA B[b]** |
| 1,2-Dichloroethene (cis) | 70 | **16[b] (MTCA B)** | MCL |
| 1,4-Dioxane | None | **0.44[d] (MTCA B)** | None |
| Vinyl chloride | 0.02/0.1 | 0.029/0.03 | MTCA B[b]/PQL |

[a] The Federal MCL for trichloroethene is currently 5 µg/L. The MTCA Method B groundwater cleanup level for this chemical is 4 µg/L, based on the revised 2012 trichloroethene oral reference dose of 0.0005 mg/kg-day.

[b] MTCA Method B groundwater cleanup level

[c] The current MTCA Method B value is 400 µg/L, and the Federal MCL for this chemical is 7 µg/L.

[d] 1,4-Dioxane was not identified as a chemical of concern in the ROD and no cleanup level was established. The current MTCA Method B groundwater cleanup level is 0.44 µg/L.

Notes:
A bolded chemical indicates an important change in its regulatory level.
µg/L - microgram per liter
MTCA - Model Toxics Control Act
MCL - maximum contaminant level
OU 1 - Operable Unit 1
PQL - practical quantitation limit
ROD - Record of Decision

Source: ROD Table 17 (U.S. Navy, Ecology, and USEPA 1993a)

## Table 7-2
## Soil Cleanup Levels for OU 2 Areas 4, 14, and 29

| **Chemical** | **ROD Cleanup Level (mg/kg)** | **Current Regulatory Level (mg/kg)** | **ROD Basis** |
|---|---|---|---|
| **Area 4** | | | |
| MCPP | 80 | 80 | MTCA B[a] |
| **PCBs** | **1** | **0.5[b] (MTCA B)** | **MTCA A[c]** |
| **Pentachlorophenol** | **8.33** | **2.5** | **MTCA B[a]** |
| **Area 14** | | | |
| Bromacil | 7 | 7[d] (MTCA B) | MTCA B and NAS Standards[e] |
| **2,3,7,8-TCDD** | **6.67 x $10^{-6}$** | **1.1 x $10^{-5}$** | **MTCA B[a]** |
| **2,4-Dichlorophenol** | **4.8** | **240** | **MTCA B[a]** |
| **Area 29** | | | |
| **Pentachlorophenol** | **8.33** | **2.5** | **MTCA B[a]** |
| **PAHs** | **1** | **0.1[f]** | **MTCA A[c]** |

[a] MTCA Method B soil cleanup value for unrestricted land use

[b] The MTCA Method A (unrestricted) soil cleanup value is currently 1 mg/kg and remains the same as identified in the ROD. The current direct contact (ingestion) Method B unrestricted land use value is 0.5 mg/kg for PCBs.

[c] MTCA Method A soil cleanup value for unrestricted land use

[d] Soil cleanup level protective of groundwater for bromacil, calculated using the MTCA Method B equations (747-1 and 747-2), groundwater cleanup level of 1,600 µg/L, $K_{oc}$ of 32 mL/g, and Henry's law of 5.39 X $10^{-9}$ (dimensionless). Groundwater cleanup level calculated as 1,600 µg/L based on MTCA Method B equation (720-1) and reference dose of 0.1 (mg/kg-day) (USEPA 2012b).

[e] Soil cleanup level protective of groundwater for bromacil, calculated using the MTCA Method B equation based on parameters obtained from NAS.

[f] The MTCA Method A (unrestricted) soil cleanup value is currently 0.1 mg/kg; the current direct contact (ingestion) Method B unrestricted land use value is 0.14 mg/kg for PAHs (based on benzo[a]pyrene).

Notes:
A bolded chemical indicates an important change in its regulatory level.
MCPP - propionic acid (2-[2-methyl-4-chlorophenoxy])
mg/kg - milligram per kilogram
MTCA - Model Toxics Control Act
NAS - National Academy of Sciences
OU 2 - Operable Unit 2
PAHs - polycyclic aromatic hydrocarbons
PCBs - polychlorinated biphenyls
ROD - Record of Decision
TCDD - tetrachlorodibenzo-p-dioxin

Source: ROD Table 12 (U.S. Navy, Ecology, and USEPA 1994)

## Table 7-3
## Groundwater Cleanup Levels for OU 2 Areas 2/3, 4, 14, and 29

| Area(s) | Chemical of Concern | ROD Regulatory Level (µg/L) | ROD Basis | Post-ROD Regulatory Level[a] (µg/L) | Final Cleanup Level (µg/L) | Current Regulatory Level (µg/L) | Final Current Regulatory Level (µg/L) |
|---|---|---|---|---|---|---|---|
| 2/3 | Antimony | 6/BK[b] | MCL/BK | NE | 6 (MCL) | 6 | 6 (MCL) |
| 2/3, 4, 29 | Arsenic | 0.05/BK[b] | MTCA B[c]/BK | 7.7 (BK) | 7.7 (BK) | 0.05/7.7 | 7.7 (BK) |
| **2/3, 4, 29** | **Manganese** | **80/BK[b]** | **MTCA B[c]/BK** | **125 (BK)** | **125 (BK)** | **747/125** | **747 (MTCA B)** |
| **2/3** | **Vinyl chloride** | **0.023/PQL[b]** | **MTCA B[c]/PQL** | **1 (PQL)** | **1 (PQL)** | **0.029/0.03** | **0.03 (PQL)** |
| 14 | Bromacil | 70 | NAS Standards | NE | 70 (NAS) | 70[d] | 70 (EPA) |
| **14** | **2,4-Dichlorophenol** | **48** | **MTCA B[c]** | **NE** | **48 (MTCA B)** | **24** | **24 (MTCA B)** |

[a] Background values for arsenic and magnesium and a PQL for vinyl chloride were established after the ROD (U.S. Navy 1997e).
[b] Cleanup level was based on the higher of the two values.
[c] MTCA Method B groundwater cleanup level
[d] Based on the lifetime health advisory of EPA's 2012 drinking water standards and health advisories

Notes:
A bolded chemical indicates an important change in its regulatory level.
BK - background
EPA - U.S. Environmental Protection Agency
MCL - maximum contaminant level
µg/L - microgram per liter
MTCA - Model Toxics Control Act
NAS - National Academy of Sciences
NE - not established
OU 2 - Operable Unit 2
PQL - practical quantitation limit
ROD - Record of Decision

Source: ROD Table 13 (U.S. Navy, Ecology, and USEPA 1994)

## Table 7-4
## Soil Cleanup Levels for OU 3 Runway Ditch Sediments

| Chemical | ROD Regulatory Level (mg/kg) | Current Regulatory Level (mg/kg) | ROD Regulatory Level Basis | ROD Cleanup Level (mg/kg) |
|---|---|---|---|---|
| Arsenic | 188 | 88 | MTCA C[a] | 16[b] (ECO) |
| Lead | 140 | 1,000 | MTCA A[c] | 18[d] (BK) |
| 2-Methylnaphthalene | - | 14,000 | MTCA C[a] | 0.8[b] (ECO) |
| Benzo(k)fluoranthene | 18 | 1,800 | MTCA C[a] | 18 (MTCA C) |
| Dibenz(a,h)anthracene | 18 | 18 | MTCA C[a] | 1.1[b] (ECO) |
| Phenanthrene | - | - | MTCA C[a] | 13[b] (ECO) |
| Total petroleum hydrocarbons | 200 | - | MTCA A[c] | 200 (MTCA A) |
| Diesel | - | 2,000 | MTCA A[e] | - |
| Heavy oil | - | 2,000 | MTCA A[e] | - |
| Mineral oil | - | 4,000 | MTCA A[e] | - |
| Gasoline with benzene | - | 30 | MTCA A[e] | - |
| Gasoline without benzene | - | 100 | MTCA A[e] | - |

[a] MTCA Method C industrial soil cleanup levels
[b] ROD cleanup level is based on ecological risks
[c] MTCA Method A industrial soil cleanup levels
[d] ROD cleanup level is based on background
[e] MTCA Method A soil cleanup levels for petroleum are the same for industrial and unrestricted land use.

Notes:
BK - background
ECO - ecological risk
mg/kg - milligram per kilogram
MTCA - Model Toxics Control Act
OU 3 - Operable Unit 3
ROD - Record of Decision

Source: ROD Table 8-1 (U.S. Navy, Ecology, and USEPA 1995)

## Table 7-5
## Soil Cleanup Levels for OU 4 Areas 39, 41, 48, and 49

| Chemical | ROD Cleanup Level (mg/kg) | Current Regulatory Level (mg/kg) | ROD Basis |
|---|---|---|---|
| 4,4'-DDD | 4.17 | 4.17 | MTCA B, Unrestricted |
| 4,4'-DDE | 2.94 | 2.94 | MTCA B, Unrestricted |
| 4,4'-DDT | 2.94 | 2.94 | MTCA B, Unrestricted |
| Arsenic | 20 | 20 | MTCA A, Unrestricted |
| **Chromium (VI)** | **400** | **240** | **MTCA B, Unrestricted** |
| Lead | 250 | 250 | MTCA A, Unrestricted |
| **cPAHs**[a] | **1** | **0.1**[b] | **MTCA A, Unrestricted** |

[a] Based on benzo(a)pyrene

[b] The MTCA Method A soil cleanup value for unrestricted land use was used in the ROD and has decreased to 0.1 mg/kg. The current direct contact (ingestion) Method B unrestricted land use value is 0.14 mg/kg for PAHs (based on benzo[a]pyrene).

Notes:
A bolded chemical indicates an important change in its regulatory level.
cPAHs - carcinogenic polycyclic aromatic hydrocarbons
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
mg/kg - milligram per kilogram
OU 4 - Operable Unit 4
MTCA - Model Toxics Control Act
ROD - Record of Decision

Source: ROD Table 13 (U.S. Navy, Ecology, and USEPA 1993b)

## Table 7-6
## Groundwater Cleanup Levels for Protection of Surface Water for OU 5 Area 1

| Chemical | ROD Cleanup Level (µg/L) | Current Regulatory Level (µg/L) | ROD Basis |
|---|---|---|---|
| Zinc | 76.6 | 81 | State WQC[a] |
| Cyanide | 1 | 1 | State and Federal WQC[b] |
| Bis(2-ethylhexyl) phthalate | 3.56 | 3.56 | MTCA B[c] |
| **1,1-Dichloroethene** | **1.93** | **23,100** | **MTCA B[c]** |

[a] The WQC for zinc is based the protection of chronic exposures for aquatic life in marine water.
[b] The WQC for cyanide is based the protection of acute exposures for aquatic life in marine water.
[c] MTCA Method B surface water cleanup level

Notes:
A bolded chemical indicates an important change in its regulatory level.
µg/L - microgram per liter
MTCA - Model Toxics Control Act
ROD - Record of Decision
WQC - water quality criteria

Source: ROD Table 12 (U.S. Navy, Ecology, and USEPA 1996)

## Table 7-7
## Groundwater Cleanup Levels for OU 5 Area 31

| Chemical | ROD Cleanup Level (µg/L) | Current Regulatory Level (µg/L) | ROD Basis |
|---|---|---|---|
| **Beryllium** | **0.0203** | **4[a] (MCL)** | **MTCA B[b]** |
| Lead | 9.7 | 15[c](MCL) | Background |
| Manganese | 142 | 747[b] (MTCA B) | Background |
| Mercury | 2 | 2 | Federal/State MCL |
| **Aroclor 1260** | **1** | **0.2[d]** | **PQL** |
| **Benzene** | **5** | **0.8[e]** | **MTCA B[b]** |
| **Naphthalene** | **320** | **160** | **MTCA B[b]** |
| **Pentachlorophenol** | **1** | **0.22[f]** | **MTCA B[b]** |
| Styrene | 1.46 | 1,600 | MTCA B[b] |
| Toluene | 1,000 | 1,000 | Federal MCL |
| **Vinyl chloride** | **0.1** | **0.03[d]** | **PQL** |
| 2,3,7,8-TCDD | $0.58 \times 10^{-6}$ | $0.58 \times 10^{-6}$ | MTCA B[b] |
| Total petroleum hydrocarbons | 1,000 | - | MTCA A[g] |
| Diesel | - | 500 | MTCA A[g] |
| Heavy oil | - | 500 | MTCA A[g] |
| Mineral oil | - | 500 | MTCA A[g] |
| Gasoline with benzene | - | 800 | MTCA A[g] |
| Gasoline without benzene | - | 1,000 | MTCA A[g] |

[a] The MTCA Method B groundwater cleanup level is 32 µg/L and the federal/state MCL for this chemical is 4 µg/L.

[b] One third of the MTCA Method B groundwater cleanup level of 2,240 µg/L. The MTCA B groundwater cleanup level was adjusted to account for EPA's recommendation to use a modifying factor of "3" should when assessing exposure from drinking water. This modification factor is based on the increased exposure of children to manganese-contaminated water (USEPA 2013).

[c] Federal MCL

[d] PCB method reporting limit based on sampling conducted in 2007. Vinyl chloride method reporting limit based on recent sampling conducted in 2009 through 2013.

[e] The federal/state MCL for this chemical is 5 µg/L.

[f] The federal/state MCL for this chemical is 1 µg/L.

[g] MTCA Method A groundwater cleanup level

Notes:
A bolded chemical indicates an important change in its regulatory level.
MCL - maximum contaminant level
µg/L - microgram per liter
MTCA - Model Toxics Control Act
NA - not applicable
PQL - practical quantitation limit
ROD - Record of Decision
TCDD - tetrachlorodibenzo-p-dioxin

Source: ROD Table 14 (U.S. Navy, Ecology, and USEPA 1996)

## Table 7-8
## Groundwater Cleanup Levels for Protection of Surface Water for OU 5 Area 52

| Chemical | ROD Cleanup Level (µg/L) | Current Regulatory Level (µg/L) | ROD Basis |
|---|---|---|---|
| **Vinyl chloride** | **2.92** | **3.7** | **MTCA B[a]** |
| Benzo(a)anthracene | 0.0296 | 0.296 | MTCA B[a] |
| Benzo(a)pyrene | 0.0296 | 0.0296 | MTCA B[a] |
| Benzo(b)fluoranthene | 0.0296 | 0.296 | MTCA B[a] |
| Chrysene | 0.0296 | 29.6 | MTCA B[a] |
| Indeno(1,2,3-cd)pyrene | 0.0296 | 0.296 | MTCA B[a] |
| Total petroleum hydrocarbons | 1,000 | - | MTCA A[b] |
| Diesel | - | 500 | MTCA A[b] |
| Heavy oil | - | 500 | MTCA A[b] |
| Mineral oil | - | 500 | MTCA A[b] |
| Gasoline with benzene | - | 800 | MTCA A[b] |
| Gasoline without benzene | - | 1,000 | MTCA A[b] |

[a] MTCA Method B surface water cleanup level
[b] MTCA Method A groundwater cleanup level

Notes:
A bolded chemical indicates an important change in its regulatory level.
µg/L - microgram per liter
MTCA - Model Toxics Control Act
ROD - Record of Decision

Source: ROD Table 13 (U.S. Navy, Ecology, and USEPA 1996)

## Table 7-9
## Remediation Goals With Changes in Toxicity Values

| Chemical | Site | Medium | Unit | ROD RG | Revised MTCA Method B Value Based on New Toxicity | Risk/Hazard Associated With ROD Value | Reason for Toxicity Revision |
|---|---|---|---|---|---|---|---|
| Benzene | OU 5 Area 31 | Groundwater | µg/L | 5 | 0.8 | $6 \times 10^{-6}$ | The MTCA B decrease is based on the oral slope factor of 0.055 $(mg/kg\text{-}day)^{-1}$ that became available in 2000. |
| Beryllium | OU 5 Area 31 | Groundwater | µg/L | 0.0203 | 32/4 (MCL) | <1 | The MTCA B increase is based on the reference dose for this chemical increased in 1998 (indicating a decrease in toxicity). The MCL of 4 µg/L is considered the current regulatory limit. |
| Chromium VI | OU 4 | Soil | mg/kg | 400 | 240 | 2 | The MTCA B decrease is based on the reference dose being lowered in 1998 (indicating an increase in toxicity). |
| 1,1-Dichloroethane | OU 1 Area 6 | Groundwater | µg/L | 800 | 1,600 | | The MTCA B increase is based on the reference dose changing from 0.1 to 0.2 mg/kg-day. |
| 1,1-Dichloroethene | OU 1 Area 6 | Groundwater | µg/L | 0.07 | 400/7 (MCL) | | The increased MTCA B value is based on this chemical no longer being considered a carcinogen. The MCL of 7 µg/L is considered the current regulatory limit. |
| | OU 5 Area 1 | Surface water | µg/L | 1.93 | 23,100 | | The increased MTCA B value is based on this chemical no longer being considered a carcinogen. |
| 1,2-Dichloroethene (cis) | OU 1 Area 6 | Groundwater | µg/L | 70 (MCL) | 16 | >1 | The MTCA B increase is based on the new RfD for this chemical of 0.002 mg/kg-day which was established in September 2010. |

## Table 7-9 (Continued)
## Remediation Goals With Changes in Toxicity Values

| Chemical | Site | Medium | Unit | ROD RG | Revised MTCA Method B Value Based on New Toxicity | Risk/Hazard Associated With ROD Value | Reason for Toxicity Revision |
|---|---|---|---|---|---|---|---|
| 2,4-Dichlorophenol | OU 2 Area 14 | Soil | mg/kg | 4.8 | 240 | <1 | The increased MTCA B value is based on this chemical now being considered volatile. |
| | | Groundwater | µg/L | 48 | 24 | 2 | The MTCA B decrease is based on this chemical now being considered volatile. |
| Manganese | OU 2 | Groundwater | µg/L | 80/125 (BK) | 747 | <1 | The MTCA B increase is based on the oral RfD of 0.14 mg/kg-day, which was revised in 1996. |
| Naphthalene | OU 5 Area 31 | Groundwater | µg/L | 320 | 160 | 2 | The MTCA B decrease is based on the lowered reference dose for this chemical, which was lowered in 1998. |
| PCBs | OU 2 Area 4 | Soil | mg/kg | 1 | 0.5 | 2 X $10^{-6}$ | ROD RG was based on MTCA A value. The MTCA B decrease is based on benzo(a)pyrene's oral slope factor of 2 (mg/kg-day)$^{-1}$. |
| Pentachloro-phenol | OU 2 Areas 4 and 29 | Soil | mg/kg | 8.33 | 2.5 | 4 X $10^{-6}$ | The MTCA B decrease is based on the oral slope factor of 0.2 (mg/kg-day)$^{-1}$, which changed in 2010. |
| | OU 5 Area 31 | Groundwater | µg/L | 1 | 0.22 | 5 X $10^{-6}$ | |
| 2,3,7,8-TCDD | OU 2 Area 14 | Soil | mg/kg | 6.67 X $10^{-6}$ | 1.1 X $10^{-5}$ | <1 X $10^{-6}$ | The MTCA B increase is based on the RfD for this chemical, which changed to 7 X $10^{-7}$ mg/kg-day in 2012. |
| Trichloroethene | OU 1 Area 6 | Groundwater | µg/L | 5 (MCL) | 4 | 5 X $10^{-6}$<br>Hazard = 1 | The ROD RG was based on MCL. The MTCB B decrease is based on the revised RfD of 0.0005 mg/kg-day in 2012. |

## Table 7-9 (Continued)
## Remediation Goals With Changes in Toxicity Values

| Chemical | Site | Medium | Unit | ROD RG | Revised MTCA Method B Value Based on New Toxicity | Risk/Hazard Associated With ROD Value | Reason for Toxicity Revision |
|---|---|---|---|---|---|---|---|
| Vinyl chloride | OU 1 Area 6 | Groundwater | µg/L | 0.02/ 0.1 (PQL) | 0.029/0.03 (PQL) | <1 X $10^{-6}$ (based on 0.02)<br>3 X $10^{-6}$ (based on PQL 0.1) | The PQL of 0.03 is the current compliance value and is similar to the revised MTCA B value. The MTCA B increase is based on the oral slope factor changing from 1.9 to 1.5 $(mg/kg\text{-}day)^{-1}$ (indicating a decrease in carcinogenicity). |
|  | OU 5 Area 52 | Surface water | µg/L | 2.92 | 3.7 | <1.0E-06 | The MTCA B increase is based on the oral slope factor changing from 1.9 to 1.5 $(mg/kg\text{-}day)^{-1}$. |

Notes:
The remedy is determined to still be protective, despite some increases in toxicity, because of the presence of land use controls.
MCL - maximum contaminant level
µg/L - microgram per liter
mg/kg - milligram per kilogram
mg/kg-day - milligram per kilogram per day
MTCA - Model Toxics Control Act
OU - operable unit
PCBs - polychlorinated biphenyls
PQL - practical quantitation limit
RfD - reference dose
RG - remediation goal
ROD - Record of Decision
TCDD - tetrachlorodibenzo-p-dioxin

## Table 7-10
## Issues

| Item No. | Issue | Affects Protectiveness? | |
|---|---|---|---|
| | | **Current** | **Future** |
| **OU 1 Area 6** | | | |
| 1 | Based on groundwater results, residual vadose zone soil impacts could act as a continuing low-grade source to groundwater. Site 55 vadose zone data gap exists. | No | Yes |
| 2 | The extraction system is not preventing the further spread of vinyl chloride in the shallow aquifer or reducing the potential risk to existing and future groundwater users downgradient of the site. | No | Yes |
| 3 | 1,4-Dioxane was not identified in the Record of Decision as a chemical of concern. However, this emergent contaminant has been identified by the U.S. Environmental Protection Agency as a potential carcinogen. The current pump and treat system is unable to capture and treat the 1,4-dioxane plume. In addition, the full extent of the 1,4-dioxane plume remains uncertain. | No | Yes |
| **OU 2 Areas 2/3** | | | |
| 4 | It is not conclusively determined whether or not arsenic and manganese in groundwater pose a risk, because sitewide background levels may not be representative of the naturally occurring local site background level. | No | Yes |
| **OU 5 Area 31** | | | |
| 5 | DRO, GRO, benzene, and dissolved manganese do not appear to be attenuating in groundwater. DRO, GRO, benzene, vinyl chloride, and dissolved manganese remain above state and/or federal levels (remediation goals). | No | Yes |

Notes:
DRO - diesel-range organics
GRO - gasoline-range organics
OU - operable unit

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The issues listed below have been identified to require follow-up action prior to the next FYR. Details on these issues are found in Sections 4 and 6.

### *General*

- Implement land use controls. Since there have been LUC failures at Areas 2/3 and 29 during the past several years, there is a need for the Navy to be vigilant and ensure that efforts to strengthen the LUC program, implement LUC outreach, and upgrade LUC signage will prevent LUC failures from occurring in the future.

- With the exception of Areas 2/3 and 6, the Navy would like to explore the possibility of deleting some of the NAS Whidbey Island sites from the NPL, as appropriate.

## Table 7-10 (Continued)
## Issues

***Operable Unit 1***

- Conduct vadose zone vapor monitoring for chlorinated volatile organic compounds in 5 years to confirm decreasing concentration trends at Area 6 Site 55, and perform additional soil sampling to address a potential data gap to the east and southeast of Site 55.

- Remove abandoned dock at Area 6.

***Operable Unit 2***

- Repair or properly abandon well N2-6B, and abandon well N2-7S at Area 2.

- The OU 2 ROD does not specify a groundwater remedy for Area 4. Dissolved arsenic in groundwater remains at concentrations slightly above decision criteria. Dissolved arsenic concentrations appear stable, and LUCs are in place that include a groundwater use prohibition and well installation. The EPA and Navy have agreed to discontinue groundwater monitoring at OU 2 Area 4.

- Properly abandon monitoring well 14-MW-1 at Area 14.

- The OU 2 ROD does not specify a groundwater remedy for Area 29. Dissolved arsenic in groundwater remains at concentrations slightly above decision criteria. Arsenic was not identified as a COC for the completed remedy at the site. Dissolved arsenic concentrations were very low in shallow wells and increase with depth. It is the Navy and EPA's opinion that the arsenic is naturally occurring. LUCs are in place that include a groundwater use prohibition and well installation. The EPA and Navy have agreed to discontinue groundwater monitoring at OU 2 Area 29.

***Operable Unit 5***

- Evaluate if armoring is needed south of the current seawall and implement as necessary.

- Monitoring well maintenance is needed at Areas 1, 31, and 52.

- Repair or properly abandon well MW-103 at Area 1.

### Table 7-10 (Continued)
### Issues

- Repair well OWS-2 or properly abandon, as necessary (not included in current monitoring), at Area 31.
- Treatment system equipment and building are no longer needed at Area 31 and should be removed.
- Repair or properly abandon well MW-6 at Area 52 (no monitoring being conducted at this site).

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# 8.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

This section presents the recommendations and follow-up actions identified as a result of the 5-year review process. Table 8-1 summarizes the recommendations. Some recommended actions are necessary to ensure long-term protectiveness of certain remedy components. Other actions do not affect protectiveness, but are necessary to achieve or maintain compliance with the RODs or subsequent approval of implementation plans. Still other actions are recommended because RAOs have been met at specific sites (such as discontinuing monitoring for select analytes at OU 2 Areas 2/3).

## Table 8-1
## Recommendations and Follow-Up Actions

| Item No. | Recommendation/ Follow-Up Action | Party Responsible | Oversight Agency | Milestone Date | Follow-Up Action: Affects Protectiveness? | |
|---|---|---|---|---|---|---|
| | | | | | Current | Future |
| 1 | **OU 1 Area 6, Site 55**<br>Complete Site 55 vadose zone data gap report to support optimization and treatability testing. | NAVFAC NW | EPA | April 2015 | No | Yes |
| 2 | **OU 1 Area 6**<br>Complete an alternative analysis and ROD amendment, if needed, to prevent the further spread of vinyl chloride downgradient and reduce the potential risk to existing and future groundwater users. | NAVFAC NW | EPA | March 2016 | No | Yes |
| 3 | **OU 1 Area 6**<br>Complete an alternative analysis and ROD amendment with a remedy to prevent the further spread of 1,4-dioxane downgradient and reduce the potential risk to existing and future groundwater users. | NAVFAC NW | EPA | March 2016 | No | Yes |
| 4 | **OU 2 Areas 2/3**<br>Determine if observed concentrations of arsenic and manganese in groundwater are representative of local site background. If concentrations exceed local site background, provide a path-forward recommendation to EPA. | NAVFAC NW | EPA | September 2018 | No | Yes |
| 5 | OU 5 Area 31<br>Continue monitoring for DRO, GRO, benzene, vinyl chloride, and dissolved manganese, and assume it may be some time before natural attenuation begins to reduce concentrations. Identify, or install if necessary, at least one downgradient well to evaluate plume stability. Discontinue residual-range organics and naphthalene monitoring. Monitor biannually for DRO, GRO, benzene, vinyl chloride, and dissolved and total manganese at wells MW31-9A and OWS-1 and an existing downgradient well, or new well if necessary, until the next 5-year review. | NAVFAC NW | EPA | Annually documented in long-term monitoring reports | No | Yes |

## Table 8-1 (Continued)
## Recommendations and Follow-Up Actions

Notes:
DRO - diesel-range organics
EPA - U.S. Environmental Protection Agency
GRO - gasoline-range organics
NAVFAC NW - Naval Facilities Engineering Command Northwest
OU - operable unit
ROD - Record of Decision

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# 9.0 CERTIFICATION OF PROTECTIVENESS

Remedy construction is complete at OU 1 for both Areas 5 and 6. The remedy is protective of human health and the environment for OU 1 Area 5.

A protectiveness determination of the remedy at OU 1 Area 6 cannot be made at this time until further information is obtained. Further information will be obtained by performing a treatability study at Area 6, completing an optimization evaluation, and preparing a ROD amendment to address 1,4-dioxane in groundwater, which was not identified in the OU 1 ROD. It is expected that the ROD amendment will be prepared for EPA and stakeholder review by March 2016.

The remedial action is operating as expected at OU 1 Area 6 and will continue to require routine, regular maintenance and monitoring.

Remedy construction is complete at OU 2 and the remedy is protective of human health and the environment.

Remedy construction is complete at OU 3 and the remedy is protective of human health and the environment.

Remedy construction is complete at OU 4 and the remedy is protective of human health and the environment.

Remedy construction is complete at OU 5 and the remedy is protective of human health and the environment.

The recommendations in Table 8-1 will be implemented in order to maintain long-term protectiveness. Maintenance of sitewide land use controls is required to ensure protectiveness of the remedies.

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# 10.0 NEXT REVIEW

The next 5-year review is scheduled to be completed August 2019.

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# APPENDIX A

# Area 6 Monitoring

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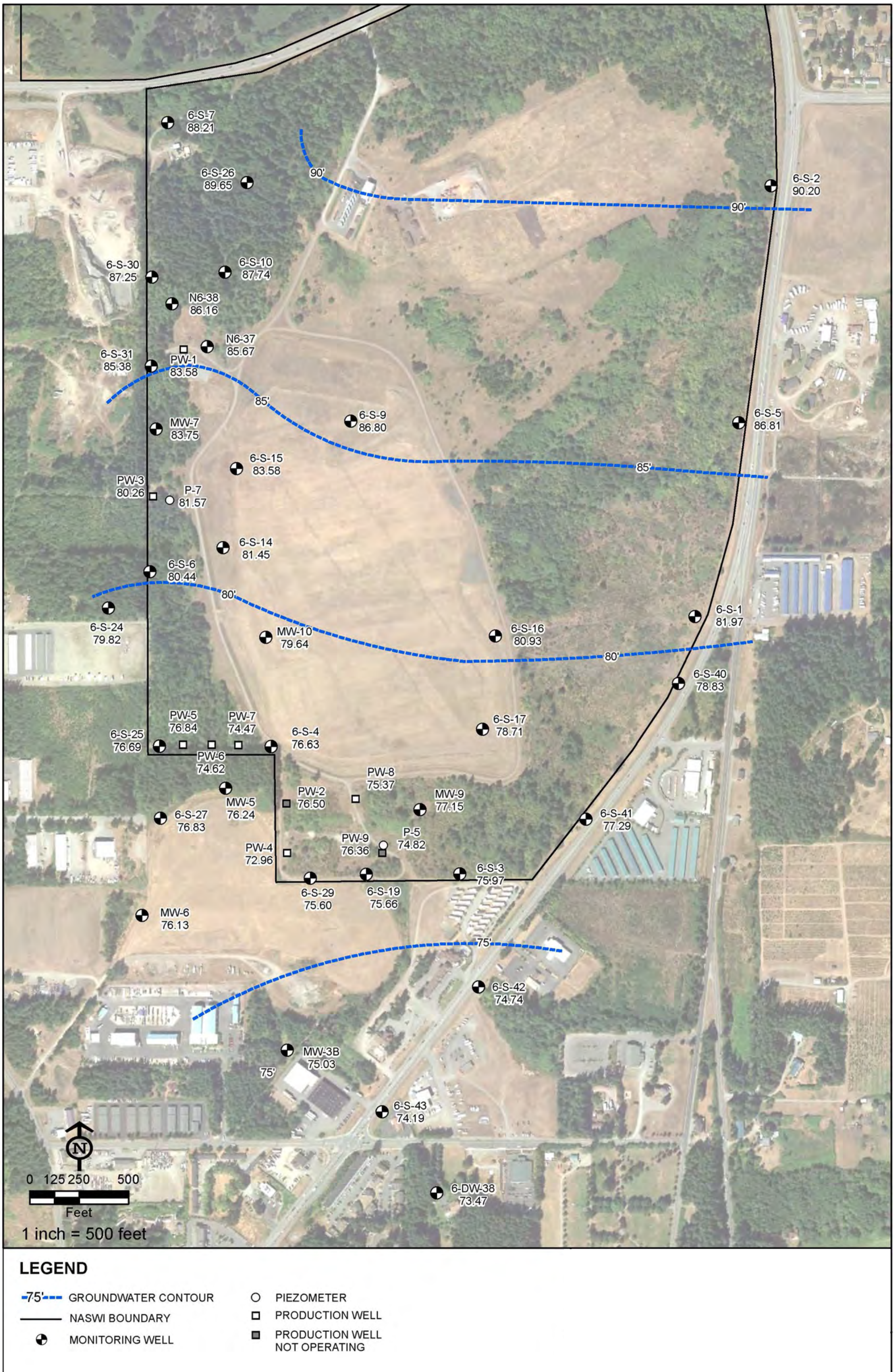
U.S. Navy 2013d

Figure A-1
Area 6 Groundwater Monitoring Locations

Figure A-2
Area 6 Production Wells and Surface Water Sampling Locations

U.S. Navy 2013d

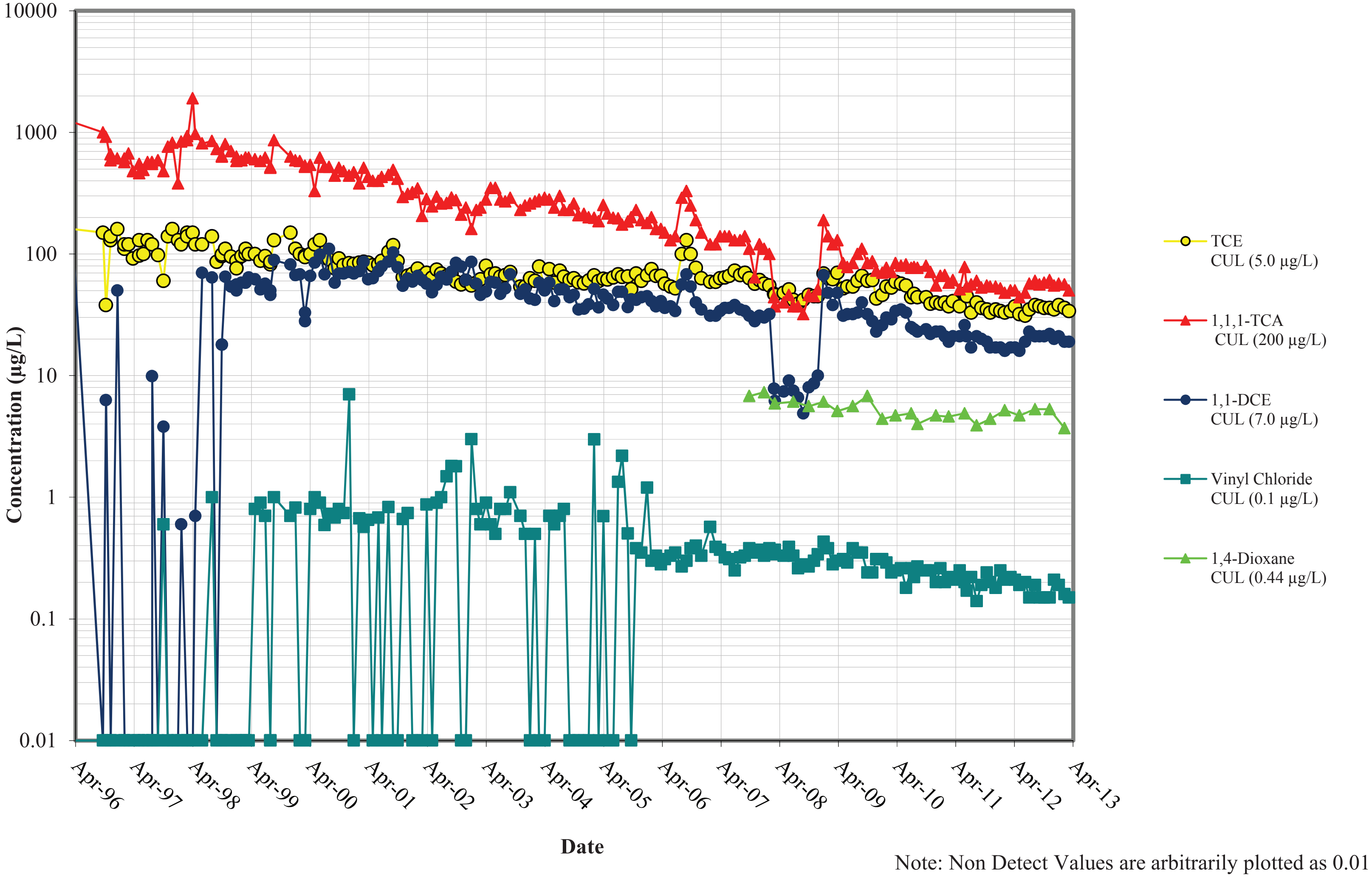


**NOTES**

1) WATER LEVELS WERE MEASURED BETWEEN FEBRUARY 4-14, 2013
2) PUMPING LEVELS OF PRODUCTION WELLS WERE NOT CONTOURED

Figure A-3
Area 6 Groundwater Levels February 2013

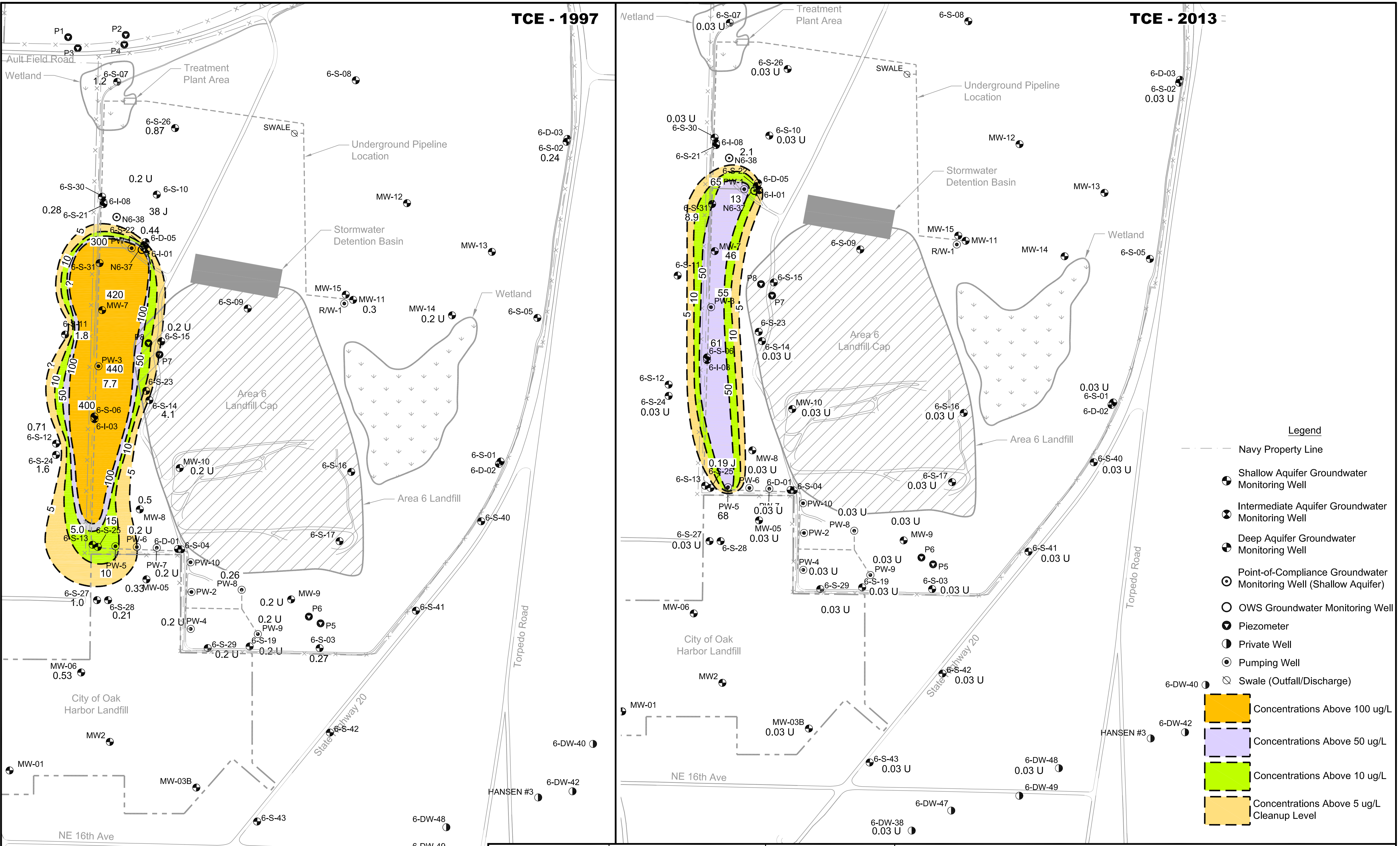
U.S. Navy 2013d



Note: Non Detect Values are arbitrarily plotted as 0.01

Figure A-4
Area 6 Treatment Plant Influent Concentrations April 1996 - March 2013

U.S. Navy 2013d



**U.S. NAVY**

DO 0066
NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

0 300 600
SCALE IN FEET

**Figure A-5**
**TCE Concentrations, 1997 and 2013**

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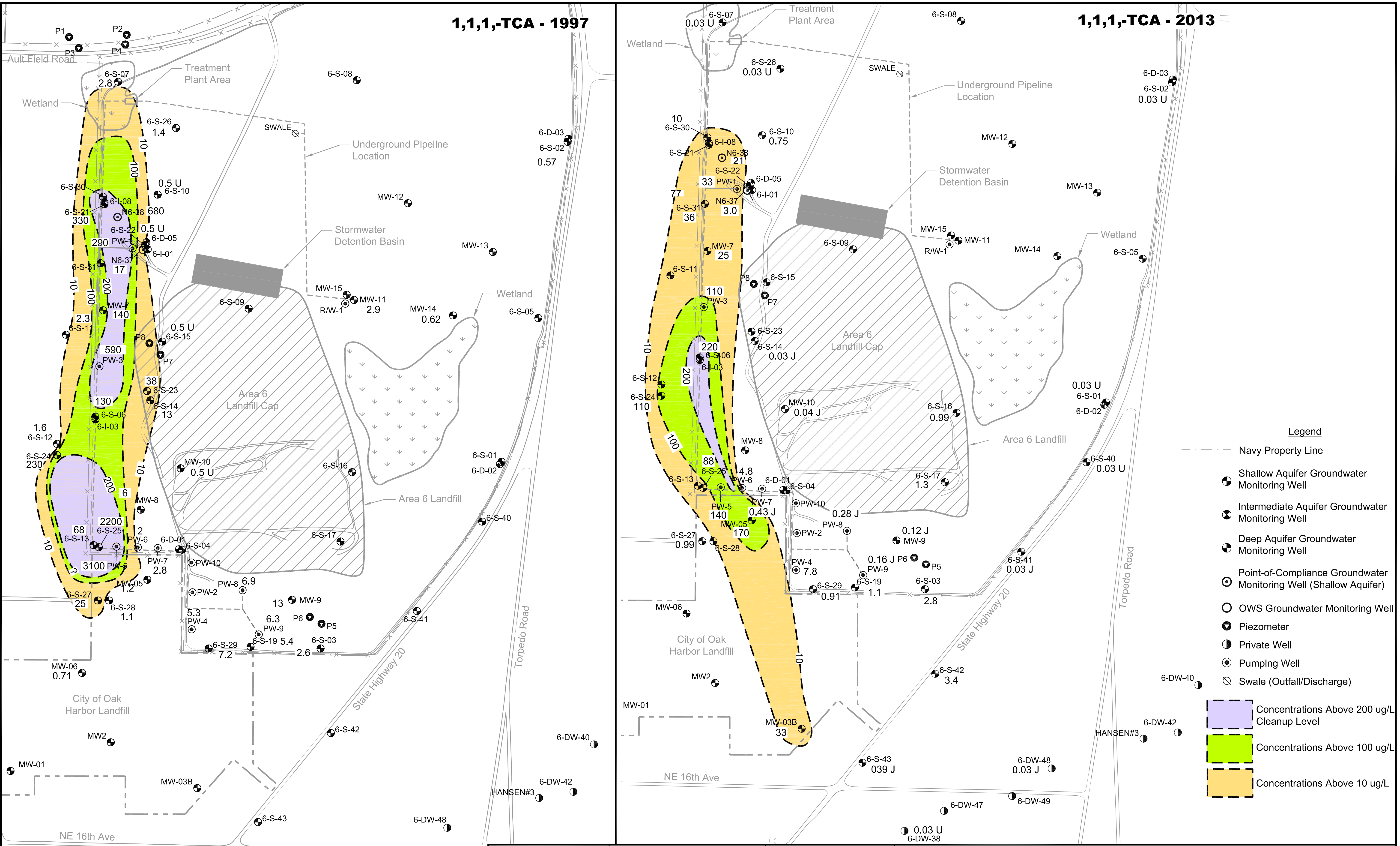

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**U.S. NAVY**

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NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

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0 300 600
SCALE IN FEET

# Figure A-6
## 1,1,1,-TCA Concentrations, 1997 and 2013

**U.S. NAVY**

DO 0066
NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

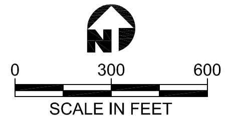

**Figure A-7**
**1,1-DCE Concentrations, 1997 and 2013**

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**U.S. NAVY**

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NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

**Figure A-8**
**cis-1,2-DCE Concentrations, 1997 and 2013**

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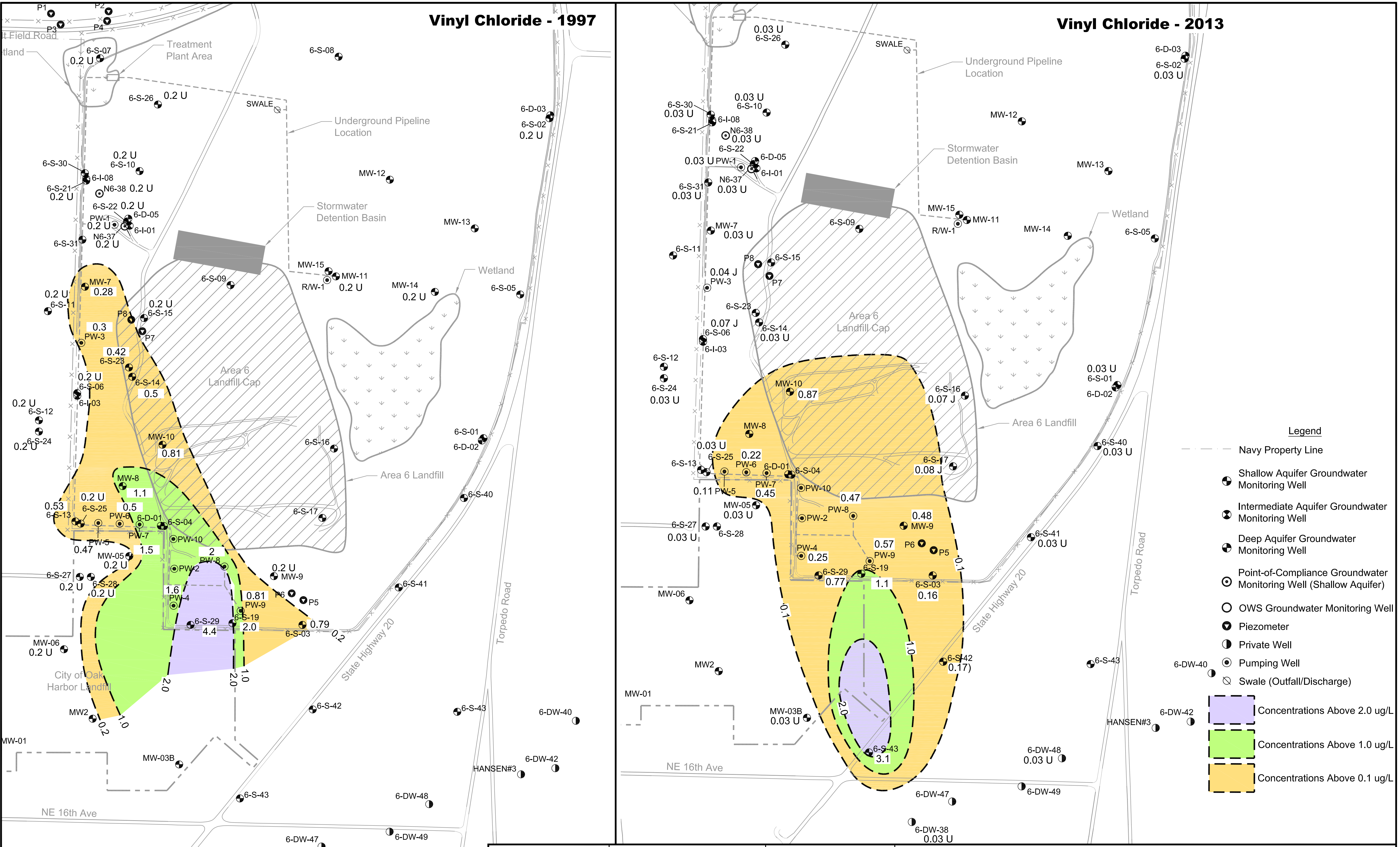

**U.S. NAVY**

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NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

## Figure A-9
## Vinyl Chloride Concentrations, 1997 and 2013

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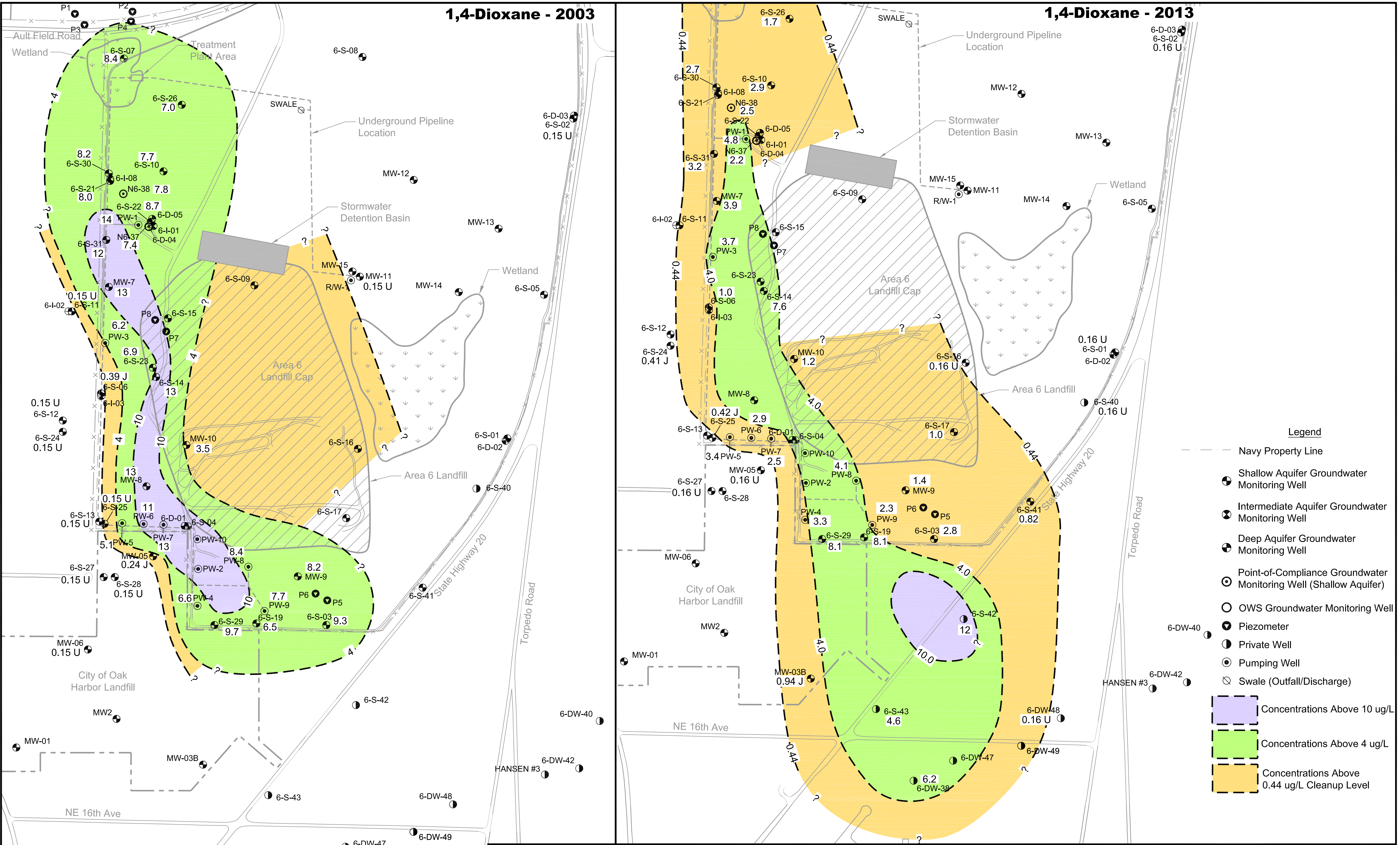

**U.S. NAVY**

DO 0066
NAS Whidbey Island
FOURTH FIVE-YEAR REVIEW

**Figure A-10**
**1,4-Dioxane Concentrations, 2003 and 2013**

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Mod: 01/08/2014, 10:08 | Plotted: 01/08/2014, 14:41 | john_knobbs

| | | | | **Parameters** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample** | **Date** | **Sample Type** | **Total Gallons Pumped** | **pH** | **TCE (µg/L)** | **1,1,1-TCA (µg/L)** | **1,1-DCA (µg/L)** | **cis-1,2-DCE (µg/L)** | **1,1-DCE (µg/L)** | **Vinyl Chloride (µg/L)** | **1,4-dioxane (µg/L)** | **Chromium (µg/L)** | **Lead (µg/L)** |
| **Effluent Limits** | | | | **6.5-8.5** | **5** | **200** | **800** | **70** | **7.0**[1/] | **0.1** | **0.44**[2/] | **80** | **5** |
| GM-09-17 | 4/30/2009 | Influent | 1,108,613,153 | 6.70 | **52** | 84 D | 22 | 11 | **31** | **0.31 J** | NA | NA | NA |
| GM-09-21 | 5/26/2009 | Influent | 1,115,723,726 | 6.80 | **54** | 78 D | 24 | 12 | **32** | **0.29 J** | NA | NA | NA |
| GM-09-25 | 6/29/2009 | Influent | 1,122,281,886 | 6.90 | **54** | 84 D | 25 | 11 | **32** | **0.38 J** | **5.6** | 0.9 J | ND (0.7) |
| GM-09-30 | 7/28/2009 | Influent | 1,129,127,501 | 6.90 | **60** | 100 D | 30 | 13 | **33** | **0.35 J** | NA | NA | NA |
| GM-09-34 | 8/25/2009 | Influent | 1,135,647,891 | 7.00 | **66** | 110 D | 27 | 12 | **40** | **0.35 J** | NA | NA | NA |
| GM-09-38 | 9/28/2009 | Influent | 1,141,334,223 | 7.07 | **60** | 84 D | 23 | 12 | **32** | **0.24 J** | **6.8** | 4.6 J | ND (0.5) |
| GM-09-43 | 10/30/2009 | Influent | 1,146,463,502 | 6.03 | **61** | 87 D | 22 | 10 | **28** | **0.24 J** | NA | NA | NA |
| GM-09-47 | 11/23/2009 | Influent | 1,153,408,604 | 6.20 | **43** | 73 | 17 | 8.8 | **23** | **0.31 J** | NA | NA | NA |
| GM-09-51 | 12/30/2009 | Influent | 1,160,733,101 | 6.26 | **46** | 70 D | 17 | 9.0 | **26** | **0.31 J** | **4.4** | 1.0 J | 0.6 J |
| GM-10-04 | 1/25/2010 | Influent | 1,167,752,358 | 6.35 | **54** | 77 D | 21 | 9.9 | **30** | **0.29 J** | NA | NA | NA |
| GM-10-08 | 2/24/2010 | Influent | 1,173,636,596 | 6.30 | **53** | 71 D | 19 | 9.7 | **29** | **0.24 J** | NA | NA | NA |
| GM-10-12 | 3/23/2010 | Influent | 1,179,654,639 | 6.35 | **59** | 84 D | 21 | 11 | **34** | **0.25 J** | **4.7** | 4.3 J | ND (0.4) |
| GM-10-17 | 4/26/2010 | Influent | 1,185,552,287 | 6.41 | **57** | 80 D | 21 | 11 | **35** | **0.26 J** | NA | NA | NA |
| GM-10-21 | 5/26/2010 | Influent | 1,191,217,400 | 6.97 | **55** | 82 D | 20 | 10 | **33** | **0.18 J** | NA | NA | NA |
| GM-10-26 | 6/28/2010 | Influent | 1,197,552,157 | 6.54 | **44** | 77 | 17 | 8.3 | **25** | **0.26 J** | **4.9** | 2.3 J | 1.1 J |
| GM-10-30 | 7/16/2010 | Influent | 1,203,800,136 | 6.46 | **47** | 78 | 19 | 9.6 | **24** | **0.22 J** | NA | NA | NA |
| GM-10-34 | 8/6/2010 | Influent | 1,211,106,652 | 6.51 | **44** | 77 | 19 | 8.9 | **23** | **0.27 J** | **4** | 6 | 1.3 J |
| GM-10-38 | 9/28/2010 | Influent | 1,218,013,606 | 6.56 | **44** | 80 | 18 | 8.4 | **24** | **0.25** | NA | NA | NA |
| GM-10-42 | 10/26/2010 | Influent | 1,225,078,331 | 6.67 | **39** | 71 | 18 | 8.2 | **22** | **0.25** | NA | NA | NA |
| GM-10-46 | 11/29/2010 | Influent | 1,231,211,804 | 6.41 | **40** | 55 D | 21 | 8.7 | **23** | **0.20** | **4.7** | 2.0 J | 1.5 J |
| GM-10-50 | 12/27/2010 | Influent | 1,237,849,417 | 6.54 | **39** | 66 | 17 | 7.7 | **23** | **0.26 J** | NA | NA | NA |
| GM-11-04 | 1/24/2011 | Influent | 1,244,354,180 | 6.20 | **40** | 67 | 16 | 7.6 | **21** | **0.2 J** | NA | NA | NA |
| GM-11-08 | 2/16/2011 | Influent | 1,250,419,432 | 6.60 | **37** | 58 | 15 | 6.9 | **19** | **0.22** | **4.6** | 3.9 J | 0.7 J |
| GM-11-13 | 3/15/2011 | Influent | 1,257,040,110 | 6.60 | **41** | 61 | 16 | 8.1 | **21** | **0.21 J** | NA | NA | NA |
| GM-11-17 | 4/25/2011 | Influent | 1,263,420,020 | 7.16 | **37** | 51 | 18 | 8.7 | **21** | **0.25** | NA | NA | NA |
| GM-11-22 | 5/26/2011 | Influent | 1,269,769,052 | 7.26 | **47** | 78 | 20 | 8.9 | **26** | **0.20** | **4.9** | 3.5 | 0.9 |
| GM-11-26 | 6/8/2011 | Influent | 1,276,062,657 | 7.32 | **45** | 54 | 16 | 11 | **21** | **0.17** | NA | NA | NA |
| GM-11-30 | 7/7/2011 | Influent | 1,284,790,308 | 7.45 | **33** | 56 | 14 | 7.7 | **17** | **0.22** | NA | NA | NA |
| GM-11-34 | 8/10/2011 | Influent | 1,292,832,990 | 7.14 | **40** | 60 | 15 | 8.7 | **21** | **0.14** | **3.9** | 5.9 | ND (0.4) |
| GM-11-38 | 9/7/2011 | Influent | 1,300,353,561 | NA | **36** | 53 | 15 | 8.1 | **20** | **0.19** | NA | NA | NA |

Table A-1
Area 6 Treatment Plant Influent Sample Summary, April 2009 - March 2013

U.S. Navy 2013d

| | | | | **Parameters** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample** | **Date** | **Sample Type** | **Total Gallons Pumped** | **pH** | **TCE (µg/L)** | **1,1,1-TCA (µg/L)** | **1,1-DCA (µg/L)** | **cis-1,2-DCE (µg/L)** | **1,1-DCE (µg/L)** | **Vinyl Chloride (µg/L)** | **1,4-dioxane (µg/L)** | **Chromium (µg/L)** | **Lead (µg/L)** |
| **Effluent Limits** | | | | **6.5-8.5** | **5** | **200** | **800** | **70** | **7.0**[1/] | **0.1** | **0.44**[2/] | **80** | **5** |
| GM-11-42 | 10/12/2011 | Influent | 1,308,503,071 | 7.16 | **35** | 55 | 14 | 6.9 | **19** | **0.24** | NA | NA | NA |
| GM-11-46 | 11/1/2011 | Influent | 1,315,948,211 | 7.12 | **33** | 54 | 14 | 7.6 | **17** | **0.20** | **4.4** | 1.8 | 0.6 |
| GM-11-50 | 12/6/2011 | Influent | 1,323,752,740 | 7.13 | **35** | 54 | 14 | 6.8 | **17** | **0.18** | NA | NA | NA |
| GM-12-04 | 1/4/2012 | Influent | 1,331,694,220 | 6.96 | **34** | 52 | 14 | 6.9 | **17** | **0.25** | NA | NA | NA |
| GM-12-08 | 2/1/2012 | Influent | 1,338,390,815 | 7.34 | **33** | 48 | 13 | 6.4 | **16** | **0.21** | **5.2** | 1.2 | 0.4 |
| GM-12-13 | 3/7/2012 | Influent | 1,346,213,828 | 7.18 | **34** | 50 | 14 | 6.6 | **17** | **0.22** | NA | NA | NA |
| GM-12-17 | 4/4/2012 | Influent | 1,354,482,642 | 7.19 | **37** | 50 | 13 | 8.2 | **17** | **0.21** | NA | NA | NA |
| GM-12-22 | 5/2/2012 | Influent | 1,362,946,497 | 7.15 | **32** | 44 | 12 | 6.4 | **16** | **0.19** | **4.7** | 1.6 J | 0.4 U |
| GM-12-26 | 6/6/2012 | Influent | 1,370,692,286 | 7.26 | **31** | 48 | 13 | 6.9 | **19** | **0.20** | NA | NA | NA |
| GM-12-30 | 7/2/2012 | Influent | 1,377,802,256 | 7.10 | **35** | 57 | 15 | 7.8 | **23** | **0.15** | NA | NA | NA |
| GM-12-34 | 8/6/2012 | Influent | 1,385,059,224 | 7.89 | **38** | 60 | 16 | 8.6 | **21** | **0.19** | **5.3** | 2.5 J | 0.4 U |
| GM-12-38 | 9/4/2012 | Influent | 1,392,550,464 | 6.84 | **37** | 56 | 14 | 8.6 | **21** | **0.15 J** | NA | NA | NA |
| GM-12-42 | 10/3/2012 | Influent | 1,399,910,524 | 7.06 | **36** | 58 | 13 | 7.8 | **21** | **0.15** | NA | NA | NA |
| GM-12-46 | 11/5/2012 | Influent | 1,406,801,766 | 6.80 | **36** | 61 | 14 | 7.4 | **22** | **0.15** | **5.3** | 1.5 J | 0.5 J |
| GM-12-50 | 12/3/2012 | Influent | 1,414,193,038 | 6.94 | **35** | 55 | 14 | 6.9 | **20** | **0.21** | NA | NA | NA |
| GM-13-54 | 1/2/2013 | Influent | 1,421,554,534 | 6.96 | **38** | 57 | 14 | 8.1 | **21** | **0.19** | NA | NA | NA |
| GM-13-58 | 2/6/2013 | Influent | 1,428,054,099 | 7.00 | **36** | 56 | 13 | 7.3 | **19** | **0.16** | **3.7** | 2.5 J | 0.7 U |
| GM-13-63 | 3/5/2013 | Influent | 1,435,460,279 | 6.88 | **34** | 50 | 13 | 6.8 | **19** | **0.15** | NA | NA | NA |

*Notes:*

Sample numbers are sequential for the purposes of submitting blind samples to the laboratory. Flow reading from computer.

**Bold** indicates exceedance of effluent limits.

[1/] Action level increased to 7.0 µg/L as agreed by EPA in June 6, 2006 meeting.

[2/] MTCA Method B value for 1,4-dioxane was lowered from 4.0 to 0.44 µg/L in August 2010.

µg/L - microgram per liter
D – diluted
DCA – dichloroethane
DCE – dichloroethene
J – Estimated value; detected, but below quantitation limit.
NA – Not analyzed for indicated parameter.
ND ( ) – indicated parameter not detected, detection limit in parenthesis.
TCA – trichloroethane
TCE –trichloroethene
U – The analyte is not detected at the indicated detection limit

Table A-1 Continued
Area 6 Treatment Plant Influent Sample Summary, April 2009 - March 2013

U.S. Navy 2013d

| | | | | **Parameters** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample** | **Date** | **Sample Type** | **Total Gallons Pumped** | **pH** | **TCE (µg/L)** | **1,1,1-TCA (µg/L)** | **1,1-DCA (µg/L)** | **cis-1,2-DCE (µg/L)** | **1,1-DCE (µg/L)** | **Vinyl Chloride (µg/L)** | **1,4-dioxane (µg/L)** | **Chromium (µg/L)** | **Lead (µg/L)** |
| **Effluent Limits** | | | | **6.5-8.5** | **5** | **200** | **800** | **70** | **$7.0^{1/}$** | **0.1 (MDL)** | **$0.44^{2/}$** | **80 (MDL)** | **5 (MDL)** |
| GM-09-16 | 4/30/2009 | Effluent | 1,108,613,153 | 8.20 | 0.86 | 0.85 | 0.61 | 0.48 J | 0.16 J | ND (0.06) | NA | NA | NA |
| GM-09-20 | 5/26/2009 | Effluent | 1,115,723,726 | 8.15 | 0.95 | 0.82 | 0.72 | 0.54 | 0.17 J | ND (0.06) | NA | NA | NA |
| GM-09-24 | 6/29/2009 | Effluent | 1,122,281,886 | 8.20 | 0.83 | 0.75 | 0.65 | 0.46 J | 0.12 J | ND (0.03) | **5.6** | ND (0.6) | ND (0.7) |
| GM-09-29 | 7/28/2009 | Effluent | 1,129,127,501 | 8.15 | 1.2 | 1.2 | 0.98 | 0.64 | 0.21 J | ND (0.03) | NA | NA | NA |
| GM-09-33 | 8/25/2009 | Effluent | 1,135,647,891 | 8.23 | 0.72 | 0.68 | 0.54 | 0.37 J | 0.18 J | ND (0.03) | NA | NA | NA |
| GM-09-37 | 9/28/2009 | Effluent | 1,141,334,223 | 7.94 | 0.57 | 0.56 | 0.48 J | 0.22 J | 0.11 J | ND (0.03) | **5.1** | 4.1 J | ND (0.5) |
| GM-09-42 | 10/30/2009 | Effluent | 1,146,463,502 | 7.54 | 1.1 | 1.0 | 0.16 J | 0.53 | 0.16 J | ND (0.03) | NA | NA | NA |
| GM-09-46 | 11/23/2009 | Effluent | 1,153,408,604 | 7.35 | 1.1 | 0.75 | 0.87 | 0.61 | 0.16 J | ND (0.03) | NA | NA | NA |
| GM-09-50 | 12/30/2009 | Effluent | 1,160,733,101 | 7.12 | 1.3 | 1.2 | 0.8 | 0.67 | 0.22 J | ND (0.03) | **4.3** | 1.7 J | 2.1 J |
| GM-10-03 | 1/25/2010 | Effluent | 1,167,752,358 | 7.36 | 1.6 | 1.3 | 1.0 | 0.76 | 0.27 J | ND (0.03) | NA | NA | NA |
| GM-10-07 | 2/24/2010 | Effluent | 1,173,636,596 | 7.45 | 1.1 | 0.96 | 0.66 | 0.54 | 0.19 J | ND (0.03) | NA | NA | NA |
| GM-10-11 | 3/23/2010 | Effluent | 1,179,654,639 | 7.46 | 0.93 | 0.83 | 0.53 | 0.44 J | 0.17 J | ND (0.03) | NA | NA | NA |
| GM-10-16 | 4/26/2010 | Effluent | 1,185,552,287 | 7.75 | 0.84 | 0.73 | 0.52 | 0.44 J | 0.14 J | ND (0.03) | NA | NA | NA |
| GM-10-20 | 5/26/2010 | Effluent | 1,191,217,400 | 8.13 | 0.98 | 0.76 | 0.63 | 0.33 | 0.15 J | ND (0.03) | NA | NA | NA |
| GM-10-24 | 6/28/2010 | Effluent | 1,197,552,157 | 7.85 | 1.1 | 0.92 | 0.71 | 0.54 | 0.19 J | ND (0.03) | **4.8** | 2.6 J | 1.4 J |
| GM-10-29 | 7/16/2010 | Effluent | 1,203,800,136 | 7.78 | 1.4 | 1.0 | 0.97 | 0.77 | 0.19 J | ND (0.03) | NA | NA | NA |
| GM-10-33 | 8/6/2010 | Effluent | 1,211,106,652 | 7.76 | 1.0 | 0.89 | 0.75 | 0.55 | 0.16 J | ND (0.03) | **4** | ND (3.0) | ND (0.9) |
| GM-10-37 | 9/28/2010 | Effluent | 1,218,013,606 | 7.95 | 2.3 | 1.9 | 1.7 | 1.1 | 0.33 J | ND (0.03) | NA | NA | NA |
| GM-10-41 | 10/26/2010 | Effluent | 1,225,078,331 | 8.00 | 2.7 | 2.0 | 2.0 | 1.4 | 0.40 J | ND (0.03) | NA | NA | NA |
| GM-10-45 | 11/29/2010 | Effluent | 1,231,211,804 | 7.95 | 3.9 | 3.5 | 3.1 | 1.7 | 0.7 | ND (0.03) | **4.9** | 2.2 J | 1.2 J |
| GM-10-49 | 12/27/2010 | Effluent | 1,237,849,417 | 7.95 | 3.2 | 2.9 | 2.4 | 1.6 | 0.48 J | ND (0.03) | NA | NA | NA |
| GM-11-03 | 1/24/2011 | Effluent | 1,244,354,180 | 7.76 | 2.9 | 2.2 | 1.9 | 1.3 | 0.41 J | ND (0.32) | N/A | NA | NA |
| GM-11-07 | 2/16/2011 | Effluent | 1,250,419,432 | 8.14 | 4.3 | 3.2 | 2.8 | 1.8 | 0.59 | ND (0.32) | **4.5** | ND (2.0) | 1.4 J |
| GM-11-11 | 3/15/2011 | Effluent | 1,257,040,110 | 8.06 | 4.7 | 3.2 | 2.8 | 2.1 | 0.65 | ND (0.32) | N/A | N/A | NA |
| GM-11-16 | 4/25/2011 | Effluent | 1,263,420,020 | **8.75** | 3.00 | 1.8 | 2.5 | 1.7 | 0.44 J | ND (0.32) | N/A | N/A | NA |
| GM-11-20 | 5/26/2011 | Effluent | 1,269,799,930 | **8.67** | 0.37 | 0.25 | 0.26 J | 0.21 J | 0.07 J | ND (0.32) | **4.7** | 2.7 J | 0.8 J |
| GM-11-25 | 6/8/2011 | Effluent | 1,276,093,535 | **8.75** | 0.43 | 0.26 | 0.25 J | 0.029 J | 0.07 J | ND (0.32) | N/A | N/A | NA |
| GM-11-29 | 7/7/2011 | Effluent | 1,284,821,186 | **8.95** | 0.61 | 0.50 | 0.43 J | 0.41 J | 0.1 J | ND (0.32) | N/A | N/A | NA |
| GM-11-33 | 8/10/2011 | Effluent | 1,292,863,868 | **8.53** | 0.43 | 0.34 | 0.28 J | 0.27 J | 0.07 J | ND (0.32) | **4.2** | 3.7 J | ND (0.4) |
| GM-11-37 | 9/7/2011 | Effluent | 1,300,384,439 | NA | 0.60 | 0.41 | 0.4 J | 0.34 J | 0.1 J | ND (0.32) | N/A | N/A | NA |
| GM-11-41 | 10/12/2011 | Effluent | 1,308,533,949 | 8.24 | 0.75 | 0.58 | 0.55 | 0.41 J | 0.16 J | ND (0.32) | N/A | N/A | NA |

Table A-2
Area 6 Treatment Plant Effluent Sample Summary, April 2009 - March 2013

U.S. Navy 2013d

| | | | | Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Date | Sample Type | Total Gallons Pumped | pH | TCE (µg/L) | 1,1,1-TCA (µg/L) | 1,1-DCA (µg/L) | cis-1,2-DCE (µg/L) | 1,1-DCE (µg/L) | Vinyl Chloride (µg/L) | 1,4-dioxane (µg/L) | Chromium (µg/L) | Lead (µg/L) |
| **Effluent Limits** | | | | **6.5-8.5** | **5** | **200** | **800** | **70** | **7.0**[1/] | **0.1 (MDL)** | **0.44**[2/] | **80** | **5** |
| GM-11-45 | 11/1/2011 | Effluent | 1,315,979,089 | 8.45 | 0.77 | 0.63 | 0.54 | 0.48 J | 0.13 J | ND (0.32) | **3.9** | 1.3 J | 1.6 J |
| GM-11-49 | 12/6/2011 | Effluent | 1,323,783,618 | **8.69** | 0.85 | 0.67 | 0.53 | 0.42 J | 0.14 J | ND (0.32) | NA | NA | NA |
| GM-12-03 | 1/4/2012 | Effluent | 1,331,725,098 | 8.07 | 0.93 | 0.73 | 0.58 | 0.47 J | 0.17 J | ND (0.32) | NA | NA | NA |
| GM-12-07 | 2/1/2012 | Effluent | 1,338,421,693 | **8.79** | 0.78 | 0.54 | 0.54 | 0.41 J | 0.13 J | ND (0.32) | **5.8** | 1.5 J | 1.7 J |
| GM-12-11 | 3/7/2012 | Effluent | 1,346,244,706 | **8.70** | 0.67 | 0.51 | 0.47 J | 0.36 J | 0.12 J | ND (0.32) | NA | NA | NA |
| GM-12-16 | 4/4/2012 | Effluent | 1,354,482,642 | **8.73** | 0.84 | 0.63 | 0.52 | 0.48 J | 0.13 J | ND (0.32) | NA | NA | NA |
| GM-12-20 | 5/2/2012 | Effluent | 1,362,946,497 | **8.80** | 0.84 | 0.58 | 0.50 | 0.46 J | 0.14 J | ND (0.32) | **3.4** | 0.7 | 0.4 |
| GM-12-25 | 6/6/2012 | Effluent | 1,370,692,286 | **8.92** | 0.77 | 0.58 | 0.52 | 0.42 J | 0.17 J | ND (0.32) | NA | NA | NA |
| GM-12-29 | 7/2/2012 | Effluent | 1,377,802,256 | 8.18 | 0.53 | 0.43 J | 0.37 J | 0.33 J | 0.11 J | ND (0.32) | NA | NA | NA |
| GM-12-33 | 8/6/2012 | Effluent | 1,385,059,224 | 7.56 | 0.56 | 0.45 J | 0.40 J | 0.34 J | 0.10 J | ND (0.32) | **5** | 1.8 | 0.6 |
| GM-12-37 | 9/4/2012 | Effluent | 1,392,550,464 | 8.31 | 0.66 | 0.51 | 0.43 J | 0.43 J | 0.14 J | ND (0.32) | NA | NA | NA |
| GM-12-41 | 10/3/2012 | Effluent | 1,399,910,524 | **8.54** | 0.63 | 0.53 | 0.42 J | 0.41 J | 0.11 J | ND (0.32) | NA | NA | NA |
| GM-12-45 | 11/5/2012 | Effluent | 1,406,801,766 | **8.62** | 0.62 | 0.51 | 0.40 J | 0.36 J | 0.13 J | ND (0.32) | **5.4** | 0.9 U | 0.4 J |
| GM-12-49 | 12/3/2012 | Effluent | 1,414,193,038 | 8.15 | 0.69 | 0.58 | 0.49 J | 0.38 J | 0.15 J | ND (0.32) | NA | NA | NA |
| GM-13-53 | 1/2/2013 | Effluent | 1,421,554,534 | 8.30 | 0.90 | 0.70 | 0.55 | 0.51 | 0.16 J | ND (0.32) | NA | NA | NA |
| GM-13-57 | 2/6/2013 | Effluent | 1,428,054,099 | 8.22 | 1.00 | 0.80 | 0.61 | 0.56 | 0.18 J | ND (0.32) | **3.5** | 1.3 J | 2.3 |
| GM-13-61 | 3/5/2013 | Effluent | 1,435,460,279 | 8.47 | 0.50 | 0.41 J | 0.31 J | 0.27 J | 0.10 J | ND (0.32) | NA | NA | NA |

NA – Not analyzed for indicated parameter.
ND ( ) – indicated parameter not detected, detection limit in parenthesis.
DCA – dichloroethane
DCE – dichloroethene
TCA trichloroethane
TCE trichloroethene
µg/L = micrograms per liter
J – Estimated value; detected, but below quantitation limit.
U – The analyte is not detected at the indicated detection limit

Table A-2 Continued
Area 6 Treatment Plant Effluent Sample Summary, April 2009 - March 2013

U.S. Navy 2013d

| | | | | Parameters | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Date | Sample Type | Total Gallons Pumped | pH | TCE (µg/L) | 1,1,1-TCA (µg/L) | 1,1-DCA (µg/L) | cis-1,2-DCE (µg/L) | 1,1-DCE (µg/L) | Vinyl Chloride (µg/L) | 1,4-dioxane (µg/L) |
| **Effluent Limits** | | | | **6.5-8.5** | **5** | **200** | **800** | **70 (MDL)** | **$7.0^{1/}$ (MDL)** | **0.1 (MDL)** | **$0.44^{2/}$** |
| GM-09-15 | 4/30/2009 | Swale | 1,108,613,153 | 8.20 | 0.11 J | 0.11 J | 0.08 J | 0.05 J | ND (0.06) | ND (0.03) | NA |
| GM-09-19 | 5/26/2009 | Swale | 1,115,723,726 | 8.10 | 0.14 J | 0.13 J | 0.10 J | 0.09 J | ND (0.06) | ND (0.03) | NA |
| GM-09-23 | 6/29/2009 | Swale | 1,122,281,886 | 8.00 | 0.12 J | 0.11 J | 0.11 J | 0.07 J | ND (0.05) | ND (0.03) | NA |
| GM-09-28 | 7/28/2009 | Swale | 1,129,127,501 | 8.00 | 0.14 J | 0.12 J | 0.11 J | 0.09 J | ND (0.05) | ND (0.03) | NA |
| GM-09-32 | 8/25/2009 | Swale | 1,135,647,891 | 8.00 | 0.22 J | 0.18 J | 0.21 J | 0.15 J | ND (0.05) | ND (0.03) | NA |
| GM-09-36 | 9/28/2009 | Swale | 1,141,334,223 | 8.20 | 0.10 J | 0.09 J | 0.07 J | 0.05 J | ND (0.05) | ND (0.03) | NA |
| GM-09-41 | 10/30/2009 | Swale | 1,146,463,502 | 6.20 | 0.06 J | 0.06 J | 0.06 J | ND (0.04) | ND (0.05) | ND (0.03) | NA |
| GM-09-45 | 11/23/2009 | Swale | 1,153,408,604 | 7.50 | 0.15 J | 0.15 J | 0.10 J | 0.08 J | ND (0.05) | ND (0.03) | NA |
| GM-09-49 | 12/30/2009 | Swale | 1,160,733,101 | 7.70 | 0.11 J | 0.09 J | 0.07 J | 0.05 J | ND (0.05) | ND (0.03) | NA |
| GM-10-02 | 1/25/2010 | Swale | 1,167,752,358 | 7.75 | 0.14 J | 0.10 J | 0.08 J | 0.06 J | ND (0.05) | ND (0.03) | NA |
| GM-10-06 | 2/24/2010 | Swale | 1,173,636,596 | 7.67 | 0.10 J | 0.07 J | 0.05 J | 0.05 J | ND (0.05) | ND (0.03) | NA |
| GM-10-10 | 3/23/2010 | Swale | 1,179,654,639 | 7.74 | 0.12 J | 0.06 J | 0.04 J | ND (0.04) | ND (0.05) | ND (0.03) | NA |
| GM-10-15 | 4/26/2010 | Swale | 1,185,552,287 | 7.86 | 0.08 J | 0.07 J | 0.04 J | 0.05 J | ND (0.05) | ND (0.03) | NA |
| GM-10-19 | 5/26/2010 | Swale | 1,191,217,400 | 7.47 | 0.12 J | 0.10 J | 0.07 J | 0.07 J | ND (0.05) | ND (0.03) | NA |
| GM-10-23 | 6/28/2010 | Swale | 1,197,552,157 | 7.74 | 0.14 J | 0.12 J | 0.11 J | 0.10 J | ND (0.05) | ND (0.03) | NA |
| GM-10-28 | 7/16/2010 | Swale | 1,203,800,136 | 7.80 | 0.17 J | 0.13 J | 0.12 J | 0.10 J | ND (0.05) | ND (0.03) | NA |
| GM-10-32 | 8/ 6/2010 | Swale | 1,211,106,652 | 7.86 | 0.24 J | 0.14 J | 0.11 J | 0.11 J | ND (0.05) | ND (0.03) | **4.1** |
| GM-10-36 | 9/28/2010 | Swale | 1,218,013,606 | 7.86 | 0.33 J | 0.23 J | 0.28 J | 0.20 J | 0.05 J | ND (0.03) | NA |
| GM-10-40 | 10/26/2010 | Swale | 1,225,078,331 | 7.97 | 0.31 J | 0.21 J | 0.21 J | 0.15 J | ND (0.05) | ND (0.03) | NA |
| GM-10-44 | 11/29/2010 | Swale | 1,231,211,804 | 7.86 | 0.29 J | 0.27 J | 0.24 J | 0.14 J | 0.05 J | ND (0.03) | **4.7** |
| GM-10-48 | 12/27/2010 | Swale | 1,237,849,417 | 7.96 | 0.22 J | 0.20 J | 0.18 J | 0.11 J | ND (0.05) | ND (0.03) | NA |
| GM-11-02 | 1/24/2011 | Swale | 1,244,354,180 | 7.47 | 0.19 J | 0.13 J | 0.12 J | 0.09 J | ND (0.05) | ND (0.03) | NA |
| GM-11-06 | 2/16/2011 | Swale | 1,250,419,432 | 7.87 | 0.40 J | 0.36 J | 0.24 J | 0.14 J | 0.07 J | ND (0.03) | **4.3** |
| GM-11-10 | 3/15/2011 | Swale | 1,257,040,110 | 7.70 | 0.37 J | 0.27 J | 0.24 J | 0.16 J | ND (0.05) | ND (0.03) | NA |
| GM-11-15 | 4/25/2011 | Swale | 1,263,420,020 | 7.61 | 0.22 J | 0.14 J | 0.22 J | 0.14 J | ND (0.05) | ND (0.03) | NA |
| GM-11-19 | 5/26/2011 | Swale | 1,269,799,930 | 7.84 | 0.04 J | 0.04 J | 0.04 J | ND (0.04) | ND (0.05) | ND (0.03) | **4.4** |
| GM-11-24 | 6/8/2011 | Swale | 1,276,093,535 | **8.65** | 0.05 J | 0.03 J | ND (0.02) | ND (0.04) | ND (0.05) | ND (0.03) | NA |
| GM-11-28 | 7/7/2011 | Swale | 1,284,821,186 | 8.01 | 0.08 J | 0.07 J | 0.06 J | 0.06 J | ND (0.05) | ND (0.03) | NA |
| GM-11-32 | 8/10/2011 | Swale | 1,292,863,868 | 8.36 | 0.06 J | 0.06 J | 0.03 J | ND (0.04) | ND (0.05) | ND (0.03) | **4.2** |
| GM-11-36 | 9/7/2011 | Swale | 1,300,384,439 | NA | 0.07 J | 0.04 J | 0.04 J | ND (0.04) | ND (0.05) | ND (0.03) | NA |

Table A-3

Area 6 Monthly Swale Surface Water Sample Summary, April 2009 - March 2013

U.S. Navy 2013d

| | | | | Parameters | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample** | **Date** | **Sample Type** | **Total Gallons Pumped** | **pH** | **TCE (µg/L)** | **1,1,1-TCA (µg/L)** | **1,1-DCA (µg/L)** | **cis-1,2-DCE (µg/L)** | **1,1-DCE (µg/L)** | **Vinyl Chloride (µg/L)** | **1,4-dioxane (µg/L)** |
| **Effluent Limits** | | | | **6.5-8.5** | **5** | **200** | **800** | **70 (MDL)** | **7.0[1/] (MDL)** | **0.1 (MDL)** | **0.44[2/]** |
| GM-11-40 | 10/12/2011 | Swale | 1,308,533,949 | 8.29 | 0.10 J | 0.07 J | 0.06 J | 0.06 J | ND (0.05) | ND (0.03) | NA |
| GM-11-44 | 11/1/2011 | Swale | 1,315,979,089 | **8.53** | 0.08 J | 0.06 J | 0.06 J | 0.06 J | ND (0.05) | ND (0.03) | **3.4** |
| GM-11-48 | 12/6/2011 | Swale | 1,323,783,618 | **8.72** | 0.10 J | 0.07 J | 0.06 J | ND (0.04) | ND (0.05) | ND (0.03) | NA |
| GM-12-02 | 1/4/2012 | Swale | 1,331,725,098 | 8.23 | 0.08 J | 0.06 J | 0.05 J | ND (0.04) | ND (0.05) | ND (0.03) | NA |
| GM-12-06 | 2/1/2012 | Swale | 1,338,421,693 | **8.92** | 0.06 J | 0.04 J | 0.04 J | ND (0.04) | ND (0.05) | ND (0.03) | **5** |
| GM-12-10 | 3/7/2012 | Swale | 1,346,244,706 | **8.96** | 0.07 J | 0.06 J | 0.05 J | ND (0.04) | ND (0.05) | ND (0.03) | NA |
| GM-12-15 | 4/4/2012 | Swale | 1,354,482,642 | **8.96** | 0.08 J | 0.06 J | 0.05 J | 0.05 J | ND (0.05) | ND (0.03) | NA |
| GM-12-19 | 5/2/2012 | Swale | 1,362,946,497 | **8.87** | 0.08 J | 0.06 J | 0.05 J | 0.05 J | ND (0.05) | ND (0.03) | **3.5** |
| GM-12-24 | 6/6/2012 | Swale | 1,370,692,286 | **8.86** | 0.08 J | 0.05 J | 0.05 J | 0.06 J | ND (0.05) | ND (0.03) | NA |
| GM-12-28 | 7/2/2012 | Swale | 1,377,802,256 | 8.27 | 0.06 J | 0.04 J | 0.05 J | ND (0.04) | ND (0.05) | ND (0.03) | NA |
| GM-12-32 | 8/6/2012 | Swale | 1,385,059,224 | 7.96 | 0.07 J | 0.04 J | 0.05 J | ND (0.04) | ND (0.05) | ND (0.03) | **4.8** |
| GM-12-36 | 9/4/2012 | Swale | 1,392,550,464 | 8.30 | 0.04 J | 0.04 J | 0.04 J | 0.05 J | ND (0.05) | ND (0.03) | NA |
| GM-12-40 | 10/3/2012 | Swale | 1,399,910,524 | **8.53** | 0.07 J | 0.05 J | 0.04 J | 0.05 J | ND (0.05) | ND (0.03) | NA |
| GM-12-44 | 11/5/2012 | Swale | 1,406,801,766 | **8.76** | 0.05 J | 0.06 J | 0.04 J | 0.05 J | ND (0.05) | ND (0.03) | **4.6** |
| GM-12-48 | 12/3/2012 | Swale | 1,414,193,038 | 8.37 | 0.06 J | 0.05 J | 0.04 J | 0.01 U | ND (0.05) | ND (0.03) | NA |
| GM-13-52 | 1/2/2013 | Swale | 1,421,554,534 | 8.42 | 0.14 J | 0.11 J | 0.09 J | 0.09 J | ND (0.05) | ND (0.03) | NA |
| GM-13-56 | 2/6/2013 | Swale | 1,428,054,099 | 8.32 | 0.17 J | 0.12 J | 0.09 J | 0.10 J | ND (0.05) | ND (0.03) | **3.5** |
| GM-13-60 | 3/5/2013 | Swale | 1,435,460,279 | 8.57 | 0.10 J | 0.07 J | 0.06 J | 0.06 J | ND (0.05) | ND (0.03) | NA |

ND ( ) – parameter not detected; detection limit in parenthesis
NA – Not analyzed for indicated parameter.
DCA – dichloroethane
DCE – dichloroethene
TCA – trichloroethane
TCE – trichloroethene
J – Estimated value; detected, but below quantitation limit.
µg/L = micrograms per liter

Table A-3 Continued
Area 6 Monthly Swale Surface Water Sample Summary, April 2009 - March 2013

U.S. Navy 2013d

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| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TCE | | 1,1,1-TCA | | 1,1-DCA | | cis-1,2-DCE | | 1,1-DCE | | Vinyl Chloride | | 1,4-dioxane | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**[1/] | | **0.1** | | **0.44** | |
| **PW-1** | 2/7/2006 | **98 D** | | 50 D | | 4.4 | | 50 D | | 2.8 | | ND | (0.13) | **12** | |
| | 5/11/2006 | **86 D** | | 49 D | | 3.6 | | 55 | | 3.2 | | ND | (0.13) | **14** | |
| | 8/17/2006 | **140 D** | | 71 D | | 6.0 | | **90 D** | | 3.2 | | ND | (0.13) | **17** | |
| | 11/6/2006 | **210 D** | | 86 D | | 7.1 | | **140 D** | | 3.6 | | ND | (0.13) | **22** | |
| | 2/27/2007 | **120 D** | | 59 | | 4.1 | | 65 D | | 3.9 | | ND | (0.13) | **11** | |
| | 5/14/2007 | **120 D** | | 58 D | | 3.8 | | 64 D | | 3 | | ND | (0.13) | **15** | |
| | 8/17/2007 | **150 D** | | 69 | | 4.7 | | **81 D** | | 3.6 | | ND | (0.13) | **14** | |
| | 2/22/2008 | **130 D** | | 59 D | | 4.3 | | **73** | | 3.9 | | ND | (0.04) | NA | |
| | 8/29/2008 | **100 D** | | 43 D | | 3.0 D | | 52 D | | 2.3 D | | ND | (0.06) | **9.6** | |
| | 4/27/2009 | **110 D** | | 56 | | 3.7 | | 65 | | 3.8 | | ND | (0.06) | NA | |
| | 8/20/2009 | **120 D** | | 55 | | 3.6 | | 63 | | 4.0 | | ND | (0.03) | **14** | |
| | 8/6/2010 | **86 D** | | 43 | | 3.0 | | 42 | | 2.9 | | ND | (0.03) | **7.1** | |
| | 2/11/2011 | **90 D** | | 38 | | 2.6 | | 42 | | 2.7 | | ND | (0.03) | **7.4** | |
| | 8/2/2011 | **69 D** | | 37 | | 2.8 | | 38 | | 2.4 | | ND | (0.03) | **7.8** | |
| | 2/1/2012 | **77** | | 33 | | 2.5 | | 33 | | 2.2 | | ND | (0.03) | **7.3** | |
| | 8/6/2012 | **74** | | 33 | | 2.8 | | 34 | | 2.5 | | ND | (0.03) | **7.6** | |
| | 2/4/2013 | **65** | | 33 | | 2.2 | | 26 | | 2.5 | | ND | (0.03) | **4.8** | |
| **PW-3** | 2/7/2006 | **100 D** | | 170 D | | 30 | | 8.7 | | **44** | | ND | (0.13) | **7.4** | |
| | 5/11/2006 | **87 D** | | 160 D | | 24 | | 7.6 | | **51** | | ND | (0.13) | **7.1** | |
| | 8/17/2006 | **150 D** | | 130 D | | 30 | | 13 | | **32** | | ND | (0.13) | **7.9** | |
| | 11/6/2006 | **160 D** | | 110 D | | 30 | | 15 | | **28** | | **0.13 J** | | **7.6** | |
| | 2/27/2007 | **99 D** | | 170 D | | 22 | | 7.5 | | **46** | | **0.18 J** | | **6.7** | |
| | 5/16/2007 | **100 D** | | 180 D | | 23 | | 7.7 | | **46** | | 0.090 J | | **6.0** | |
| | 8/17/2007 | **100 D** | | 190 D | | 24 | | 7.7 | | **45** | | 0.070 J | | **6.3** | |
| | 2/22/2008 | **110 D** | | 160 D | | 25 | | 8.5 | | **44** | | 0.070 J | | **5.1** | |
| | 8/29/2008 | **110 D** | | 99 D | | 21 | | 7.8 | | **24** | | ND | (0.06) | **5.5** | |
| | 4/27/2009 | **93 D** | | 110 D | | 20 | | 6.7 | | **32** | | 0.070 J | | **5.7** | |
| | 8/20/2009 | **100 D** | | 160 D | | 22 | | 6.9 | | **42** | | 0.080 J | | **7.5** | |
| | 8/6/2010 | **68 D** | | 150 D | | 20 | | 5.6 | | **36** | | 0.060 J | | **5.0** | |
| | 2/11/2011 | **70** | | 130 D | | 15 | | 5.0 | | **28** | | 0.050 J | | **5.1** | |
| | 8/2/2011 | **60** | | 100 D | | 14 | | 4.4 | | **24** | | 0.040 J | | **4.9** | |
| | 2/1/2012 | **64** | | 100 D | | 15 | | 4.9 | | **26** | | 0.040 J | | **6.3** | |
| | 8/6/2012 | **61** | | 110 D | | 17 | | 5 | | **29** | | 0.040 J | | **6.1** | |
| | 2/4/2013 | **55** | | 110 D | | 14 | | 5 | | **28** | | 0.040 J | | **3.7** | |
| **PW-4** | 11/9/2006 | ND | (0.21) | 1.2 | | 12 | | ND | (0.13) | 0.25 J | | **0.44 J** | | **19** | |
| | 2/27/2007 | ND | (0.21) | 44 | | 11 | | ND | (0.13) | 0.44 J | | **0.53** | | **14** | |
| | 5/16/2007 | ND | (0.21) | 4.7 | | 9.5 | | ND | (0.13) | 0.38 J | | **0.47 J** | | **13** | |
| | 8/17/2007 | ND | (0.21) | 7.9 | | 10 | | ND | (0.13) | 0.53 | | **0.43 J** | | **14** | |
| | 2/22/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **8.7** | |
| | 8/29/2008 | ND | (0.07) | 4.9 | | 9.6 | | ND | (0.04) | 0.40 J | | **0.33 J** | | **8.0** | |
| | 4/27/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **7.4** | |
| | 8/20/2009 | ND | (0.03) | 8.6 | | 13 | | ND | (0.04) | 0.92 | | **0.43 J** | | **8.5** | |
| | 8/6/2010 | ND | (0.03) | 6.3 | | 13 | | ND | (0.04) | 0.68 | | **0.28** | | **5.1** | |

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Table A-4
Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TCE | | 1,1,1-TCA | | 1,1-DCA | | cis-1,2-DCE | | 1,1-DCE | | Vinyl Chloride | | 1,4-dioxane | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**[1/] | | **0.1** | | **0.44** | |
| | 2/11/2011 | ND | (0.03) | 6.9 | | 11 | | ND | (0.04) | 0.85 | | **0.22** | | **5.0** | |
| | 8/2/2011 | ND | (0.03) | 6.0 | | 11 | | ND | (0.04) | 0.81 | | **0.17** | | **4.3** | |
| | 2/1/2012 | ND | (0.03) | 6.0 | | 11 | | ND | (0.04) | 0.98 | | **0.2** | | **5.4** | |
| | 8/6/2012 | ND | (0.03) | 6.3 | | 13 | | ND | (0.04) | 1.3 | | **0.25** | | **5.2** | |
| | 2/4/2013 | ND | (0.03) | 7.8 | | 12 | | ND | (0.04) | 1.6 | | **0.25** | | **3.3** | |
| **PW-5** | 2/7/2006 | **140 D** | | **670 D** | | 150 D | | 16 | | **150 D** | | **0.34 J** | | **5.3** | |
| | 5/11/2006 | **110 D** | | **530 D** | | 82 D | | 13 | | **110 D** | | **0.27 J** | | **5.4** | |
| | 8/17/2006 | **220 D** | | **1300 D** | | 150 D | | 23 | | **250 D** | | **0.49 J** | | **9.1** | |
| | 11/6/2006 | **230 D** | | **1100 D** | | 160 D | | 25 D | | **280 D** | | ND | (0.61) | **11** | |
| | 2/27/2007 | **130 D** | | **580 D** | | 110 D | | 13 | | **150 D** | | **0.50** | | **5.3** | |
| | 5/16/2007 | **120 D** | | **560 D** | | 92 D | | 12 | | **140 D** | | **0.27 J** | | **4.7** | |
| | 8/17/2007 | **130 D** | | **540 D** | | 99 D | | 12 | | **140 D** | | **0.25 J** | | **4.8** | |
| | 4/27/2009 | **110 D** | | **350 D** | | 90 D | | 9.9 | | **150 D** | | **0.24 J** | | NA | |
| | 8/20/2009 | **100 D** | | **290 D** | | 78 D | | 8.1 | | **130 D** | | **0.24 J** | | **4.4** | |
| | 8/6/2010 | **89 D** | | **200 D** | | 70 | | 6.9 | | **96 D** | | **0.17** | | **2.6** | |
| | 2/11/2011 | **72 D** | | 150 D | | 52 | | 5.6 | | **84 D** | | **0.13** | | **3.3** | |
| | 8/2/2011 | **76** | | 150 D | | 56 | | 4.9 | | **76 D** | | **0.11** | | **3.3** | |
| | 2/1/2012 | **70 D** | | 130 D | | 56 | | 4.8 | | **83 D** | | **0.11** | | **5.0** | |
| | 8/6/2012 | **69 D** | | 150 D | | 60 | | 5.3 | | **91 D** | | **0.12** | | **5** | |
| | 2/4/2013 | **68** | | 140 D | | 48 | | 4.3 | | **72 D** | | **0.11** | | **3.4** | |
| **PW-6** | 2/6/2006 | ND | (0.21) | 1.4 | | 2.4 | | 0.22 J | | ND | (0.24) | **0.36 J** | | **6.5** | |
| | 5/11/2006 | ND | (0.21) | 2.2 | | 2.1 | | 0.20 J | | 0.26 J | | **0.40 J** | | **6.4** | |
| | 8/17/2006 | ND | (0.21) | 1.4 | | 2.3 | | ND | (0.13) | ND | (0.24) | **0.38 J** | | **9.8** | |
| | 11/6/2006 | ND | (0.21) | 0.98 | | 2 | | ND | (0.13) | ND | (0.24) | **0.35 J** | | **11** | |
| | 2/27/2007 | ND | (0.21) | 1.4 | | 1.9 | | 0.24 J | | ND | (0.24) | **0.39 J** | | **6.7** | |
| | 5/16/2007 | ND | (0.21) | 1.7 | | 2 | | 0.24 J | | 0.12 J | | **0.38 J** | | **6.5** | |
| | 8/17/2007 | ND | (0.21) | 1.7 | | 2.2 | | 0.25 J | | 0.12 J | | **0.37 J** | | **6.8** | |
| | 2/25/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **4.0** | |
| | 8/29/2008 | ND | (0.07) | 1.3 | | 1.2 | | 0.11 J | | ND | (0.6) | **0.22 J** | | **4.0** | |
| | 4/27/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **4.9** | |
| | 8/20/2009 | ND | (0.05) | 14 | | 1.9 | | 0.31 J | | 0.37 J | | **0.43 J** | | **5.7** | |
| | 8/6/2010 | 0.11 J | | 2.4 | | 8.6 | | 0.21 J | | 0.35 J | | **0.45** | | **3.2** | |
| | 2/11/2011 | 0.090 J | | 3.9 | | 1.4 | | 0.43 J | | 0.27 J | | **0.25** | | **3.7** | |
| | 8/2/2011 | 0.070 J | | 3.4 | | 1.4 | | 0.39 J | | 0.29 J | | **0.21** | | **2.8** | |
| | 2/1/2012 | ND | (0.03) | 3.4 | | 1.3 | | 0.38 J | | 0.31 J | | **0.22** | | **4.2** | |
| | 8/6/2012 | ND | (0.03) | 4.3 | | 1.5 | | 0.39 J | | 0.46 J | | **0.24** | | **3.9** | |
| | 2/4/2013 | ND | (0.03) | 4.8 | | 1.4 | | 0.49 J | | 0.66 | | **0.22** | | **2.9** | |
| **PW-7** | 2/7/2006 | ND | (0.21) | 0.58 | | 9.8 | | 0.53 | | ND | (0.24) | **0.56** | | **4.4** | |
| | 5/11/2006 | ND | (0.21) | 0.67 | | 8.2 | | 0.53 | | ND | (0.24) | **0.59** | | **5.4** | |
| | 8/17/2006 | ND | (0.21) | 0.69 | | 8.3 | | 0.56 | | ND | (0.24) | **0.69** | | **5.4** | |
| | 11/6/2006 | ND | (0.21) | 0.63 | | 7.4 | | 0.65 | | ND | (0.24) | **0.63** | | **5.3** | |
| | 2/27/2007 | ND | (0.21) | 0.74 | | 7.8 | | 0.56 | | ND | (0.24) | **0.63** | | **3.9** | |
| | 5/14/2007 | ND | (0.21) | 0.79 | | 8.0 | | 0.47 J | | ND | (0.24) | **0.71** | | **4.1** | |

Table A-4 Continued

Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

U.S. Navy 2013d

| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TCE | | 1,1,1-TCA | | 1,1-DCA | | cis-1,2-DCE | | 1,1-DCE | | Vinyl Chloride | | 1,4-dioxane | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**$^{1/}$ | | **0.1** | | **0.44** | |
| | 8/17/2007 | ND | (0.21) | 0.76 | | 8.0 | | 0.47 J | | 0.07 J | | **0.67** | | **3.9** | |
| | 8/29/2008 | ND | (0.07) | 0.65 | | 6.1 | | 0.52 | | ND | (0.06) | **0.66** | | **3.1** | |
| | 8/20/2009 | ND | (0.03) | 0.73 | | 7.5 | | 0.49 J | | ND | (0.50)* | **0.83** | | **3.9** | |
| | 8/6/2010 | ND | (0.03) | 0.52 | | 7.1 | | 0.51 | | 0.08 J | | **0.54** | | **2.6** | |
| | 2/11/2011 | ND | (0.03) | 0.47 J | | 5.9 | | 0.48 J | | 0.08 J | | **0.54** | | **4.0** | |
| | 8/2/2011 | ND | (0.03) | 0.43 J | | 5.9 | | 0.43 J | | 0.05 J | | **0.42** | | **2.4** | |
| | 2/1/2012 | ND | (0.03) | 0.38 J | | 5.9 | | 0.46 J | | 0.07 J | | **0.46** | | **3.3** | |
| | 8/6/2012 | ND | (0.03) | 0.45 J | | 6.7 | | 0.53 | | 0.08 J | | **0.5** | | **3.1** | |
| | 2/4/2013 | ND | (0.03) | 0.43 J | | 5.7 | | 0.48 J | | 0.07 J | | **0.45** | | **2.5** | |
| **PW-8** | 2/7/2006 | ND | (0.21) | 0.47 J | | 5.3 | | ND | (0.13) | ND | (0.24) | **0.80** | | **5.9** | |
| | 5/11/2006 | ND | (0.21) | 0.56 | | 4.5 | | ND | (0.13) | ND | (0.24) | **0.69** | | **5.3** | |
| | 8/17/2006 | ND | (0.21) | 0.46 J | | 5.4 | | ND | (0.13) | ND | (0.24) | **0.78** | | **4.2** | |
| | 11/6/2006 | ND | (0.21) | 0.59 | | 4.9 | | ND | (0.13) | ND | (0.24) | **0.79** | | **4.7** | |
| | 2/27/2007 | ND | (0.21) | 0.56 | | 4.4 | | ND | (0.13) | ND | (0.24) | **0.64** | | **4.1** | |
| | 5/14/007 | ND | (0.21) | 0.51 | | 4.2 | | ND | (0.13) | 0.08 J | | **0.71** | | **3.5** | |
| | 8/17/2007 | ND | (0.21) | 0.20 J | | 5.1 | | 0.060 J | | 0.07 J | | **0.84** | | **2.2** | |
| | 8/29/2008 | ND | (0.07) | 0.46 J | | 4.1 | | ND | (0.04) | ND | (0.06) | **0.57** | | **2.2** | |
| | 8/20/2009 | ND | (0.03) | ND | (0.50)* | 4.4 | | 0.050 J | | ND | (0.50)* | **0.70** | | **4.1** | |
| | 8/9/2010 | 0.08 J | | 0.39 J | | 6.2 | | 0.11 J | | 0.19 J | | **0.53** | | **5.1** | |
| | 2/15/2011 | ND | (0.03) | 0.18 J | | 4.7 | | 0.10 J | | 0.07 J | | **0.52** | | **5.8** | |
| | 8/2/2011 | ND | (0.03) | 0.29 J | | 3.7 | | 0.05 J | | 0.07 J | | **0.37** | | **4.4** | |
| | 2/1/2012 | ND | (0.03) | 0.30 J | | 3.6 | | 0.06 J | | 0.07 J | | **0.44** | | **6.3** | |
| | 8/6/2012 | ND | (0.03) | 0.30 J | | 4.5 | | 0.06 J | | 0.08 J | | **0.49** | | **6.0** | |
| | 2/4/2013 | ND | (0.03) | 0.28 J | | 4.2 | | 0.06 J | | 0.09 J | | **0.47** | | **4.1** | |
| **PW-9** | 2/7/2006 | ND | (0.21) | 0.68 | | 6.8 | | ND | (0.13) | ND | (0.24) | **0.79** | | **6.1** | |
| | 5/11/2006 | ND | (0.21) | 0.84 | | 5.5 | | ND | (0.13) | ND | (0.24) | **0.68** | | **6.0** | |
| | 8/17/2006 | ND | (0.21) | 0.72 | | 7.3 | | ND | (0.13) | ND | (0.24) | **0.87** | | **6.8** | |
| | 11/6/2006 | ND | (0.21) | 0.63 | | 6.5 | | ND | (0.13) | ND | (0.24) | **0.74** | | **6.3** | |
| | 2/27/2007 | ND | (0.21) | 0.79 | | 5.8 | | ND | (0.13) | ND | (0.24) | **0.65** | | **4.6** | |
| | 5/14/2007 | ND | (0.21) | 0.76 | | 6.1 | | ND | (0.13) | 0.11 J | | **0.73** | | **5.0** | |
| | 8/17/2007 | ND | (0.21) | 0.77 | | 6.5 | | ND | (0.13) | 0.12 J | | **0.68** | | **4.5** | |
| | 8/20/2009 | ND | (0.03) | 0.63 | | 6.8 | | ND | (0.04) | ND | (0.50)* | **0.75** | | **5.2** | |
| | 8/6/2010 | ND | (0.03) | 0.54 | | 6.9 | | ND | (0.04) | 0.16 J | | **0.57** | | **2.4** | |
| | 2/11/2011 | ND | (0.03) | 0.44 J | | 5.4 | | ND | (0.04) | 0.15 J | | **0.48** | | **3.2** | |
| | 8/2/2011 | ND | (0.03) | 0.37 J | | 4.8 | | ND | (0.04) | 0.12 J | | **0.38** | | **3.6** | |
| | 2/1/2012 | ND | (0.03) | 0.37 J | | 5.0 | | ND | (0.04) | 0.13 J | | **0.45** | | **4.7** | |
| | 8/16/2012 | 0.06 J | | 0.24 J | | 8.5 | | 0.15 J | | 0.21 J | | **0.42** | | **2.9** | |
| | 2/4/2013 | ND | (0.03) | 0.16 J | | 9.0 | | 0.12 J | | 0.16 J | | **0.57** | | **2.3** | |
| **AREA 6 MONITORING WELLS** | | | | | | | | | | | | | | | |
| **6-S-1** | 4/10/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **4.7** | |
| | 5/22/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **4.2** | |
| | 8/18/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **1.6** | |
| | 11/14/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **0.60 J** | |

Table A-4 Continued

Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **$7.0^{1/}$** | | **0.1** | | **0.44** | |
| | 2/26/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **3** | |
| | 5/9/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **1.9** | |
| | 8/15/2007 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.26) |
| | 2/22/2008 | NA | | NA | | NA | | NA | | NA | | NA | | 0.31 J | |
| | 8/26/2008 | NA | | NA | | NA | | NA | | NA | | NA | | 0.33 J | |
| | 4/29/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **ND** | **(1.0)*** |
| | 8/14/2009 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.16) |
| | 8/4/2010 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **ND** | **(1.0)*** |
| | 2/7/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/3/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/2/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/6/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/5/2013 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| **6-S-2** | 5/9/2006 | ND | (0.21) | ND | (0.21) | ND | (0.16) | ND | (0.13) | ND | (0.24) | ND | (0.13) | ND | $(0.47)^{2/}$ |
| | 11/14/2006 | ND | (0.21) | ND | (0.21) | ND | (0.16) | ND | (0.13) | ND | (0.24) | ND | (0.13) | NA | |
| | 5/9/2007 | ND | (0.21) | ND | (0.21) | ND | (0.16) | ND | (0.13) | ND | (0.24) | ND | (0.13) | ND | (0.27) |
| | 8/26/2008 | ND | (0.07) | ND | (0.05) | ND | (0.04) | ND | (0.04) | ND | (0.06) | ND | (0.06) | ND | (0.24) |
| | 8/19/2009 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | NA | |
| | 8/4/2010 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **ND** | **(1.0)*** |
| | 2/7/2011 | ND | (0.03) | 0.04 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/3/2011 | 0.07 J | | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/1/2012 | 0.05 J | | 0.08 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/6/2012 | 0.09 J | | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/4/2013 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| **6-S-3** | 2/8/2006 | ND | (0.21) | 4.3 | | 2.9 | | ND | (0.13) | ND | (0.24) | **0.36 J** | | **18** | |
| | 5/8/2006 | ND | (0.21) | 4.5 | | 2.5 | | ND | (0.13) | 0.28 J | | **0.40 J** | | **22** | |
| | 8/15/2006 | ND | (0.21) | 4.8 | | 3.0 | | ND | (0.13) | ND | (0.24) | **0.43 J** | | **20** | |
| | 11/7/2006 | ND | (0.21) | 4.2 | | 2.9 | | ND | (0.13) | ND | (0.24) | **0.45 J** | | **19** | |
| | 2/21/2007 | ND | (0.21) | 3.5 | | 2.7 | | ND | (0.13) | 0.37 J | | **0.47 J** | | **17** | |
| | 5/8/2007 | ND | (0.04) | 4.3 | | 2.9 | | ND | (0.13) | 0.21 J | | **0.46 J** | | **14** | |
| | 8/13/2007 | ND | (0.06) | 4.0 | | 3.0 | | ND | (0.05) | 0.22 J | | **0.44 J** | | **14** | |
| | 2/21/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **5.0** | |
| | 8/28/2008 | ND | (0.5) | 3.3 | | 3.1 | | ND | (0.5) | 0.21 J | | **0.39 J** | | **5.3** | |
| | 4/28/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **4.8** | |
| | 8/18/2009 | ND | (0.03) | 4.0 | | 3.3 | | ND | (0.04) | 0.34 J | | **0.38 J** | | **7.6** | |
| | 8/2/2010 | ND | (0.03) | 2.7 | | 3.0 | | ND | (0.04) | 0.25 J | | **0.29 J** | | **4.8** | |
| | 2/10/2011 | ND | (0.03) | 2.9 | | 2.8 | | ND | (0.04) | 0.26 J | | **0.29** | | **5.9** | |
| | 8/9/2011 | ND | (0.03) | 2.8 | | 2.6 | | ND | (0.04) | 0.26 J | | **0.26** | | **4.8** | |
| | 2/13/2012 | ND | (0.03) | 2.6 | | 2.5 | | ND | (0.04) | 0.26 J | | **0.19** | | **3.6** | |
| | 8/14/2012 | ND | (0.03) | 2.6 | | 2.6 | | ND | (0.04) | 0.28 J | | **0.18** | | **3.5** | |
| | 2/12/2013 | ND | (0.03) | 2.8 | | 2.7 | | ND | (0.04) | 0.30 J | | **0.16** | | **2.8** | |
| **6-S-6** | 2/21/2006 | **160 D** | | **830 D** | | 4.3 | | 7.8 | | **180 D** | | ND | (0.13) | ND | $(0.47)^{2/}$ |
| | 5/11/2006 | **130 D** | | **910 D** | | 4.6 | | 6.9 | | **180 D** | | ND | (0.13) | ND | $(0.47)^{2/}$ |

Table A-4 Continued
Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**$^{1/}$ | | **0.1** | | **0.44** | |
| | 8/17/2006 | **160 D** | | **1200 D** | | 3.6 | | 7.1 | | **260 D** | | ND | (0.13) | ND | (0.27) |
| | 11/16/2006 | **170 D** | | **1300 D** | | 2.3 | | 7.1 | | **350 D** | | ND | (0.13) | ND | (0.27) |
| | 2/23/2007 | **130 D** | | **710 D** | | 2.4 | | 5.7 | | **260 D** | | ND | (0.13) | ND | (0.27) |
| | 5/11/2007 | **130 D** | | **510 D** | | 3.0 | | 5.7 | | **220 D** | | ND | (0.04) | **0.51 J** | |
| | 8/16/2007 | **120 D** | | **510 D** | | 1.9 | | 5.4 | | **220 D** | | ND | (0.04) | **0.59 J** | |
| | 8/29/2008 | **110 D** | | **640 D** | | 1.3 | | 4.6 | | **210 D** | | ND | (0.06) | **4.4** | |
| | 8/20/2009 | **80 D** | | **890 D** | | 1.3 | | 4.1 | | **300 D** | | 0.040 J | | **9.1** | |
| | 8/9/2010 | **79 D** | | **430 D** | | 1.2 | | 4.6 | | **160 D** | | 0.040 J | | **0.87 J** | |
| | 2/16/2011 | **68 D** | | **760 D** | | 1.1 | | 3.9 | | **150 D** | | ND | (0.03) | **2.6** | |
| | 8/11/2011 | **57** | | **220 D** | | 0.98 | | 3.1 | | **85 D** | | 0.040 J | | 0.40 J | |
| | 2/15/2012 | **66 D** | | **830 D** | | 1.3 JD | | 3.4 D | | **150 D** | | ND | (0.08) | **1.1** | |
| | 8/16/2012 | **61** | | **270 D** | | 0.96 | | 3.4 | | **72** | | 0.06 J | | **0.85 J** | |
| | 2/14/2013 | **61** | | **220 D** | | 0.92 | | 3.2 | | **59** | | 0.07 J | | **1.0** | |
| **6-S-7** | 11/14/2006 | ND | (0.21) | ND | (0.21) | ND | (0.16) | ND | (0.13) | ND | (0.24) | ND | (0.13) | **6.1** | |
| | 8/26/2008 | ND | (0.07) | ND | (0.05) | ND | (0.04) | ND | (0.04) | ND | (0.06) | ND | (0.06) | ND | (0.24) |
| | 8/17/2009 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | NA | |
| | 8/3/2010 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **4.4** | |
| | 2/14/2011 | 0.060 J | | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **4.6** | |
| | 8/8/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **4.3** | |
| | 2/7/2012 | ND | (0.03) | 0.060 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **5.5** | |
| | 8/9/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **4.6** | |
| | 2/7/2013 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **3.3** | |
| **6-S-9** | 8/9/2012 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.16) |
| | 2/12/2013 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.16) |
| **6-S-10** | 5/10/2006 | ND | (0.21) | 6.6 | | 0.53 | | ND | (0.13) | 2.0 | | ND | (0.13) | **6.2** | |
| | 11/13/2006 | ND | (0.21) | 0.92 | | ND | (0.16) | ND | (0.13) | 0.33 J | | ND | (0.13) | **6.2** | |
| | 5/9/2007 | ND | (0.04) | 0.19 J | | 0.04 J | | ND | (0.05) | 0.08 J | | ND | (0.04) | **4.8** | |
| | 8/27/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **4.8** | |
| | 8/19/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **7.2** | |
| | 8/2/2010 | ND | (0.03) | 0.29 J | | 0.07 J | | ND | (0.04) | 0.16 J | | ND | (0.03) | **4.5** | |
| | 2/14/2011 | ND | (0.03) | 0.30 J | | 0.05 J | | ND | (0.04) | 0.18 J | | ND | (0.03) | **4.4** | |
| | 8/8/2011 | ND | (0.03) | 1.1 | | 0.23 J | | ND | (0.04) | 0.62 | | ND | (0.03) | **3.9** | |
| | 2/8/2012 | ND | (0.03) | 0.38 J | | 0.09 J | | ND | (0.04) | 0.16 J | | ND | (0.03) | **4.7** | |
| | 8/13/2012 | ND | (0.03) | 0.27 J | | 0.07 J | | ND | (0.04) | 0.12 J | | ND | (0.03) | **4.5** | |
| | 2/11/2013 | ND | (0.03) | 0.75 | | 0.16 J | | ND | (0.04) | 0.65 | | ND | (0.03) | **2.9** | |
| **6-S-14** | 11/16/2006 | ND | (0.21) | ND | (0.21) | 0.46 J | | ND | (0.13) | ND | (0.24) | ND | (0.13) | **16** | |
| | 2/22/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **9.1** | |
| | 8/27/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **9.5** | |
| | 4/28/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **11** | |
| | 8/20/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **13** | |
| | 8/5/2010 | ND | (0.03) | ND | (0.03) | 0.65 | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **8.9** | |
| | 2/15/2011 | ND | (0.03) | ND | (0.03) | 0.63 | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **8.8** | |
| | 8/9/2011 | ND | (0.03) | 0.030 J | | 0.72 | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **8.9** | |

Table A-4 Continued
Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

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| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**[1/] | | **0.1** | | **0.44** | |
| | 2/8/2012 | ND | (0.03) | ND | (0.03) | 0.57 | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **11** | |
| | 8/13/2012 | ND | (0.03) | ND | (0.03) | 0.73 | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **8.0** | |
| | 2/11/2013 | ND | (0.03) | 0.030 J | | 0.58 | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **7.6** | |
| **6-S-15** | 8/13/2012 | NA | | NA | | NA | | NA | | NA | | NA | | **3.7** | |
| | 2/11/2013 | NA | | NA | | NA | | NA | | NA | | NA | | **2.8** | |
| **6-S-16** | 4/10/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **3.9** | |
| | 5/22/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **4.1** | |
| | 8/18/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **5.5** | |
| | 11/9/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **12** | |
| | 2/26/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **4.9** | |
| | 5/9/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **3.5** | |
| | 8/13/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **4.7** | |
| | 2/21/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **5.3** | |
| | 8/28/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **3.3** | |
| | 4/28/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **2.5** | |
| | 8/14/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **1.4** | |
| | 8/3/2010 | ND | (0.03) | 1.1 J | | 0.35 J | | ND | (0.04) | ND | (0.05) | **0.12 J** | | 0.32 J | |
| | 2/14/2011 | ND | (0.03) | 1.3 J | | 0.45 J | | 0.05 J | | 0.07 J | | **0.30** | | 0.18 J | |
| | 8/10/2011 | ND | (0.03) | 1.3 J | | 0.51 | | 0.08 J | | 0.09 J | | **0.34** | | ND | (0.16) |
| | 2/9/2012 | ND | (0.03) | 1.0 | | 0.37 J | | 0.09 J | | 0.06 J | | **0.24** | | ND | (0.16) |
| | 8/14/2012 | ND | (0.03) | 1.3 | | 0.38 J | | 0.11 J | | 0.07 J | | **0.38** | | **0.52 J** | |
| | 2/12/2013 | ND | (0.03) | 0.99 | | 0.30 J | | 0.14 | | 0.07 J | | 0.070 J | | ND | (0.16) |
| **6-S-17** | 4/10/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **7.5** | |
| | 5/22/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **17** | |
| | 8/18/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **14** | |
| | 11/9/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **17** | |
| | 2/26/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **14** | |
| | 5/9/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **11** | |
| | 8/13/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **13** | |
| | 2/22/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **11** | |
| | 8/28/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **8.7** | |
| | 4/28/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **10** | |
| | 8/18/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **11** | |
| | 8/3/2010 | ND | (0.03) | 0.56 J | | 1.4 | | ND | (0.04) | 0.10 J | | 0.09 J | | **8.3** | |
| | 2/15/2011 | ND | (0.03) | 0.59 J | | 1.2 | | ND | (0.04) | 0.11 J | | 0.09 J | | **9.4** | |
| | 8/10/2011 | ND | (0.03) | 0.56 J | | 1.1 | | ND | (0.04) | 0.09 J | | 0.05 J | | **7.8** | |
| | 2/9/2012 | ND | (0.03) | 0.71 | | 1.1 | | ND | (0.04) | 0.10 J | | 0.07 J | | **8.3** | |
| | 8/14/2012 | ND | (0.03) | 1.1 | | 1.1 | | ND | (0.04) | 0.13 J | | **0.10** | | **1.8** | |
| | 2/11/2013 | ND | (0.03) | 1.3 | | 1.1 | | ND | (0.04) | 0.13 J | | 0.080 J | | **1.0** | |
| **6-S-19** | 2/8/2006 | ND | (0.21) | 2.7 | | 3.0 | | ND | (0.13) | 0.38 J | | **2.2** | | **7.4** | |
| | 5/8/2006 | ND | (0.21) | 3.1 | | 2.2 | | ND | (0.13) | 0.40 J | | **1.9** | | **6.9** | |
| | 8/15/2006 | ND | (0.21) | 2.3 | | 1.5 | | ND | (0.13) | 0.32 J | | **1.8** | | **6.3** | |
| | 11/7/2006 | ND | (0.21) | 2.1 | | 3.5 | | ND | (0.13) | 0.40 J | | **1.5** | | **4.7** | |

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Table A-4 Continued

Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TCE | | 1,1,1-TCA | | 1,1-DCA | | cis-1,2-DCE | | 1,1-DCE | | Vinyl Chloride | | 1,4-dioxane | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**[1/] | | **0.1** | | **0.44** | |
| | 2/21/2007 | ND | (0.21) | 2.2 | | 1.9 | | ND | (0.13) | 0.39 J | | **1.7** | | **5.6** | |
| | 5/7/2007 | ND | (0.04) | 2.5 | | 4.2 | | ND | (0.05) | 0.43 J | | **1.4** | | **10** | |
| | 8/13/2007 | ND | (0.06) | 2.3 | | 3.8 | | ND | (0.05) | 0.41 J | | **1.2** | | **12** | |
| | 8/28/2008 | ND | (0.50) | 1.2 | | 3.1 | | ND | (0.50) | 0.26 J | | **1.4** | | **9.5** | |
| | 8/18/2009 | ND | (0.03) | 1.9 | | 4.0 | | ND | (0.04) | 0.44 J | | **1.5** | | **10** | |
| | 8/2/2010 | ND | (0.03) | 0.98 J | | 2.6 | | ND | (0.04) | 0.24 J | | **1.2** | | **5.7** | |
| | 2/10/2011 | ND | (0.03) | 1.6 | | 3.8 | | ND | (0.04) | 0.38 J | | **0.91** | | **5.1** | |
| | 8/9/2011 | ND | (0.03) | 1.4 | | 3.9 | | ND | (0.04) | 0.30 J | | **0.63** | | **3.2** | |
| | 2/13/2012 | ND | (0.03) | 1.7 | | 4.5 | | ND | (0.04) | 0.40 J | | **0.78** | | **4.7** | |
| | 8/14/2012 | ND | (0.03) | 1.2 | | 3.3 | | ND | (0.04) | 0.35 J | | **1.1** | | **6.7** | |
| | 2/12/2013 | ND | (0.03) | 1.1 | | 3.2 | | ND | (0.04) | 0.32 J | | **1.1** | | **8.1** | |
| **6-S-24** | 2/10/2006 | ND | (0.21) | 130 D | | ND | (0.16) | ND | (0.13) | ND | (0.24) | ND | (0.13) | ND | (0.47)[2/] |
| | 5/12/2006 | ND | (0.21) | 130 D | | ND | (0.16) | ND | (0.13) | 0.35 J | | ND | (0.13) | ND | (0.47)[2/] |
| | 8/18/2006 | ND | (0.21) | 160 D | | ND | (0.16) | ND | (0.13) | 0.37 J | | ND | (0.13) | ND | (0.27) |
| | 11/14/2006 | ND | (0.21) | 150 D | | ND | (0.16) | ND | (0.13) | 0.43 J | | ND | (0.13) | ND | (0.27) |
| | 2/26/2007 | ND | (0.21) | 140 D | | ND | (0.16) | ND | (0.13) | 4.4 | | ND | (0.13) | ND | (0.27) |
| | 5/11/2007 | 0.09 J | | 160 D | | ND | (0.03) | ND | (0.05) | 0.12 J | | ND | (0.04) | ND | (0.27) |
| | 8/16/2007 | 0.16 J | | 140 D | | ND | (0.03) | ND | (0.05) | 0.55 | | ND | (0.04) | ND | (0.26) |
| | 2/22/2008 | ND | (0.06) | 170 D | | ND | (0.03) | ND | (0.05) | 0.55 | | ND | (0.04) | NA | |
| | 8/25/2008 | ND | (0.50) | 160 D | | ND | (0.50) | ND | (0.50) | 0.65 | | ND | (0.06) | NA | |
| | 4/30/2009 | ND | (0.50) | 160 D | | ND | (0.50) | ND | (0.50) | 1.0 | | ND | (0.06) | NA | |
| | 8/20/2009 | 0.26 J | | 140 D | | ND | (0.02) | ND | (0.04) | 1.3 | | ND | (0.03) | NA | |
| | 8/10/2010 | ND | (0.03) | 120 D | | ND | (0.02) | ND | (0.04) | 0.9 | | ND | (0.03) | ND | (0.16) |
| | 2/9/2011 | ND | (0.03) | 98 D | | 0.04 J | | ND | (0.04) | 0.84 | | ND | (0.03) | 0.36 J | |
| | 8/4/2011 | ND | (0.03) | 120 D | | ND | (0.02) | ND | (0.04) | 0.87 | | ND | (0.03) | ND | (0.16) |
| | 2/7/2012 | ND | (0.03) | 89 D | | 0.07 J | | ND | (0.04) | 1.0 | | ND | (0.03) | **0.57 J** | |
| | 8/7/2012 | ND | (0.03) | 120 D | | 0.05 J | | ND | (0.04) | 1.3 | | ND | (0.03) | **0.80 J** | |
| | 2/6/2013 | ND | (0.03) | 110 D | | 0.070 J | | ND | (0.04) | 1.1 | | ND | (0.03) | 0.41 J | |
| **6-S-25** | 2/9/2006 | 0.65 | | 130 D | | ND | (0.16) | ND | (0.13) | **22** | | ND | (0.13) | ND | (0.47)[2/] |
| | 5/11/2006 | ND | (0.21) | 78 D | | ND | (0.16) | ND | (0.13) | **18** | | ND | (0.13) | ND | (0.47)[2/] |
| | 8/17/2006 | ND | (0.21) | **480 D** | | 0.19 J | | ND | (0.13) | **39** | | ND | (0.13) | ND | (0.27) |
| | 11/17/2006 | ND | (0.21) | **510 D** | | 0.32 J | | ND | (0.13) | **55** | | ND | (0.13) | ND | (0.27) |
| | 2/23/2007 | ND | (0.21) | **240 D** | | ND | (0.16) | ND | (0.13) | **30** | | ND | (0.13) | ND | (0.27) |
| | 5/10/2007 | 0.07 J | | **220 D** | | 0.06 J | | ND | (0.05) | **24** | | ND | (0.04) | ND | (0.27) |
| | 8/15/2007 | 0.28 J | | 140 D | | 0.05 J | | ND | (0.05) | **17** | | ND | (0.04) | ND | (0.26) |
| | 2/21/2008 | ND | (0.06) | **290 D** | | 0.07 J | | ND | (0.05) | **26** | | ND | (0.04) | NA | |
| | 8/27/2008 | ND | (0.07) | **760 D** | | 0.34 J | | ND | (0.50) | **52** | | ND | (0.06) | NA | |
| | 4/30/2009 | 0.08 J | | **350 D** | | 0.05 J | | ND | (0.50) | **27** | | ND | (0.06) | NA | |
| | 8/20/2009 | ND | (0.03) | 130 D | | 0.03 J | | ND | (0.04) | **14** | | ND | (0.03) | NA | |
| | 8/5/2010 | ND | (0.03) | **290 D** | | 0.05 J | | ND | (0.04) | **18** | | ND | (0.03) | ND | (0.16) |
| | 2/16/2011 | 0.05 J | | 90 D | | ND | (0.02) | ND | (0.04) | **8.2** | | ND | (0.03) | ND | (0.16) |
| | 8/11/2011 | 0.18 J | | 110 D | | 0.03 J | | ND | (0.04) | **9.7** | | ND | (0.03) | ND | (0.16) |
| | 2/15/2012 | 0.24 J | | 100 D | | ND | (0.02) | ND | (0.04) | **7.8** | | ND | (0.03) | ND | (0.16) |

Table A-4 Continued

Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

U.S. Navy 2013d

| | | **Analytes** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**[1/] | | **0.1** | | **0.44** | |
| | 8/15/2012 | 0.12 J | | 100 D | | 0.03 J | | ND | (0.04) | **8.9** | | ND | (0.03) | ND | (0.16) |
| | 2/14/2013 | 0.19 J | | 88 D | | ND | (0.02) | ND | (0.04) | 6.7 | | ND | (0.03) | 0.42 J | |
| **6-S-26** | 11/16/2006 | ND | (0.21) | ND | (0.21) | ND | (0.16) | ND | | ND | (0.24) | ND | (0.13) | **5.8** | |
| | 8/27/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **4.4** | |
| | 8/18/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **5.1** | |
| | 8/2/2010 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **2.9** | |
| | 2/14/2011 | ND | (0.03) | ND | (0.03) | 0.03 J | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **3.2** | |
| | 8/8/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **2.5** | |
| | 2/8/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **3.1** | |
| | 8/13/2012 | ND | (0.03) | ND | (0.03) | 0.03 J | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **3.5** | |
| | 2/7/2013 | ND | (0.03) | ND | (0.03) | 0.03 J | | ND | (0.04) | ND | (0.05) | ND | (0.03) | **1.7** | |
| **6-S-27** | 2/9/2006 | ND | (0.21) | 2.0 | | ND | (0.16) | ND | (0.13) | ND | (0.24) | ND | (0.13) | ND | (0.47)[2/] |
| | 5/9/2006 | ND | (0.21) | 3.0 | | ND | (0.16) | ND | (0.13) | 0.27 J | | ND | (0.13) | ND | (0.47)[2/] |
| | 8/16/2006 | ND | (0.21) | 4.2 | | ND | (0.16) | ND | (0.13) | 0.29 J | | ND | (0.13) | ND | (0.27) |
| | 11/9/2006 | ND | (0.21) | 4.7 | | ND | (0.16) | ND | (0.13) | 0.35 J | | ND | (0.13) | ND | (0.27) |
| | 2/22/2007 | ND | (0.21) | 3.6 | | ND | (0.16) | ND | (0.13) | 0.37 J | | ND | (0.13) | ND | (0.27) |
| | 5/8/2007 | ND | (0.04) | 3.4 | | 0.05 J | | ND | (0.05) | 0.25 J | | ND | (0.04) | ND | (0.27) |
| | 8/15/2007 | ND | (0.06) | 1.8 | | ND | (0.32) | ND | (0.05) | 0.13 J | | ND | (0.04) | ND | (0.26) |
| | 8/26/2008 | ND | (0.07) | 2.2 | | ND | (0.16) | ND | (0.04) | 0.18 J | | ND | (0.13) | NA | |
| | 8/19/2009 | ND | (0.03) | 1.3 | | ND | (0.02) | ND | (0.04) | 0.12 J | | ND | (0.03) | NA | |
| | 8/3/2010 | ND | (0.03) | 1.3 J | | ND | (0.02) | ND | (0.04) | 0.12 J | | ND | (0.03) | ND | (0.16) |
| | 2/9/2011 | ND | (0.03) | 0.95 | | ND | (0.02) | ND | (0.04) | 0.07 J | | ND | (0.03) | ND | (0.16) |
| | 8/8/2011 | ND | (0.03) | 1.1 | | ND | (0.02) | ND | (0.04) | 0.08 J | | ND | (0.03) | ND | (0.16) |
| | 2/6/2012 | ND | (0.03) | 0.67 | | ND | (0.02) | ND | (0.04) | 0.05 J | | ND | (0.03) | ND | (0.16) |
| | 8/8/2012 | ND | (0.03) | 0.96 | | ND | (0.02) | ND | (0.04) | 0.07 J | | ND | (0.03) | ND | (0.16) |
| | 2/6/2013 | ND | (0.03) | 0.99 | | ND | (0.02) | ND | (0.04) | 0.07 J | | ND | (0.03) | ND | (0.16) |
| **6-S-29** | 2/8/2006 | ND | (0.21) | 1.8 | | 7.8 | | ND | (0.13) | 0.41 J | | **2.1** | | **12** | |
| | 5/8/2006 | ND | (0.21) | 1.5 | | 5.4 | | ND | (0.13) | 0.38 J | | **1.7** | | **13** | |
| | 8/15/2006 | ND | (0.21) | 1.7 | | 7.5 | | ND | (0.13) | 0.45 J | | **1.6** | | **16** | |
| | 11/7/2006 | ND | (0.21) | 1.5 | | 8.5 | | ND | (0.13) | 0.55 | | **1.6** | | **16** | |
| | 2/20/2007 | ND | (0.21) | 1.3 | | 6.5 | | ND | (0.13) | 0.38 J | | **1.3** | | **14** | |
| | 5/7/2007 | ND | (0.04) | 1.6 | | 8.6 | | ND | (0.05) | 0.53 | | **1.7** | | **17** | |
| | 8/13/2007 | ND | (0.06) | 1.4 | | 8.2 | | ND | (0.05) | 0.51 | | **1.5** | | **18** | |
| | 2/21/2008 | ND | (0.06) | 1.7 | | 8.2 | | ND | (0.05) | 0.57 | | **1.4** | | **16** | |
| | 8/28/2008 | ND | (0.07) | 0.97 | | 7.5 | | ND | (0.05) | 0.46 J | | **1.3** | | **13** | |
| | 4/29/2009 | ND | (0.07) | 1.3 | | 8.4 | | ND | (0.05) | 0.60 | | **1.1** | | **9.6** | |
| | 8/18/2009 | ND | (0.03) | 1.1 | | 8.4 J | | ND | (0.04) | 0.55 | | **1.3** | | **10** | |
| | 8/2/2010 | ND | (0.03) | 0.79 J | | 6.6 | | ND | (0.04) | 0.40 J | | **0.75** | | **7.0** | |
| | 2/10/2011 | ND | (0.03) | 1.0 | | 6.4 | | ND | (0.04) | 0.42 J | | **0.83** | | **7.1** | |
| | 8/9/2011 | ND | (0.03) | 0.75 | | 7.4 | | ND | (0.04) | 0.46 J | | **0.79** | | **8.0** | |
| | 2/13/2012 | ND | (0.03) | 0.94 | | 6.8 | | ND | (0.04) | 0.43 J | | **0.72** | | **10** | |
| | 8/14/2012 | ND | (0.03) | 0.93 | | 6.4 | | ND | (0.04) | 0.43 J | | **0.75** | | **9.4** | |
| | 2/12/2013 | ND | (0.03) | 0.91 | | 5.8 | | ND | (0.04) | 0.39 J | | **0.77** | | **8.1** | |

Table A-4 Continued
Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

| | | **Analytes** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **$7.0^{1/}$** | | **0.1** | | **0.44** | |
| **6-S-30** | 2/8/2006 | ND | (0.21) | 36 | | ND | (0.16) | ND | (0.13) | 3.5 | | ND | (0.13) | **6.3** | |
| | 5/10/2006 | ND | (0.21) | 53 | | ND | (0.16) | ND | (0.13) | 4.8 | | ND | (0.13) | **6.9** | |
| | 8/16/2006 | ND | (0.21) | 59 | | ND | (0.16) | ND | (0.13) | 5.2 | | ND | (0.13) | **5.2** | |
| | 11/13/2006 | ND | (0.21) | 29 | | ND | (0.16) | ND | (0.13) | 3.0 | | ND | (0.13) | **6.9** | |
| | 2/22/2007 | ND | (0.21) | 24 | | ND | (0.16) | ND | (0.13) | 3.6 | | ND | (0.13) | **6.4** | |
| | 5/8/2007 | ND | (0.04) | 29 | | ND | (0.03) | ND | (0.05) | 3.9 | | ND | (0.04) | **6.1** | |
| | 8/14/2007 | ND | (0.06) | 25 | | ND | (0.03) | ND | (0.05) | 3.8 | | ND | (0.04) | **5.6** | |
| | 8/27/2008 | ND | (0.07) | 31 | | ND | (0.04) | ND | (0.04) | 5.1 | | ND | (0.06) | **4.2** | |
| | 8/19/2009 | ND | (0.03) | 30 | | ND | (0.02) | ND | (0.04) | 5.3 | | ND | (0.03) | **6.0** | |
| | 8/4/2010 | ND | (0.03) | 22 | | ND | (0.02) | ND | (0.04) | 3.8 | | ND | (0.03) | **3.6** | |
| | 2/14/2011 | ND | (0.03) | 14 | | ND | (0.02) | ND | (0.04) | 2.8 | | ND | (0.03) | **3.4** | |
| | 8/8/2011 | ND | (0.03) | 5.0 | | ND | (0.02) | ND | (0.04) | 1.3 | | ND | (0.03) | **3.2** | |
| | 2/7/2012 | ND | (0.03) | 19 | | ND | (0.02) | ND | (0.04) | 4.1 | | ND | (0.03) | **4.1** | |
| | 8/15/2012 | ND | (0.03) | 8.2 | | ND | (0.02) | ND | (0.04) | 2.1 | | ND | (0.03) | **3.8** | |
| | 2/13/2013 | ND | (0.03) | 10 | | ND | (0.02) | ND | (0.04) | 1.8 | | ND | (0.03) | **2.7** | |
| **6-S-31** | 2/9/2006 | **18** | | 66 D | | 0.24 J | | 0.31 J | | **16** | | ND | (0.13) | **6.7** | |
| | 5/10/2006 | **30** | | **230 D** | | 0.56 | | 0.53 | | **35** | | ND | (0.13) | **6.8** | |
| | 8/16/2006 | **22** | | 90 D | | 0.22 J | | ND | (0.13) | **22** | | ND | (0.13) | **7.1** | |
| | 11/13/2006 | **22** | | 78 D | | 0.21 J | | 0.38 J | | **20** | | ND | (0.13) | **7.7** | |
| | 2/22/2007 | **16** | | 41 | | ND | (0.16) | 0.28 J | | **12** | | ND | (0.13) | **6.8** | |
| | 5/10/2007 | **16** | | 54 | | 0.14 J | | 0.24 J | | **12** | | ND | (0.04) | **6.7** | |
| | 8/14/2007 | **17** | | 65 | | 0.18 J | | 0.28 J | | **15** | | ND | (0.04) | **7.1** | |
| | 2/25/2008 | **14** | | 48 | | 0.15 J | | 0.23 J | | **13** | | ND | (0.04) | **5.7** | |
| | 8/28/2008 | **17** | | 62 | | 0.24 J | | 0.30 J | | **14** | | ND | (0.06) | **5.1** | |
| | 4/29/2009 | **14** | | 43 | | 0.13 J | | 0.22 J | | **12** | | ND | (0.06) | **4.8** | |
| | 8/19/2009 | **17** | | 68 | | 0.22 J | | 0.28 J | | **15** | | ND | (0.03) | **6.7** | |
| | 8/4/2010 | **14** | | 45 | | 0.15 J | | 0.29 J | | **11** | | ND | (0.03) | **4.8** | |
| | 2/16/2011 | **12** | | 37 | | 0.13 J | | 0.22 J | | **8.9** | | ND | (0.03) | **5.6** | |
| | 8/11/2011 | **11** | | 33 | | 0.11 J | | 0.18 J | | **8.7** | | ND | (0.03) | **3.9** | |
| | 2/14/2012 | **13** | | 59 | | 0.17 J | | 0.25 J | | **12** | | ND | (0.03) | **3.7** | |
| | 8/15/2012 | **8.3** | | 30 | | 0.09 J | | 0.14 J | | **7.8** | | ND | (0.03) | **4.1** | |
| | 2/13/2013 | **8.9** | | 36 | | 0.12 J | | 0.19 J | | **9.0** | | ND | (0.03) | **3.2** | |
| **6-S-40** | 2/19/2008 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.26) |
| | 8/25/2008 | NA | | NA | | NA | | NA | | NA | | NA | | 0.39 J | |
| | 8/13/2009 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.16) |
| | 8/9/2010 | ND | (0.03) | 0.030 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/7/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/3/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/2/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/7/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/5/2013 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |

Table A-4 Continued
Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

U.S. Navy 2013d

| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **$7.0^{1/}$** | | **0.1** | | **0.44** | |
| **6-S-41** | 2/20/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **0.82 J** | |
| | 8/25/2008 | NA | | NA | | NA | | NA | | NA | | NA | | 0.38 J | |
| | 8/13/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **0.66 J** | |
| | 8/10/2010 | ND | (0.03) | 0.040 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/7/2011 | ND | (0.03) | ND | (0.04) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **0.50 J** | |
| | 8/3/2011 | ND | (0.03) | ND | (0.04) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **0.75 J** | |
| | 2/2/2012 | ND | (0.03) | 0.030 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **1.5** | |
| | 8/7/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **1.8** | |
| | 2/5/2013 | ND | (0.03) | 0.030 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **0.82** | |
| **6-S-42** | 2/25/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **5.3** | |
| | 8/25/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **7.8** | |
| | 8/13/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **14** | |
| | 8/10/2010 | ND | (0.03) | 4.4 | | 0.070 J | | ND | (0.04) | 0.10 J | | **0.30** | | **14** | |
| | 2/8/2011 | ND | (0.03) | 4.0 | | 0.090 J | | ND | (0.04) | ND | (0.05) | **0.23** | | **15** | |
| | 8/4/2011 | ND | (0.03) | 3.9 | | 0.13 J | | ND | (0.04) | 0.09 J | | **0.15** | | **17 J** | |
| | 2/7/2012 | ND | (0.03) | 3.4 | | 0.14 J | | ND | (0.04) | 0.05 J | | **0.17** | | **18** | |
| | 8/9/2012 | ND | (0.03) | 3.6 | | 0.20 J | | ND | (0.04) | 0.11 J | | **0.19** | | **16** | |
| | 2/7/2013 | ND | (0.03) | 3.4 | | 0.19 J | | ND | (0.04) | 0.11 J | | **0.17** | | **12** | |
| **6-S-43** | 2/20/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **2.9** | |
| | 8/25/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **2.3** | |
| | 8/13/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **1.8** | |
| | 8/10/2010 | ND | (0.03) | 0.23 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | **2.7** | | **3.7** | |
| | 2/8/2011 | ND | (0.03) | 0.27 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | **2.3** | | **2.2** | |
| | 8/4/2011 | ND | (0.03) | 0.24 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | **1.8** | | **2.3 J** | |
| | 2/6/2012 | ND | (0.03) | 0.23 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | **2.6** | | **4.8** | |
| | 8/8/2012 | ND | (0.03) | 0.22 J | | 0.030 J | | ND | (0.04) | ND | (0.05) | **3.7** | | **8.4** | |
| | 2/7/2013 | ND | (0.03) | 0.39 J | | 0.030 J | | ND | (0.04) | ND | (0.05) | **3.1** | | **4.6** | |
| **MW-3B** | 2/9/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **0.92 J** | |
| | 5/9/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **1.2** | |
| | 8/16/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **0.98 J** | |
| | 11/9/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **0.95 J** | |
| | 2/22/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **0.86 J** | |
| | 5/8/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **0.84 J** | |
| | 8/15/2007 | NA | | NA | | NA | | NA | | NA | | NA | | **0.78 J** | |
| | 2/22/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **0.85 J** | |
| | 8/26/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **0.81 J** | |
| | 4/28/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **0.92 J** | |
| | 8/19/2009 | NA | | NA | | NA | | NA | | NA | | NA | | **1.2 J** | |
| | 8/3/2010 | ND | (0.03) | 36 | | 0.040 J | | ND | (0.04) | 1.1 | | ND | (0.03) | **0.73 J** | |
| | 2/9/2011 | ND | (0.03) | 33 | | ND | (0.02) | ND | (0.04) | 1.2 | | ND | (0.03) | **0.81 J** | |
| | 8/8/2011 | ND | (0.03) | 34 | | ND | (0.02) | ND | (0.04) | 1.3 | | ND | (0.03) | **ND** | **(1.0)*** |
| | 2/6/2012 | ND | (0.03) | 27 | | ND | (0.02) | ND | (0.04) | 1.2 | | ND | (0.03) | **1.3** | |
| | 8/8/2012 | ND | (0.03) | 30 | | ND | (0.02) | ND | (0.04) | 1.3 | | ND | (0.03) | **1.5** | |

Table A-4 Continued
Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

U.S. Navy 2013d

| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**[1/] | | **0.1** | | **0.44** | |
| | 2/6/2013 | ND | (0.03) | 33 | | ND | (0.02) | ND | (0.04) | 1.3 | | ND | (0.03) | **0.94 J** | |
| **MW-5** | 2/9/2006 | ND | (0.21) | 33 | | 0.66 | | ND | (0.13) | 0.28 J | | ND | (0.13) | ND | (0.47)[2/] |
| | 5/9/2006 | ND | (0.21) | 35 | | 0.72 | | ND | (0.13) | 0.43 J | | ND | (0.13) | ND | (0.47)[2/] |
| | 8/16/2006 | ND | (0.21) | 38 | | 0.92 | | ND | (0.13) | 0.40 J | | ND | (0.13) | ND | (0.27) |
| | 11/9/2006 | ND | (0.21) | 33 | | 0.60 | | ND | (0.13) | 0.31 J | | ND | (0.13) | 0.35 J | |
| | 2/27/2007 | ND | (0.21) | 18 | | 0.42 J | | ND | (0.13) | 1.3 | | ND | (0.13) | ND | (0.27) |
| | 5/8/2007 | ND | (0.04) | 11 | | ND | (0.03) | ND | (0.05) | 0.14 J | | ND | (0.04) | ND | (0.27) |
| | 8/15/2007 | ND | (0.06) | 6.9 | | ND | (0.03) | ND | (0.05) | 0.09 J | | ND | (0.04) | ND | (0.26) |
| | 2/25/2008 | ND | (0.06) | 16 | | 0.24 J | | ND | (0.05) | 0.46 J | | ND | (0.04) | NA | |
| | 8/26/2008 | ND | (0.07) | 13 | | 0.30 J | | ND | (0.50) | 0.67 | | ND | (0.24) | **0.60 J** | |
| | 4/28/2009 | ND | (0.07) | 12 | | 0.21 J | | ND | (0.50) | 0.84 | | ND | (0.24) | NA | |
| | 8/19/2009 | ND | (0.03) | 8.1 | | 0.16 J | | ND | (0.04) | 0.64 | | ND | (0.03) | **3.9** | |
| | 8/4/2010 | ND | (0.03) | 5.5 | | 0.09 J | | ND | (0.04) | 0.25 J | | ND | (0.03) | **ND** | **(1.3)**$^{UJ}$ |
| | 2/10/2011 | ND | (0.03) | **600 D** | | 0.32 J | | ND | (0.04) | 1.8 | | ND | (0.03) | 0.43 J | |
| | 8/9/2011 | ND | (0.03) | **790 D** | | 0.47 J | | ND | (0.04) | 2.7 | | ND | (0.03) | ND | (0.16) |
| | 2/7/2012 | ND | (0.03) | **750 D** | | 0.68 | | ND | (0.04) | 5.3 | | ND | (0.03) | ND | (0.16) |
| | 8/8/2012 | ND | (0.03) | **310 D** | | 3.9 | | ND | (0.04) | 3.5 | | ND | (0.03) | ND | (0.16) |
| | 2/7/2013 | ND | (0.03) | 170 D | | 1.1 | | ND | (0.04) | 6.0 | | ND | (0.03) | ND | (0.16) |
| **MW-7** | 2/9/2006 | **100 D** | | 56 | | 9.3 | | 5.1 | | **18** | | ND | (0.13) | **6.7** | |
| | 5/10/2006 | **85 D** | | 49 | | 4.4 | | 4.6 | | **16** | | ND | (0.13) | **8.5** | |
| | 8/17/2006 | **100 D** | | 54 | | 2.1 | | 4.0 | | **15** | | ND | (0.13) | **8.9** | |
| | 11/16/2006 | **99 D** | | 51 | | 3.3 | | 4.3 | | **16** | | ND | (0.13) | **8.0** | |
| | 2/23/2007 | **76 D** | | 34 | | 3.1 | | 3.9 | | **11** | | ND | (0.13) | **6.9** | |
| | 5/10/2007 | **110 D** | | 54 | | 0.33 J | | 3.9 | | **16** | | ND | (0.04) | **6.6** | |
| | 8/16/2007 | **100 D** | | 52 | | 0.26 J | | 3.9 | | **17** | | ND | (0.04) | **7.0** | |
| | 2/25/2008 | **80** | | 36 | | 1.5 | | 3.0 | | **9.8** | | ND | (0.04) | **6.2** | |
| | 8/29/2008 | **67 D** | | 37 | | 0.89 | | 2.5 | | **8.9** | | ND | (0.06) | **6.1** | |
| | 4/29/2009 | **74 D** | | 37 | | 0.88 | | 2.9 | | **11** | | ND | (0.06) | **5.3** | |
| | 8/20/2009 | **76** | | 37 | | 0.91 | | 2.2 | | **9.6** | | ND | (0.03) | **8.1** | |
| | 8/5/2010 | **68** | | 36 | | 2.8 | | 2.2 | | **7.8** | | ND | (0.03) | **5.1** | |
| | 2/16/2011 | **53** | | 25 | | 0.52 | | 1.7 | | 5.6 | | ND | (0.03) | **5.4** | |
| | 8/11/2011 | **53** | | 25 | | 0.13 J | | 1.8 | | 6.5 | | ND | (0.03) | **5.0** | |
| | 2/15/2012 | **63** | | 36 | | 0.15 J | | 2.1 | | **9.7** | | ND | (0.03) | **3.9** | |
| | 8/15/2012 | **49** | | 25 | | 0.53 | | 1.8 | | 6.1 | | ND | (0.03) | **6.0** | |
| | 2/14/2013 | **46** | | 25 | | 2.7 | | 1.7 | | 5.9 | | ND | (0.03) | **3.9** | |
| **MW-9** | 11/16/2006 | ND | (0.21) | ND | (0.21) | 9.5 | | ND | (0.13) | ND | (0.24) | **0.69** | | **6.5** | |
| | 8/28/2008 | ND | (0.07) | 0.080 J | | 7.9 | | ND | (0.04) | 0.19 J | | **0.53** | | **3.0** | |
| | 8/19/2009 | ND | (0.03) | ND | (0.50)* | 8.7 | | 0.50 J | | 0.26 J | | **0.66** | | **2.7** | |
| | 8/5/2010 | 0.050 J | | ND | (0.03) | 7.1 | | 0.090 J | | 0.19 J | | **0.38** | | **2.0** | |
| | 2/10/2011 | ND | (0.03) | 0.040 J | | 6.9 | | 0.13 J | | 0.21 J | | **0.41** | | **2.2** | |
| | 8/9/2011 | ND | (0.03) | 0.060 J | | 5.9 | | 0.080 J | | 0.16 J | | **0.34** | | **ND** | **(1.1)**$^{UJ}$ |
| | 2/13/2012 | ND | (0.03) | 0.15 J | | 7.8 | | 0.10 J | | 0.19 J | | **0.41** | | **1.2** | |
| | 8/14/2012 | ND | (0.03) | 0.21 J | | 7.5 | | 0.11 J | | 0.25 J | | **0.40** | | **1.3** | |

Table A-4 Continued

Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

U.S. Navy 2013d

| | | **Analytes** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**$^{1/}$ | | **0.1** | | **0.44** | |
| | 2/13/2013 | ND | (0.03) | 0.12 J | | 6.2 | | 0.080 J | | 0.19 J | | **0.48** | | **1.4** | |
| **MW-10** | 11/14/2006 | ND | (0.21) | ND | (0.21) | 7.4 | | 0.30 J | | ND | (0.24) | **0.79** | | **1.4** | |
| | 2/22/2008 | ND | (0.06) | ND | (0.06) | 3.6 | | 0.39 J | | ND | (0.06) | **0.59** | | NA | |
| | 8/28/2008 | ND | (0.07) | 0.060 J | | 12 | | 0.37 J | | ND | (0.06) | **1.2** | | NA | |
| | 4/30/2009 | ND | (0.07) | 0.22 J | | 4.7 | | 0.31 J | | 0.070 J | | **0.43 J** | | **3.4** | |
| | 8/20/2009 | ND | (0.50)* | ND | (0.50)* | 3.5 | | 0.28 J | | ND | (0.50)* | **0.33 J** | | **4.7** | |
| | 8/9/2010 | 0.24 J | | 0.33 J | | 3.7 | | 0.34 J | | 0.34 J | | **0.23** | | **2.2** | |
| | 2/15/2011 | ND | (0.03) | ND | (0.03) | 9.9 | | 0.48 J | | 0.070 J | | **0.66** | | **0.53 J** | |
| | 8/9/2011 | ND | (0.03) | ND | (0.03) | 1.4 | | 0.22 J | | ND | (0.05) | **0.39** | | **1.4** | |
| | 2/9/2012 | ND | (0.03) | ND | (0.03) | 3.2 | | 0.29 J | | ND | (0.05) | **0.32** | | **2.6** | |
| | 8/13/2012 | ND | (0.03) | ND | (0.03) | 6.3 | | 0.45 J | | ND | (0.05) | **0.40** | | **0.80 J** | |
| | 2/11/2013 | ND | (0.03) | 0.040 J | | 12 | | 0.67 | | 0.090 J | | **0.81** | | **1.2** | |
| **N6-37** | 2/8/2006 | **12** | | 3.3 | | ND | (0.16) | 1.5 | | ND | (0.24) | ND | (0.13) | **6.1** | |
| | 5/10/2006 | **23** | | 8.4 | | 0.34 J | | 4.2 | | 0.42 J | | ND | (0.13) | **5.5** | |
| | 8/17/2006 | **28** | | 12 | | 0.58 | | 6.1 | | 0.43 J | | ND | (0.13) | **5.3** | |
| | 11/13/2006 | **13** | | 6.8 | | 0.27 J | | 2.4 | | 0.31 J | | ND | (0.13) | **5.8** | |
| | 2/21/2007 | **11** | | 2.9 | | ND | (0.16) | 1.0 | | 0.40 J | | ND | (0.13) | **6.0** | |
| | 5/10/2007 | **19** | | 5.5 | | 0.16 J | | 2.4 | | 0.25 J | | ND | (0.04) | **5.1** | |
| | 8/14/2007 | **34** | | 8.8 | | 0.43 J | | 6.7 | | 0.43 J | | ND | (0.04) | **4.7** | |
| | 2/21/2008 | **58** | | 16 | | 0.85 | | 12 | | 0.88 | | ND | (0.04) | NA | |
| | 8/27/2008 | **97 D** | | 25 | | 2.0 | | 27 | | 1.1 | | ND | (0.06) | NA | |
| | 4/29/2009 | **63** | | 12 D | | 0.72 | | 12 | | 0.91 | | ND | (0.06) | NA | |
| | 8/20/2009 | **19** | | 4.7 | | 0.14 J | | 1.7 | | 0.42 J | | ND | (0.03) | **5.6** | |
| | 8/4/2010 | **26** | | 6.3 | | 0.41 J | | 5.0 | | 0.40 J | | ND | (0.03) | **3.9** | |
| | 2/16/2011 | **29** | | 6.2 | | 0.29 J | | 4.6 | | 0.47 J | | ND | (0.03) | **3.6** | |
| | 8/10/2011 | 3.6 | | 0.87 J | | ND | (0.02) | 0.17 J | | 0.06 J | | ND | (0.03) | **2.5** | |
| | 2/14/2012 | **27** | | 7.5 | | 0.57 | | 6.4 | | 0.41 J | | ND | (0.03) | **3.2** | |
| | 8/15/2012 | **6.3** | | 2.0 | | 0.09 J | | 0.83 | | 0.14 J | | ND | (0.03) | **2.5** | |
| | 2/13/2013 | **13** | | 3.0 | | 0.17 J | | 2.3 | | 0.21 J | | ND | (0.03) | **2.2** | |
| **N6-38** | 2/8/2006 | 3.7 | | 61 D | | 0.21 J | | 0.26 J | | **7.1** | | ND | (0.13) | **6.2** | |
| | 5/10/2006 | 3.7 | | 68 D | | 0.20 J | | 0.27 J | | **7.8** | | ND | (0.13) | **6.6** | |
| | 8/15/2006 | **5.0** | | 100 D | | 0.47 J | | 0.72 | | **8.6** | | ND | (0.13) | **7.4** | |
| | 11/13/2006 | 4.2 | | 110 D | | 0.39 J | | 0.37 J | | **9.8** | | ND | (0.13) | **7.0** | |
| | 2/21/2007 | 2.9 | | 39 | | ND | (0.16) | 0.14 J | | 6.8 | | ND | (0.13) | **6.5** | |
| | 5/10/2007 | 2.8 | | 40 | | 0.08 J | | 0.13 J | | 5.9 | | ND | (0.04) | **5.4** | |
| | 8/14/2007 | 3.4 | | 54 | | 0.19 J | | 0.31 J | | **8.1** | | ND | (0.04) | **5.7** | |
| | 2/21/2008 | 3.3 | | 42 | | 0.12 J | | 0.31 J | | **7.7** | | ND | (0.04) | NA | |
| | 8/27/2008 | 3.7 | | 55 | | 0.14 J | | 0.27 J | | **8.2** | | ND | (0.06) | NA | |
| | 4/29/2009 | 3.7 | | 40 | | 0.09 J | | 0.16 J | | **8.2** | | ND | (0.06) | NA | |
| | 8/20/2009 | **5.5** | | 63 | | 0.23 J | | 0.44 J | | **12** | | ND | (0.03) | **8.2** | |
| | 8/5/2010 | 3.3 | | 40 | | 0.11 J | | 0.16 J | | **7.9** | | ND | (0.03) | **3.5** | |
| | 2/16/2011 | 1.9 | | 15 | | 0.05 J | | 0.06 J | | 3.6 | | ND | (0.03) | **3.3** | |
| | 8/10/2011 | 1.8 | | 21 | | 0.05 J | | 0.08 J | | 4.5 | | ND | (0.03) | **2.7** | |

Table A-4 Continued
Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

U.S. Navy 2013d

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| | | Analytes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **TCE** | | **1,1,1-TCA** | | **1,1-DCA** | | **cis-1,2-DCE** | | **1,1-DCE** | | **Vinyl Chloride** | | **1,4-dioxane** | |
| **Well No.** | **Date** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** | **(µg/L)** | **(MDL)** |
| **Compliance Levels** | | **5** | | **200** | | **800** | | **70** | | **7.0**[1/] | | **0.1** | | **0.44** | |
| | 2/14/2012 | 3.7 | | 40 | | 0.12 J | | 0.22 J | | **7.3** | | ND | (0.03) | **3.5** | |
| | 8/15/2012 | 2.2 | | 32 | | 0.10 J | | 0.13 J | | 4.7 | | ND | (0.03) | **3.1** | |
| | 2/13/2013 | 2.1 | | 21 | | 0.060 J | | 0.080 J | | 2.9 | | ND | (0.03) | **2.5** | |
| **6-DW-38** | 4/10/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **2.3 J** | |
| | 5/23/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **2.9** | |
| | 8/21/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **2.8** | |
| | 11/15/2006 | NA | | NA | | NA | | NA | | NA | | NA | | **2.7** | |
| | 2/20/2008 | NA | | NA | | NA | | NA | | NA | | NA | | **3.0** | |
| | 8/25/2008 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (1.0)[2/] |
| | 8/14/2009 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.16) |
| | 8/9/2010 | 0.030 J | | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **0.75 J** | |
| | 2/8/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **2.9** | |
| | 8/2/2011 | ND | (0.03) | 0.070 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/2/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **1.0** | |
| | 8/7/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **6.4** | |
| | 2/5/2013 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | **6.2** | |
| **PRIVATE (DOMESTIC) WELLS** | | | | | | | | | | | | | | | |
| **6-DW-38B** | 8/14/2009 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.16) |
| | 8/9/2010 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/8/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/2/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/2/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/7/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/5/2013 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| **6-DW-47** | 4/10/2006 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.47)[2/] |
| | 5/23/2006 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.47)[2/] |
| | 8/21/2006 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.27) |
| | 11/15/2006 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.27) |
| | 8/20/2009 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (1.0)*[2/] |
| | 8/10/2010 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/8/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| **6-DW-48** | 4/10/2006 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.47)[2/] |
| | 5/23/2006 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.47)[2/] |
| | 8/21/2006 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.27) |
| | 11/15/2006 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.27) |
| | 8/14/2009 | NA | | NA | | NA | | NA | | NA | | NA | | ND | (0.16) |
| | 8/9/2010 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/8/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/3/2011 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/2/2012 | ND | (0.03) | ND | (0.03) | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 8/8/2012 | ND | (0.03) | 0.03 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |
| | 2/6/2013 | ND | (0.03) | 0.03 J | | ND | (0.02) | ND | (0.04) | ND | (0.05) | ND | (0.03) | ND | (0.16) |

U.S. Navy 2013d

Table A-4 Continued

Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

*Notes:*

Sample numbers are sequential for the purposes of submitting blind samples to the laboratory.

[1/] Action level increased to 7.0 µg/L as agreed by EPA in June 6, 2006 meeting.

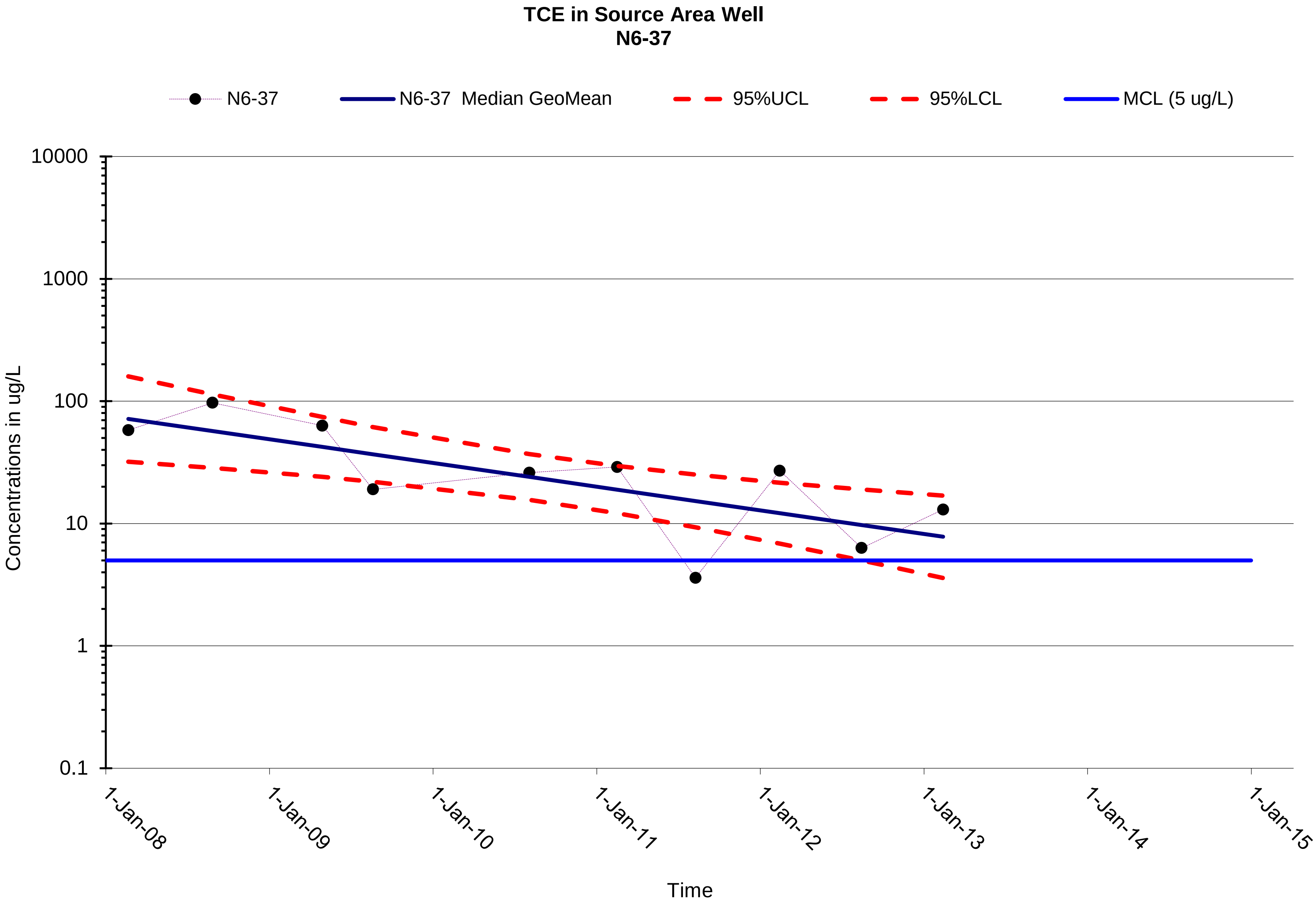
[2/] The Washington State MTCA Method B Value for 1,4-dioxane was lowered from 4.0 to 0.44 µg/l in August 2010; therefore this ND result is not considered an exceedance of compliance levels.

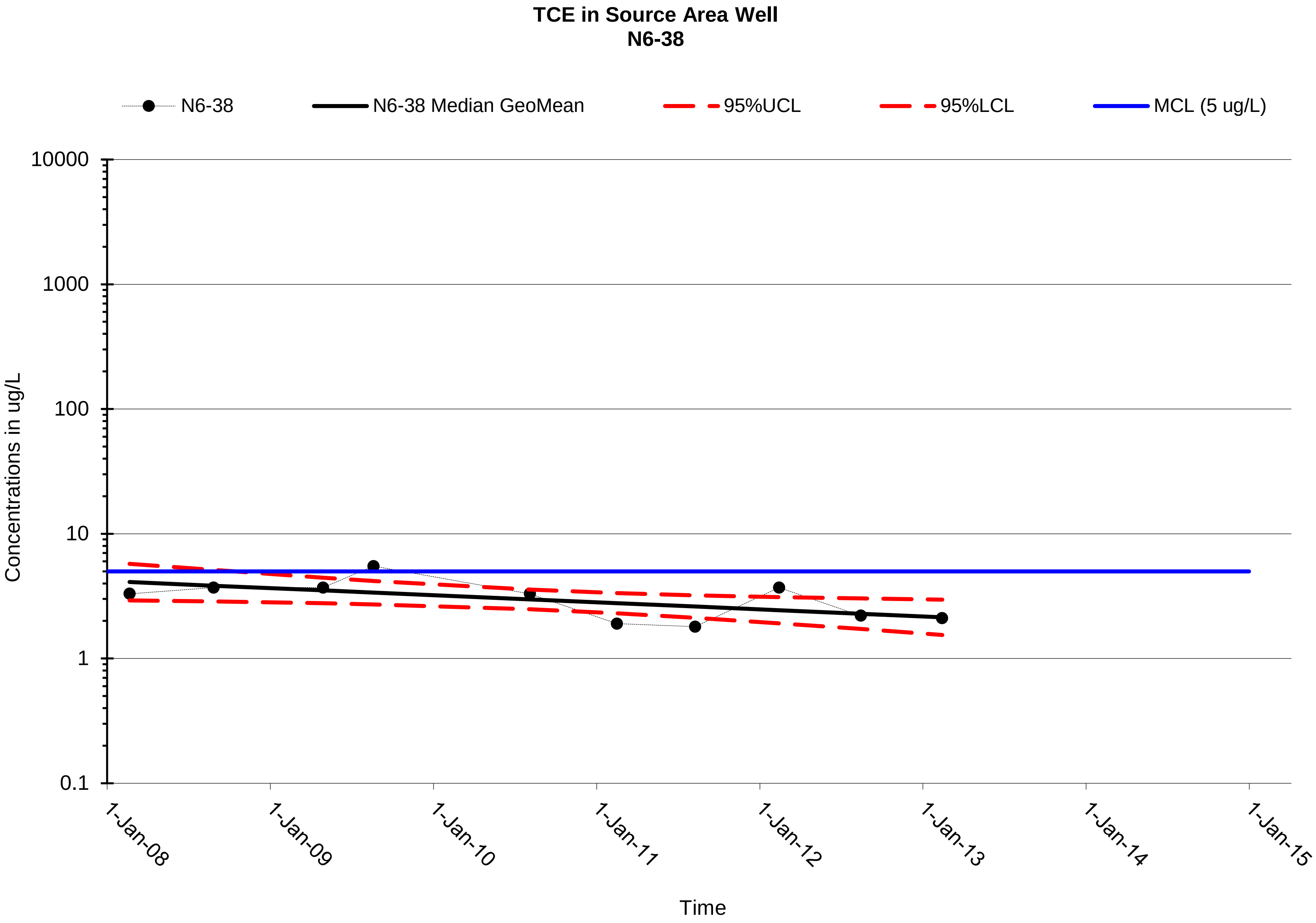
Compliance limitations are shown on this Table for comparison to groundwater quality criteria.

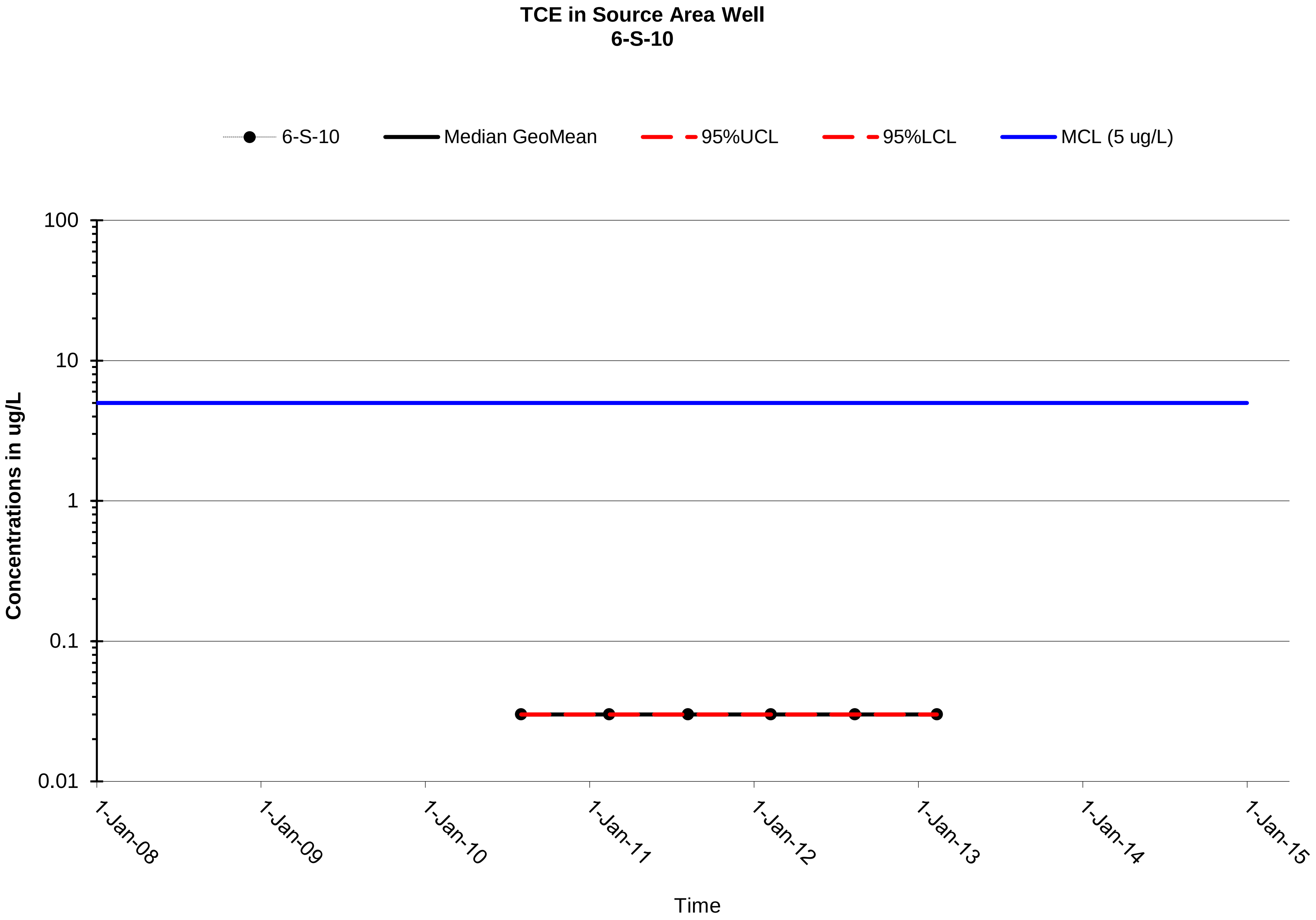
**Bold text** indicates an exceedance of compliance levels.

-- – No compliance level
D – diluted
J – Estimated value; detected, but below quantitation limit or qualified as estimated due to a QC outlier.
MDL - Method Detection Limit
NA – Not analyzed for indicated parameter.
ND ( ) – indicates parameter not detected; Method Detection Limit in parenthesis
ND ( )* - indicated parameter not detected; Method Reporting Limit in parenthesis.
ND ( )$^{UJ}$ - indicated parameter not detected at an elevated detection limit indicated in parenthesis.

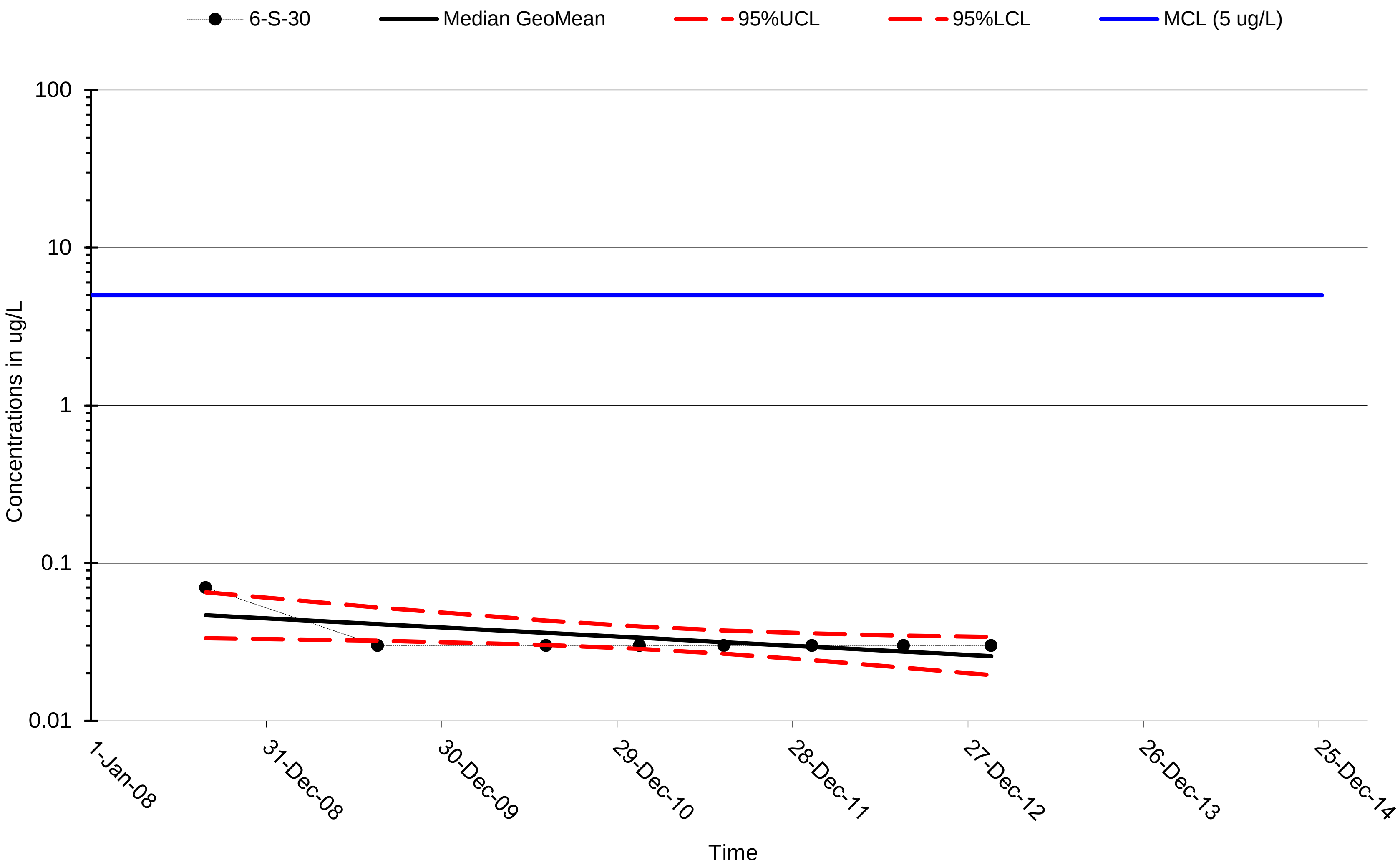
Table A-4 Continued
Area 6 Production, Monitoring, and Domestic Well Sample Summary, February 2006 Through February 2013

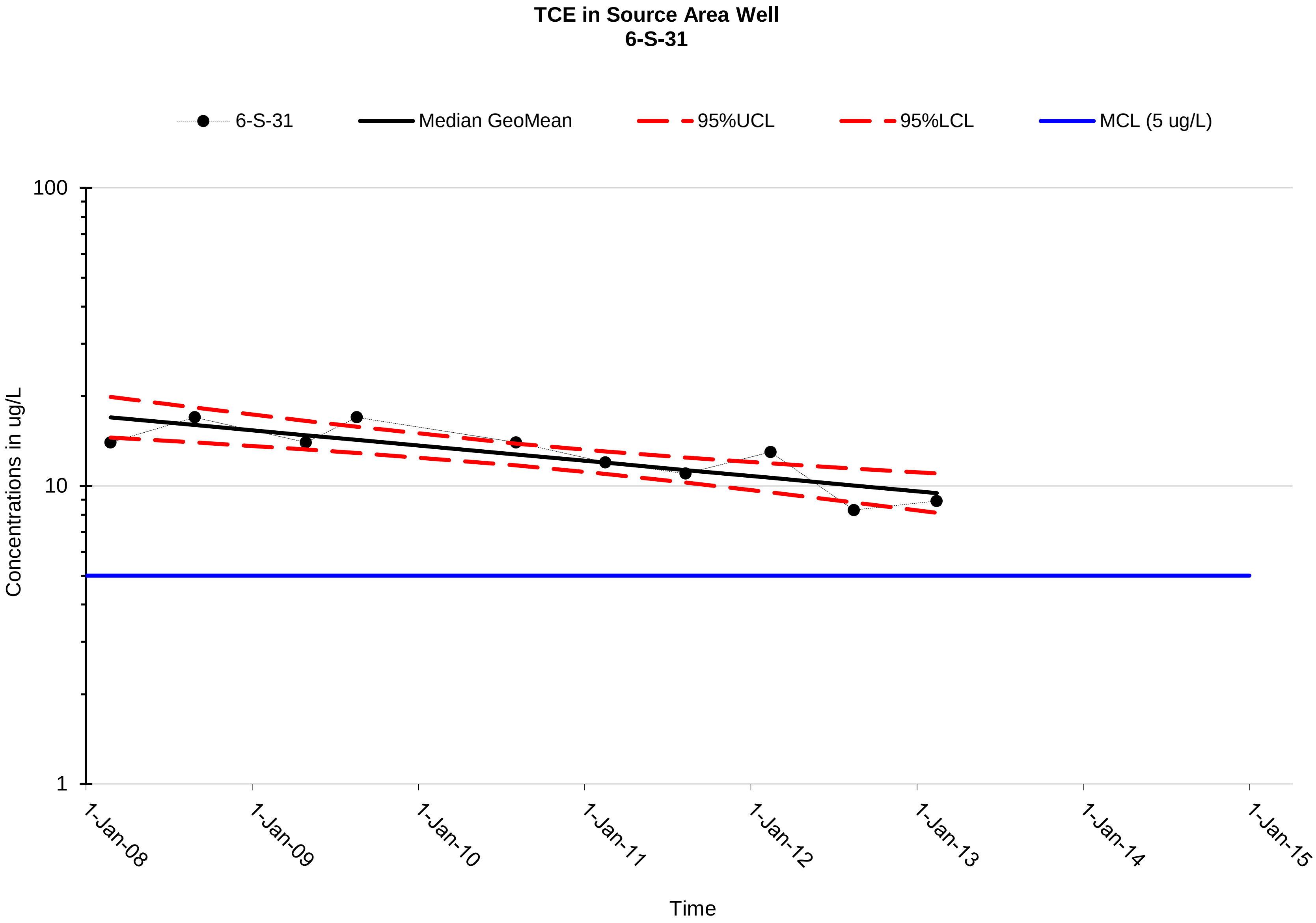

TCE in Source Area Well
N6-37
N6-37
N6-37 Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
10000
1000
100
10
1
0.1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time


TCE in Source Area Well
N6-38
N6-38
N6-38 Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
Concentrations in ug/L
10000
1000
100
10
1
0.1
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

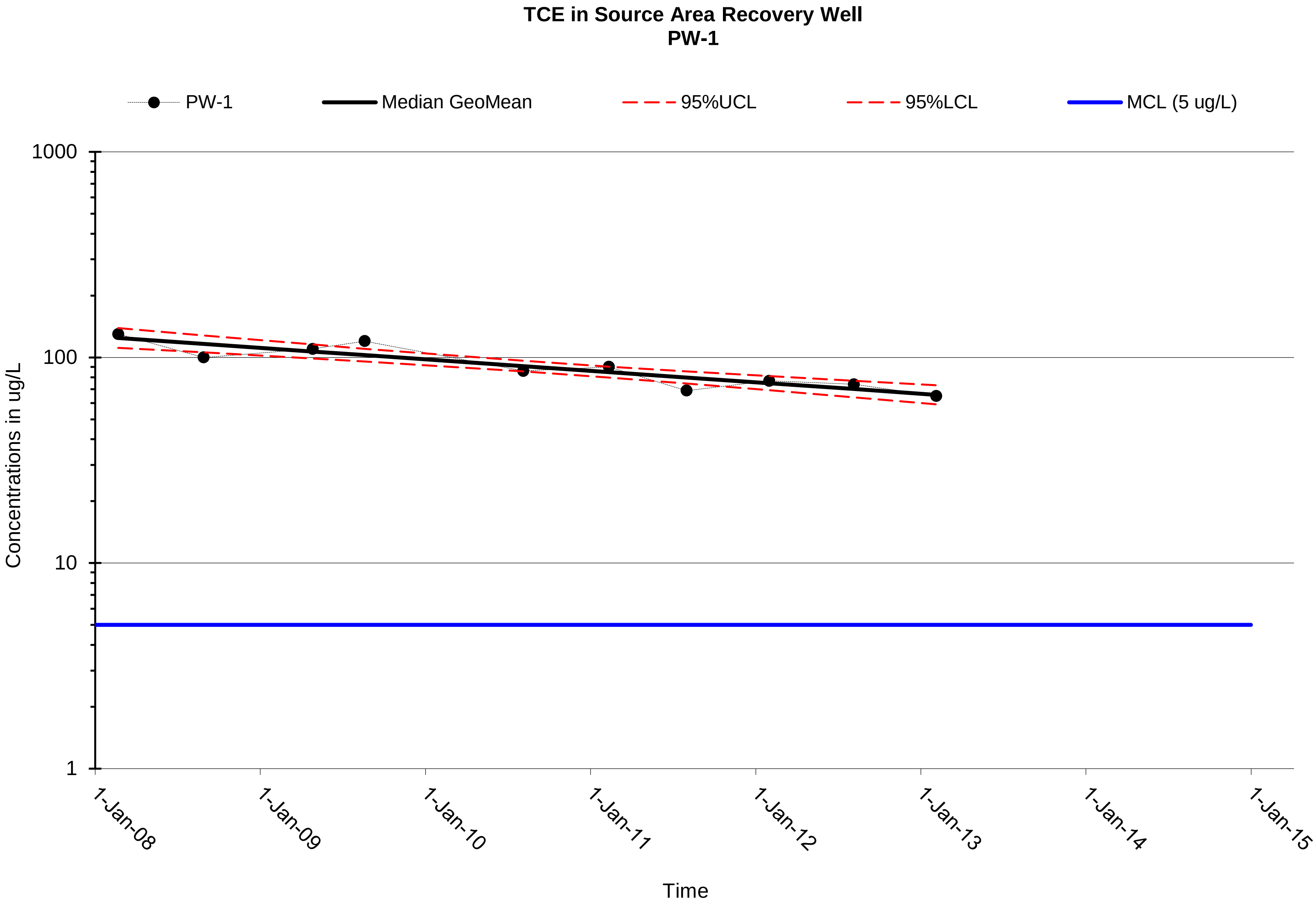

TCE in Source Area Well
6-S-10
6-S-10
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
Concentrations in ug/L
100
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

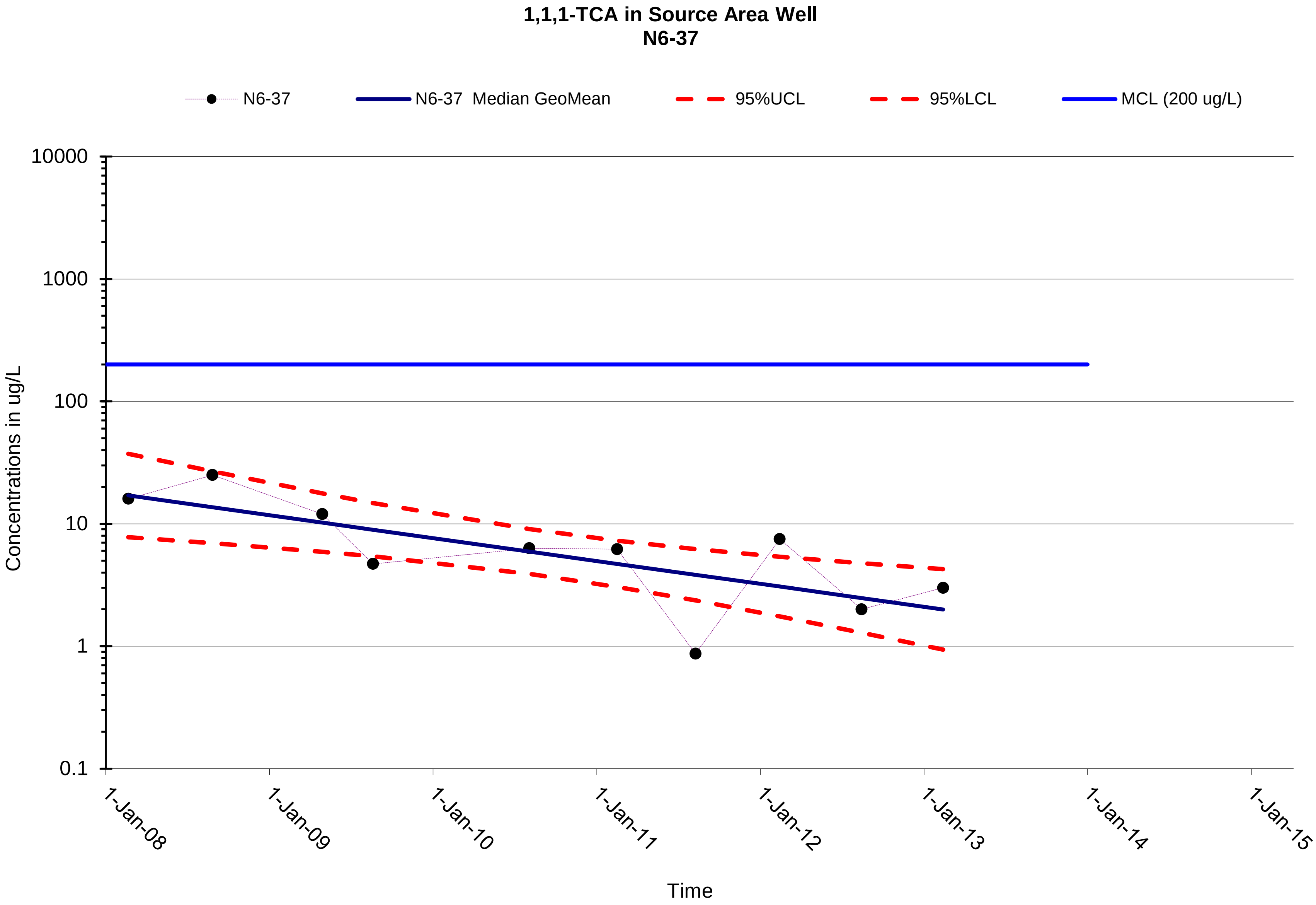
## TCE in Source Area Well
## 6-S-30





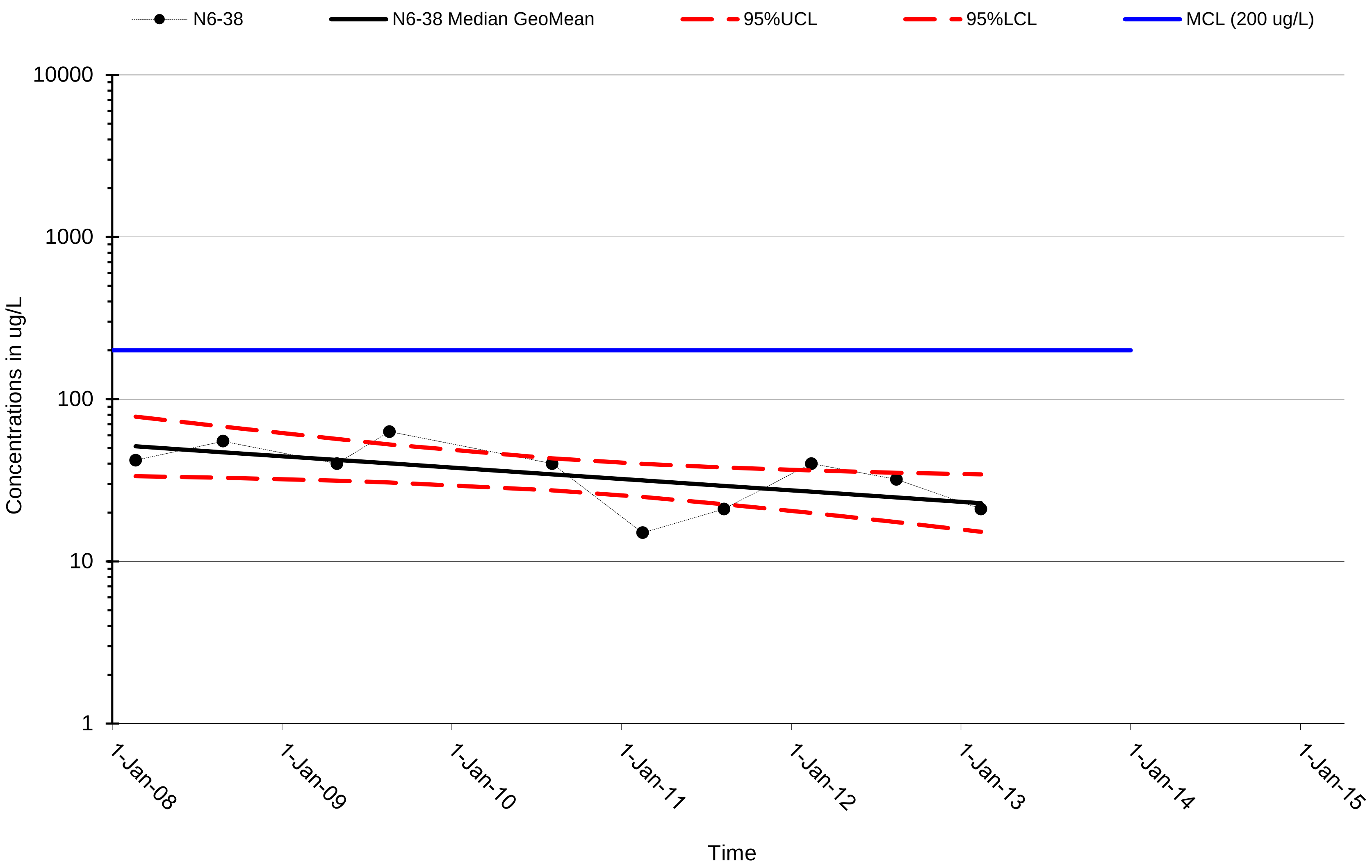
TCE in Source Area Well
6-S-31


TCE in Source Area Recovery Well
PW-1
PW-1
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
1000
100
10
1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

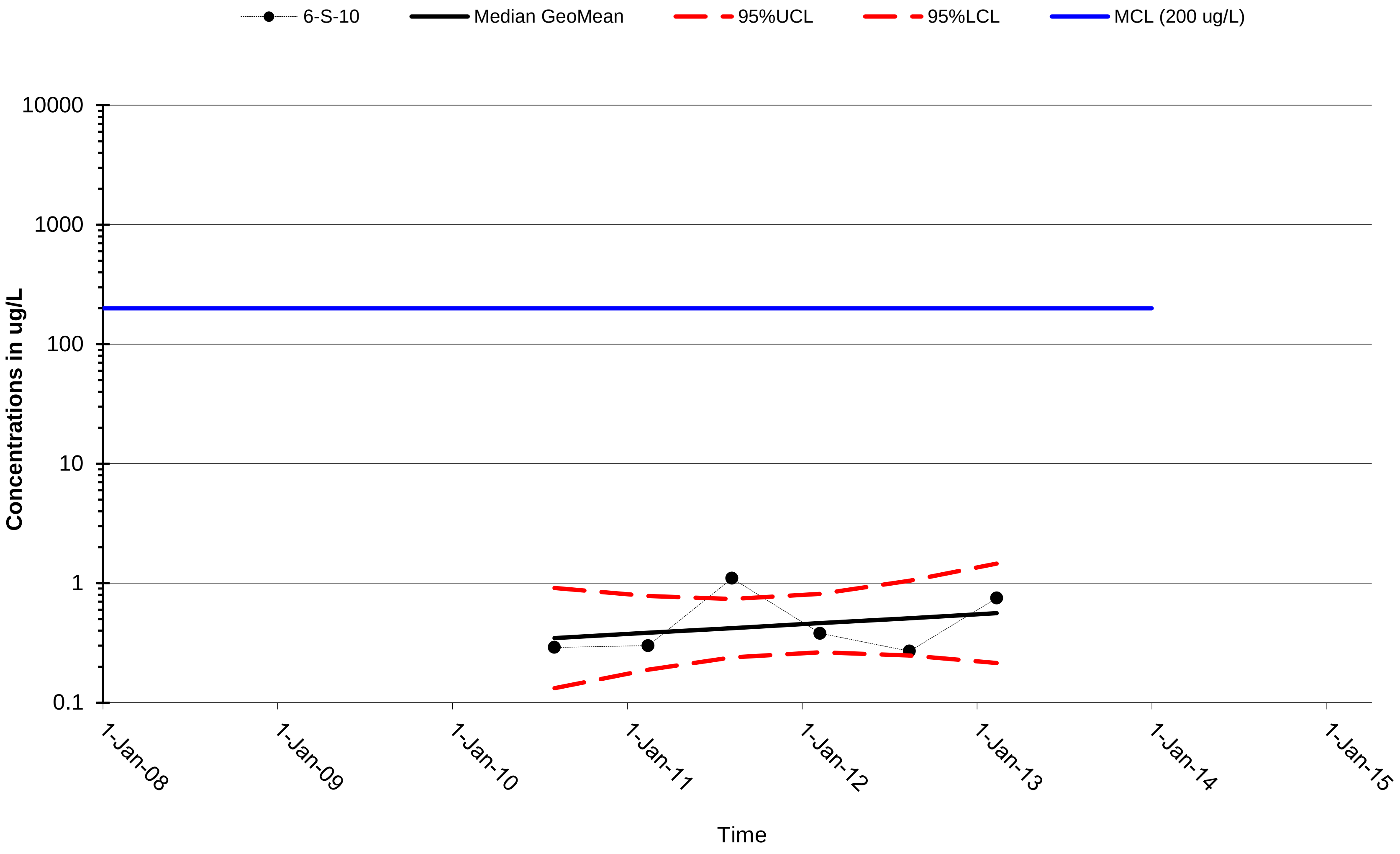


1,1,1-TCA in Source Area Well
N6-37
N6-37
N6-37 Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
Concentrations in ug/L
10000
1000
100
10
1
0.1
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

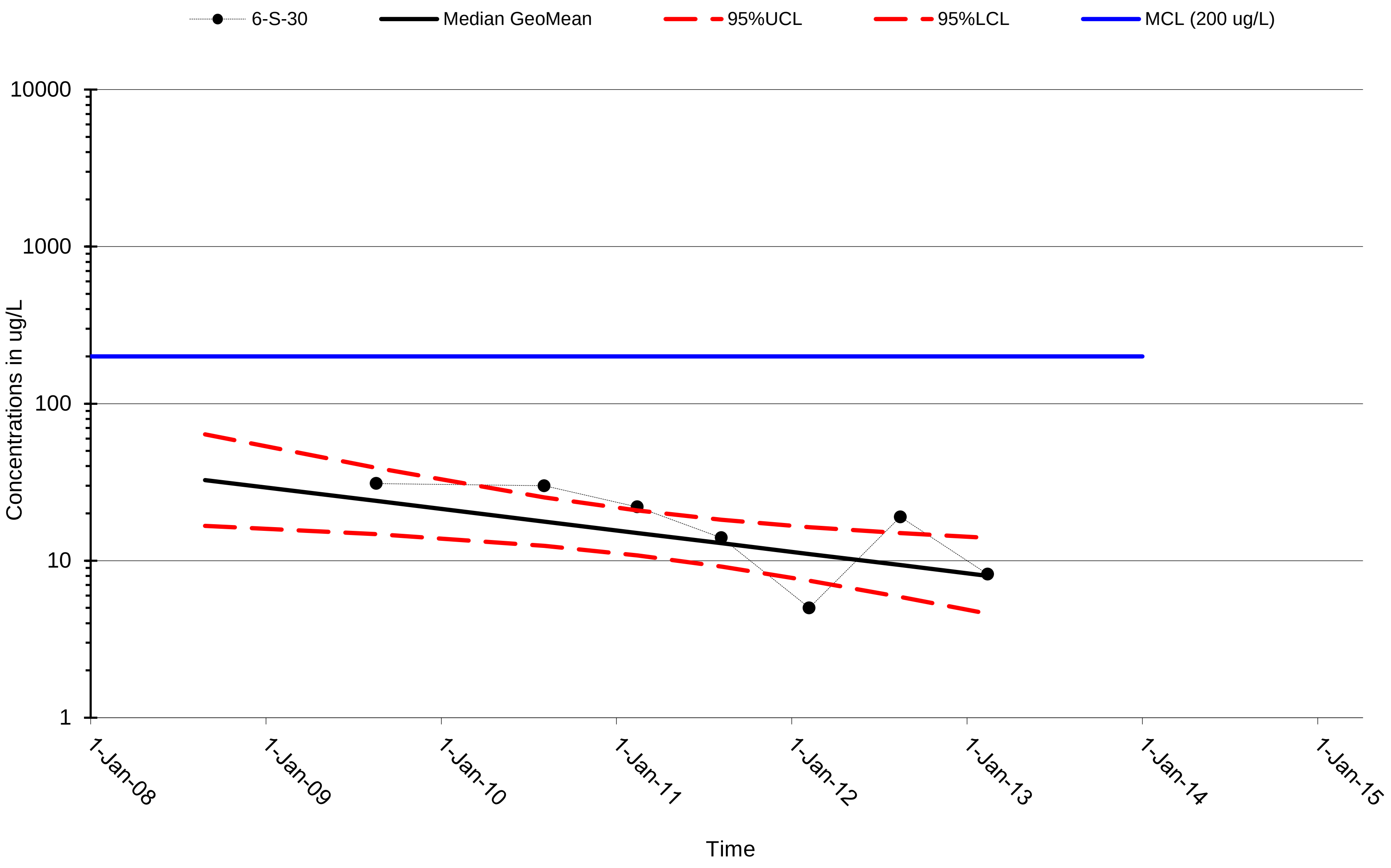
## 1,1,1-TCA in Source Area Well
## N6-38

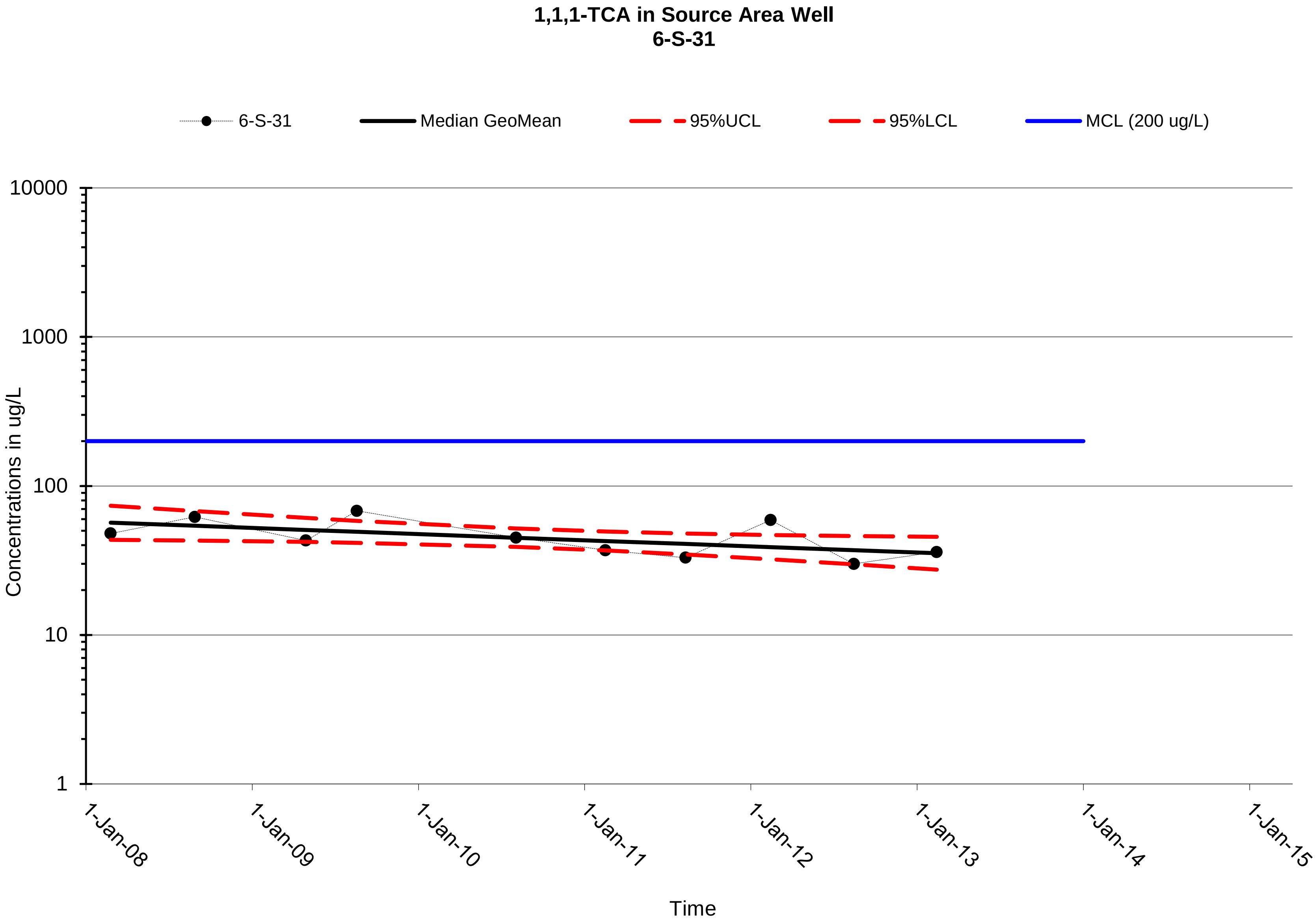


## 1,1,1-TCA in Source Area Well
## 6-S-10

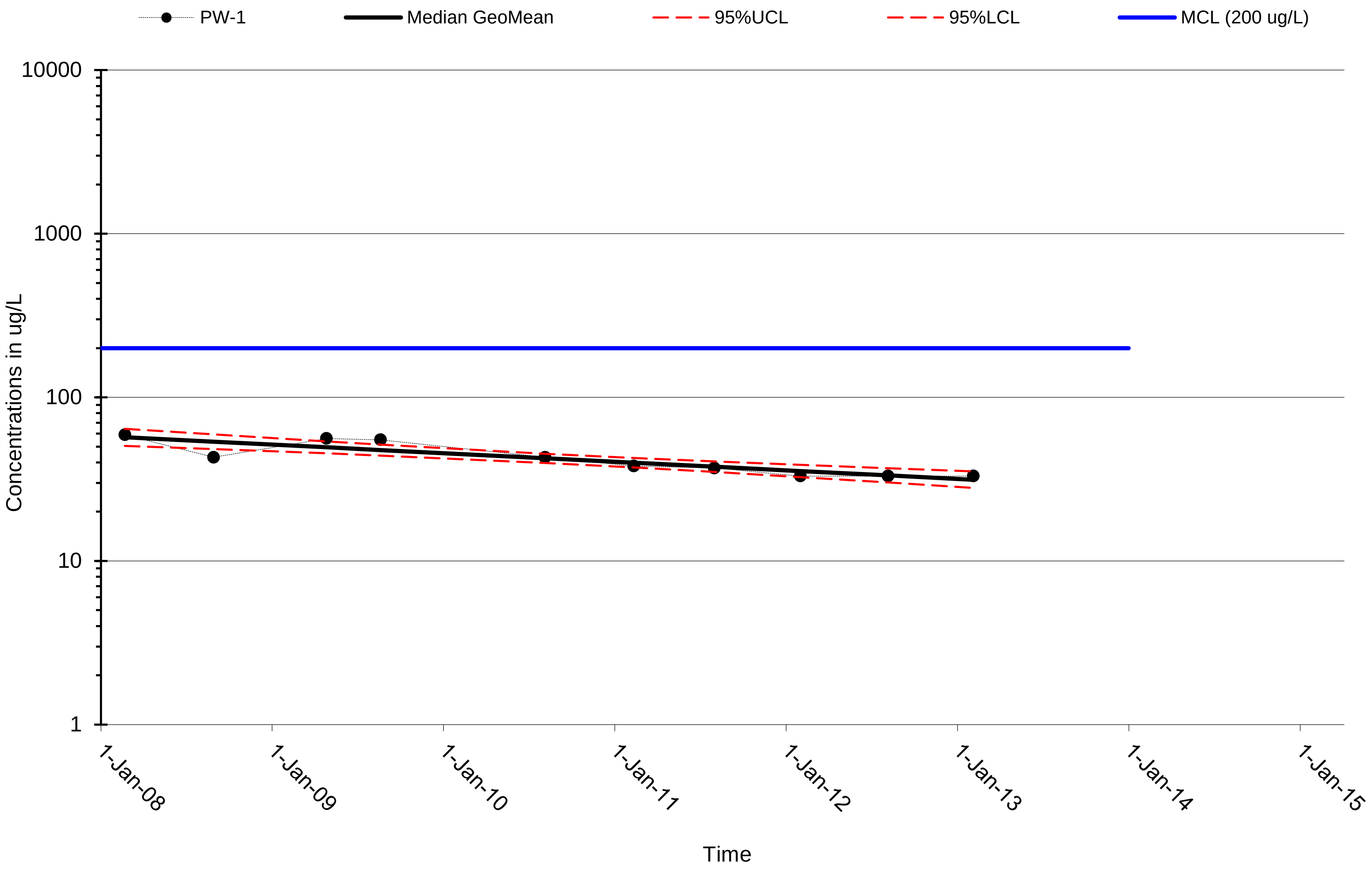


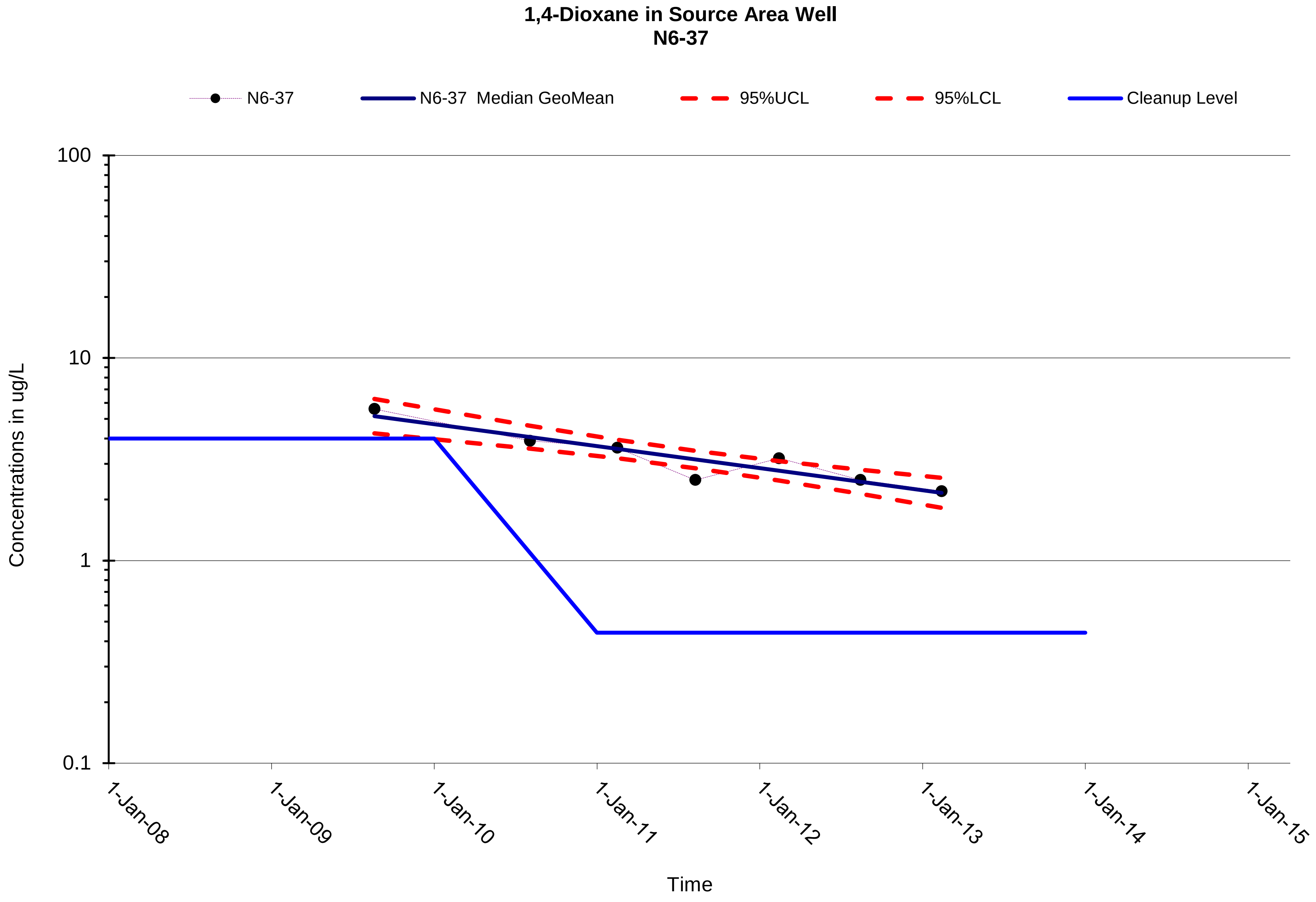
## 1,1,1-TCA in Source Area Well
## 6-S-30



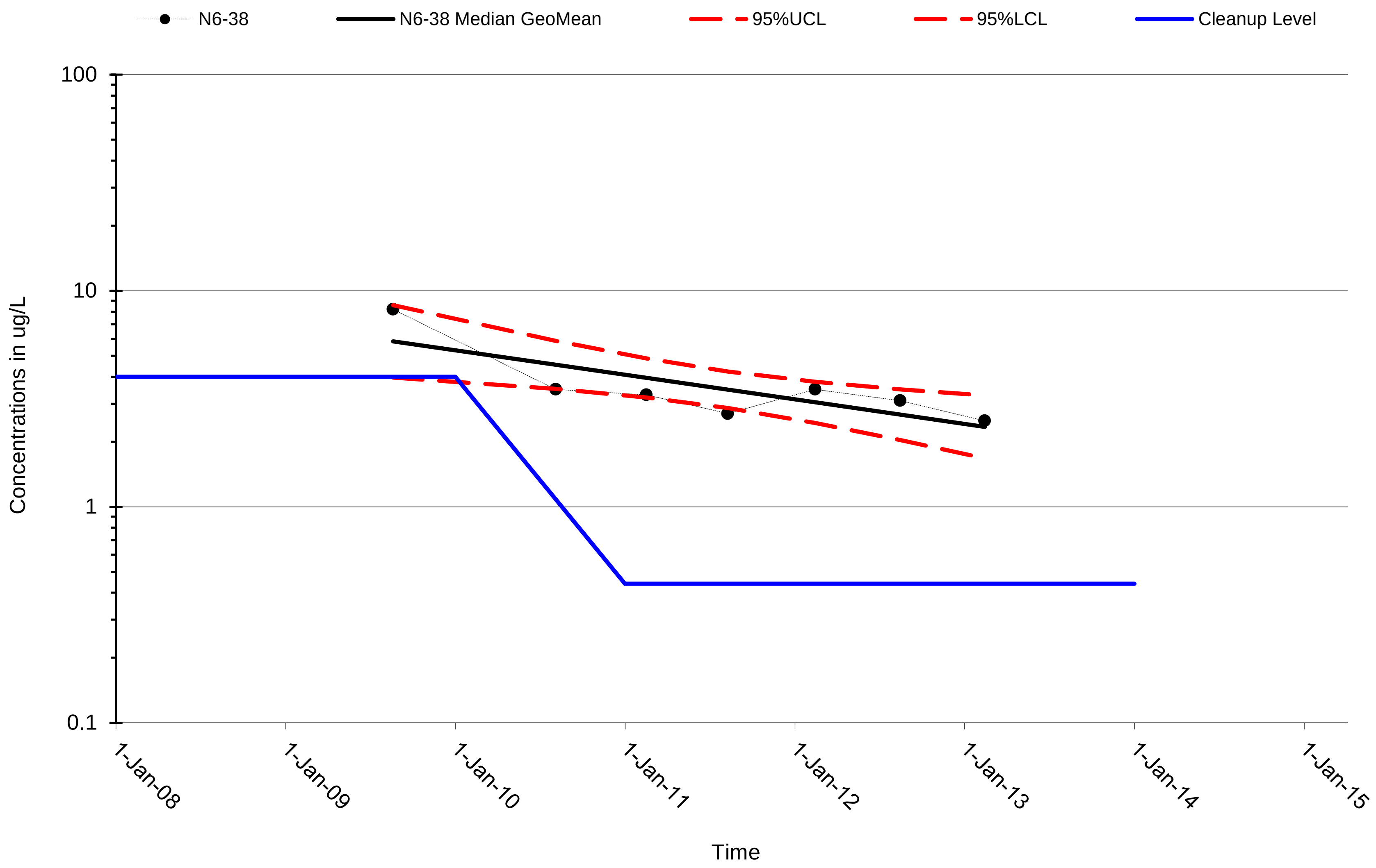

1,1,1-TCA in Source Area Well
6-S-31
6-S-31
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
Concentrations in ug/L
10000
1000
100
10
1
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

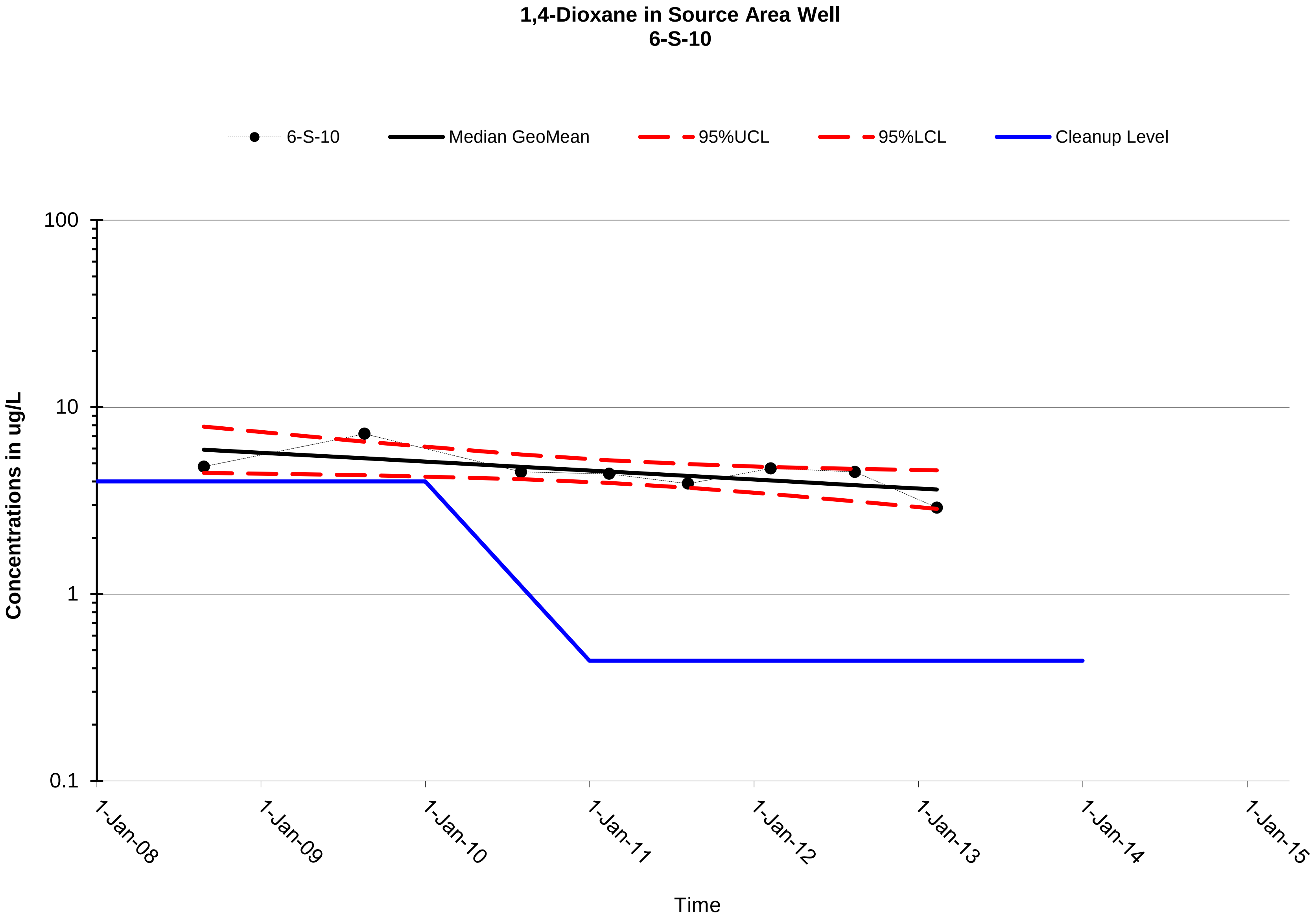
# 1,1,1-TCA in Source Area Recovery Well
# PW-1




1,4-Dioxane in Source Area Well
N6-37
N6-37
N6-37 Median GeoMean
95%UCL
95%LCL
Cleanup Level
100
10
1
0.1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

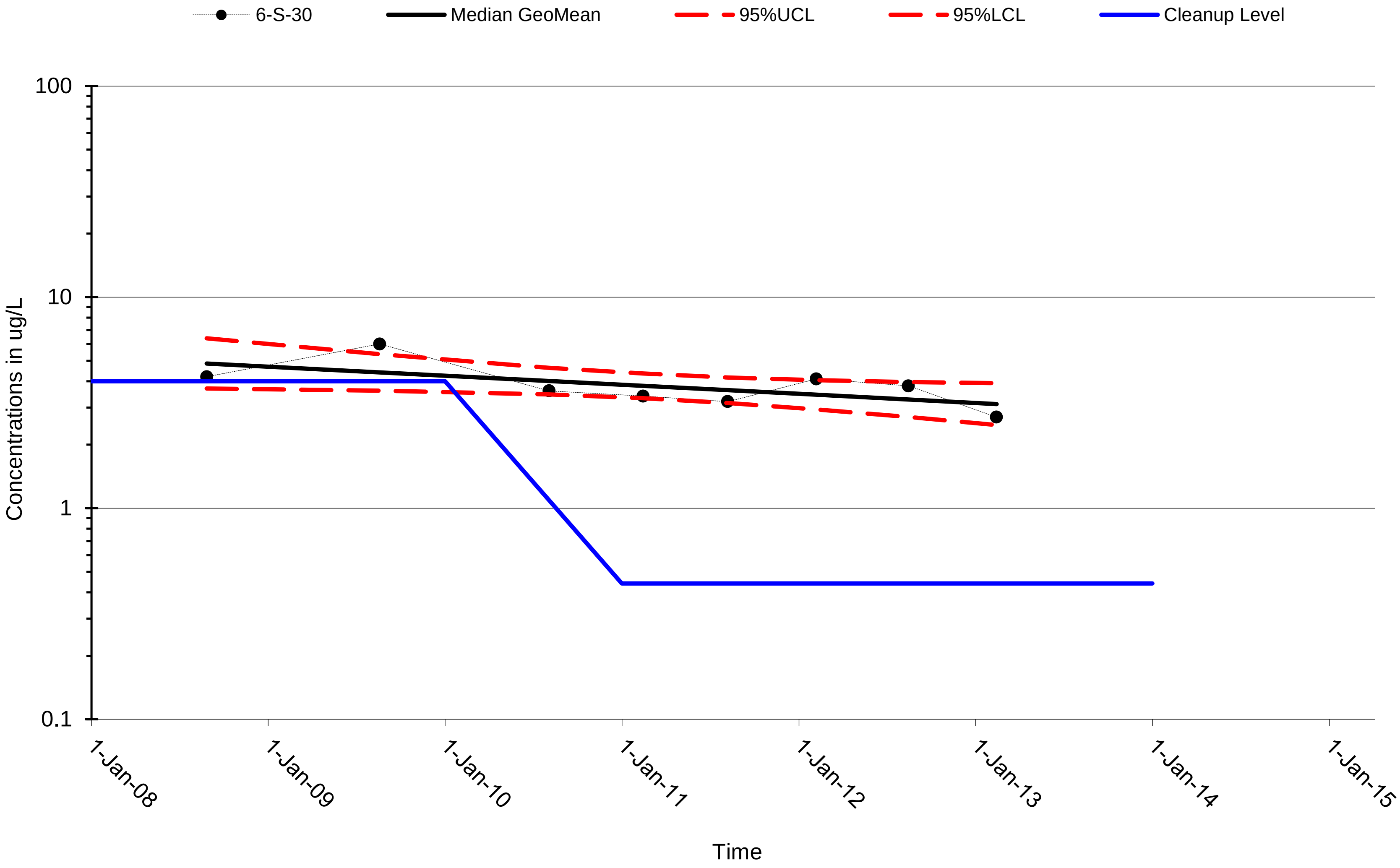
## 1,4-Dioxane in Source Area Well
## N6-38

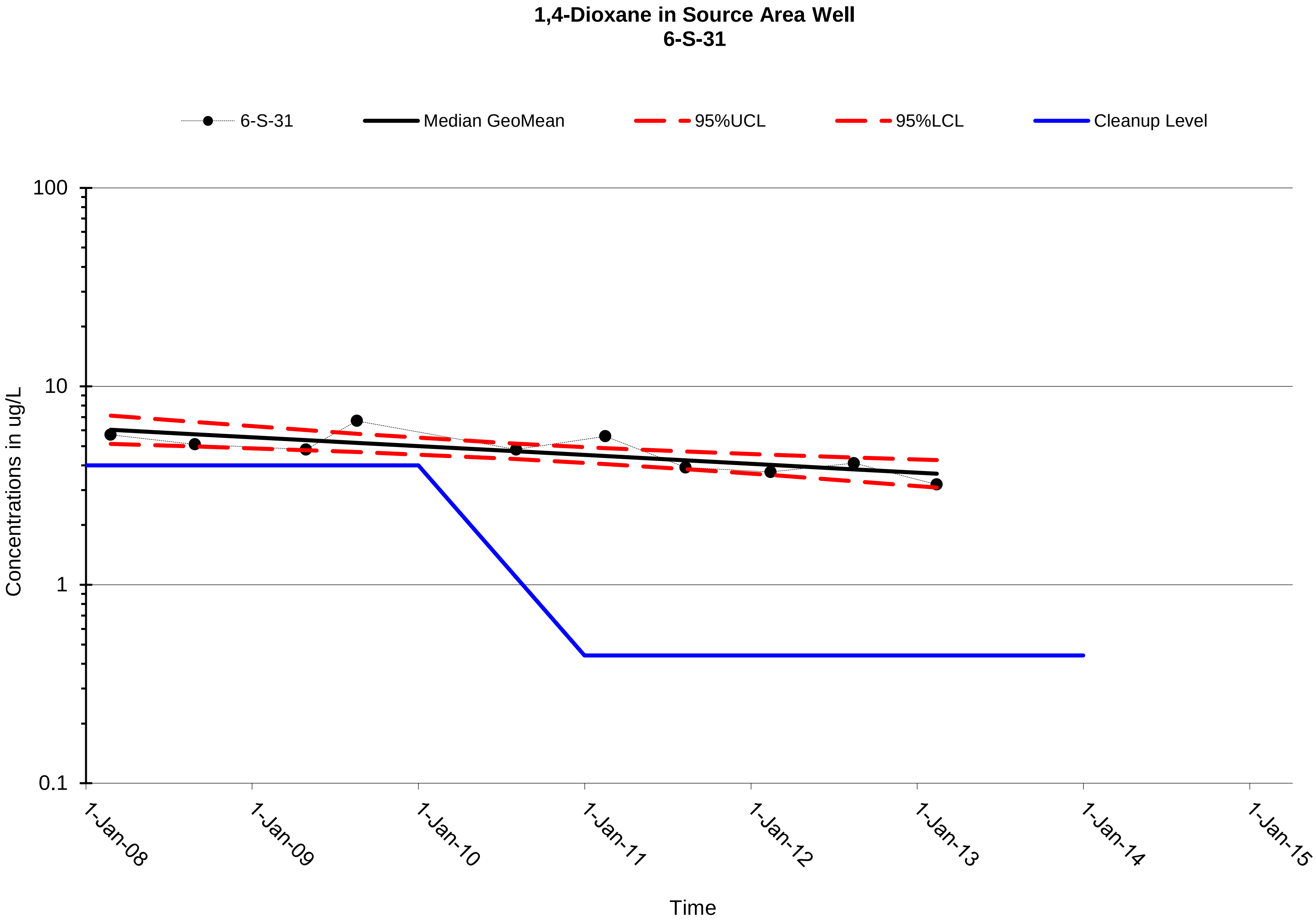



1,4-Dioxane in Source Area Well
6-S-10
6-S-10
Median GeoMean
95%UCL
95%LCL
Cleanup Level
100
10
1
0.1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

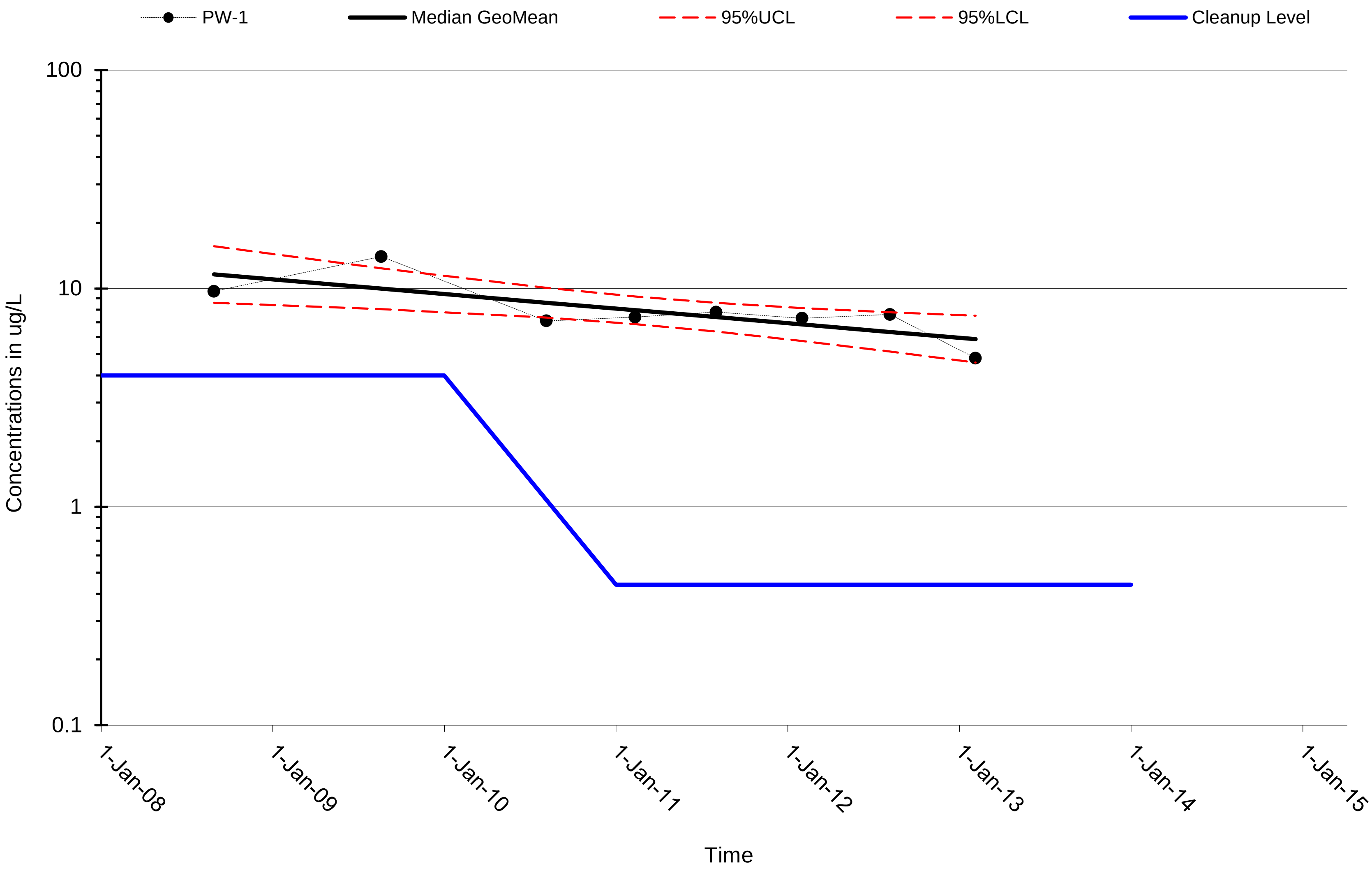
]

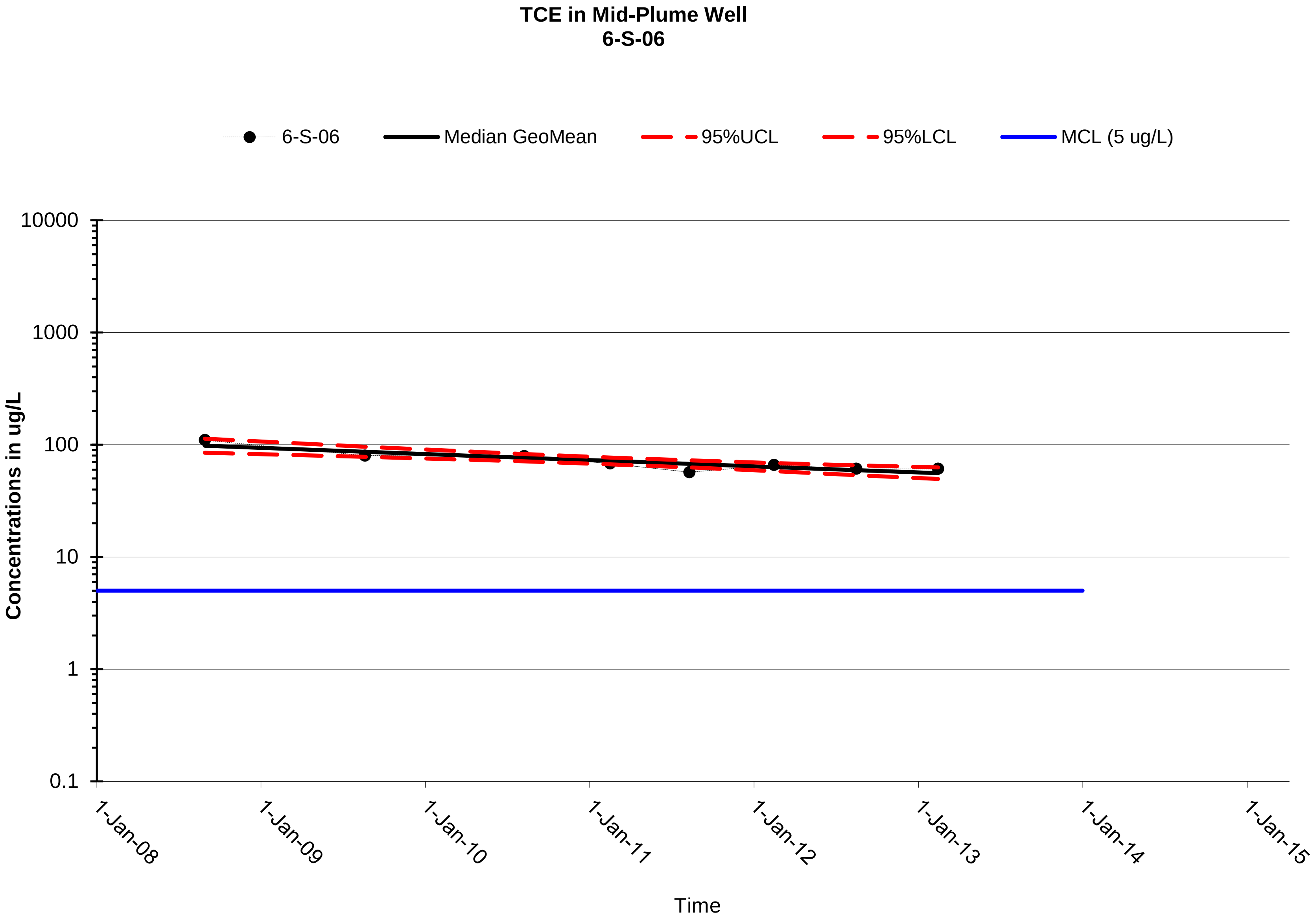
# 1,4-Dioxane in Source Area Well
## 6-S-30

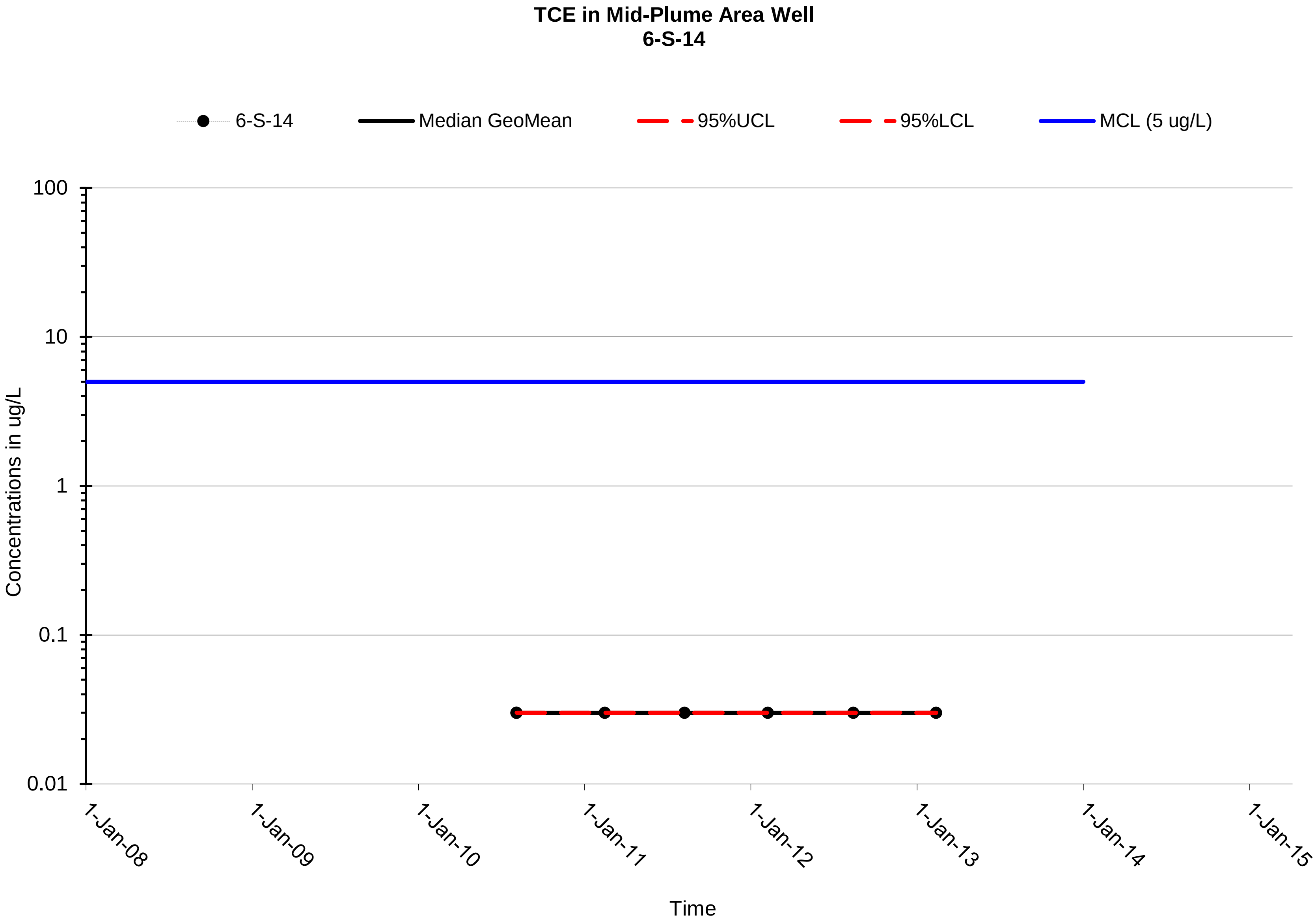



1,4-Dioxane in Source Area Well
6-S-31
6-S-31
Median GeoMean
95%UCL
95%LCL
Cleanup Level
100
10
1
0.1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

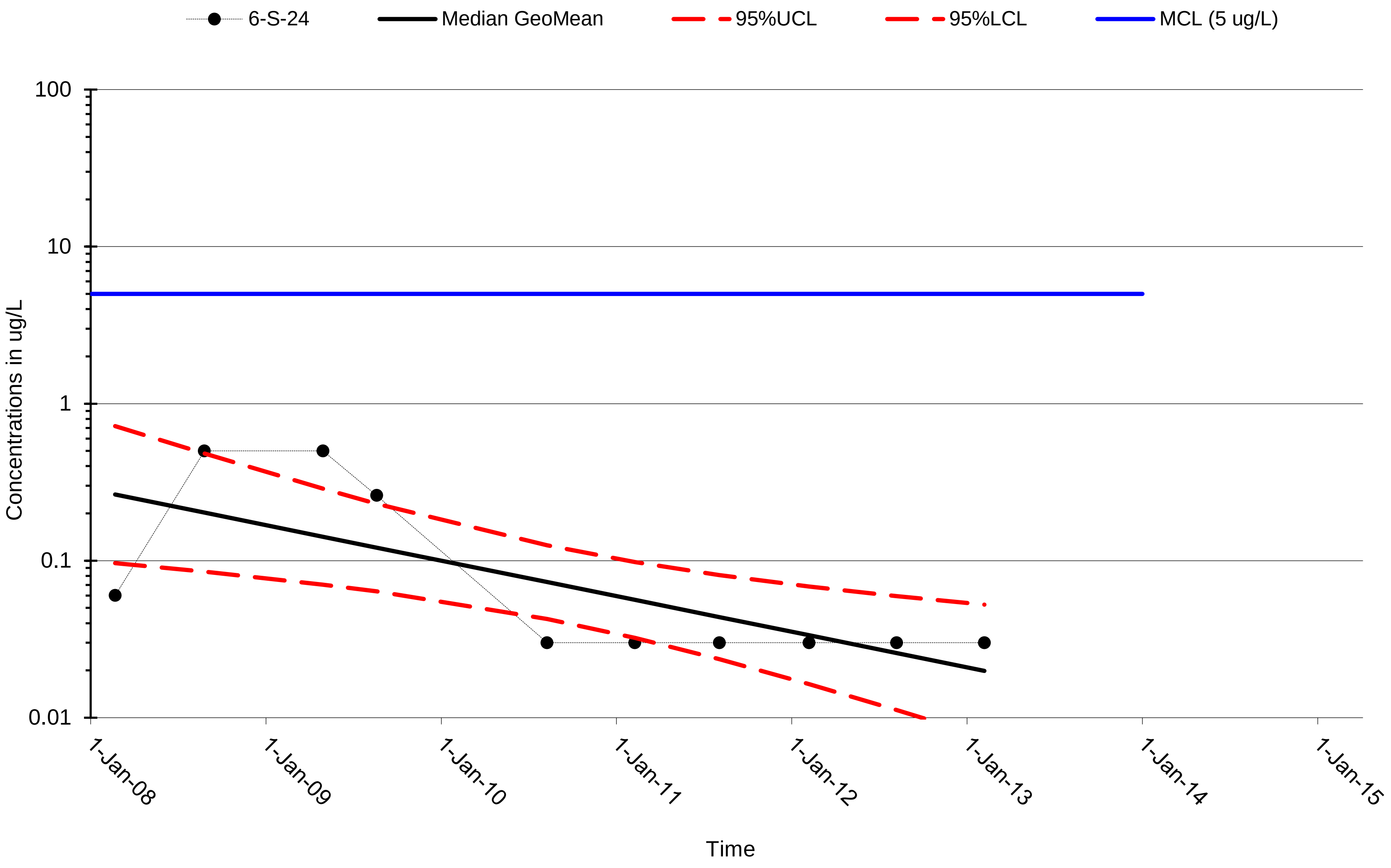
# 1,4-Dioxane in Source Area Recovery Well
## PW-1

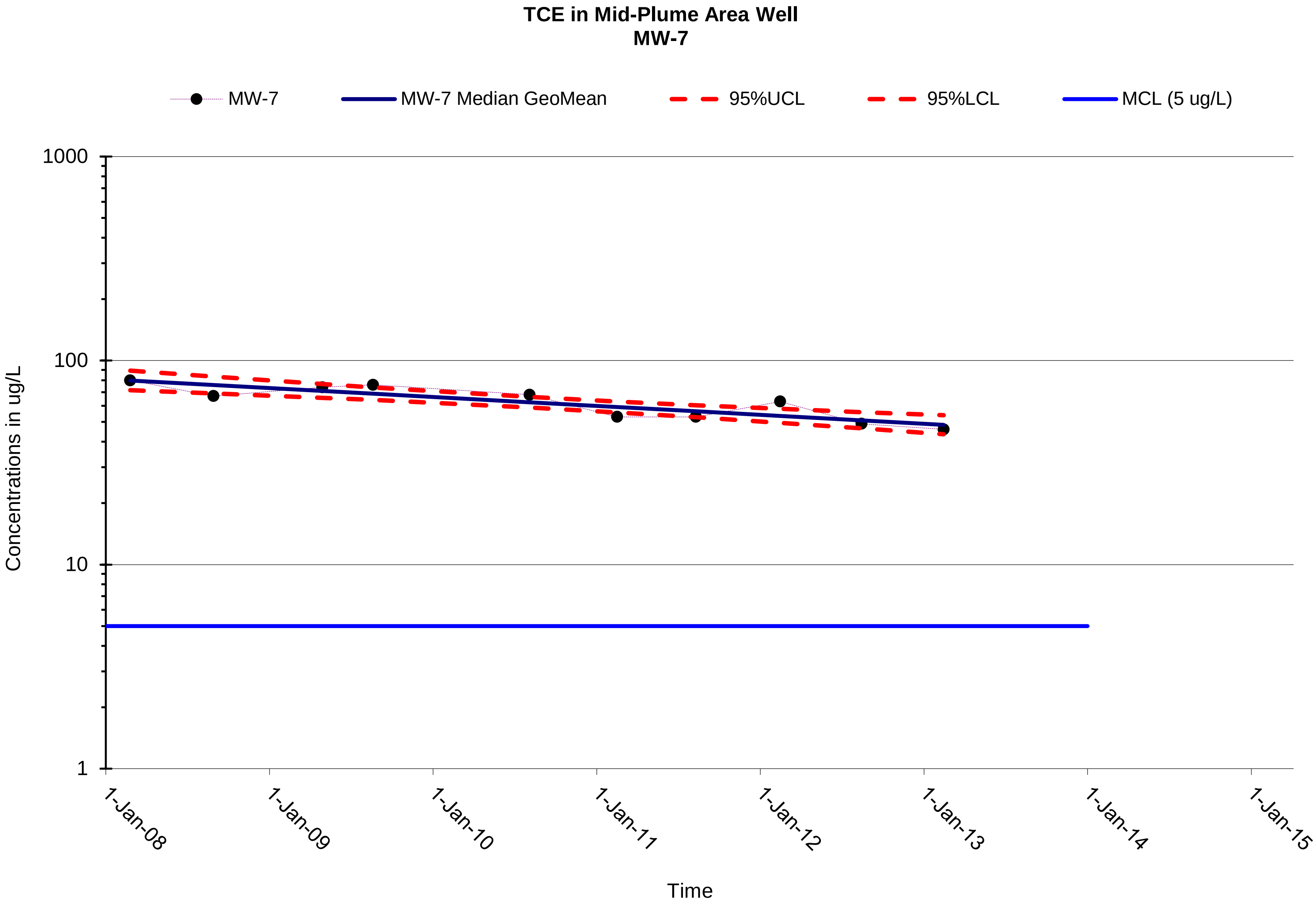


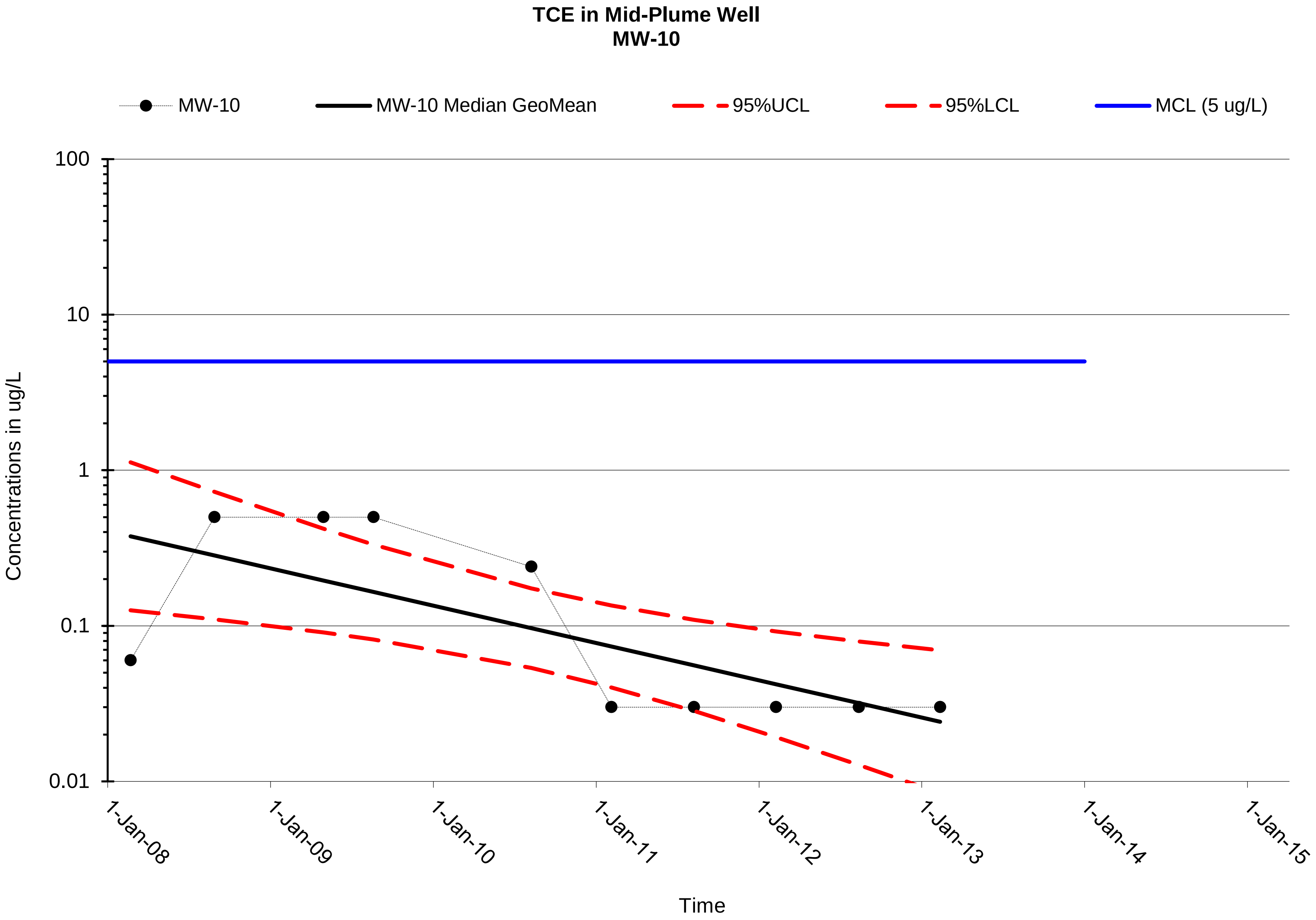

TCE in Mid-Plume Well
6-S-06
6-S-06
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
Concentrations in ug/L
10000
1000
100
10
1
0.1
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time


TCE in Mid-Plume Area Well
6-S-14
6-S-14
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

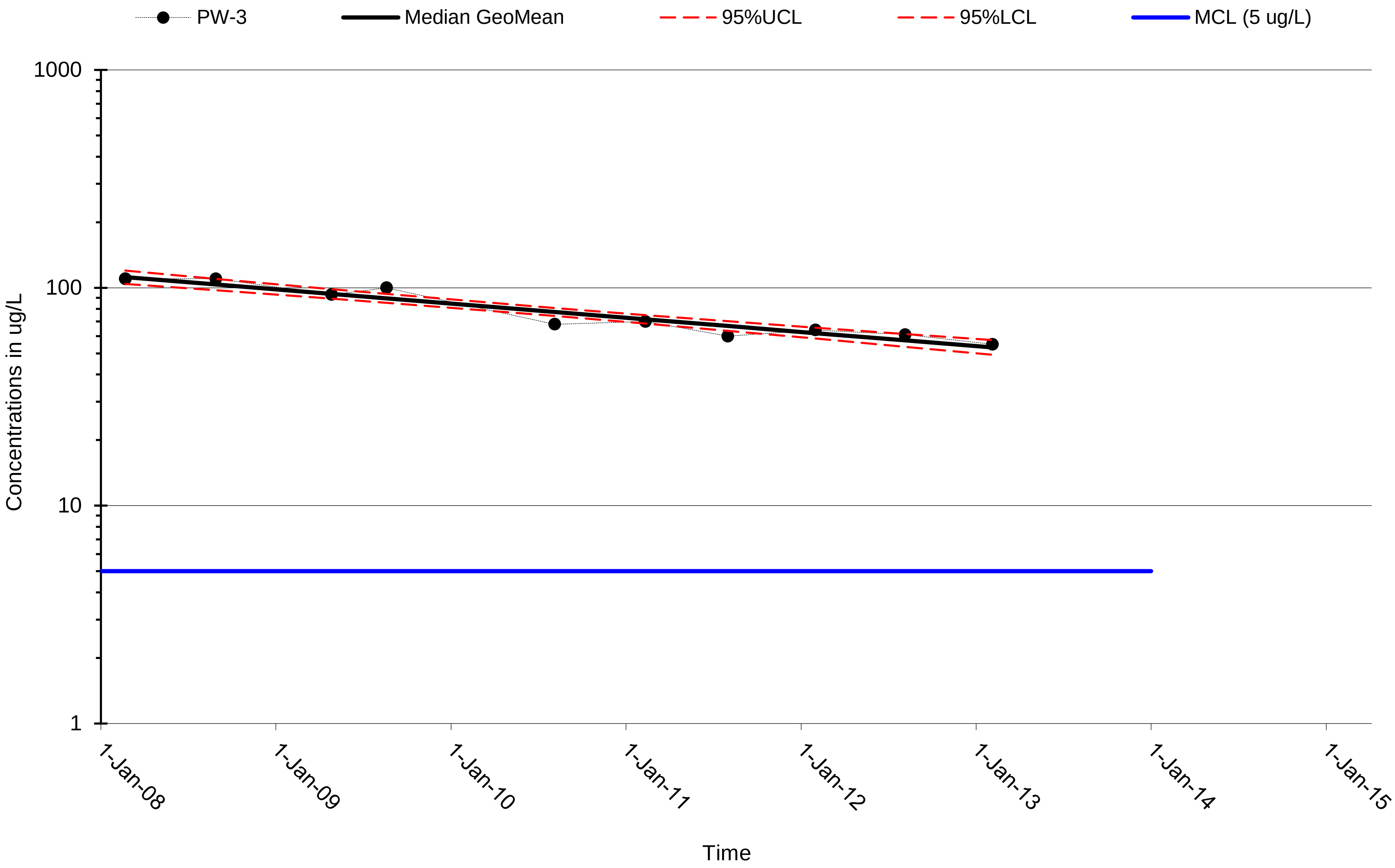
## TCE in Mid-Plume Area Well
## 6-S-24

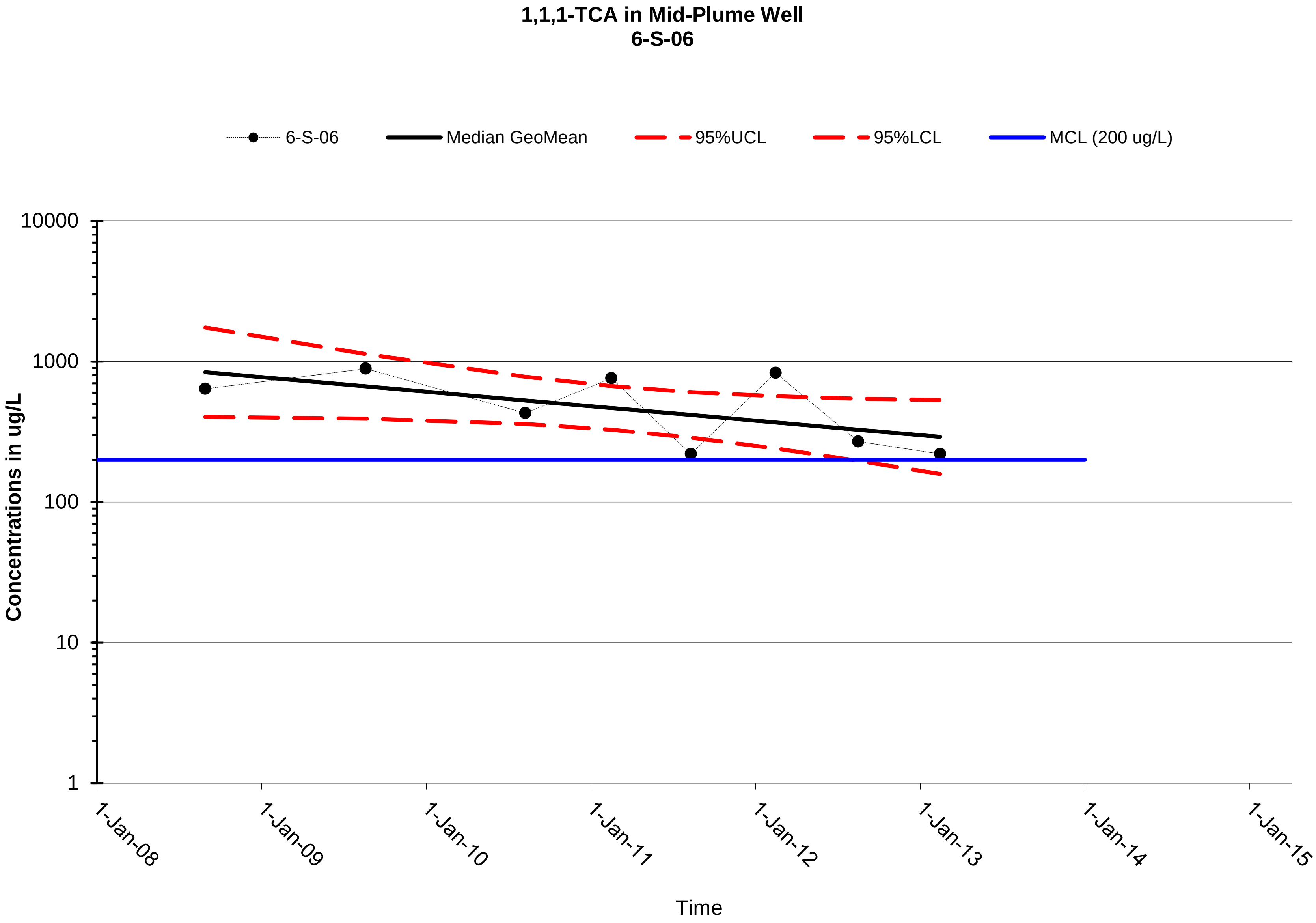



TCE in Mid-Plume Area Well
MW-7
MW-7
MW-7 Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
Concentrations in ug/L
1000
100
10
1
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

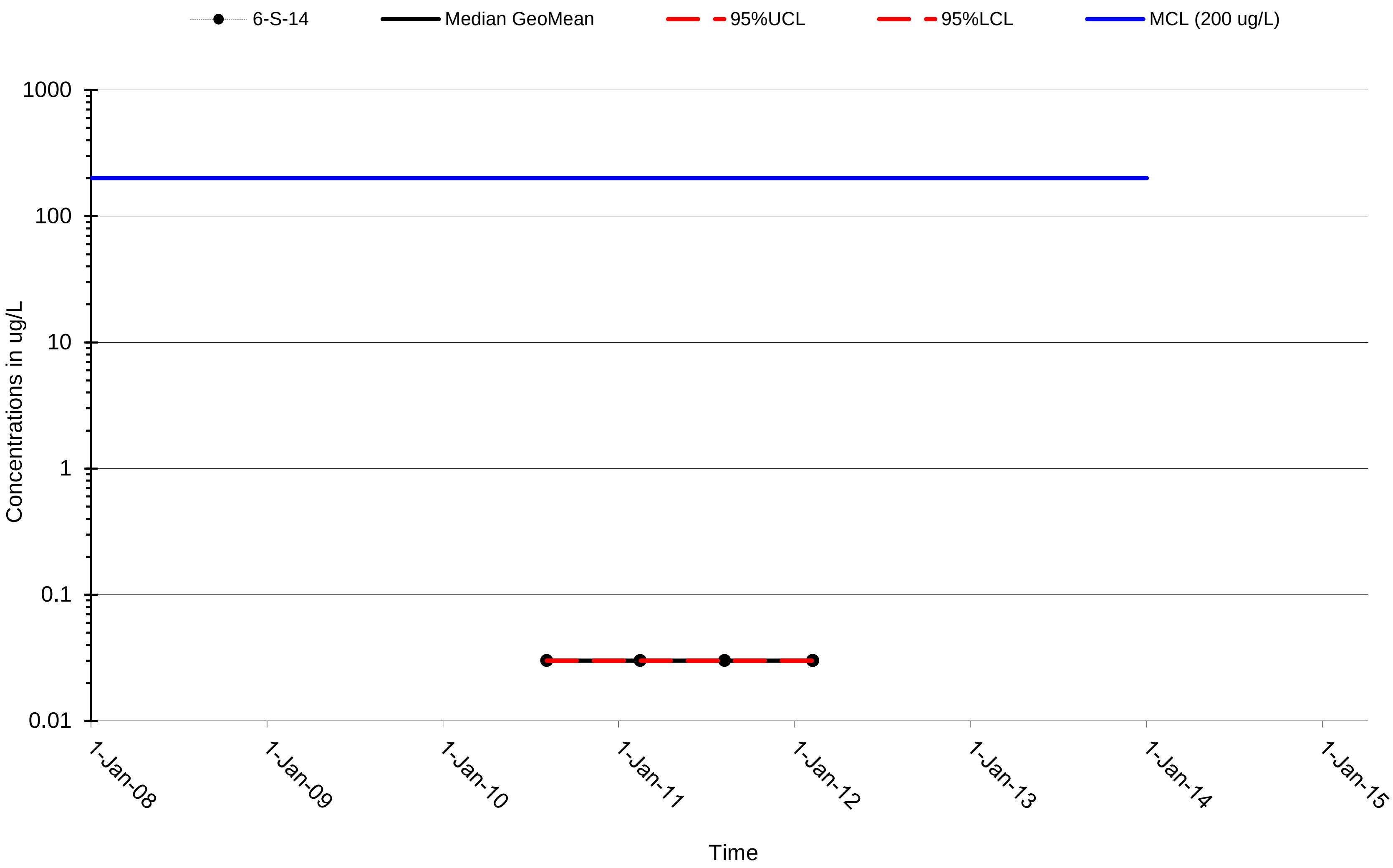

TCE in Mid-Plume Well
MW-10
MW-10
MW-10 Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
Concentrations in ug/L
100
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

# TCE in Mid-Plume Area Recovery Well
## PW-3

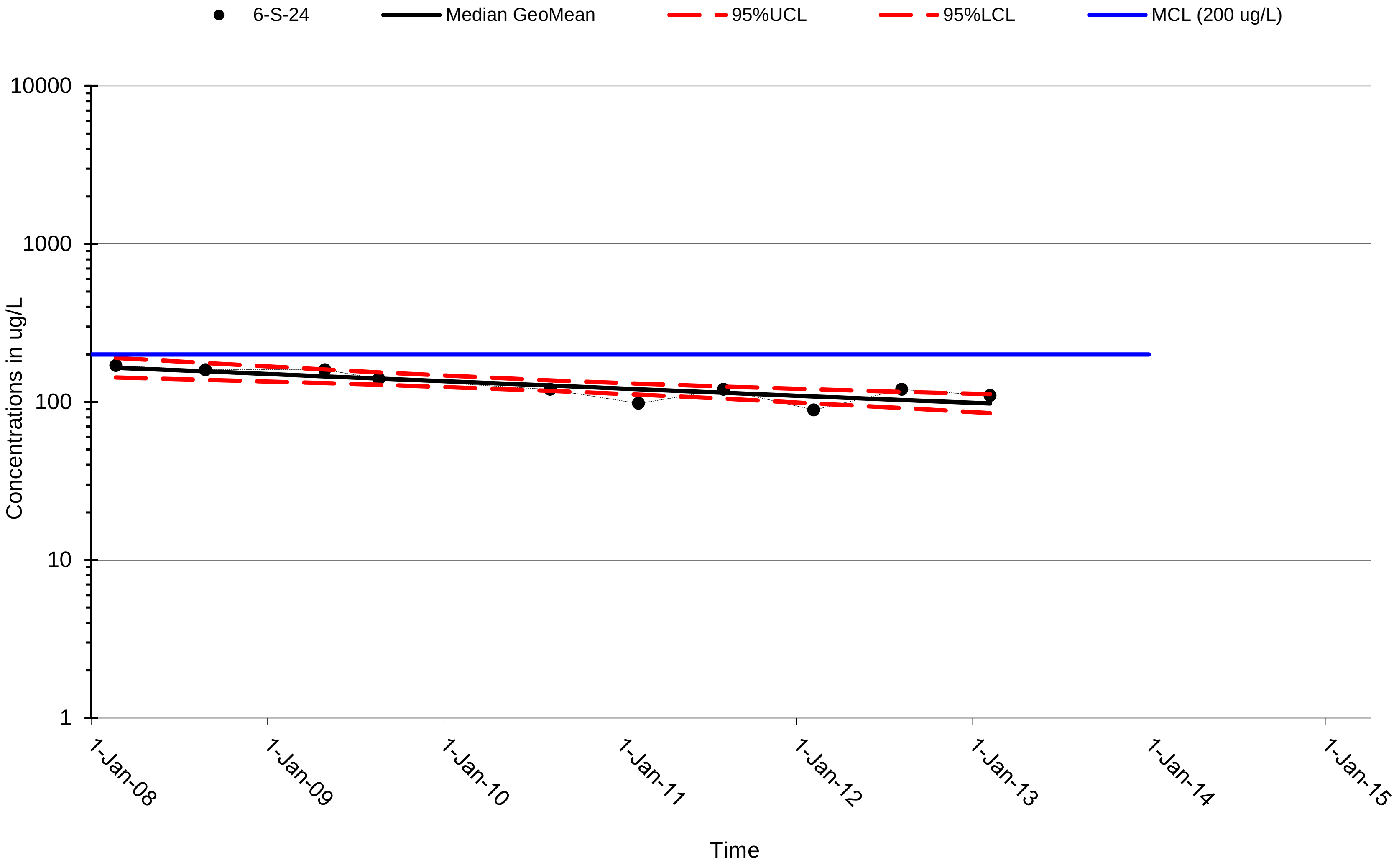



1,1,1-TCA in Mid-Plume Well
6-S-06
6-S-06
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
Concentrations in ug/L
10000
1000
100
10
1
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

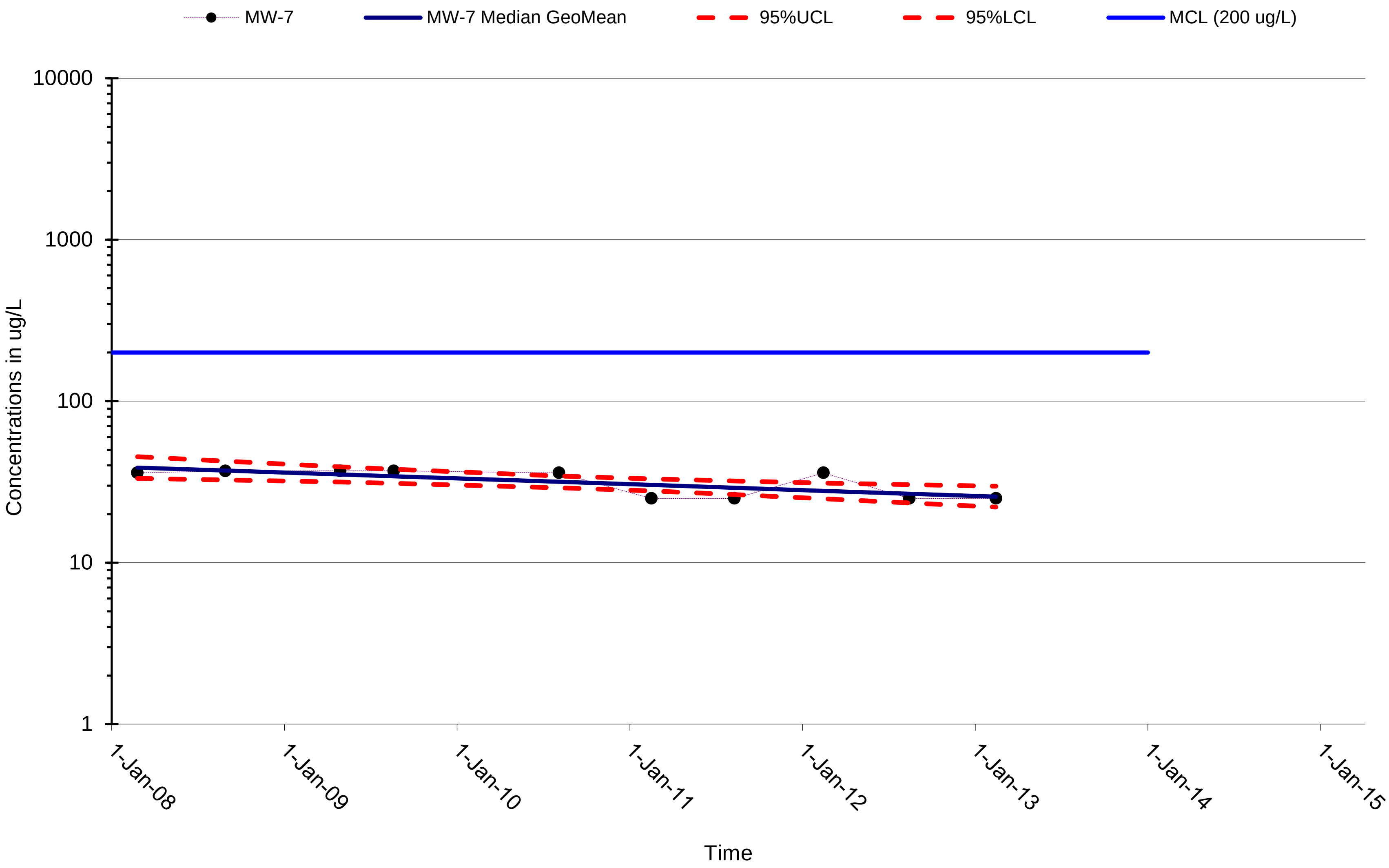
# 1,1,1-TCA in Mid-Plume Area Well
## 6-S-14



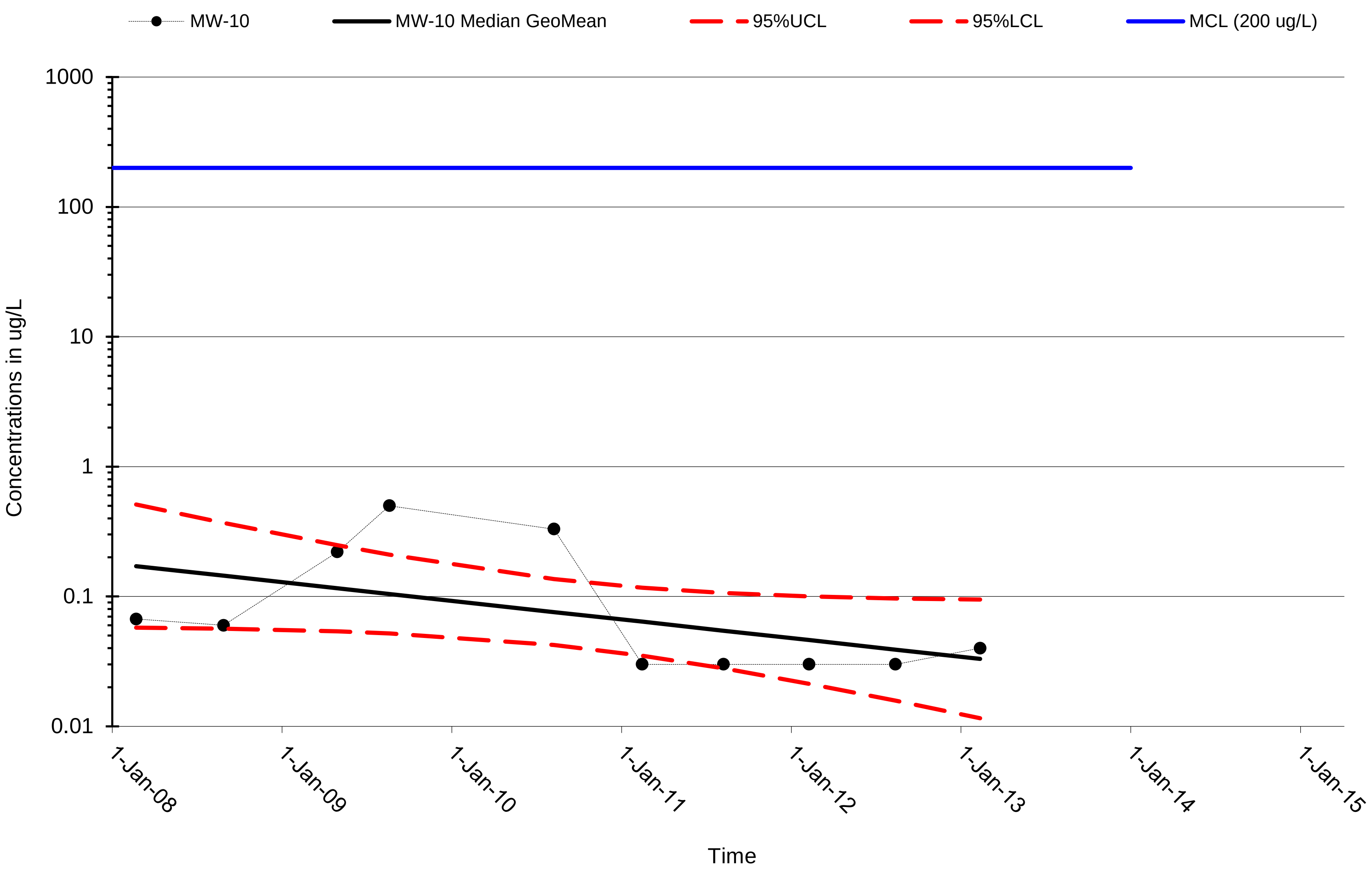
## 1,1,1-TCA in Mid-Plume Area Well
## 6-S-24

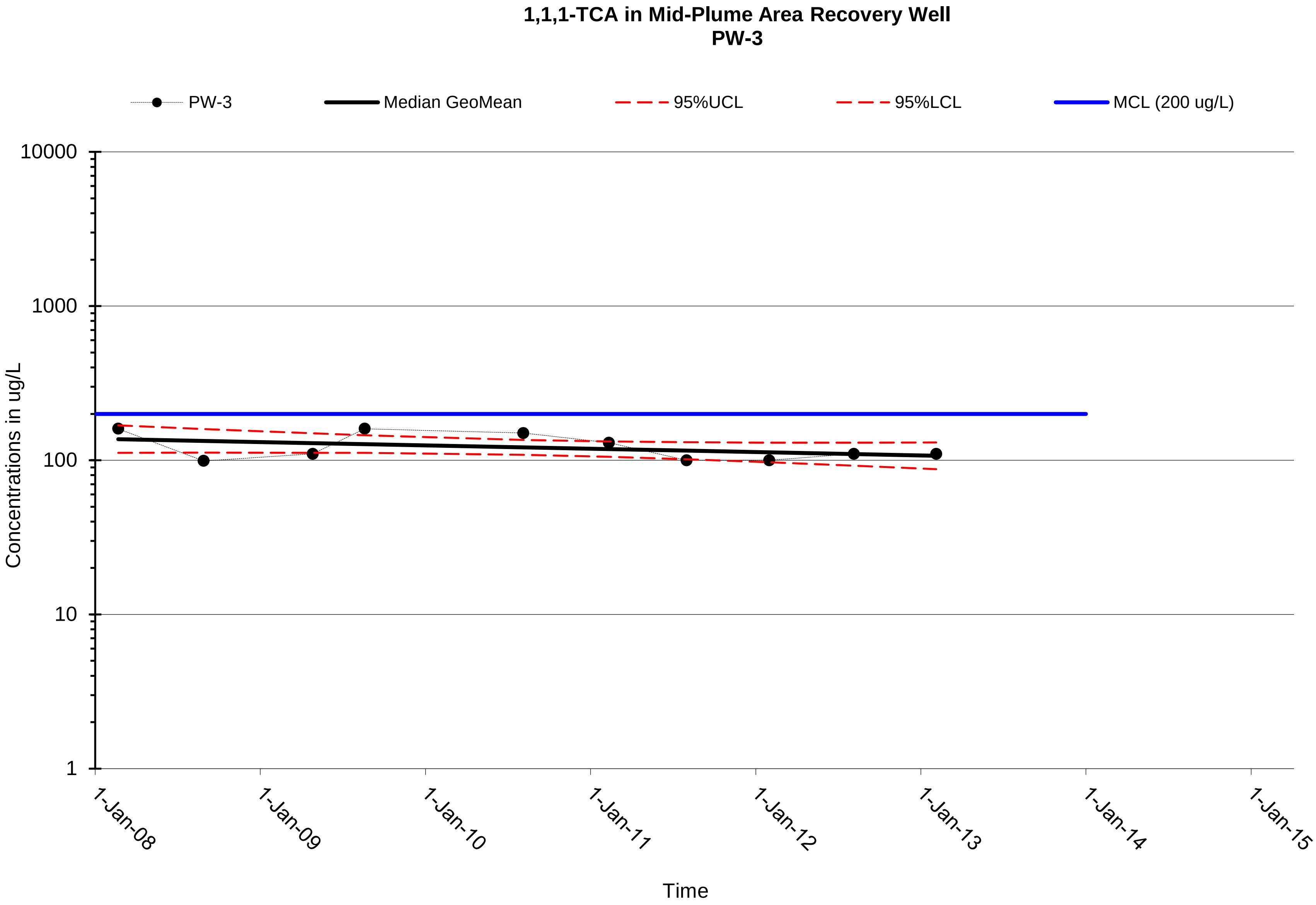


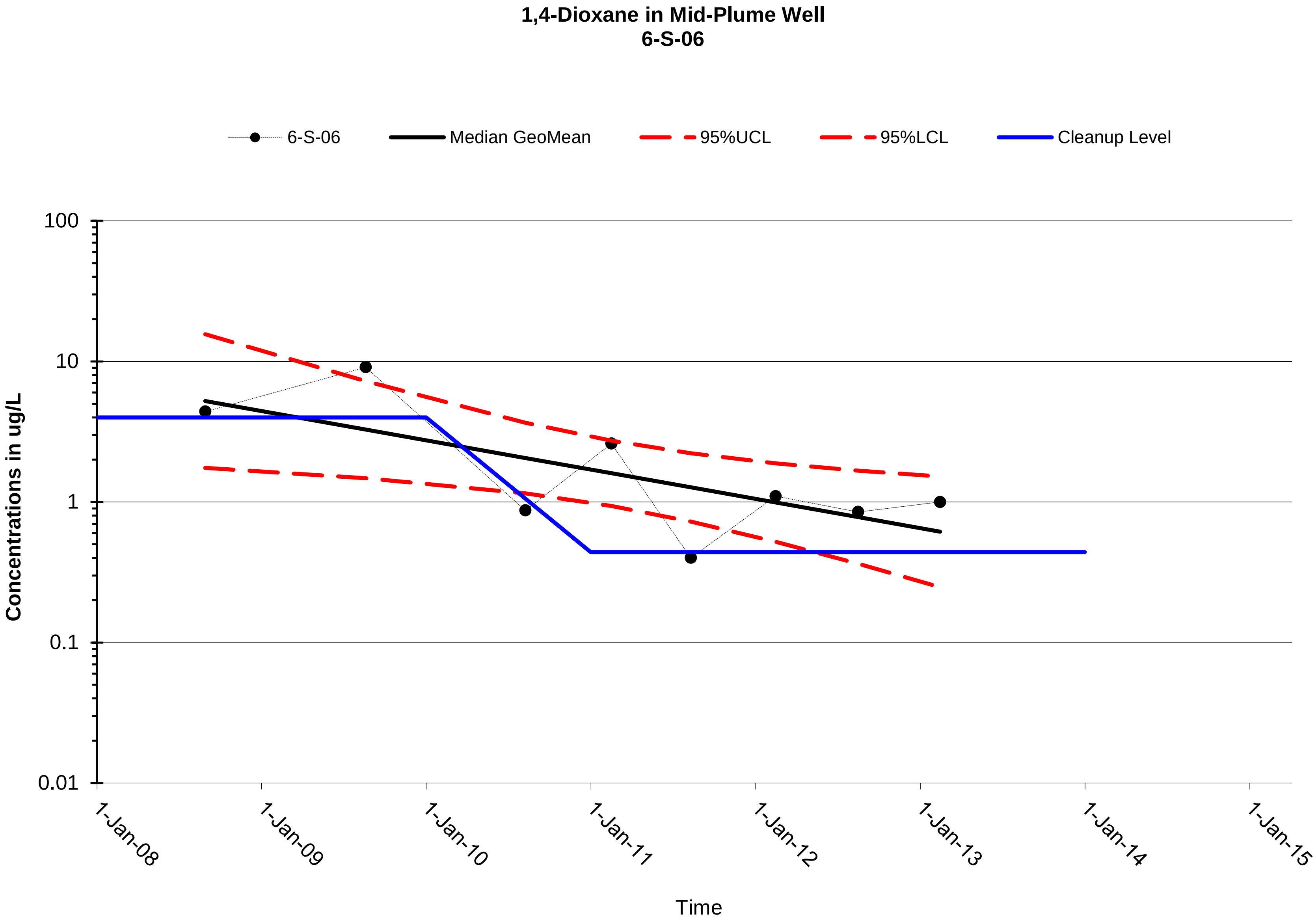
## 1,1,1-TCA in Mid-Plume Area Well
## MW-7

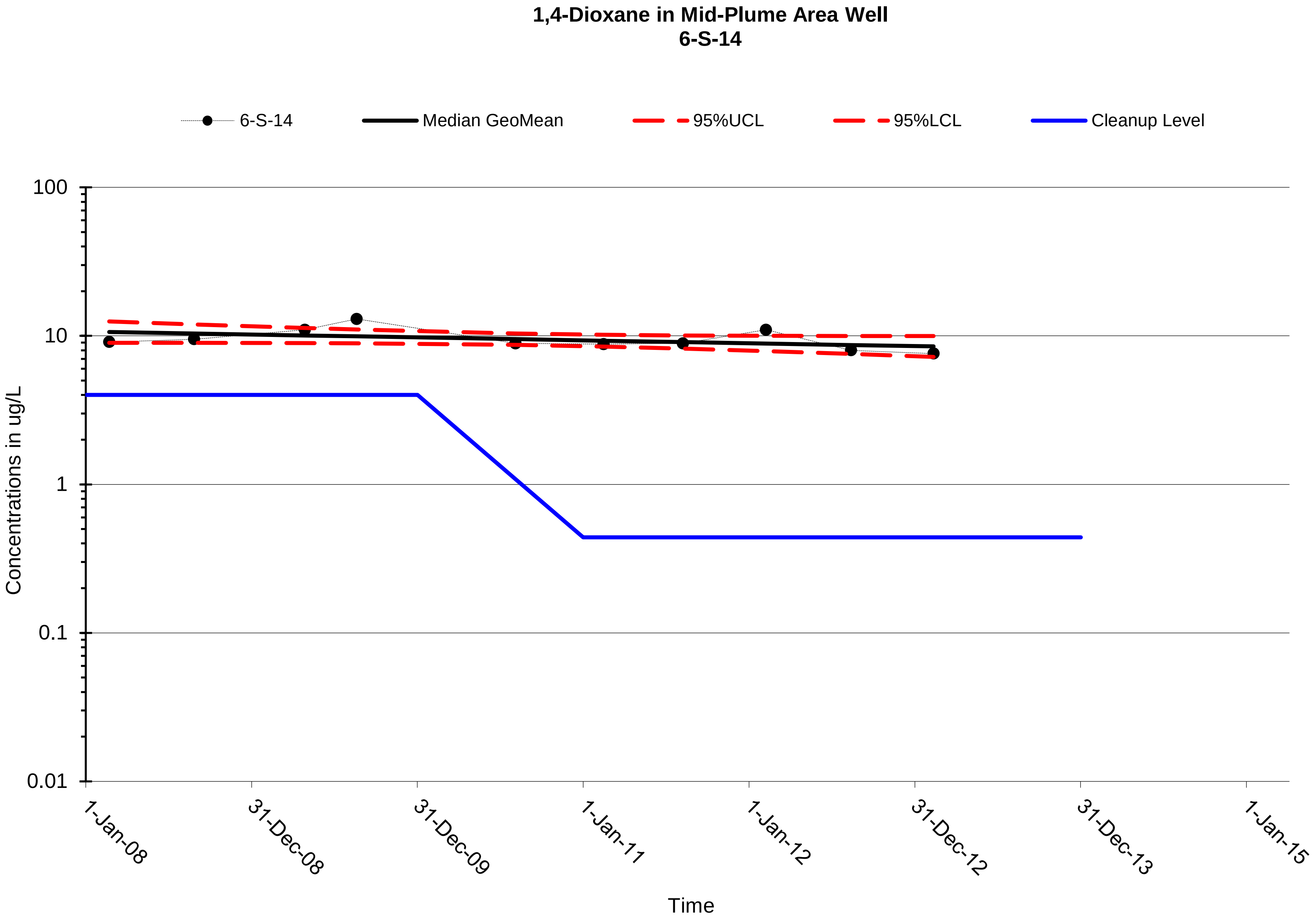


## 1,1,1-TCA in Mid-Plume Well
## MW-10

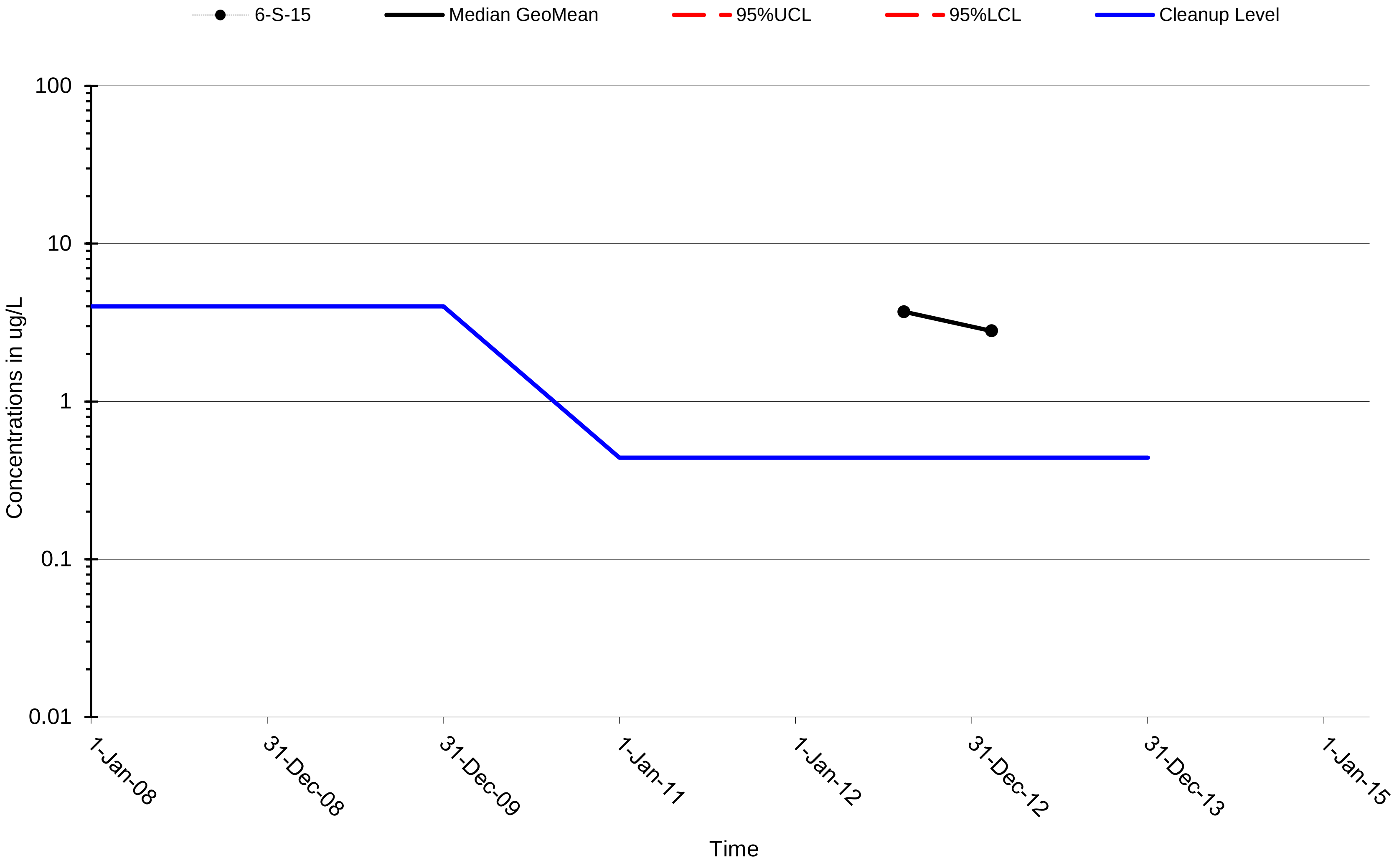


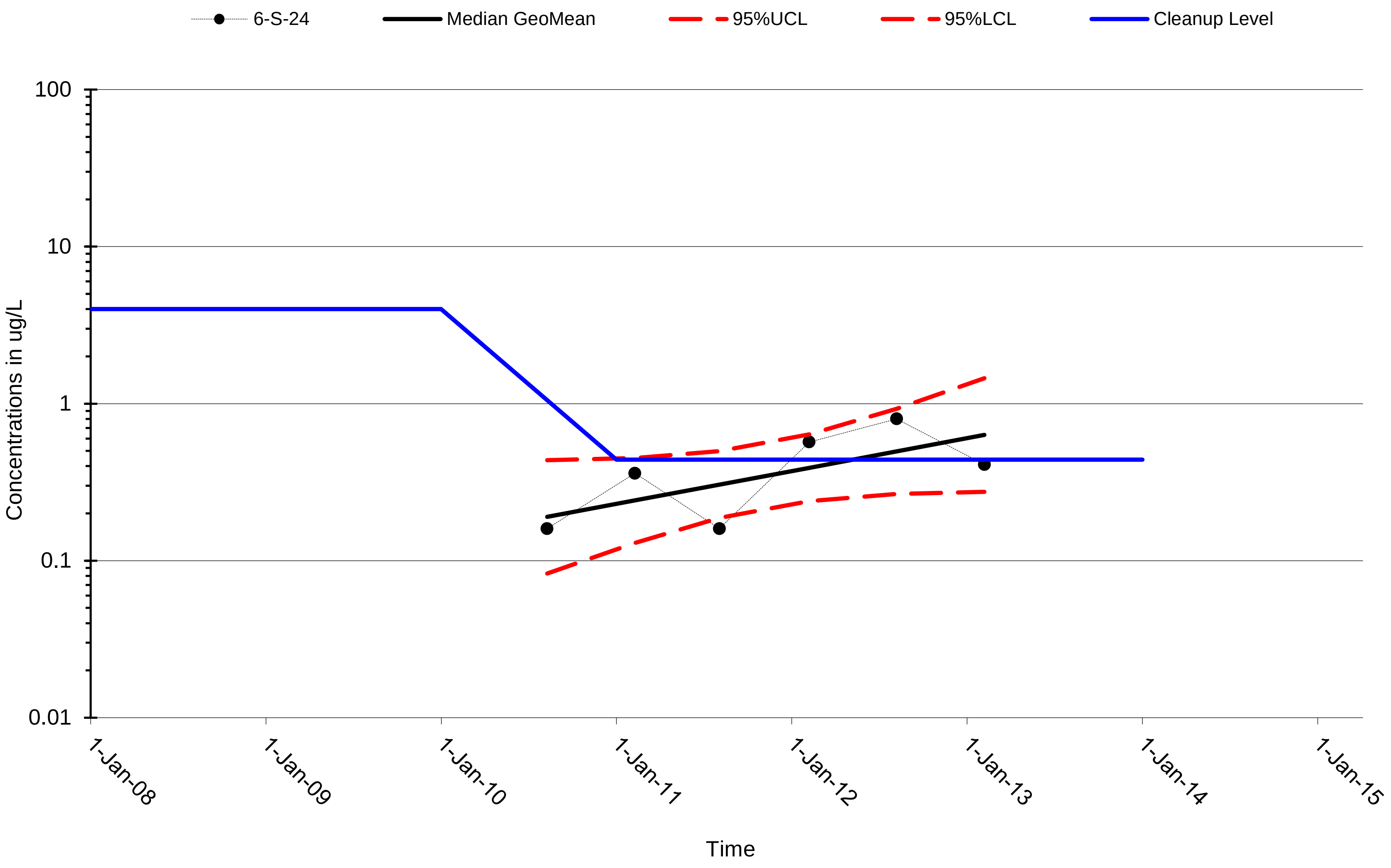

1,1,1-TCA in Mid-Plume Area Recovery Well
PW-3
PW-3
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
10000
1000
100
10
1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time


1,4-Dioxane in Mid-Plume Well
6-S-06
6-S-06
Median GeoMean
95%UCL
95%LCL
Cleanup Level
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

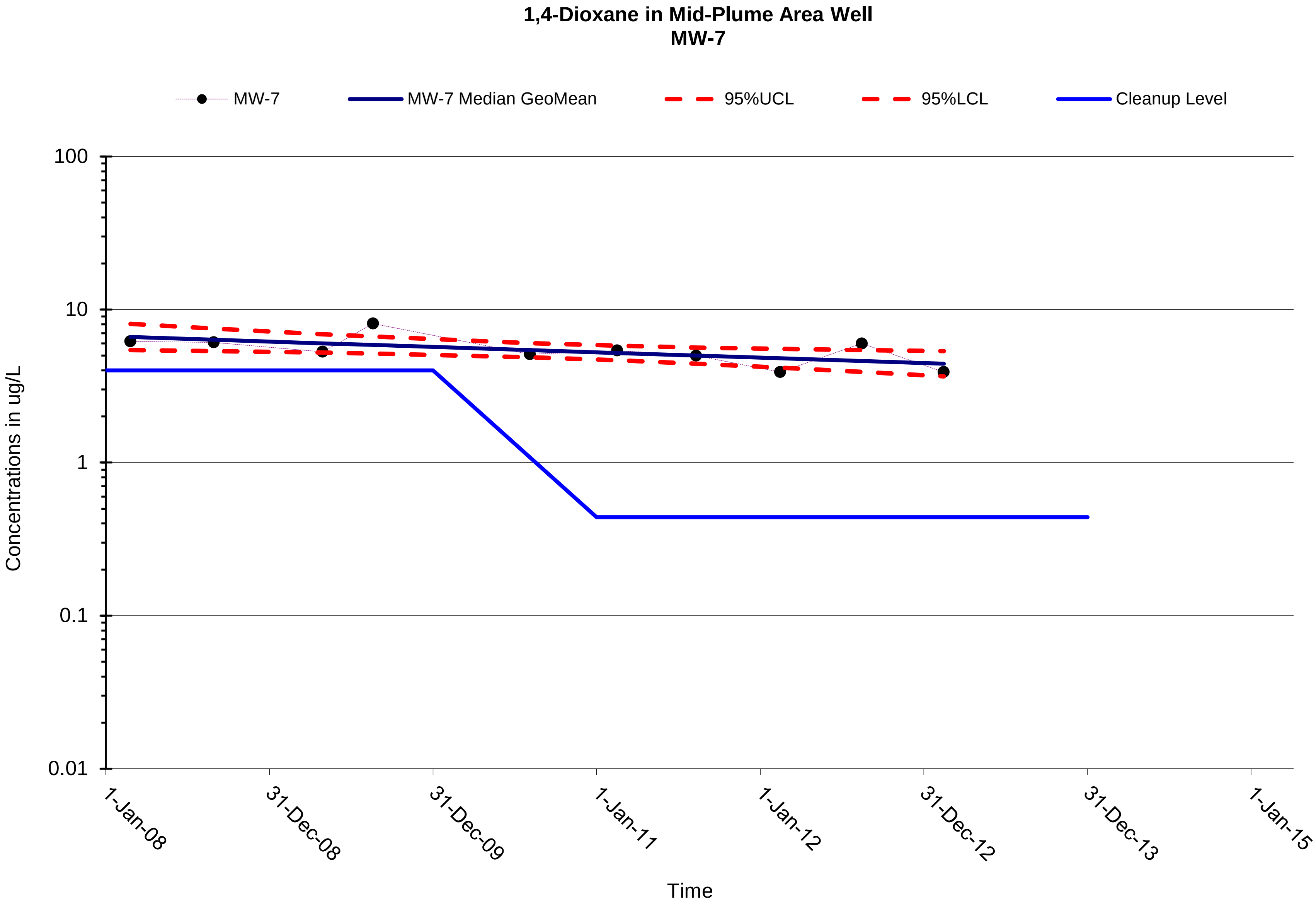

1,4-Dioxane in Mid-Plume Area Well
6-S-14
6-S-14
Median GeoMean
95%UCL
95%LCL
Cleanup Level
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
31-Dec-08
31-Dec-09
1-Jan-11
1-Jan-12
31-Dec-12
31-Dec-13
1-Jan-15
Time

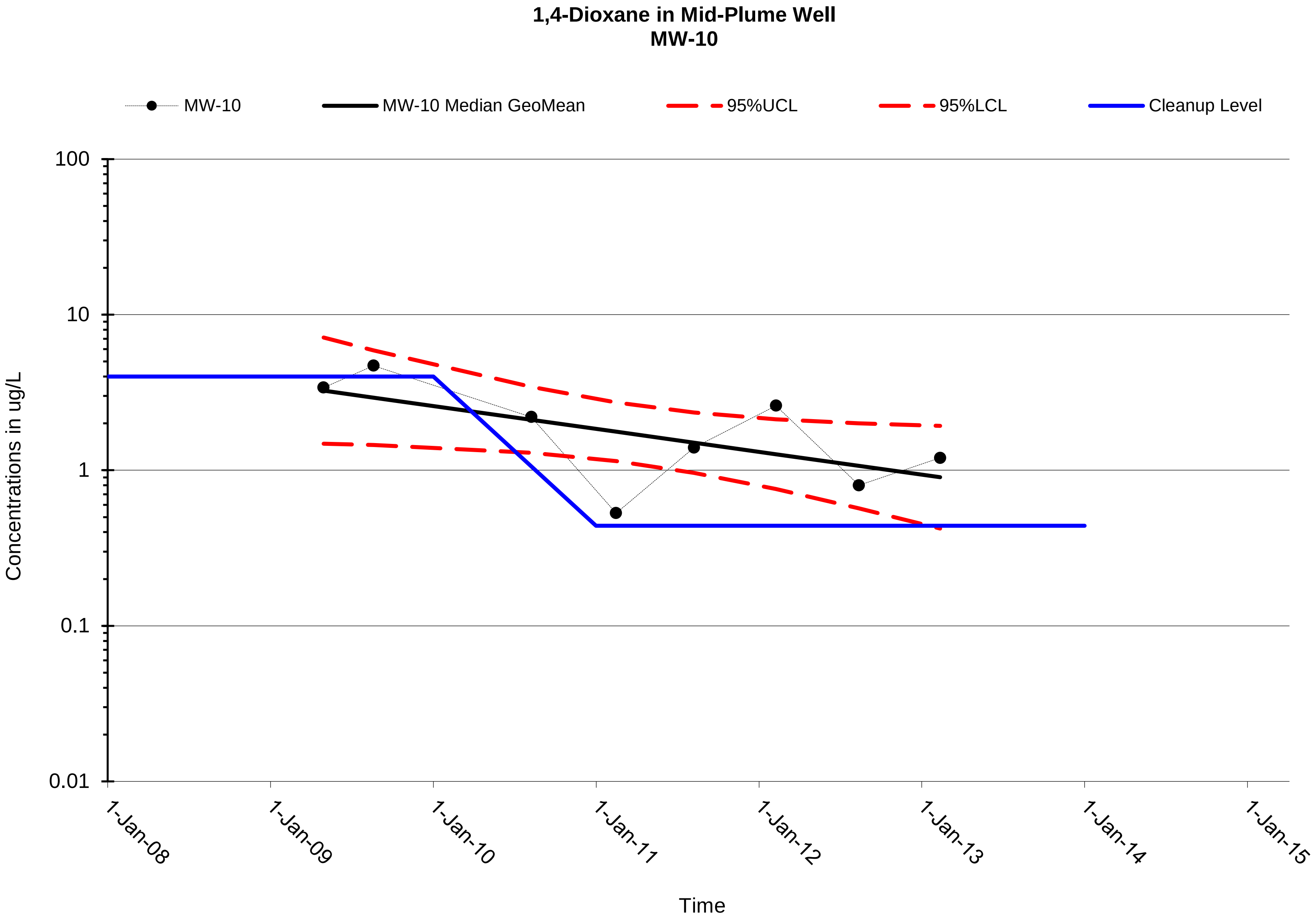
## 1,4-Dioxane in Mid-Plume Area Well
## 6-S-15





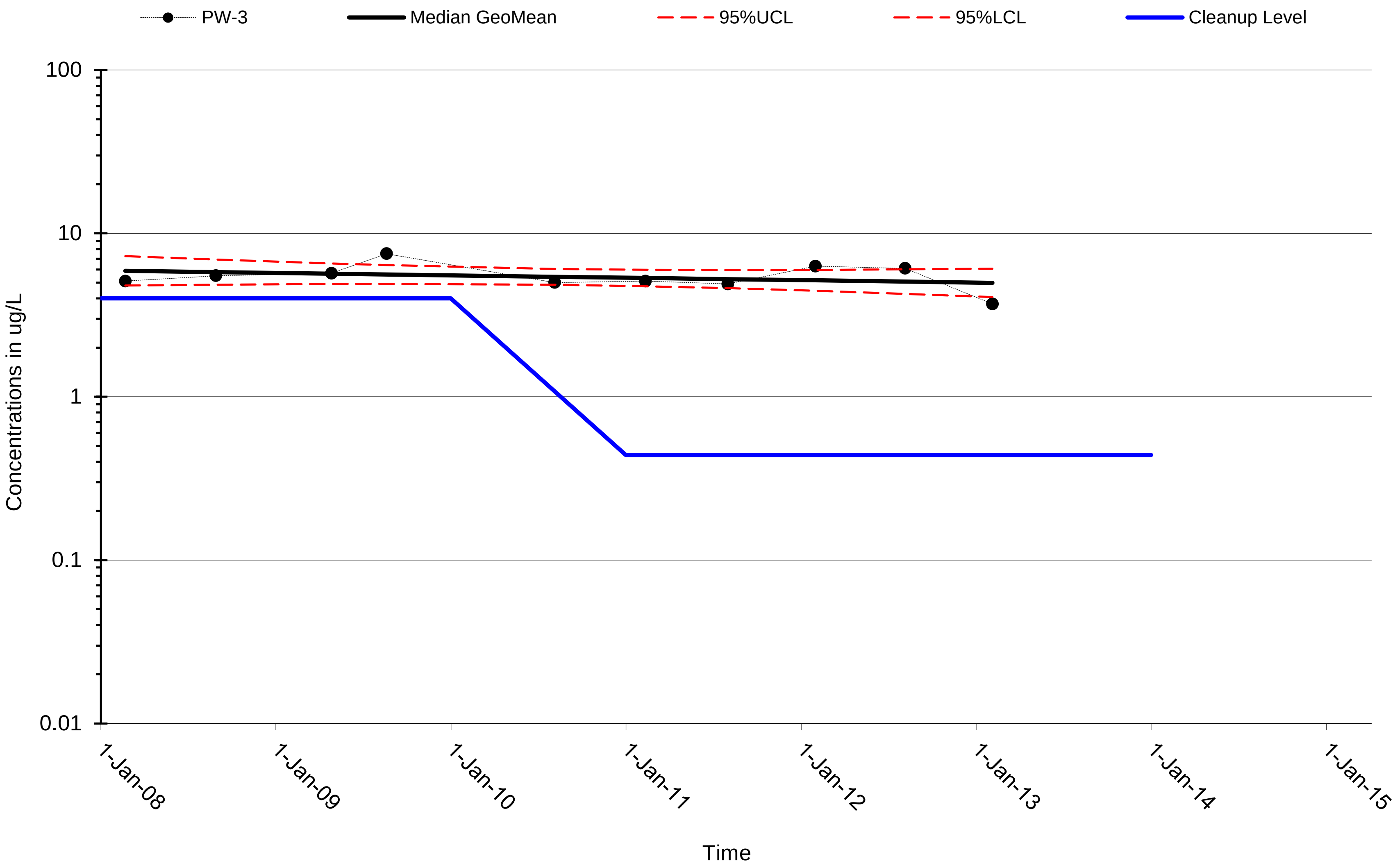
**1,4-Dioxane in Mid-Plume Area Well**
**6-S-24**

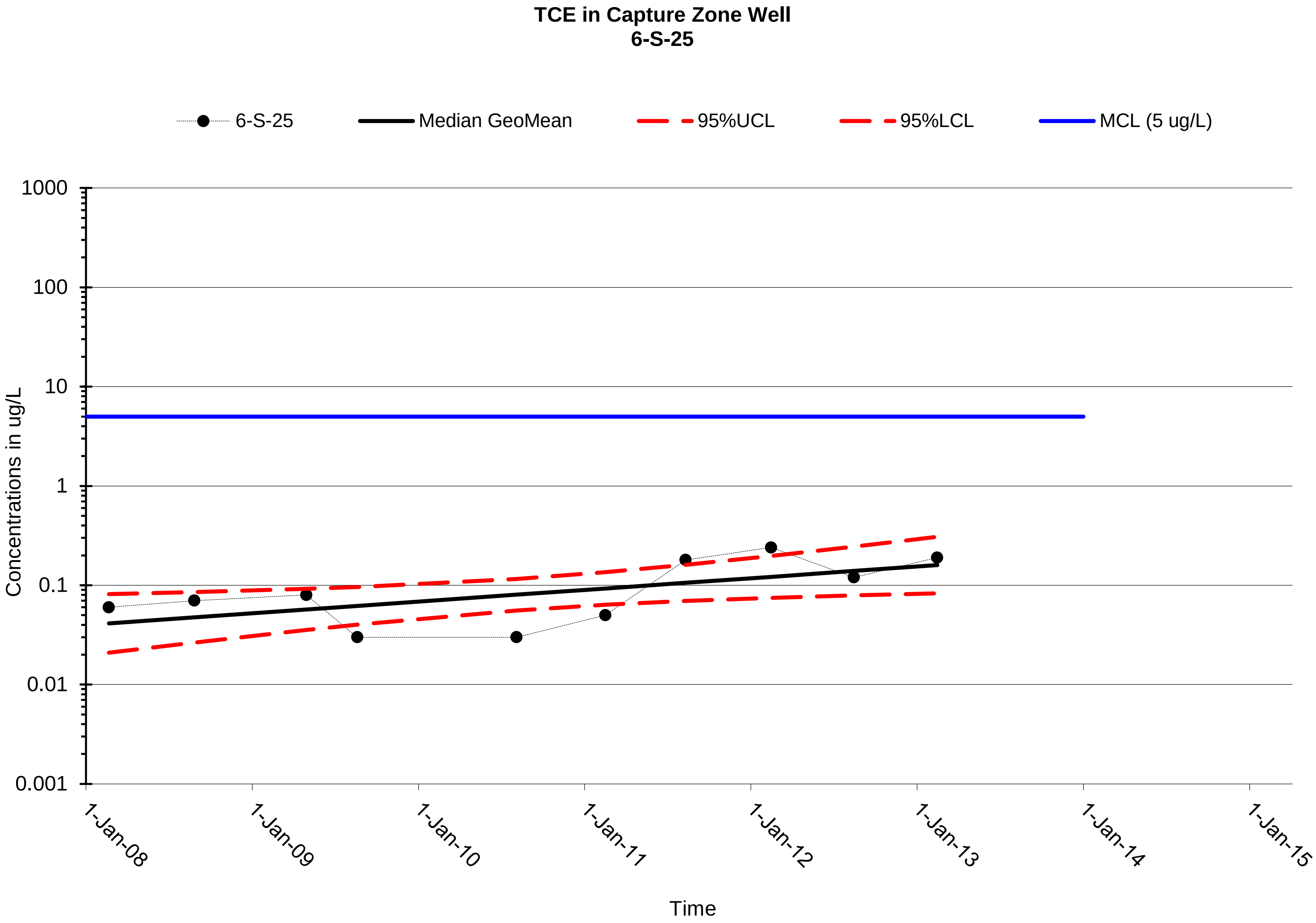

1,4-Dioxane in Mid-Plume Area Well
MW-7
MW-7
MW-7 Median GeoMean
95%UCL
95%LCL
Cleanup Level
Concentrations in ug/L
100
10
1
0.1
0.01
1-Jan-08
31-Dec-08
31-Dec-09
1-Jan-11
1-Jan-12
31-Dec-12
31-Dec-13
1-Jan-15
Time

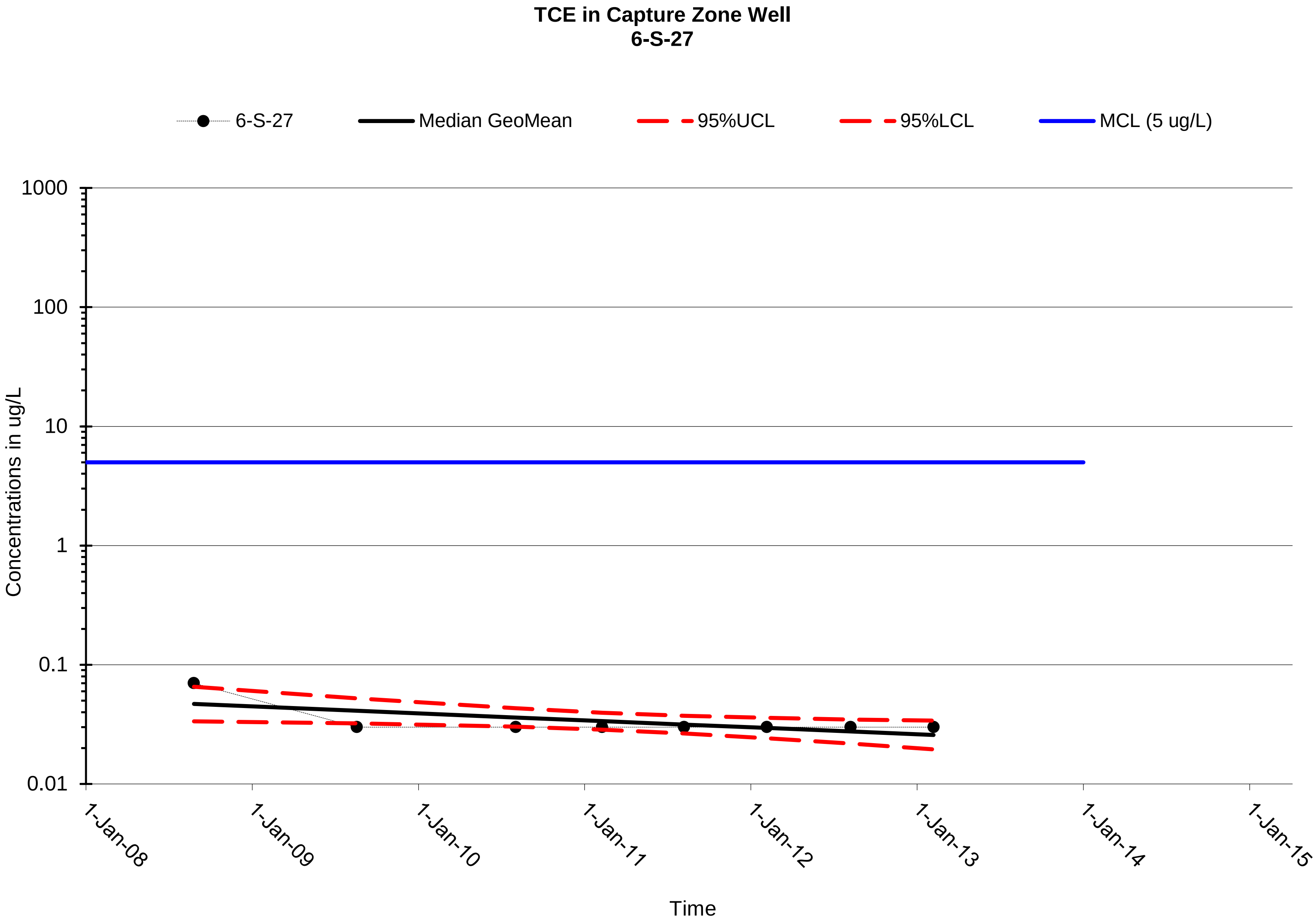


**1,4-Dioxane in Mid-Plume Well**
**MW-10**

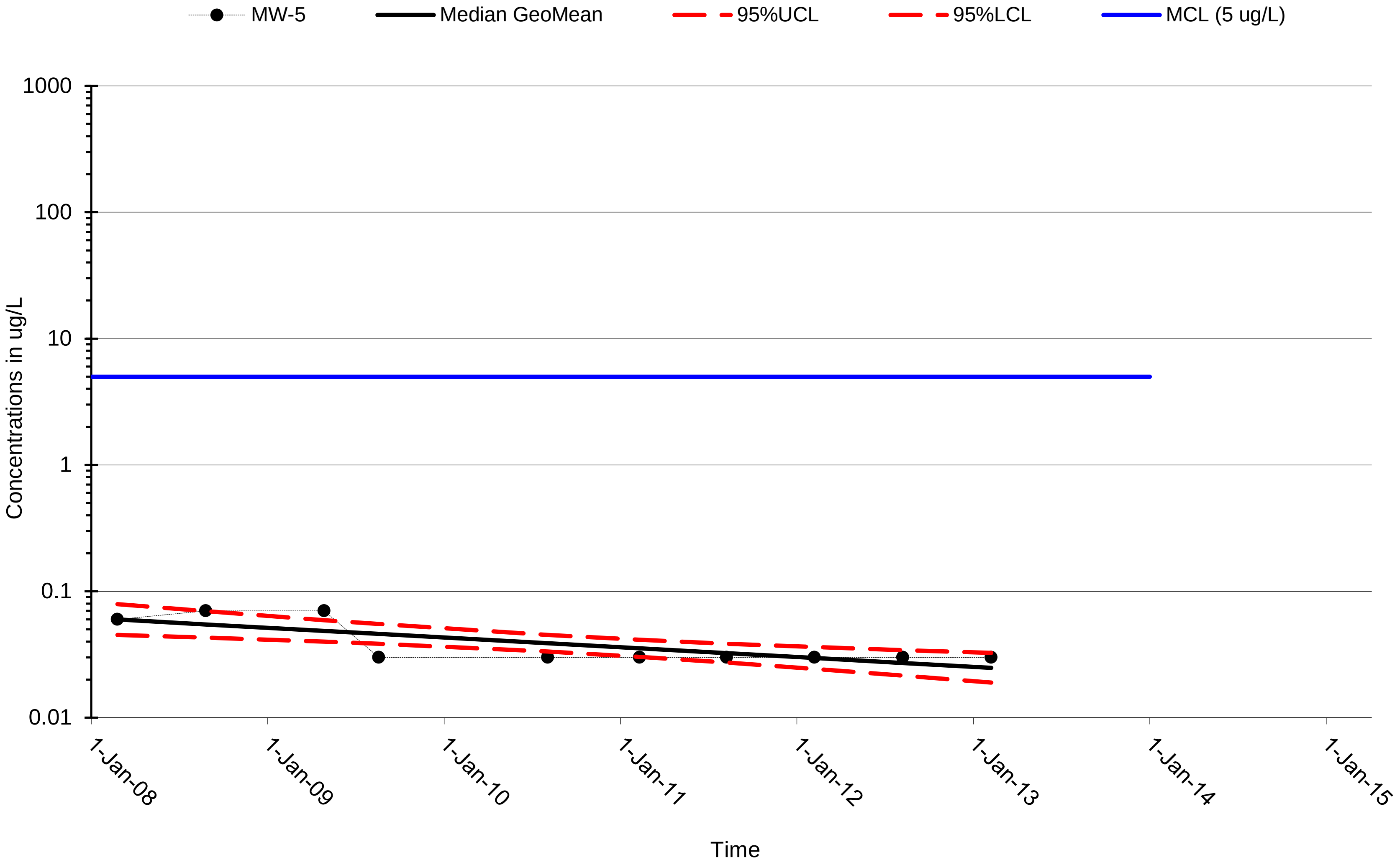
## 1,4-Dioxane in Mid-Plume Area Recovery Well
## PW-3



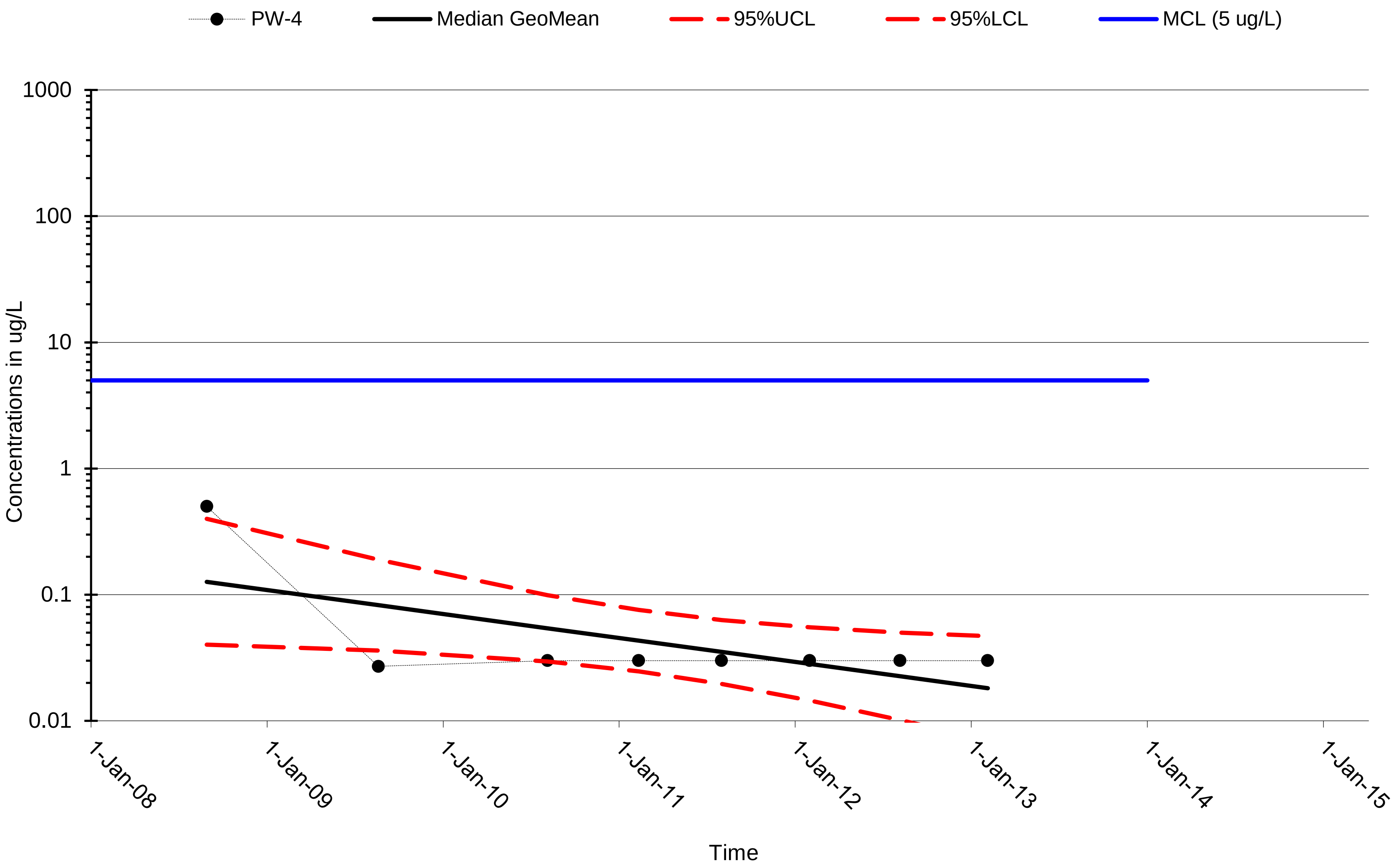

TCE in Capture Zone Well
6-S-25
6-S-25
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
Concentrations in ug/L
1000
100
10
1
0.1
0.01
0.001
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

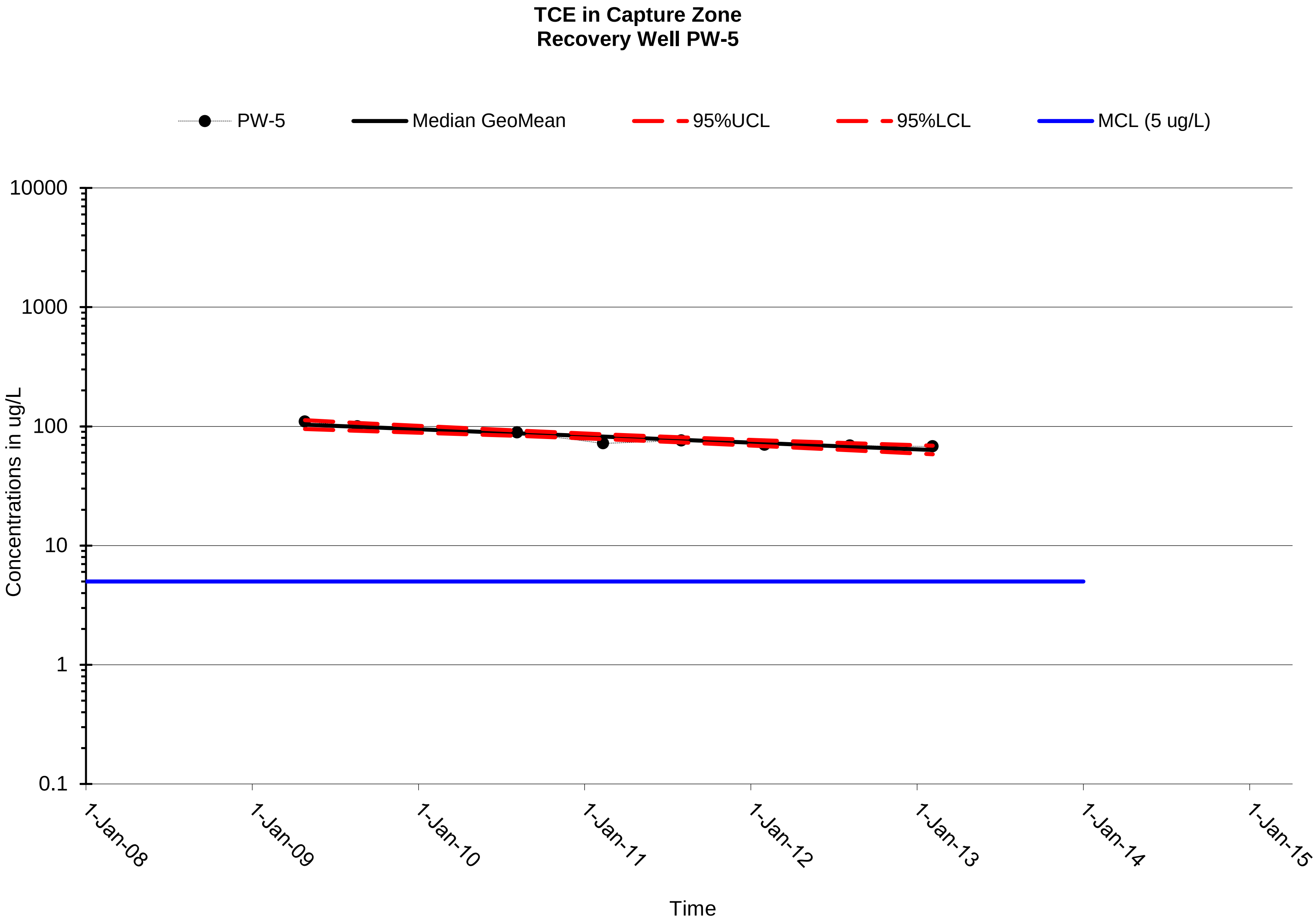

TCE in Capture Zone Well
6-S-27
6-S-27
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
1000
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

## TCE in Capture Zone Well
## MW-5

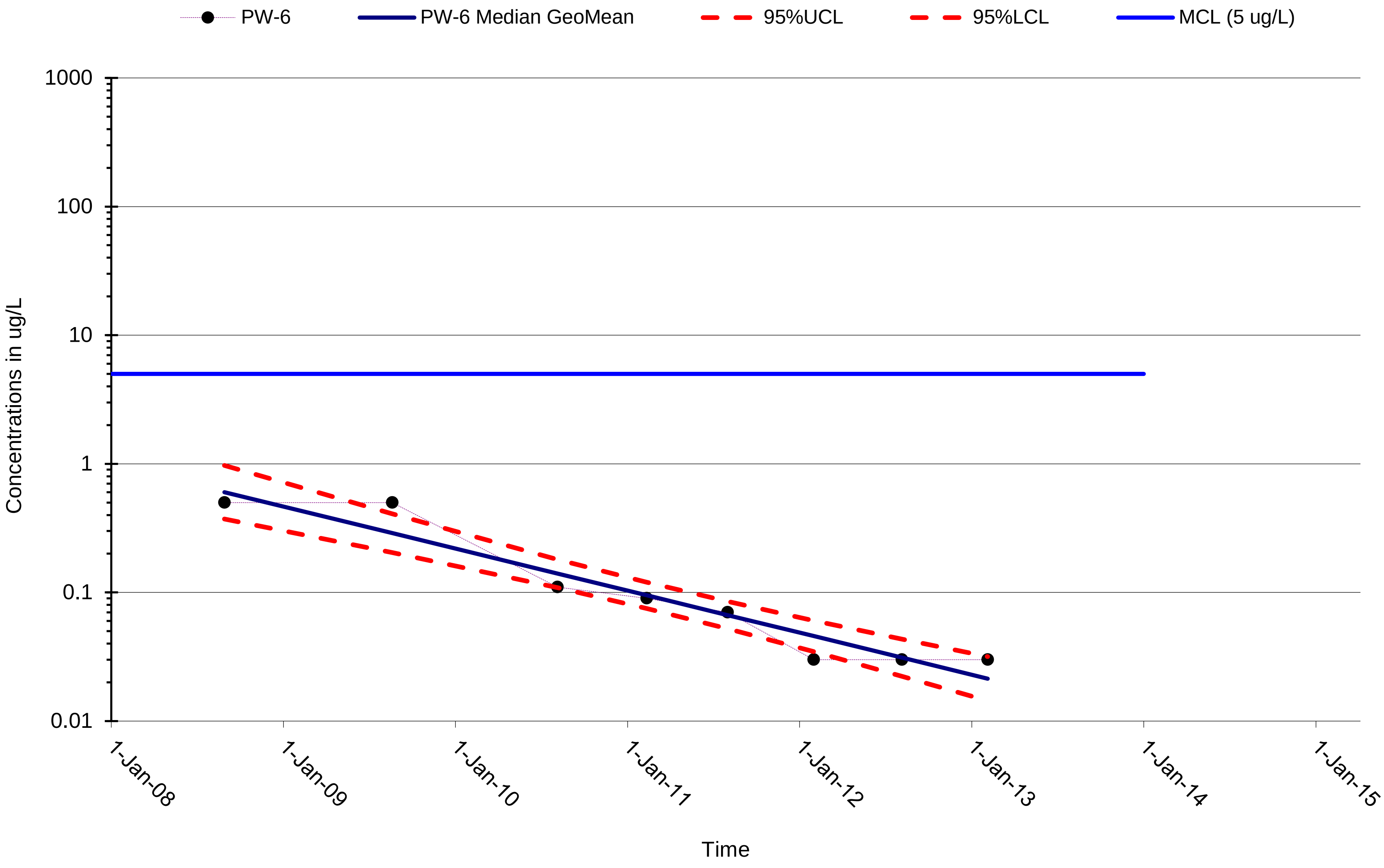


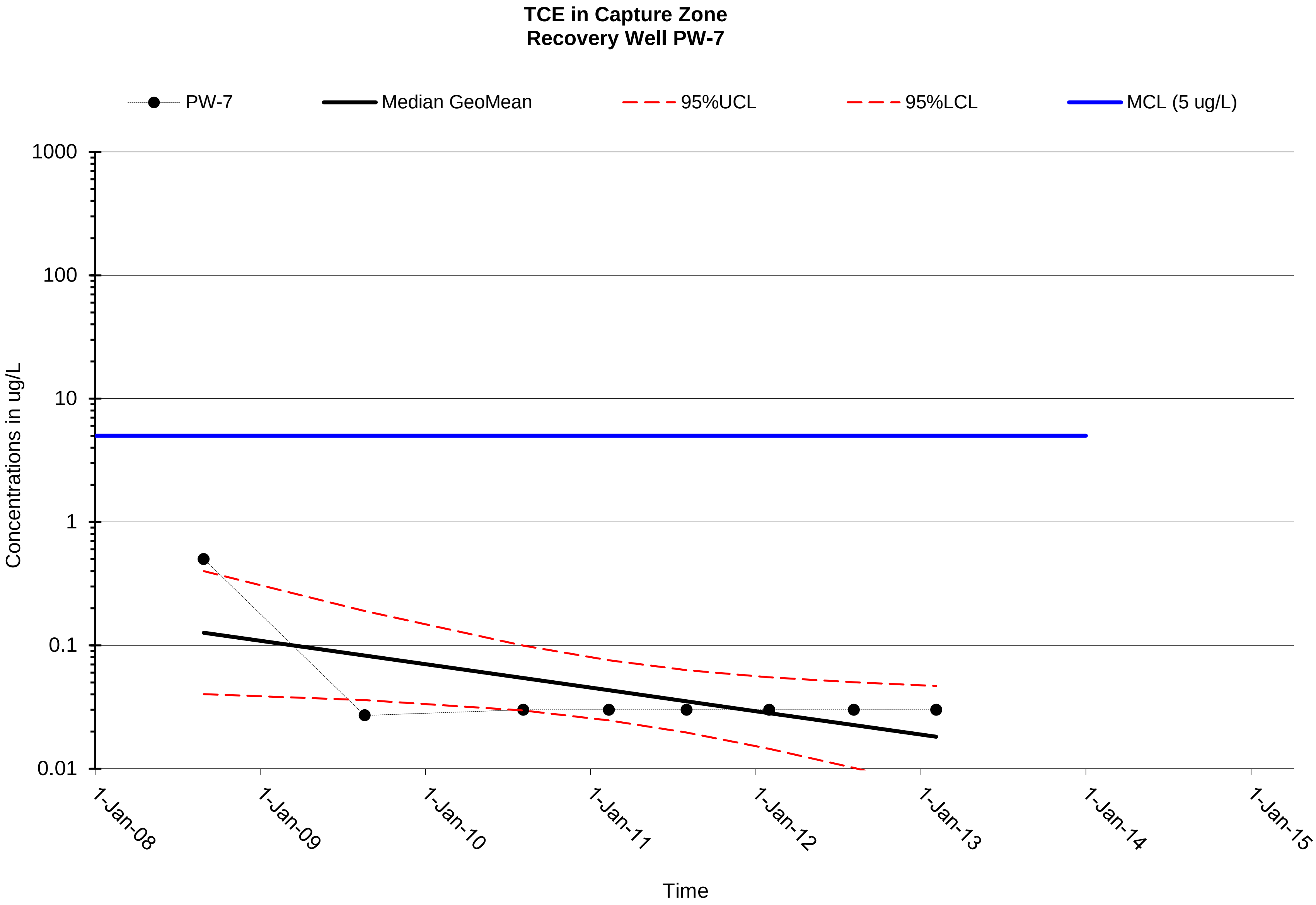
## TCE in Capture Zone
## Recovery Well PW-4



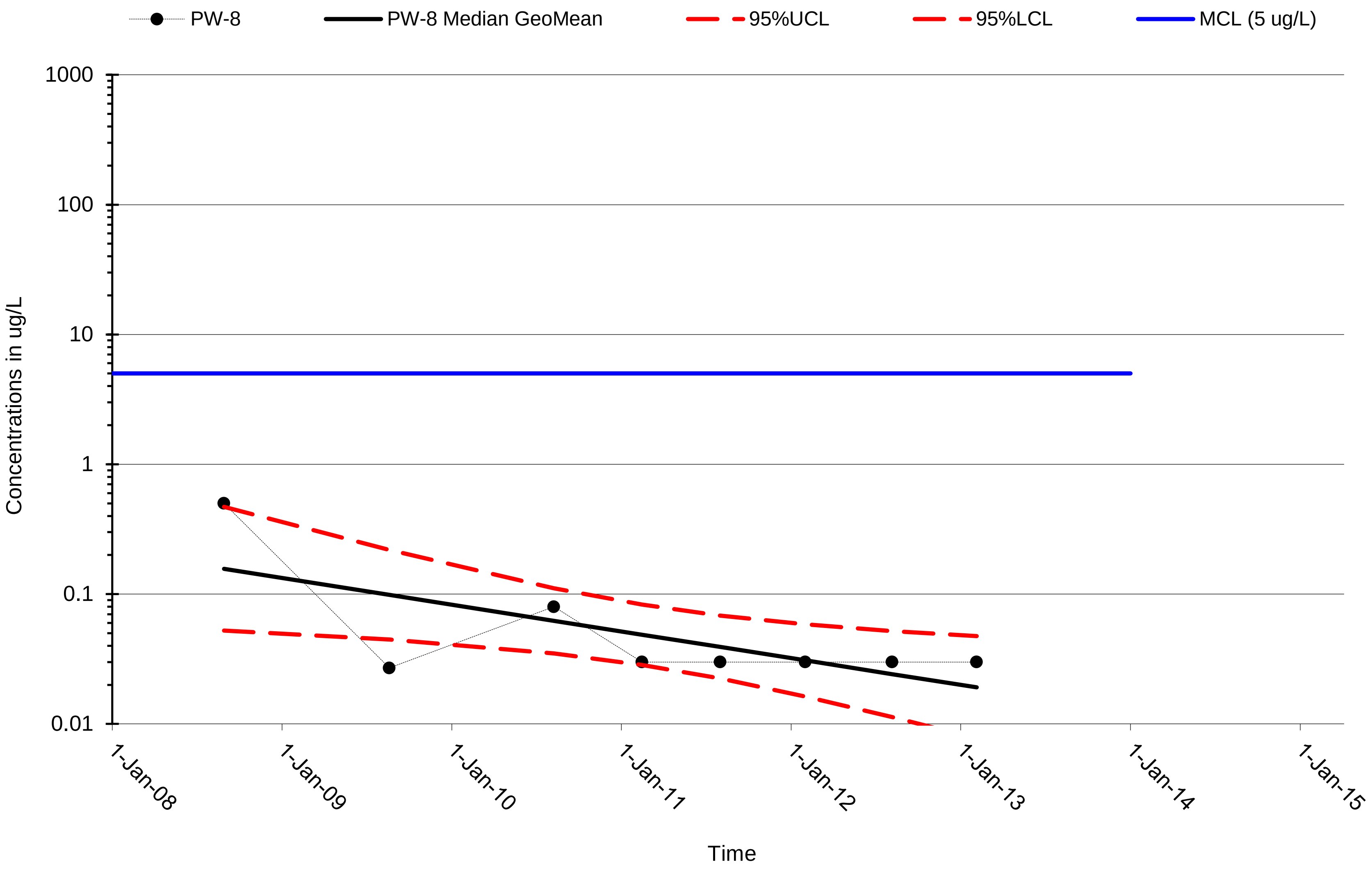

TCE in Capture Zone
Recovery Well PW-5
PW-5
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
10000
1000
100
10
1
0.1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

## TCE in Capture Zone
## Recovery Well PW-6

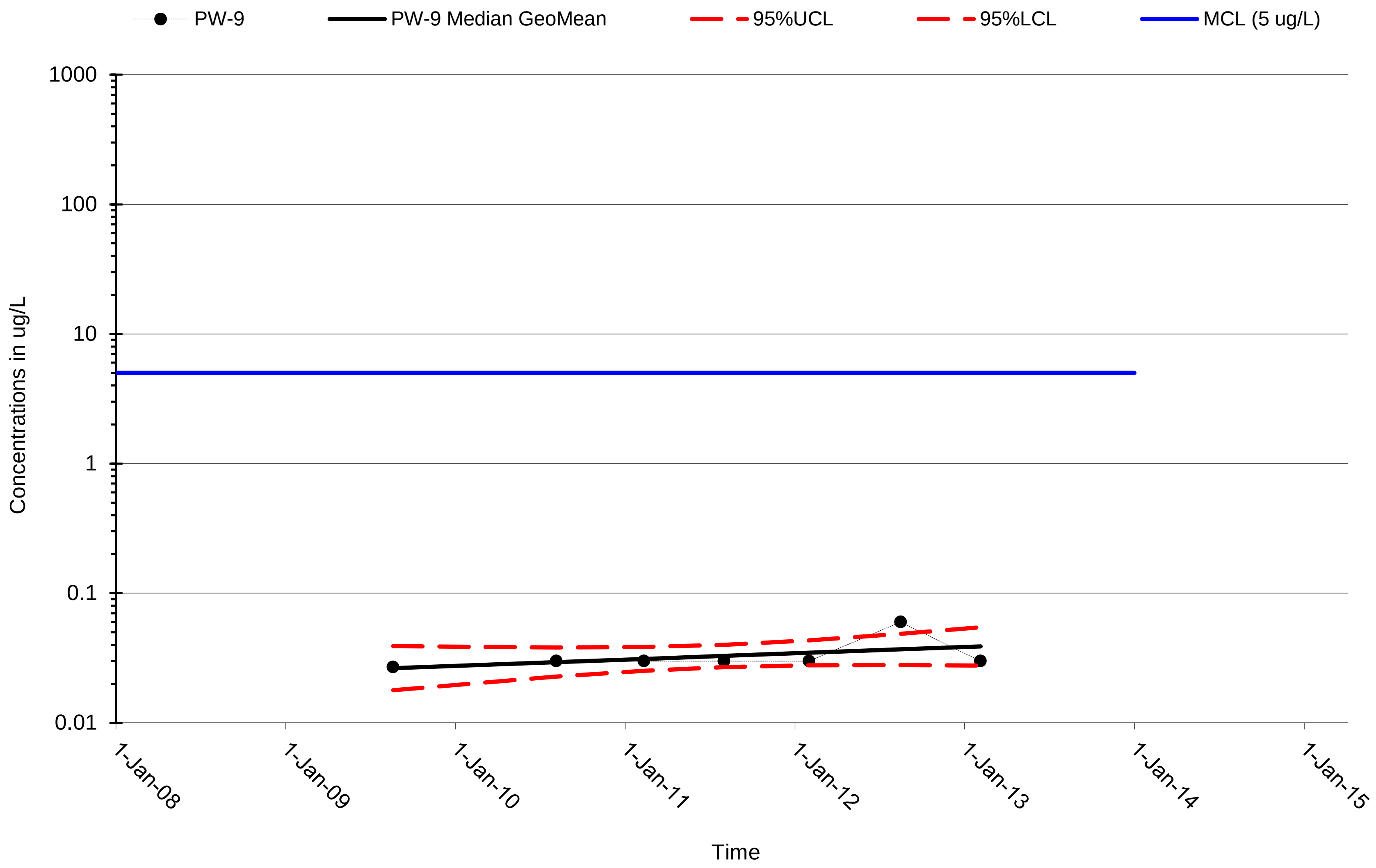



TCE in Capture Zone
Recovery Well PW-7
PW-7
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
Concentrations in ug/L
1000
100
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

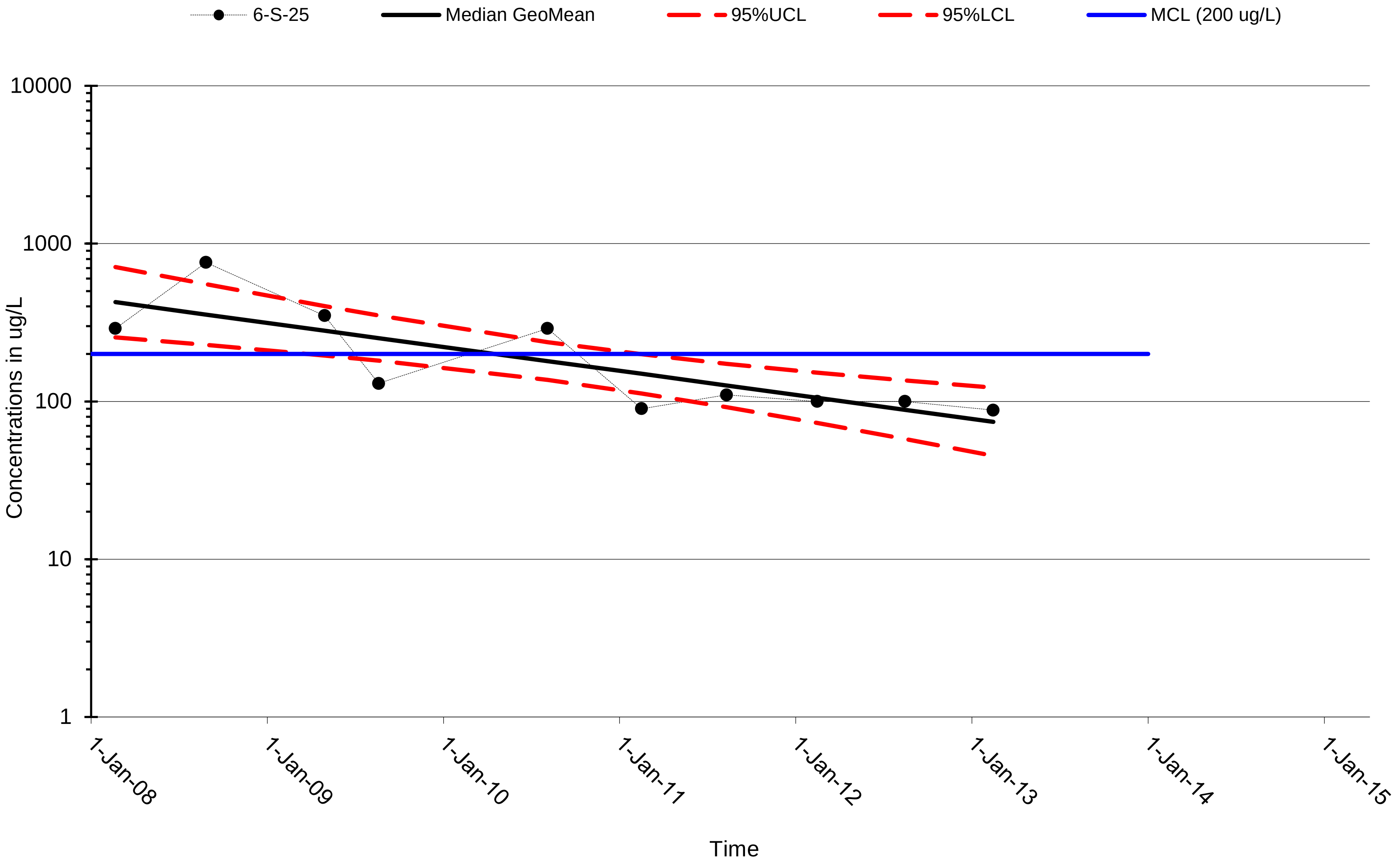
**TCE in Capture Zone**
**Recovery Well PW-8**



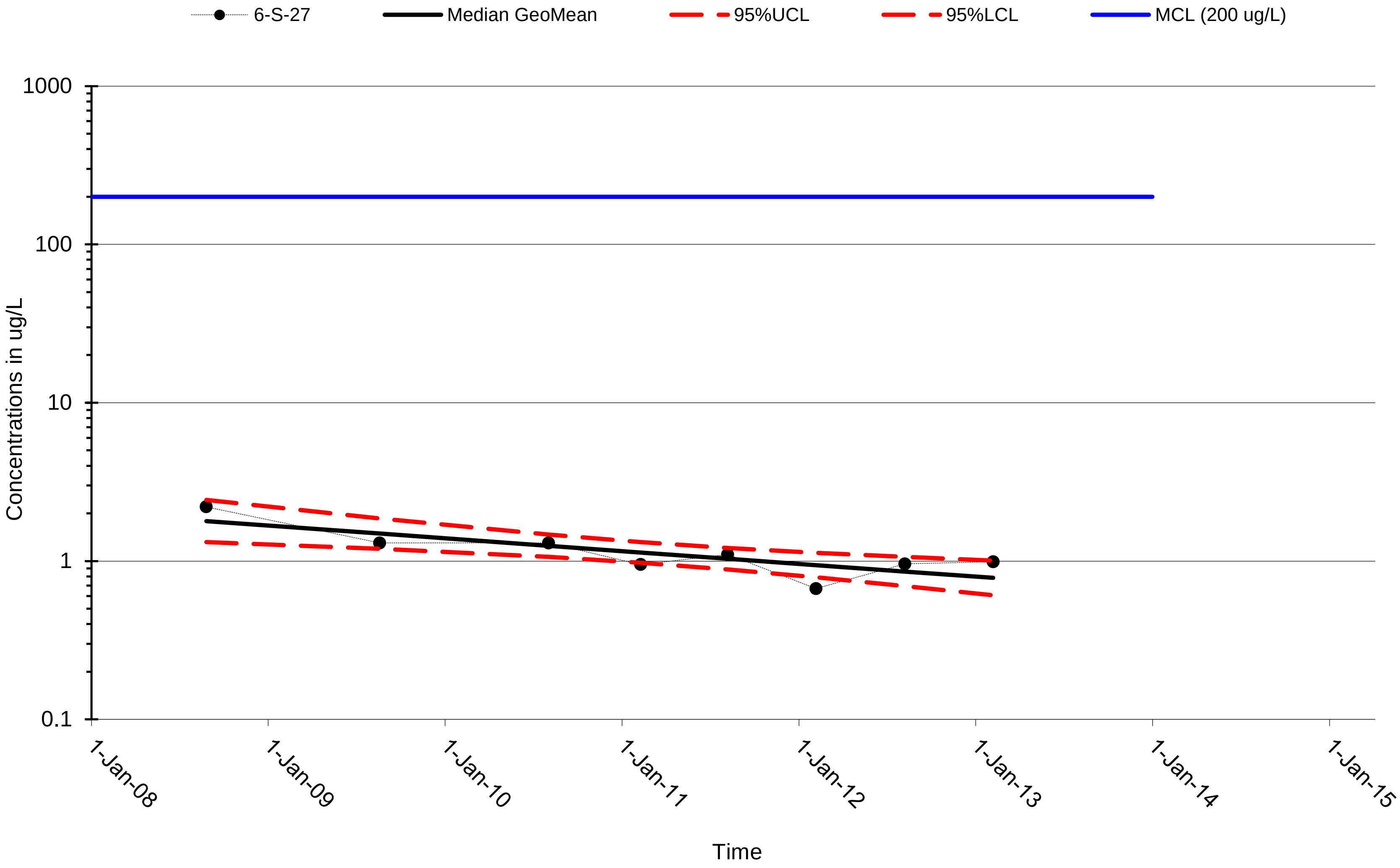
## TCE in Capture Zone
## Recovery Well PW-9

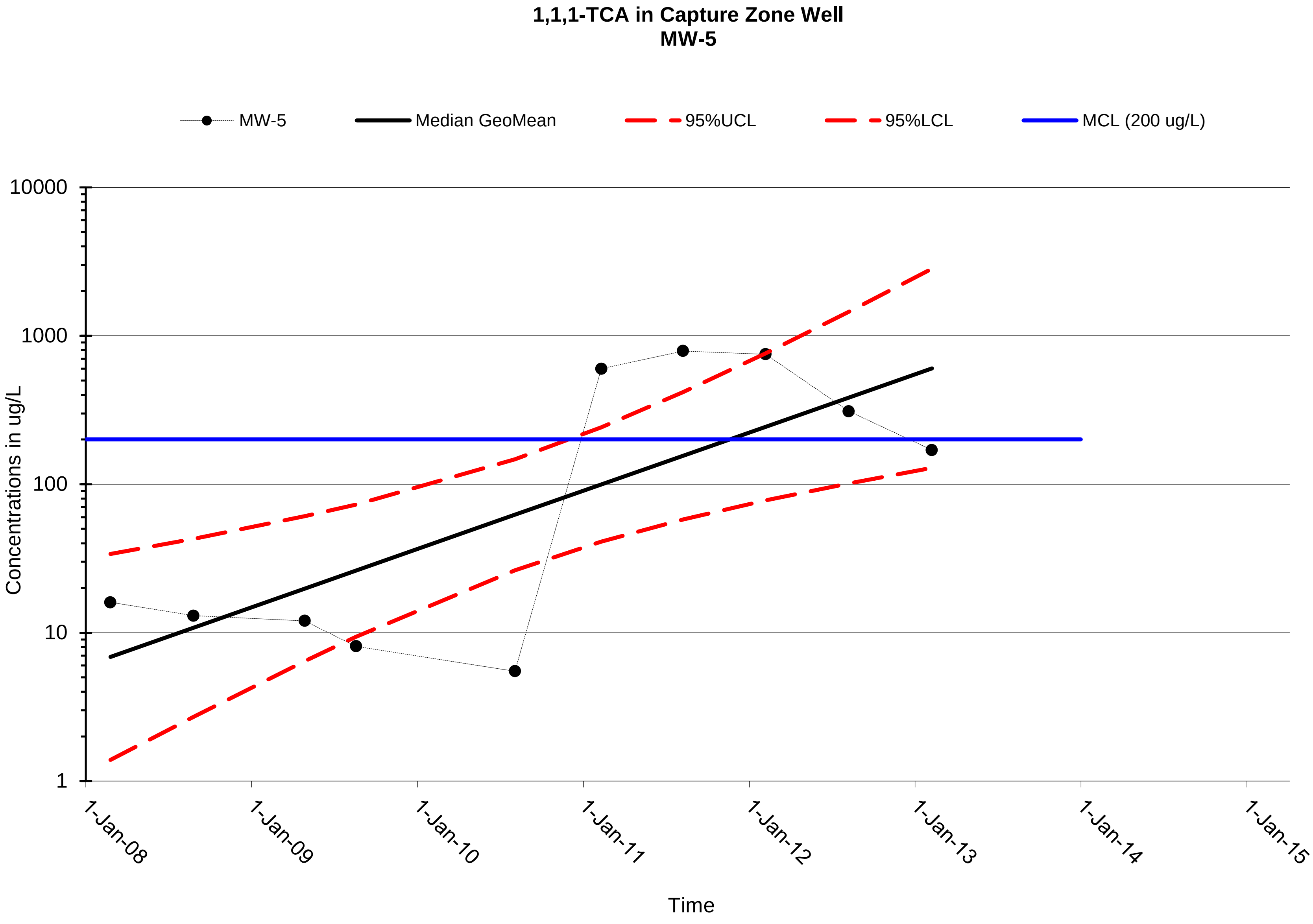


## 1,1,1-TCA in Capture Zone Well
### 6-S-25

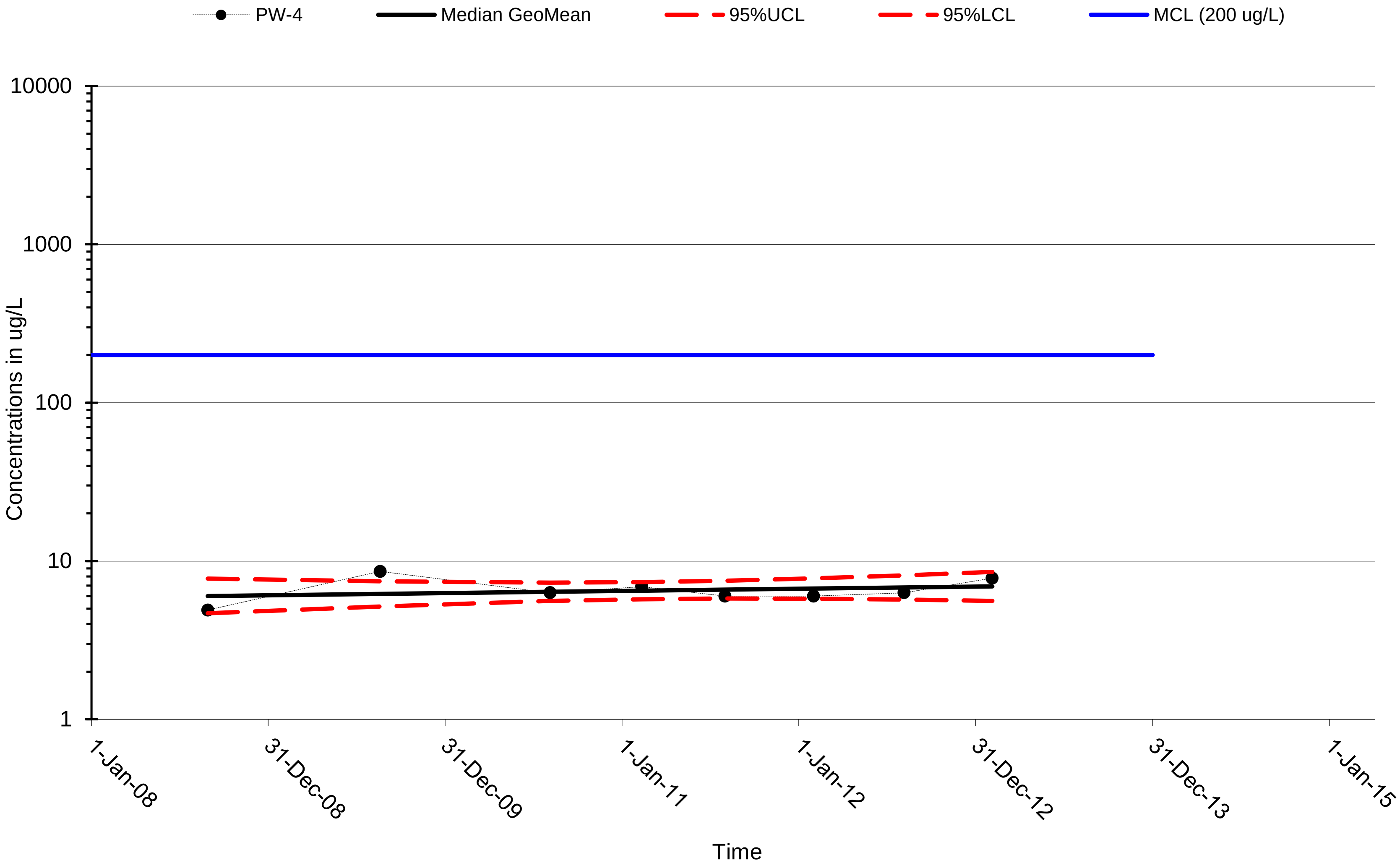


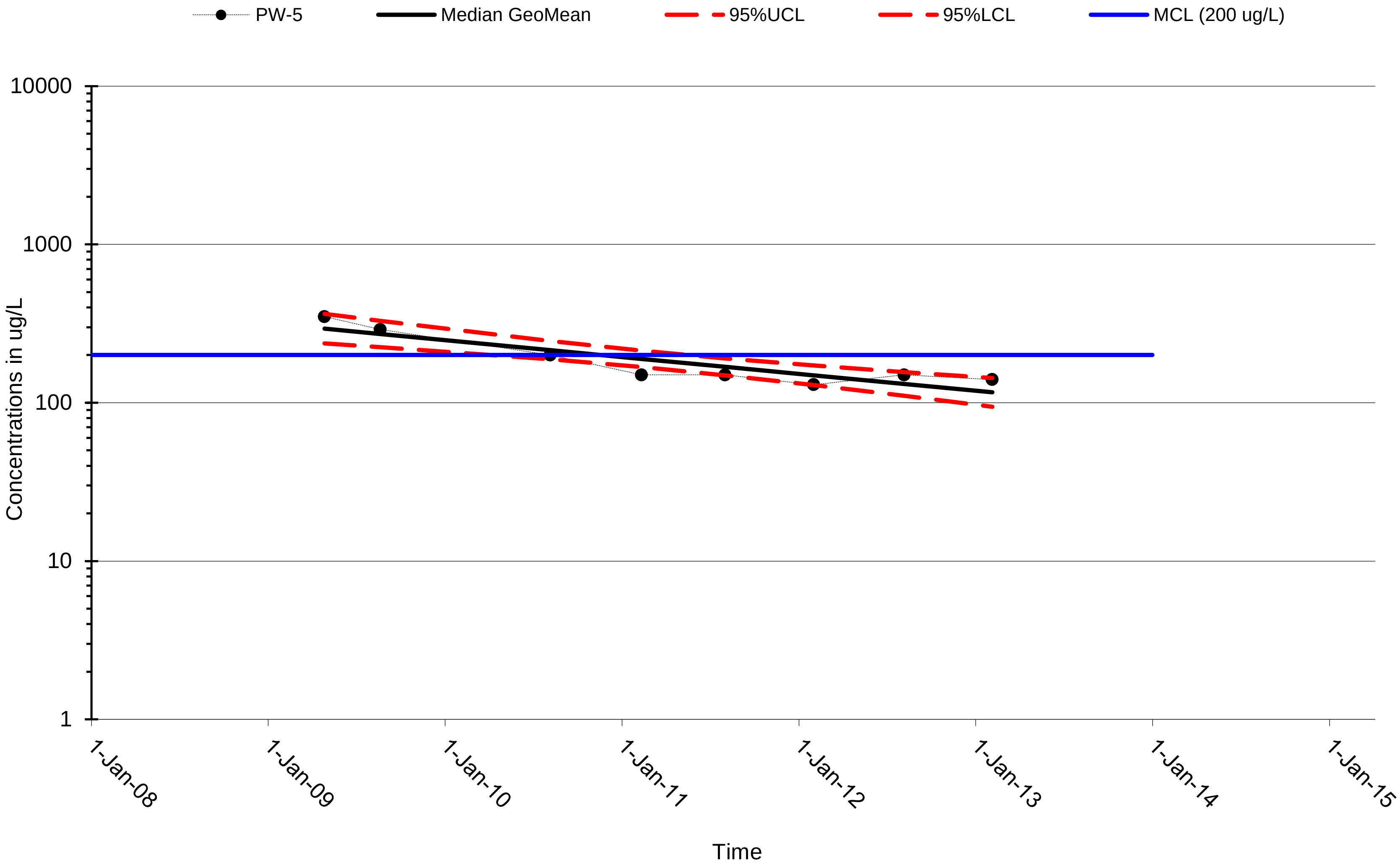
**1,1,1-TCA in Capture Zone Well**
**6-S-27**



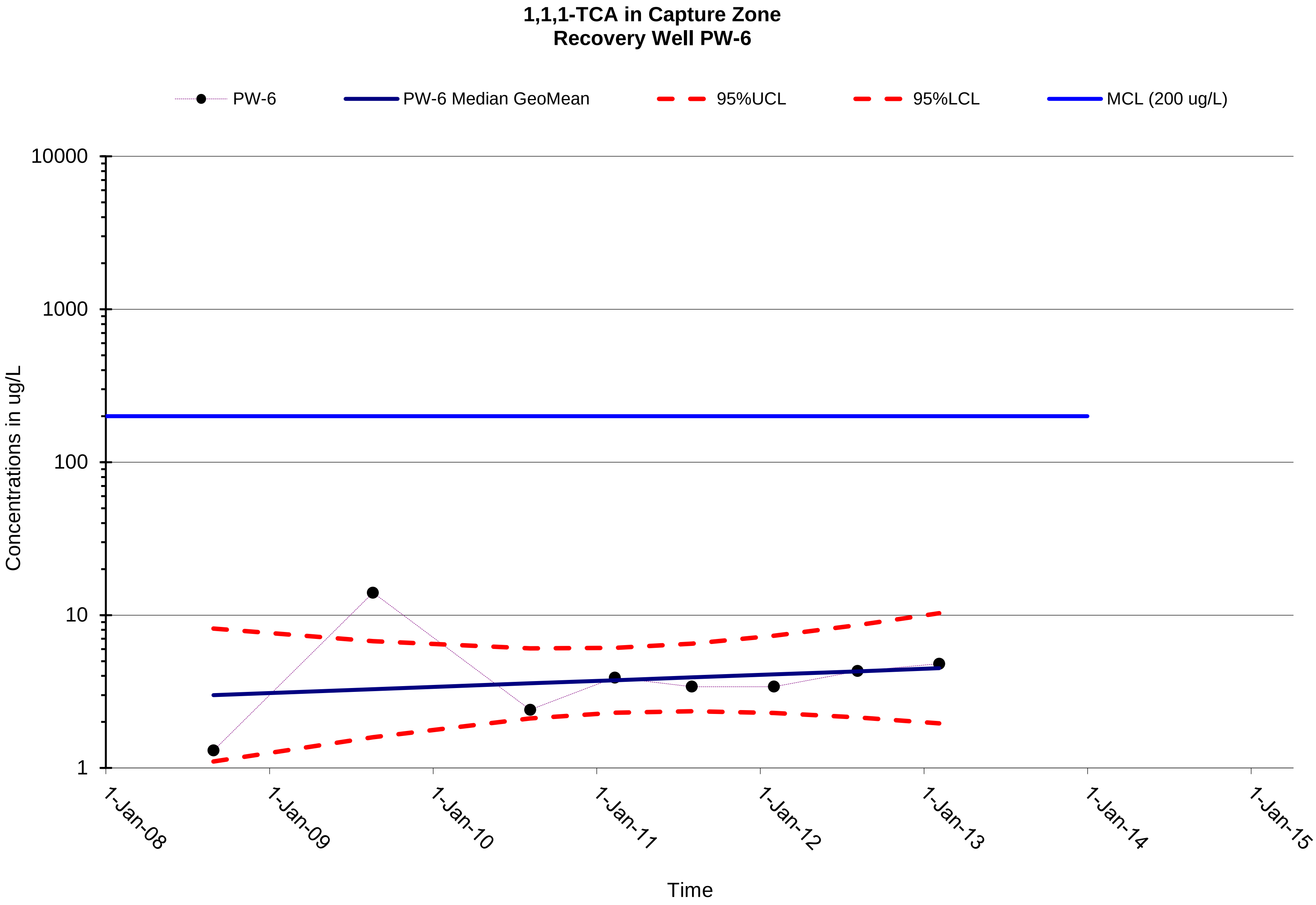
1,1,1-TCA in Capture Zone Well
MW-5
MW-5
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
10000
1000
100
10
1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

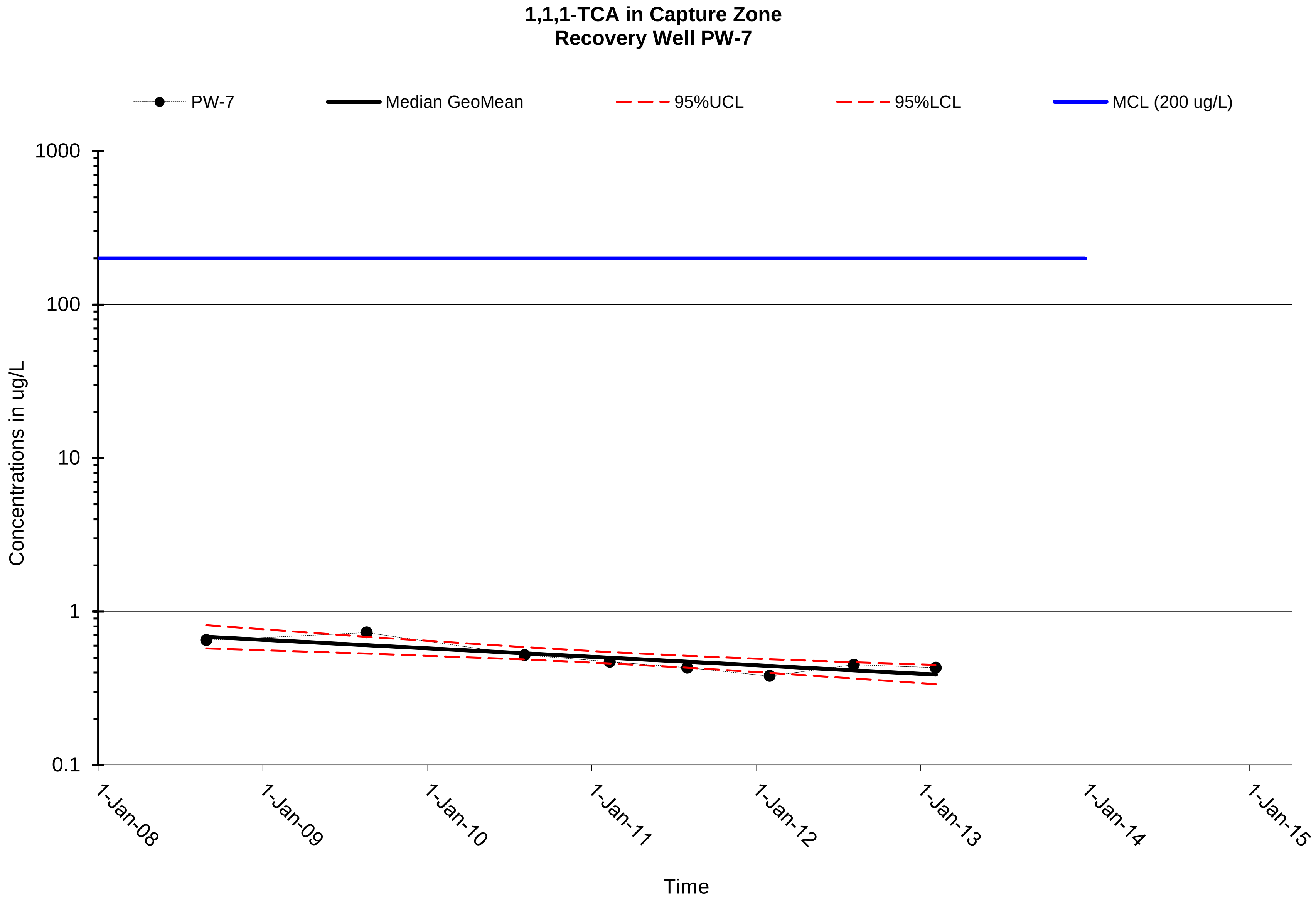
# 1,1,1-TCA in Capture Zone
# Recovery Well PW-4

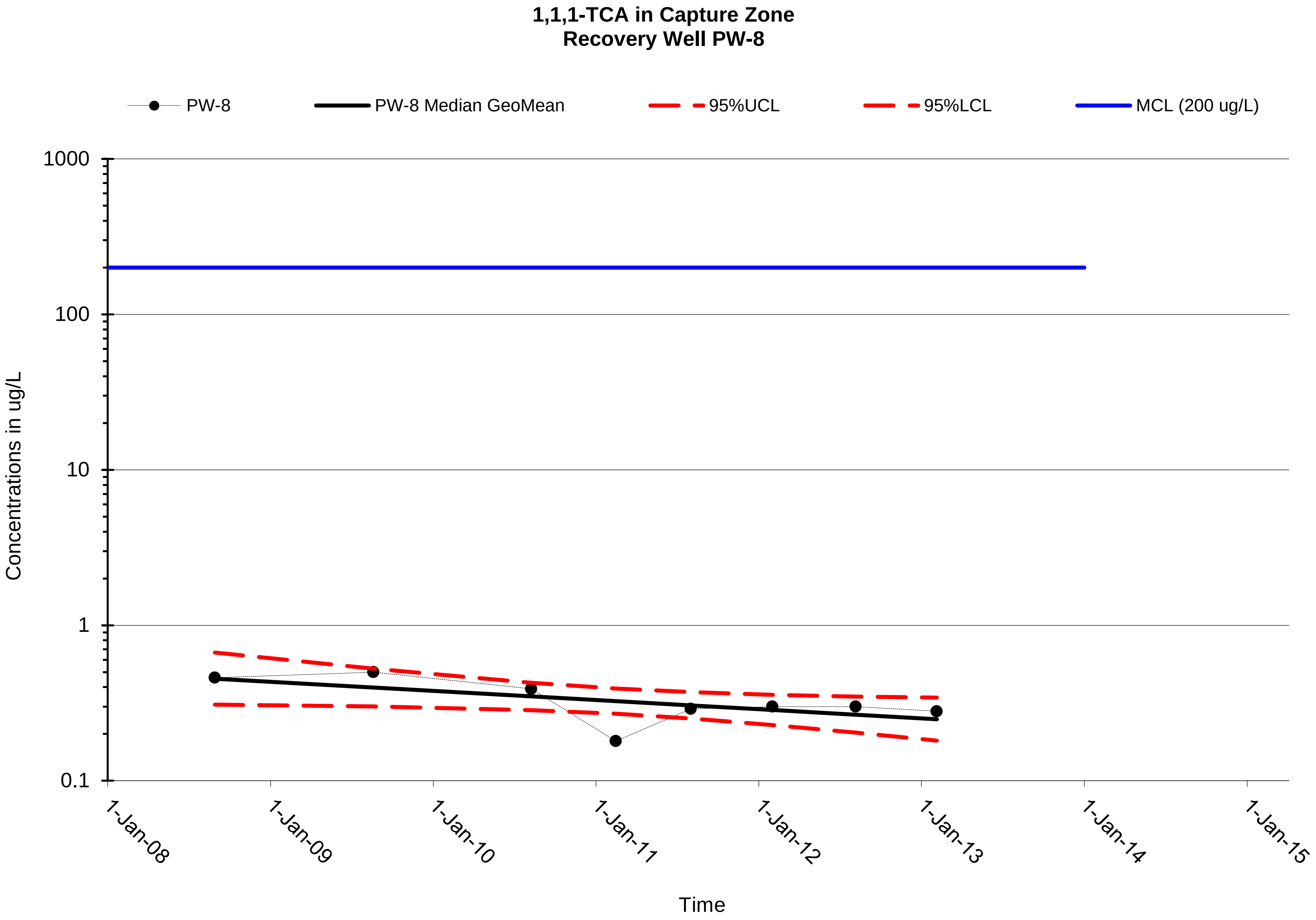




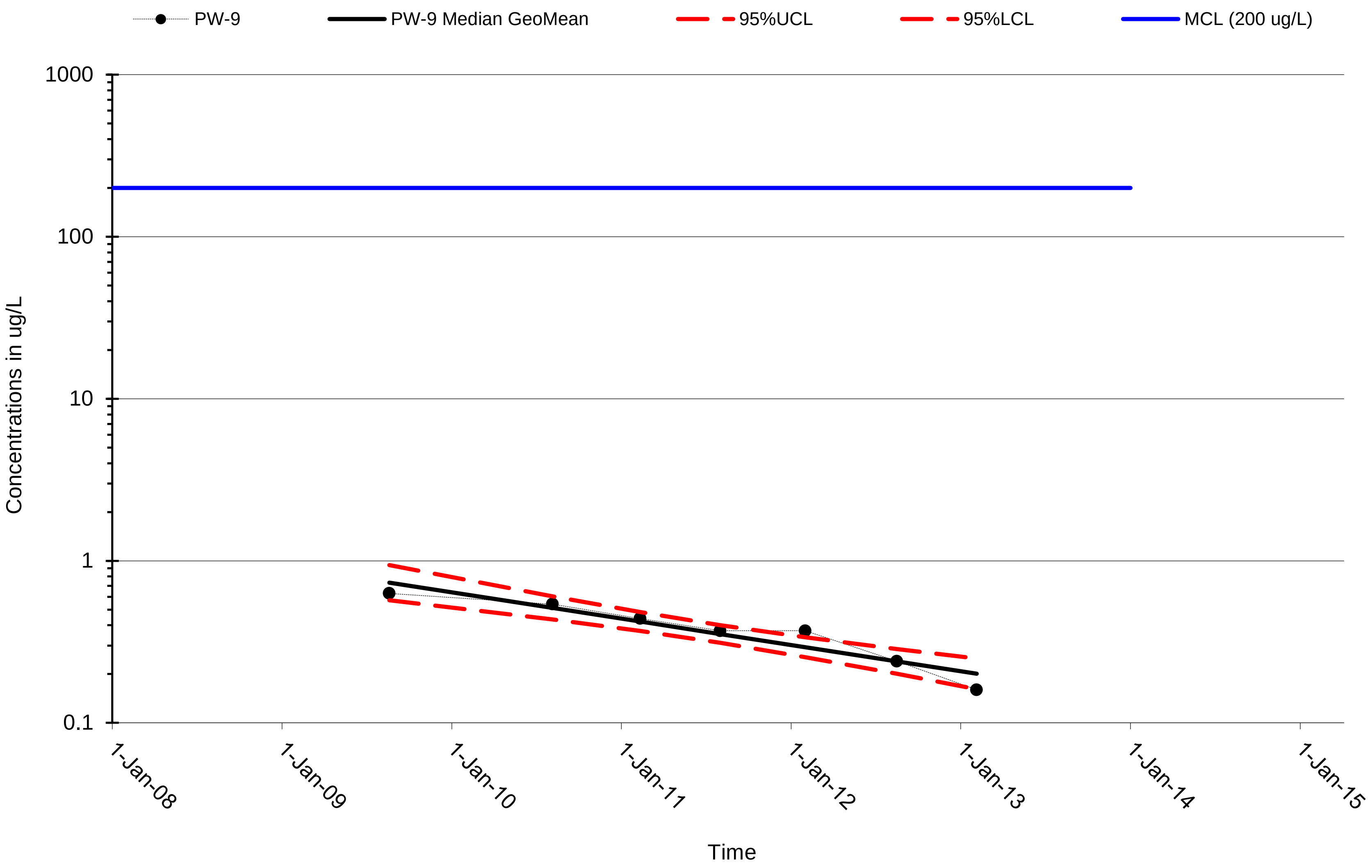
**1,1,1-TCA in Capture Zone**
**Recovery Well PW-5**


1,1,1-TCA in Capture Zone
Recovery Well PW-6
PW-6
PW-6 Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
Concentrations in ug/L
10000
1000
100
10
1
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

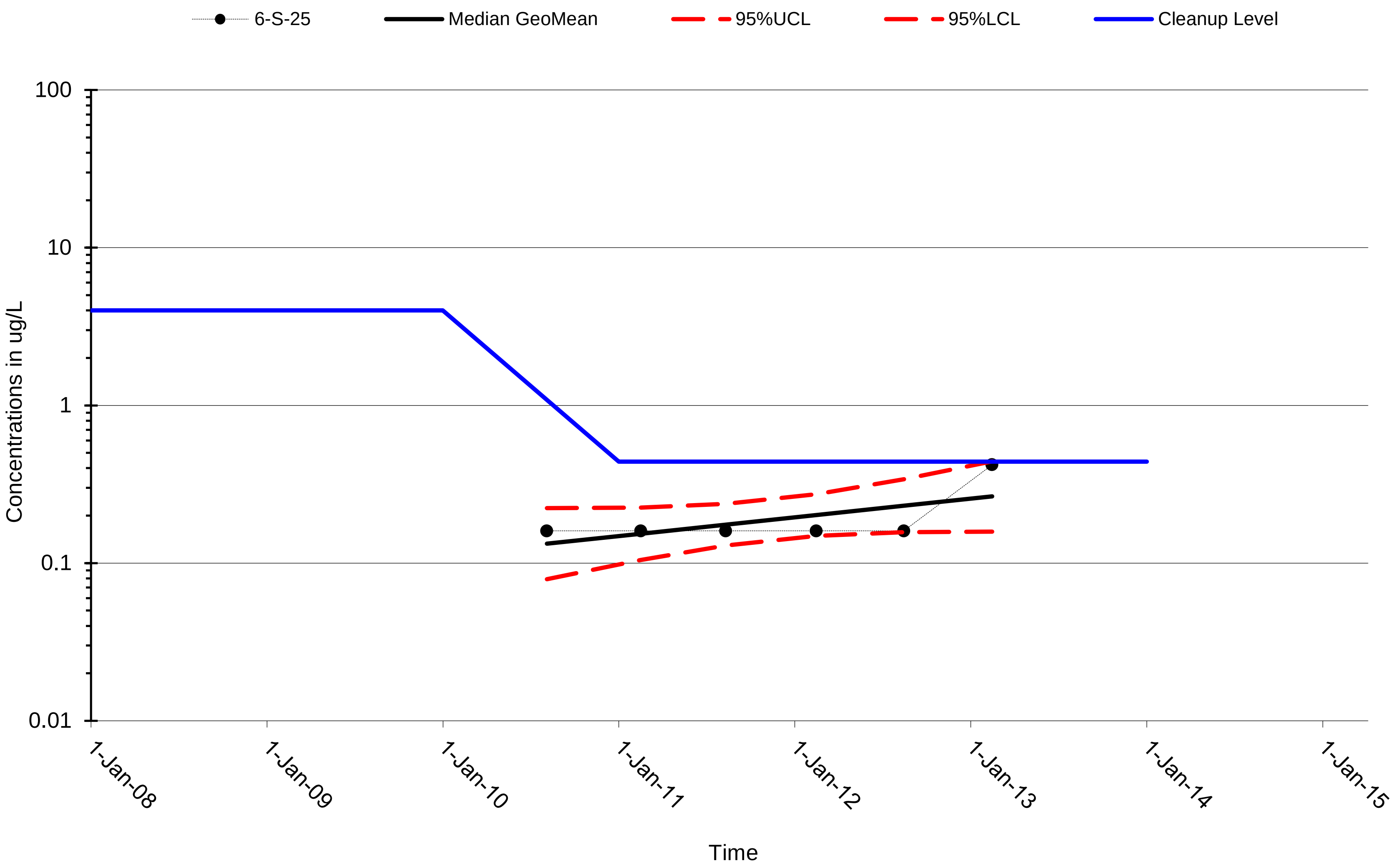

1,1,1-TCA in Capture Zone
Recovery Well PW-7
PW-7
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
1000
100
10
1
0.1
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

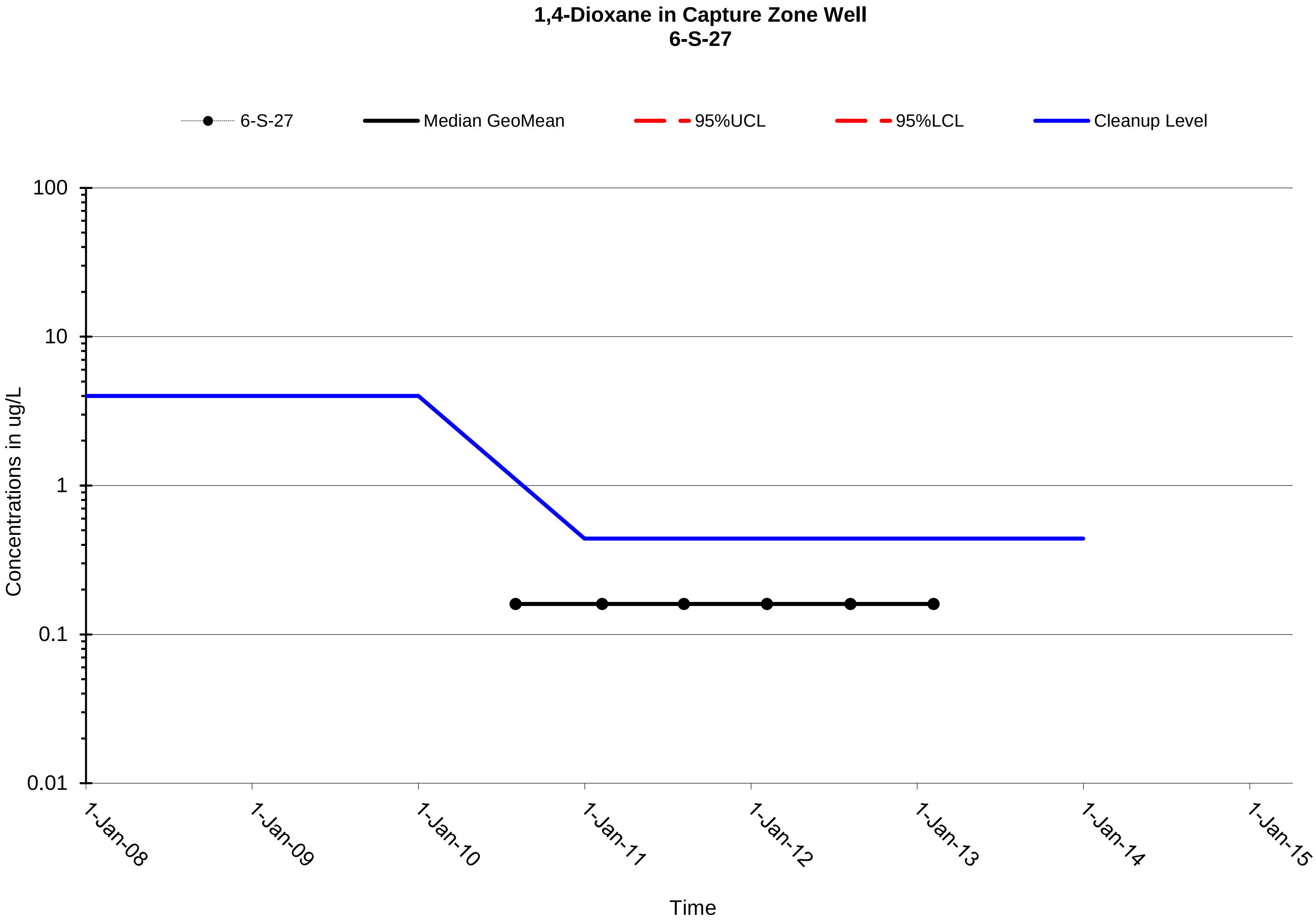

1,1,1-TCA in Capture Zone
Recovery Well PW-8
PW-8
PW-8 Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
Concentrations in ug/L
1000
100
10
1
0.1
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

## 1,1,1-TCA in Capture Zone
## Recovery Well PW-9

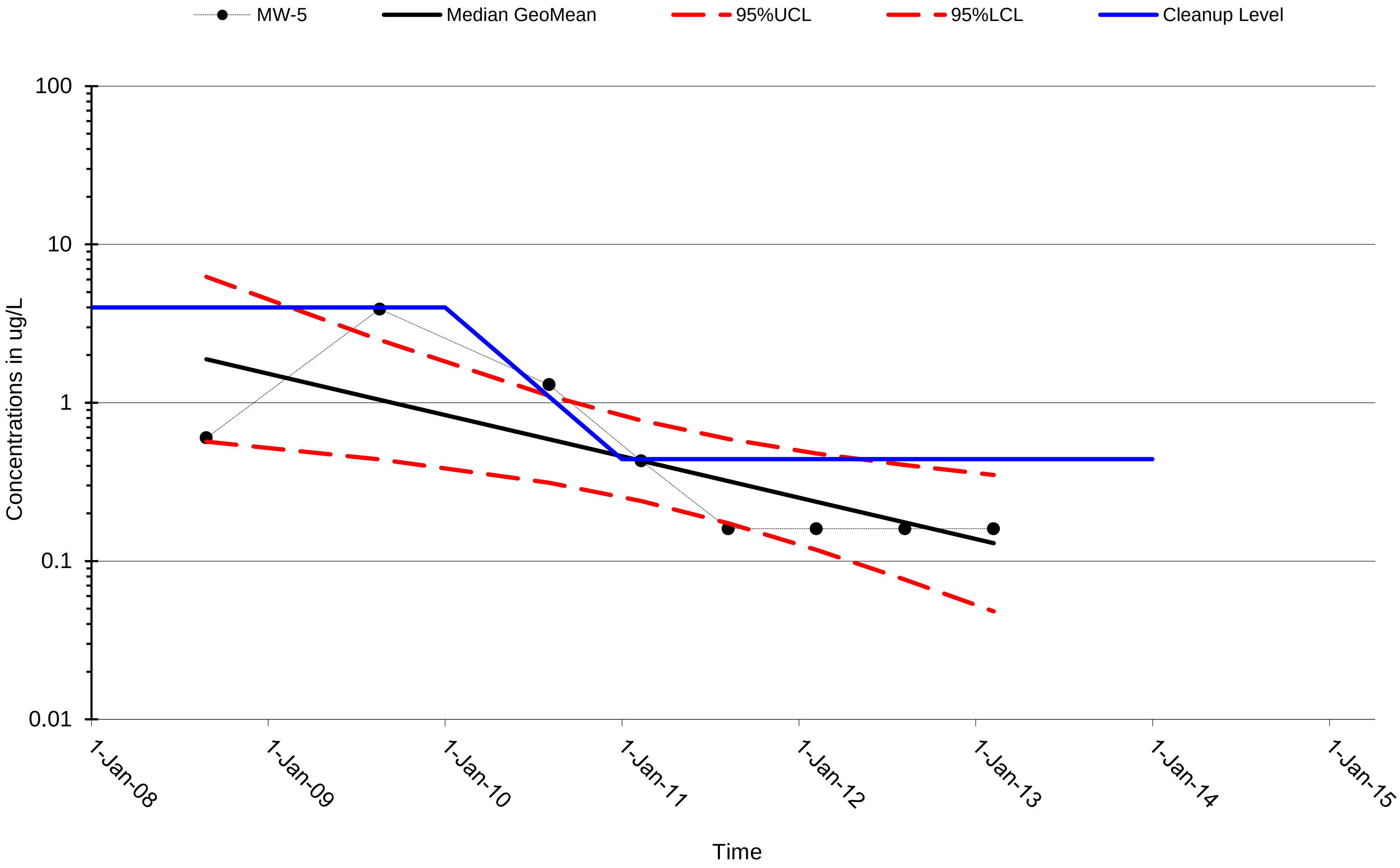


## 1,4-Dioxane in Capture Zone Well
## 6-S-25

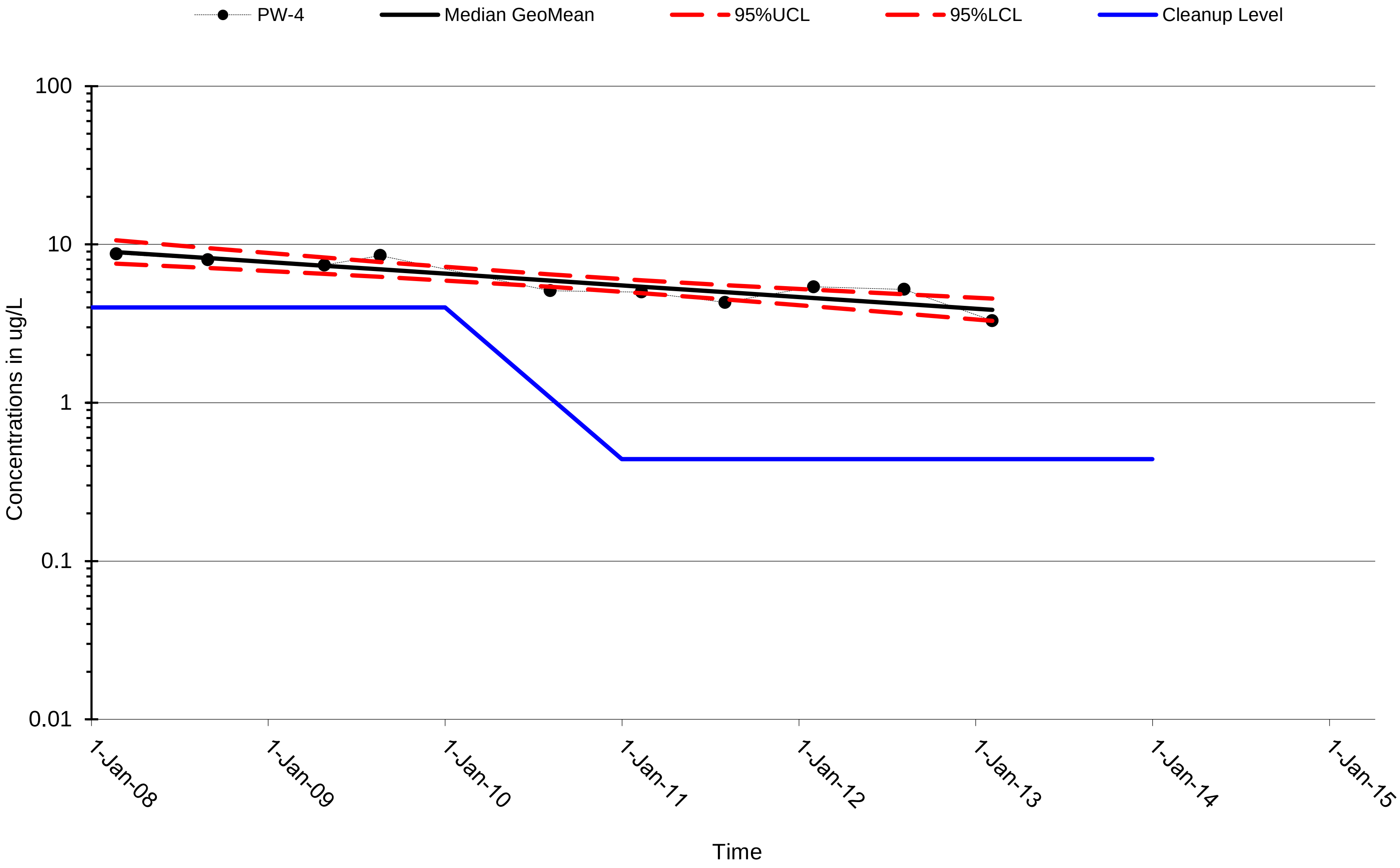



1,4-Dioxane in Capture Zone Well
6-S-27
6-S-27
Median GeoMean
95%UCL
95%LCL
Cleanup Level
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

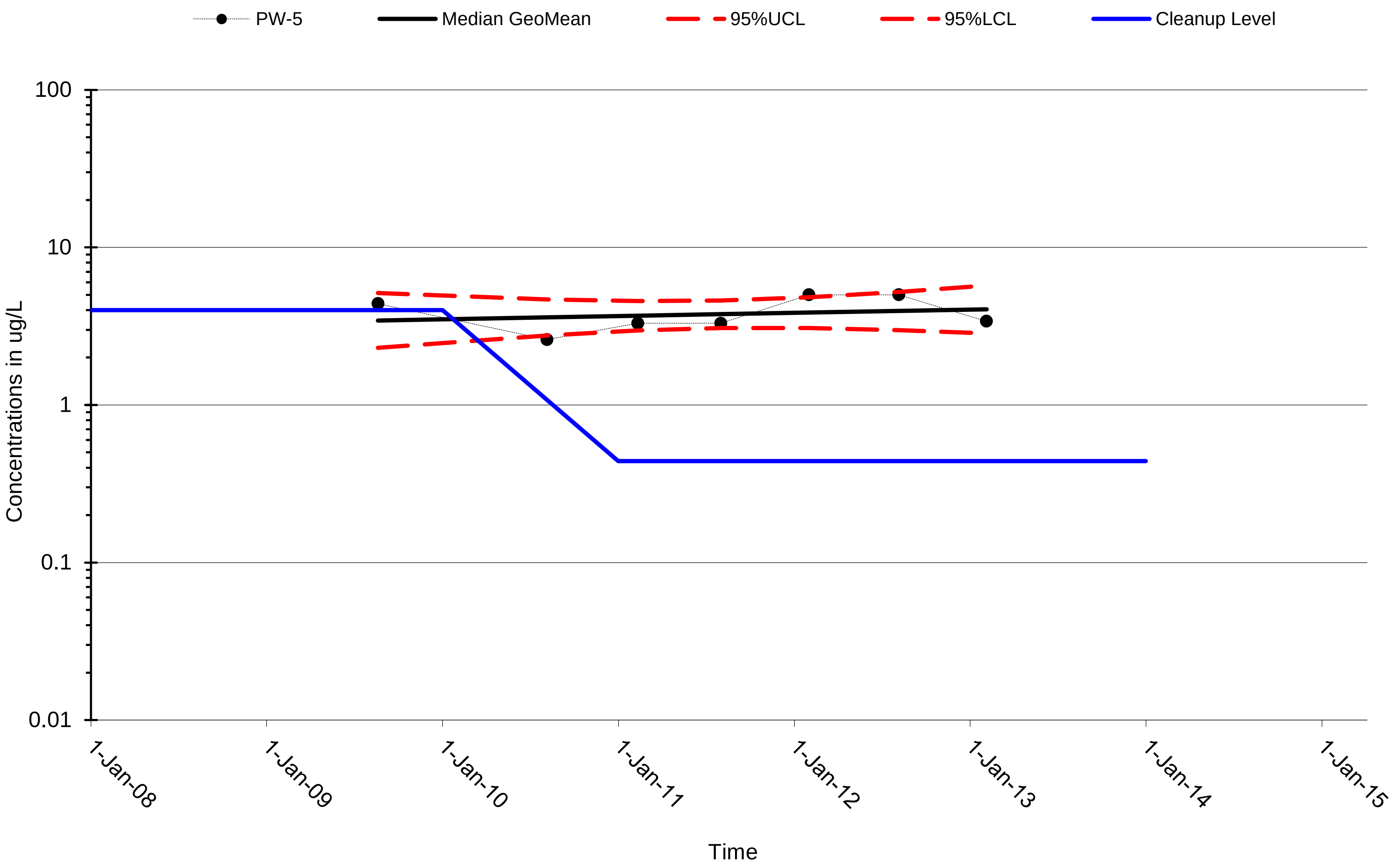
## 1,4-Dioxane in Capture Zone Well
## MW-5



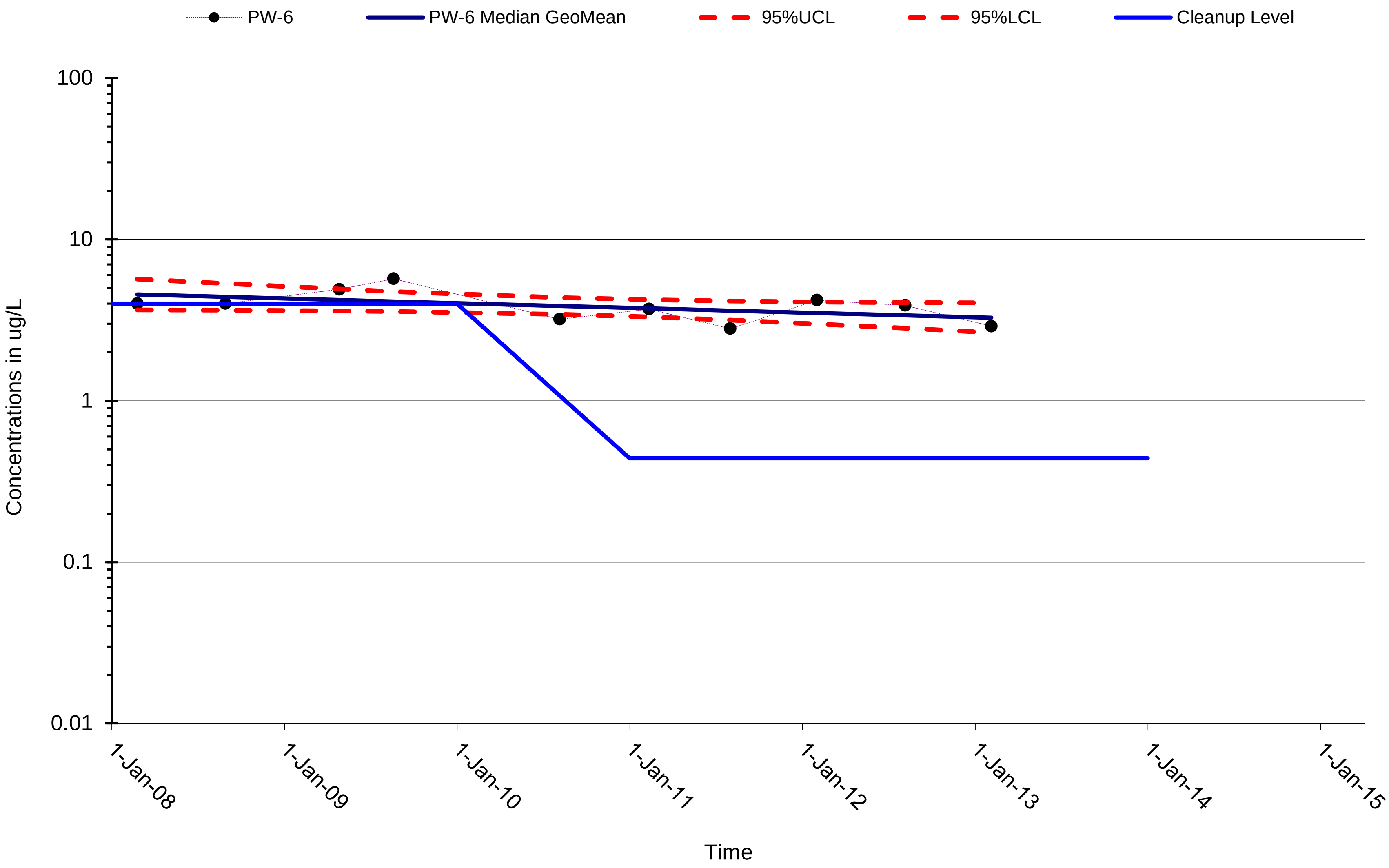
## 1,4-Dioxane in Capture Zone
## Recovery Well PW-4



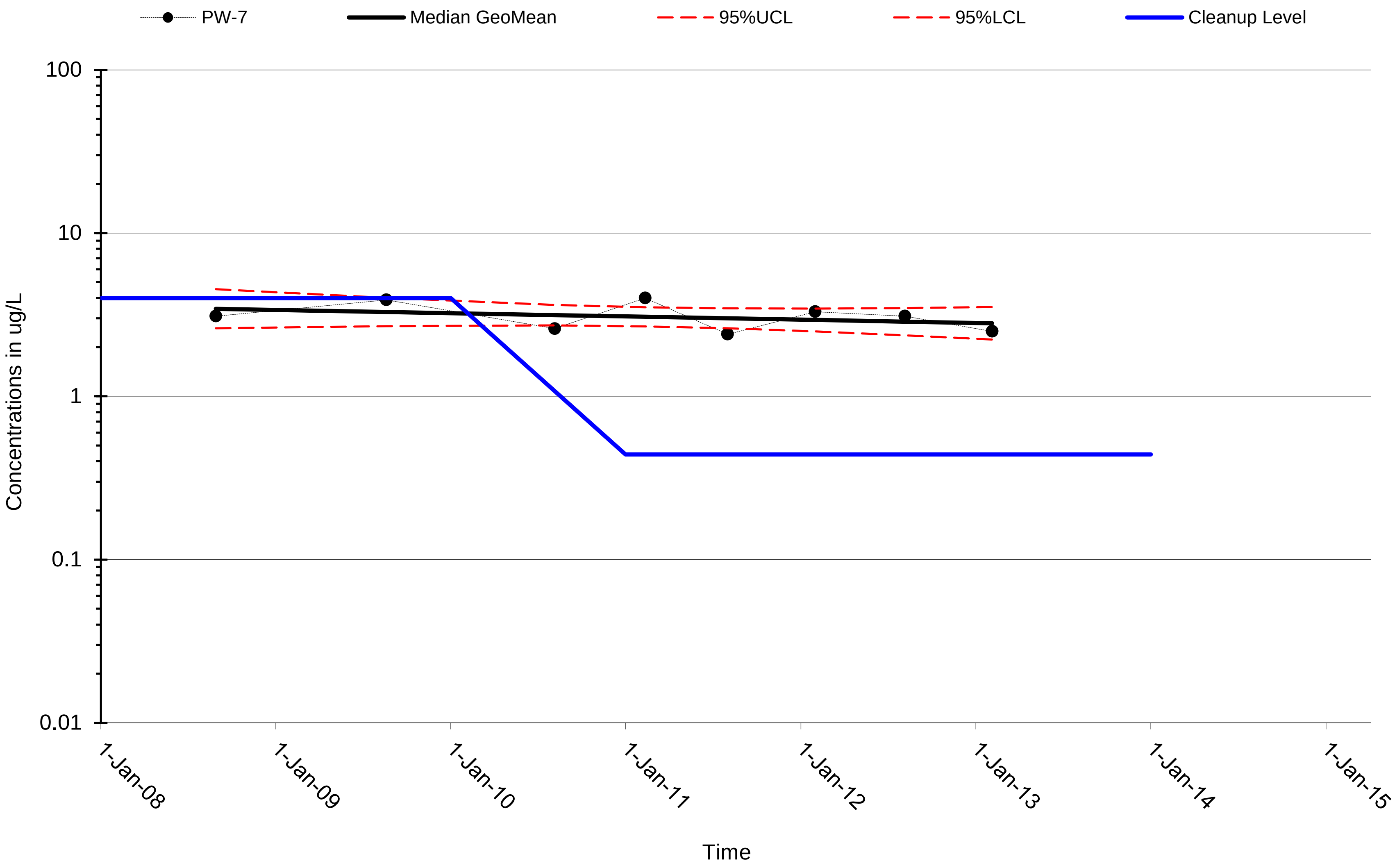
# 1,4-Dioxane in Capture Zone
## Recovery Well PW-5



## 1,4-Dioxane in Capture Zone
## Recovery Well PW-6



## 1,4-Dioxane in Capture Zone
## Recovery Well PW-7



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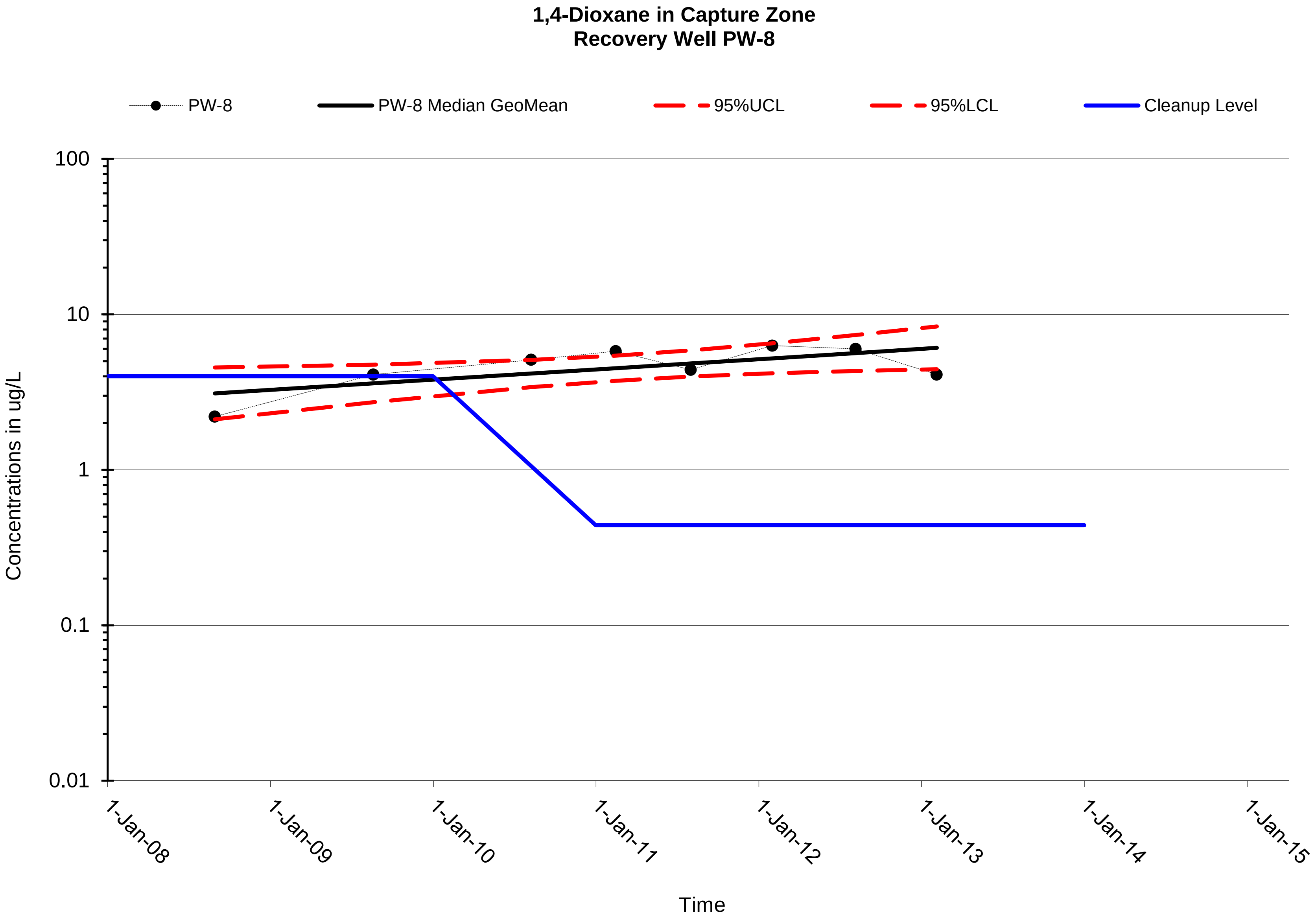
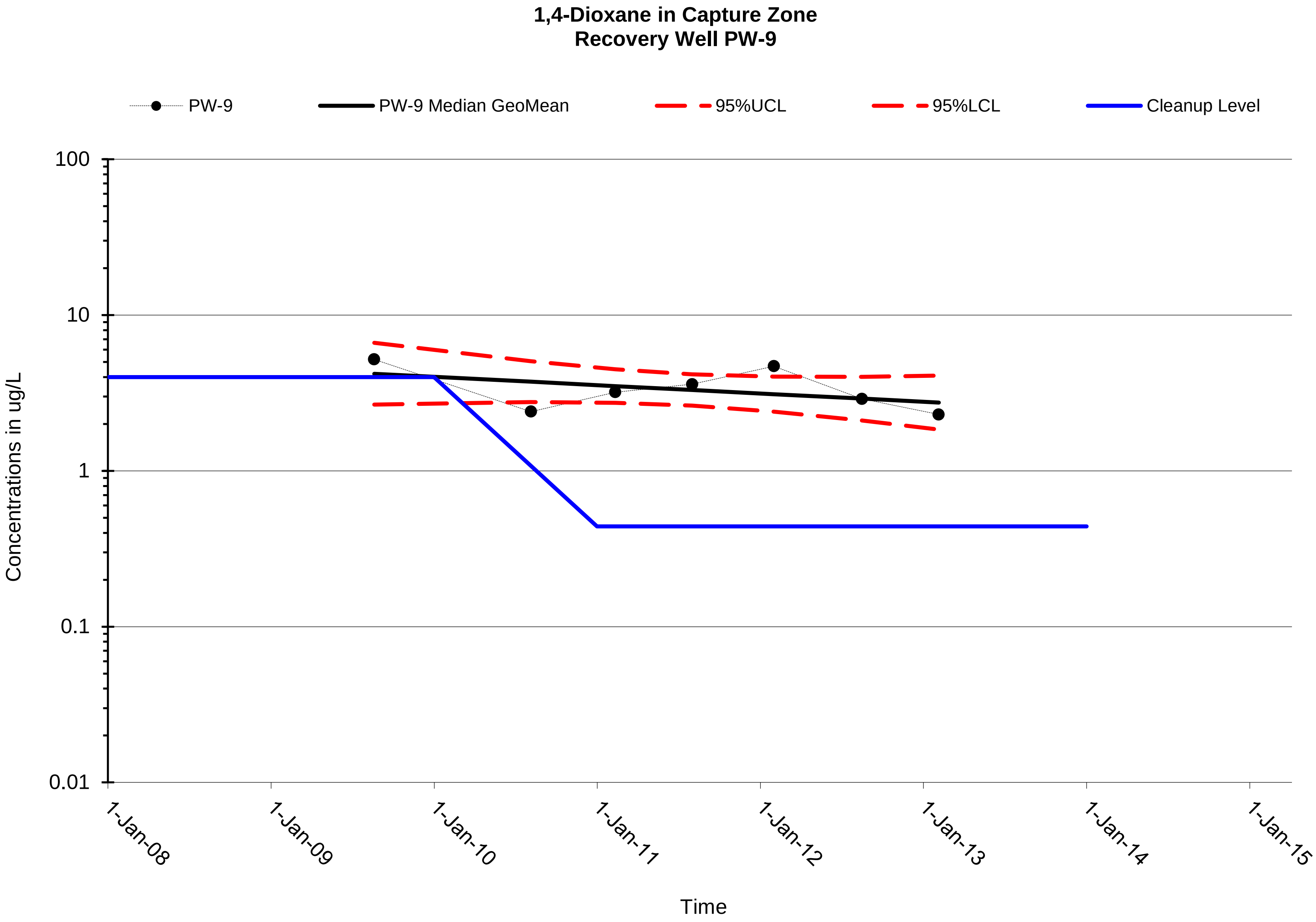
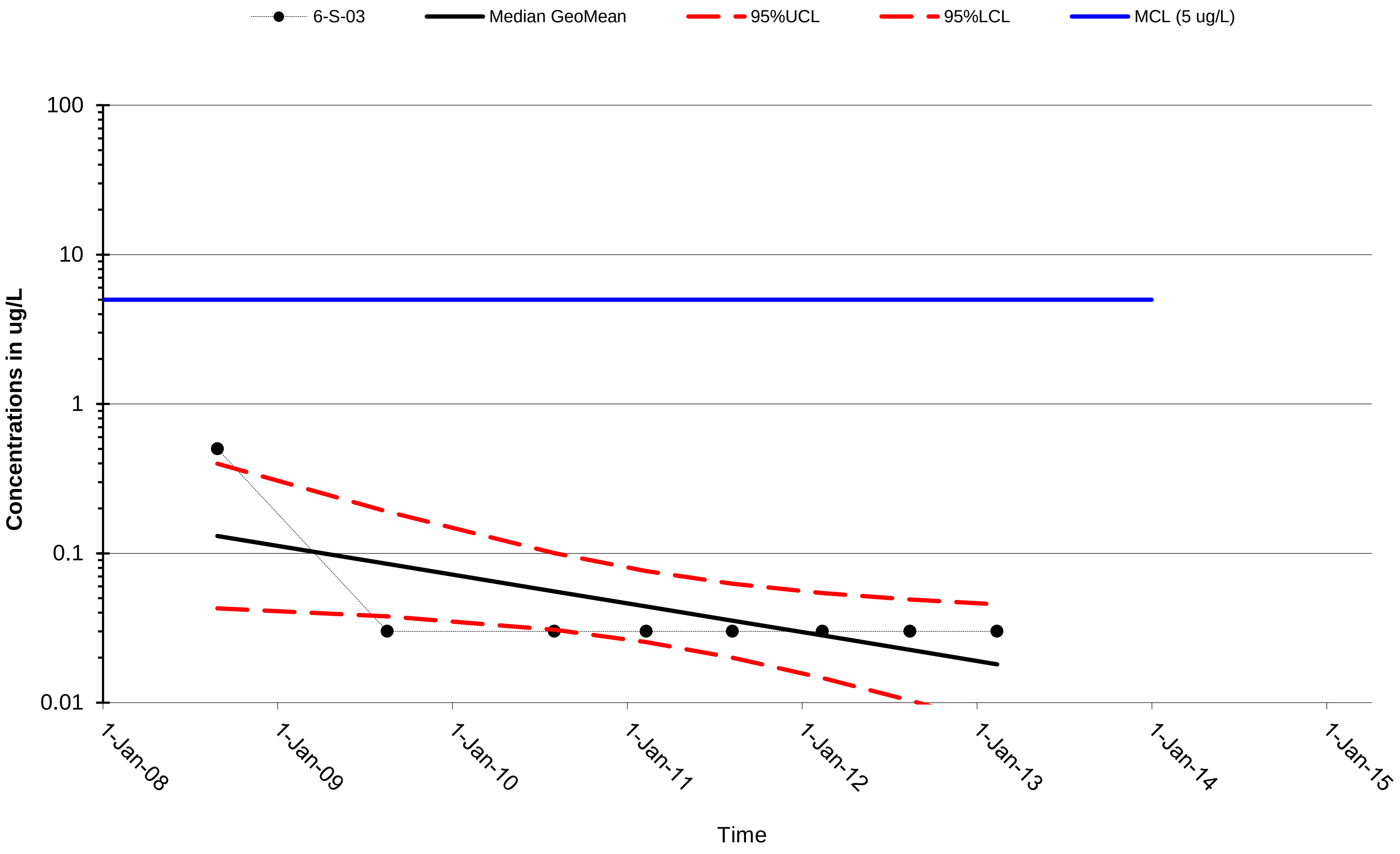
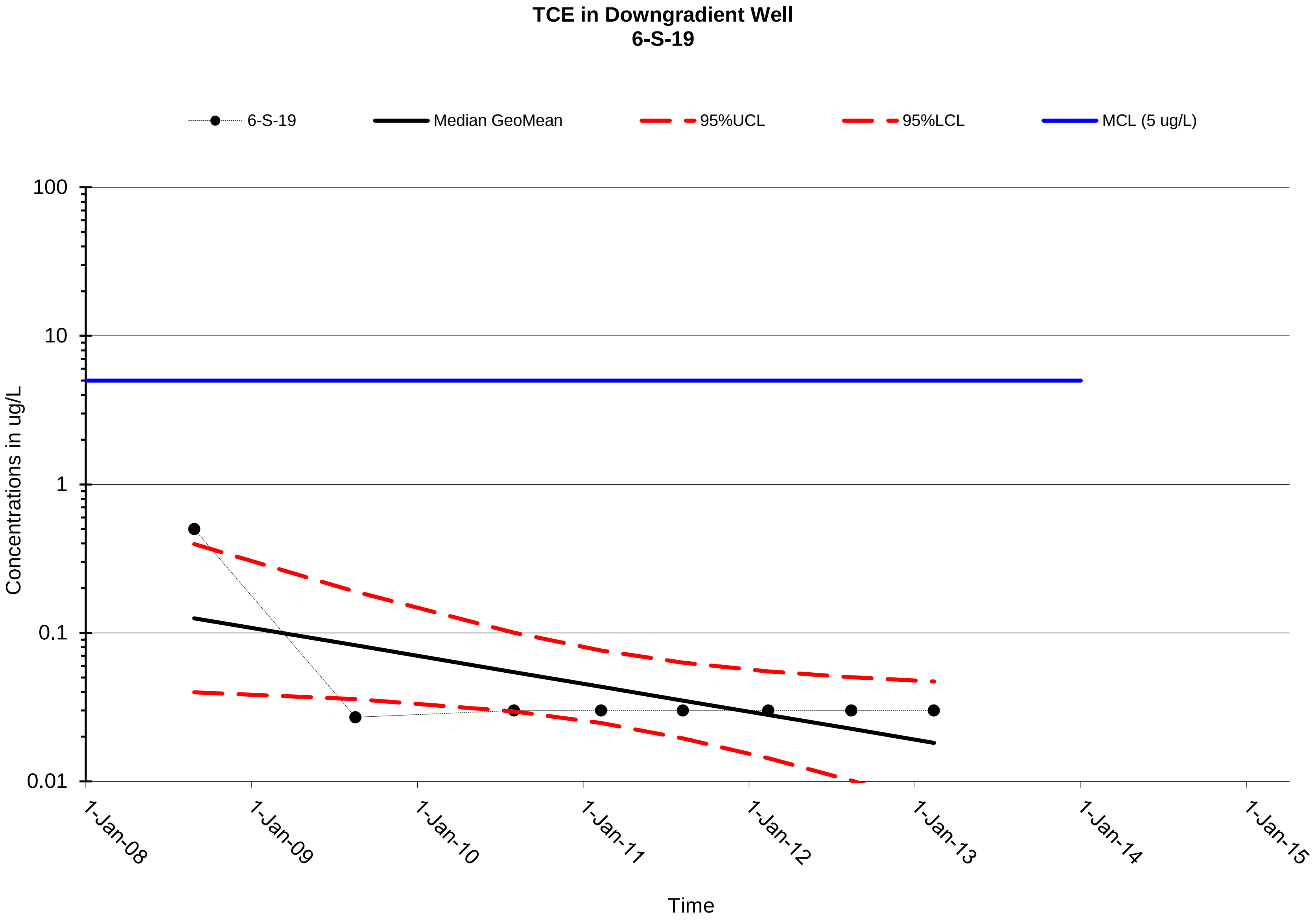

1,4-Dioxane in Capture Zone
Recovery Well PW-8
PW-8
PW-8 Median GeoMean
95%UCL
95%LCL
Cleanup Level
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

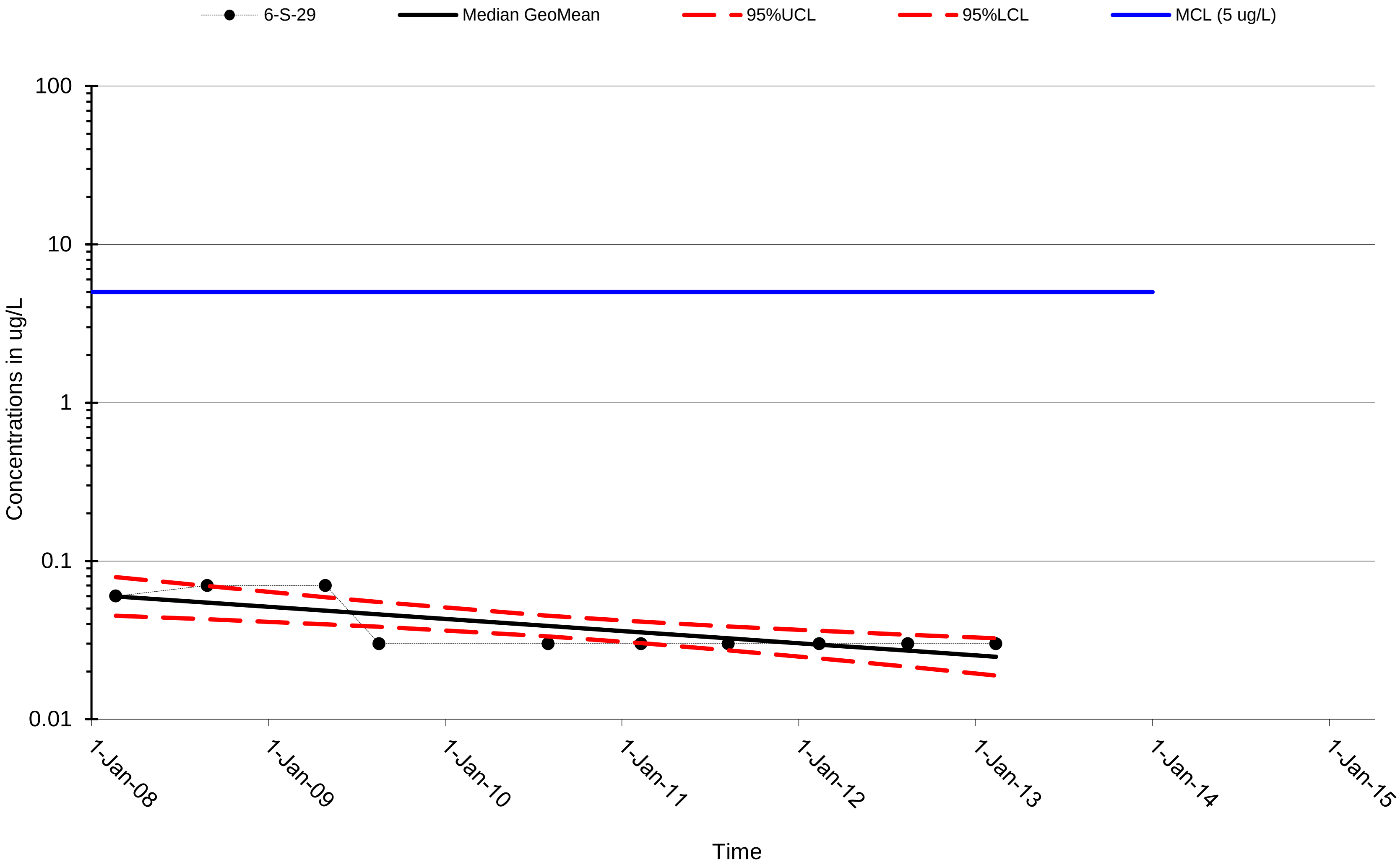

1,4-Dioxane in Capture Zone
Recovery Well PW-9
PW-9
PW-9 Median GeoMean
95%UCL
95%LCL
Cleanup Level
Concentrations in ug/L
100
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

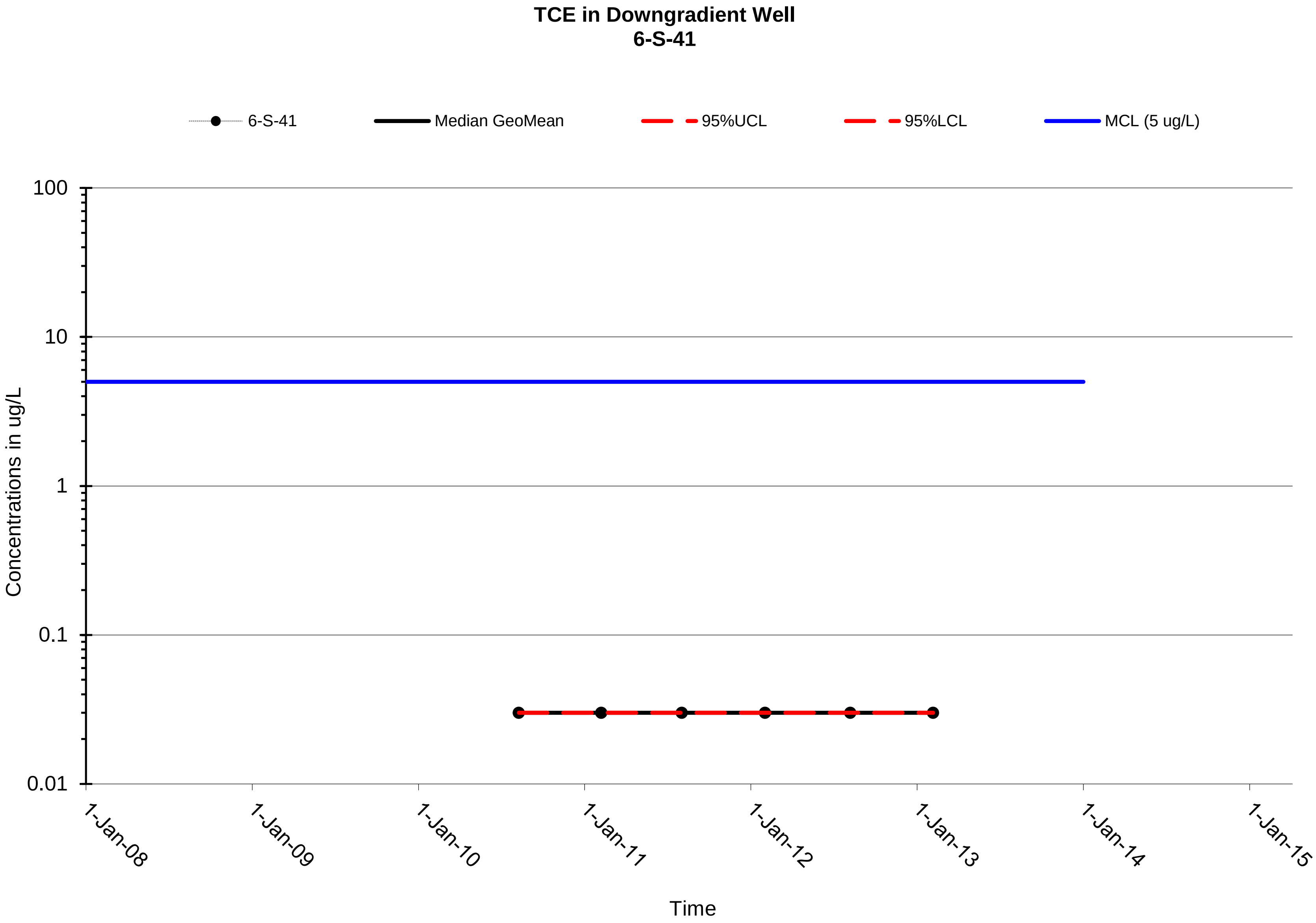
**TCE in Downgradient Well**
**6-S-03**



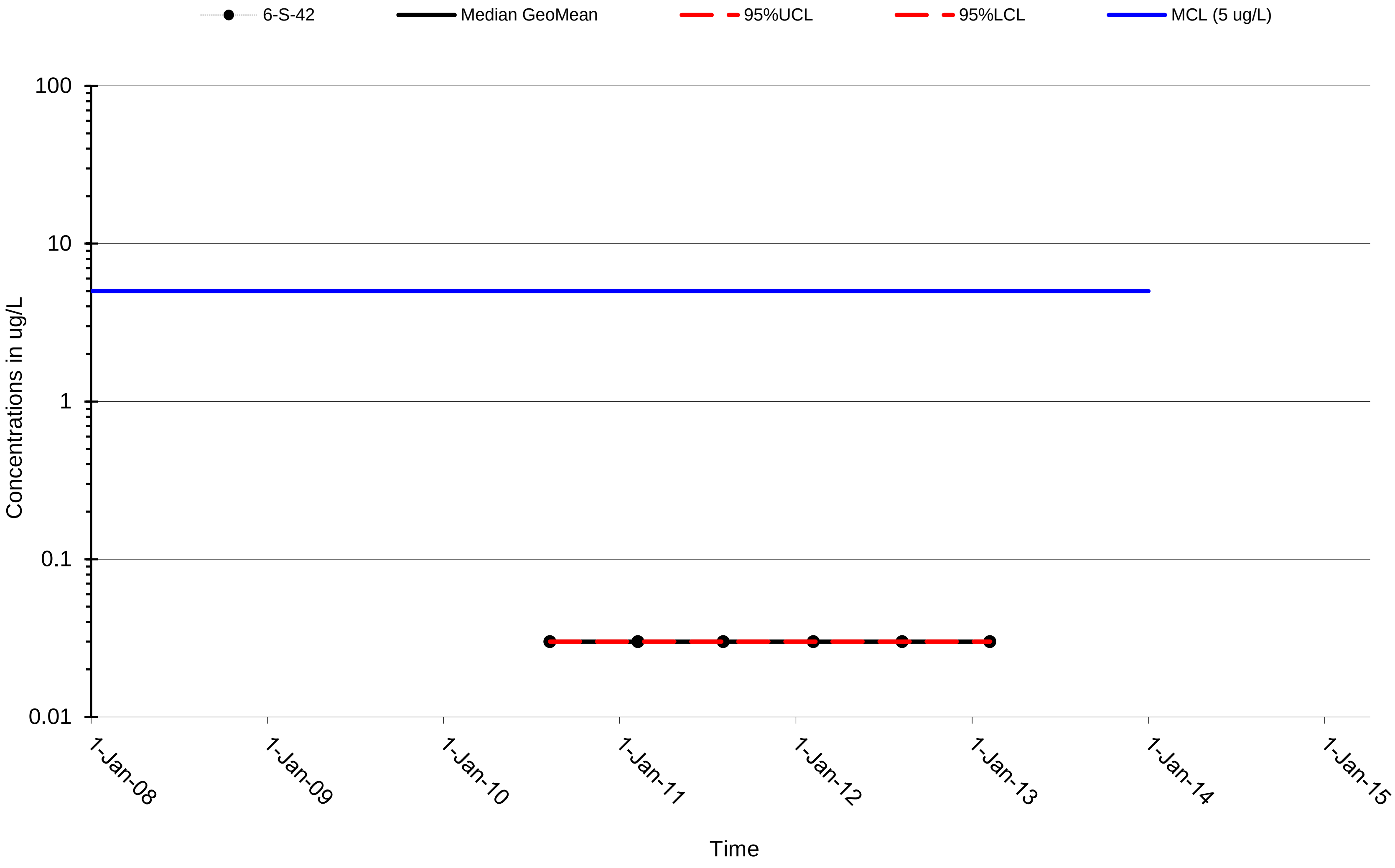

TCE in Downgradient Well
6-S-19
6-S-19
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

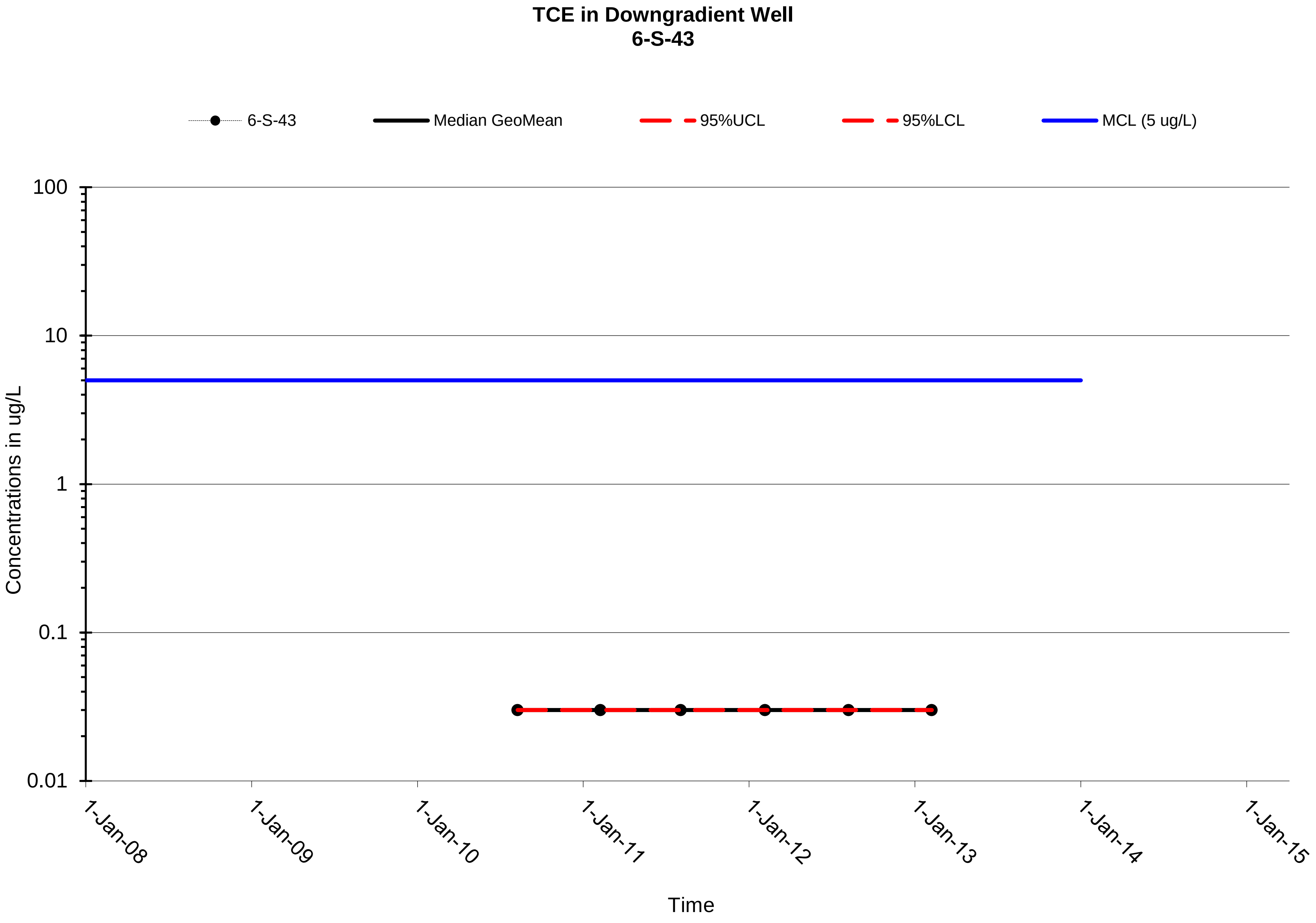
## TCE in Downgradient Well
## 6-S-29



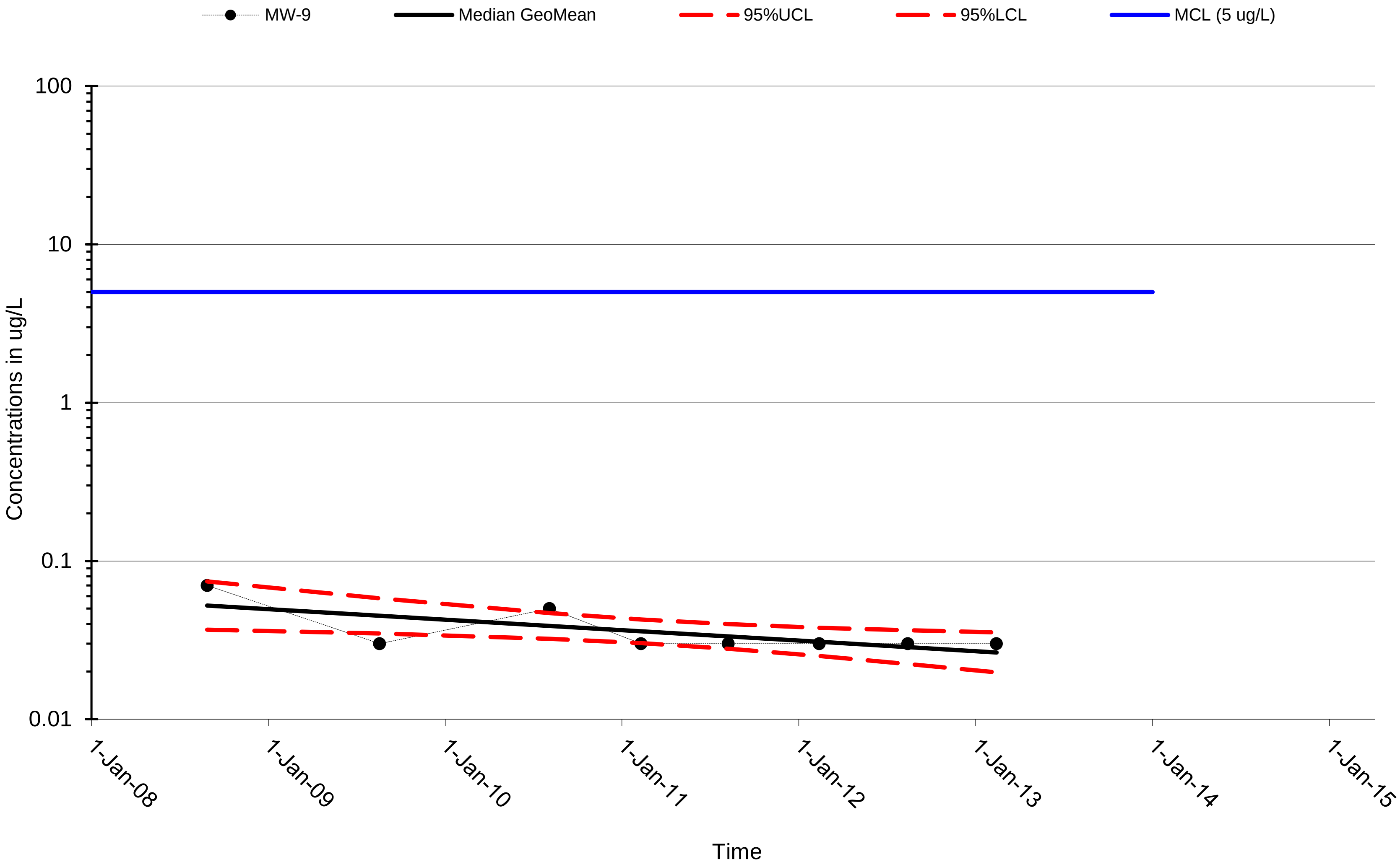

TCE in Downgradient Well
6-S-41

# TCE in Downgradient Well
## 6-S-42

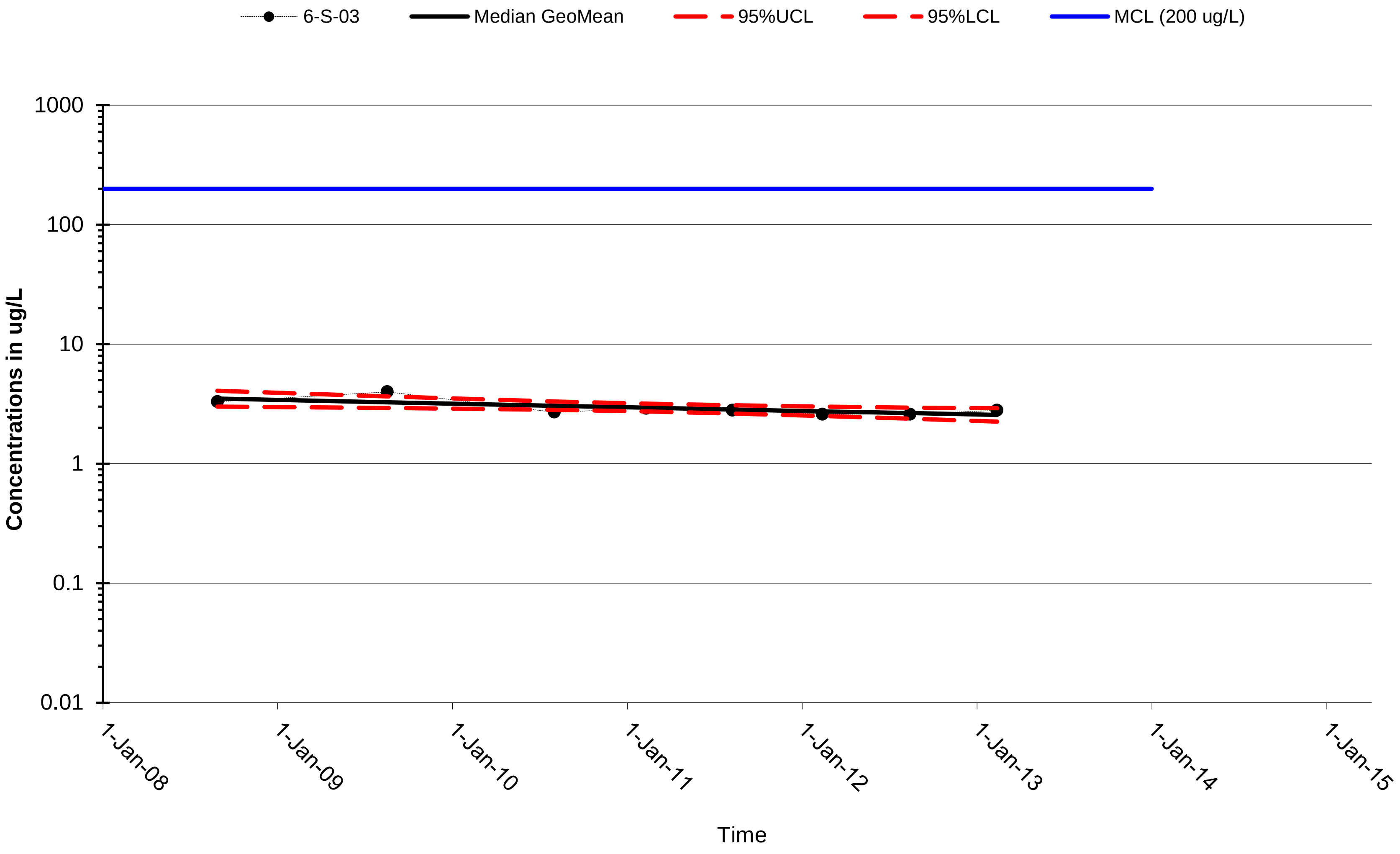


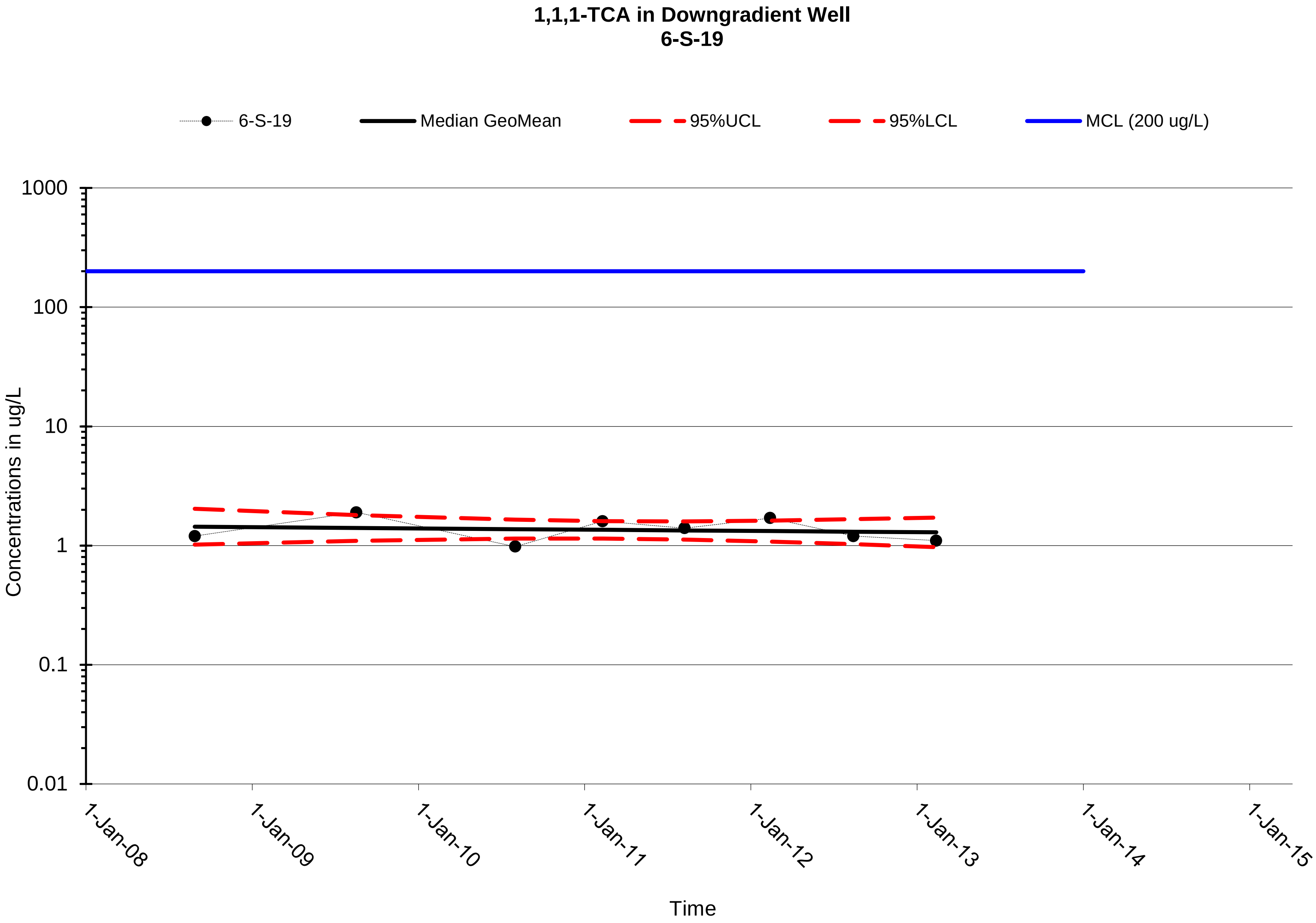

TCE in Downgradient Well
6-S-43
6-S-43
Median GeoMean
95%UCL
95%LCL
MCL (5 ug/L)
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

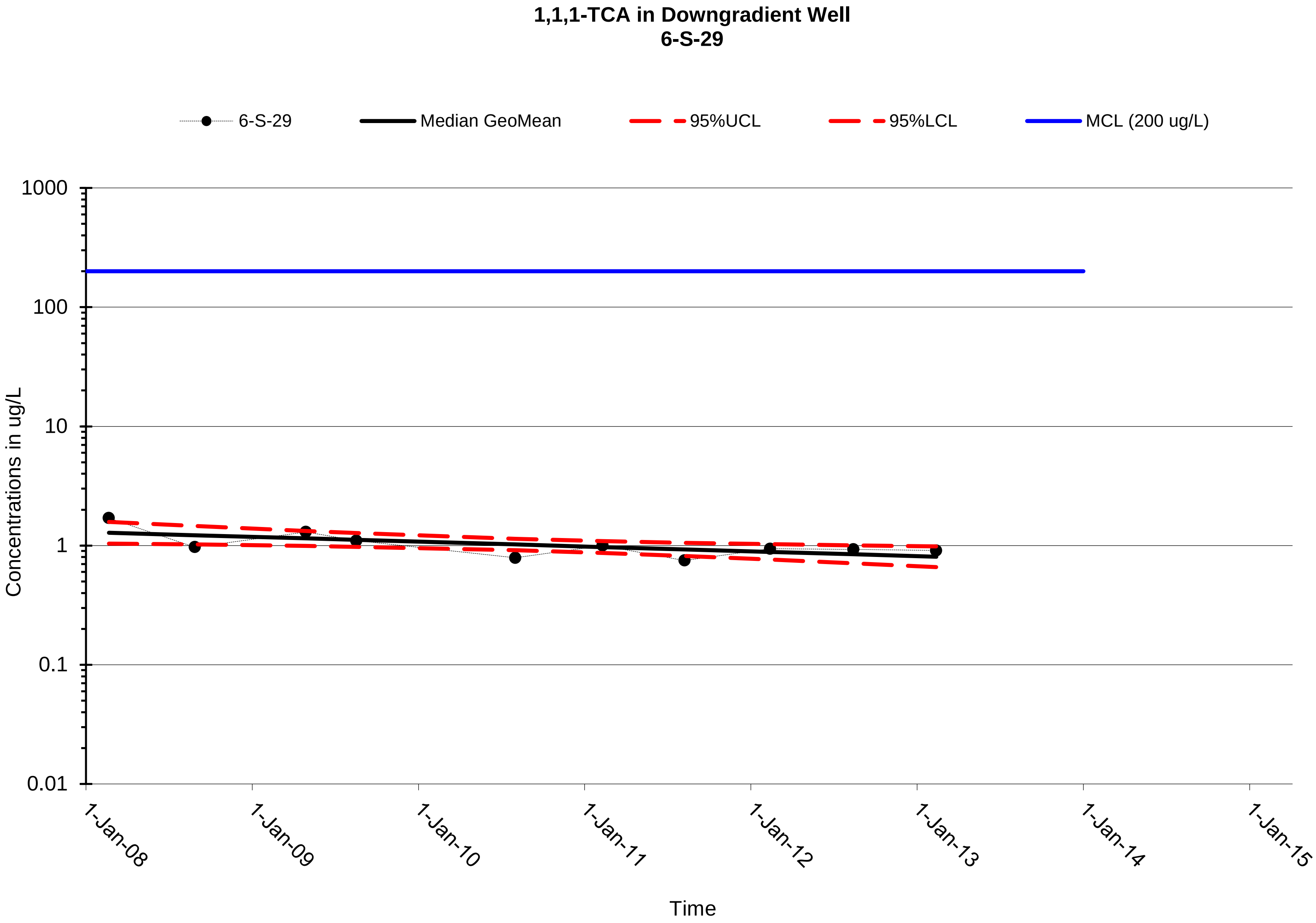
# TCE in Downgradient Well
MW-9

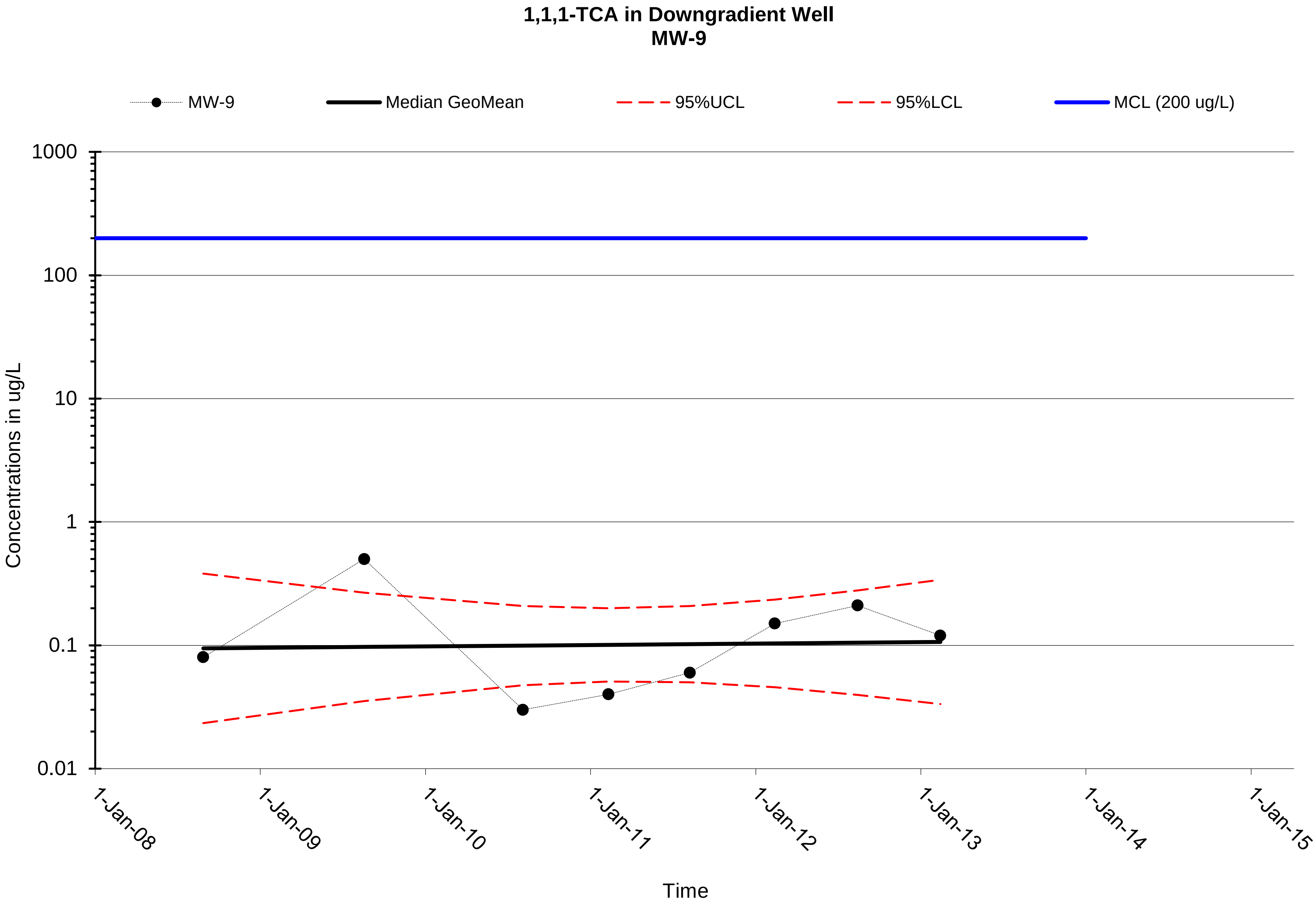


## 1,1,1-TCA in Downgradient Well
## 6-S-03

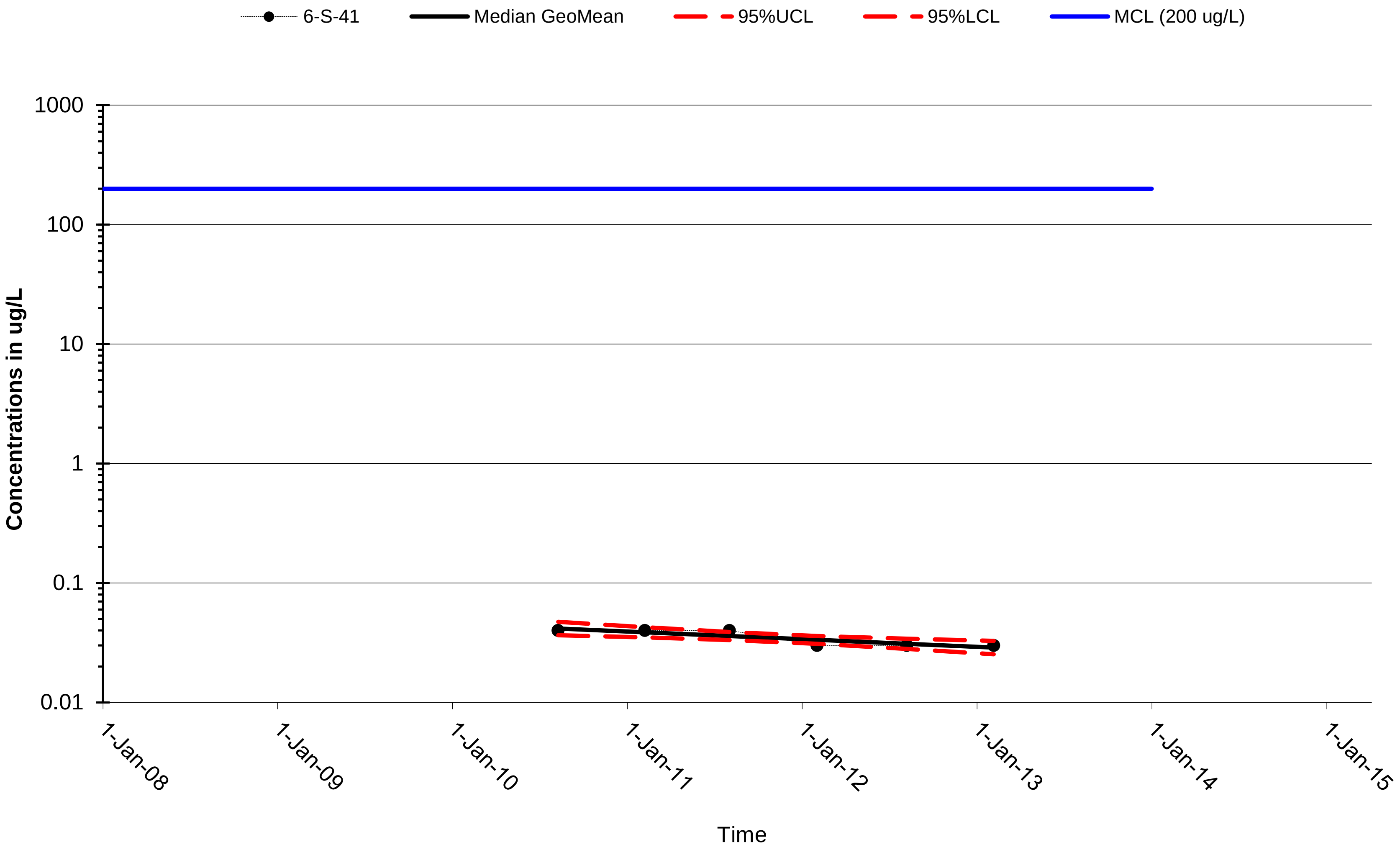



1,1,1-TCA in Downgradient Well
6-S-19
6-S-19
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
Concentrations in ug/L
1000
100
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

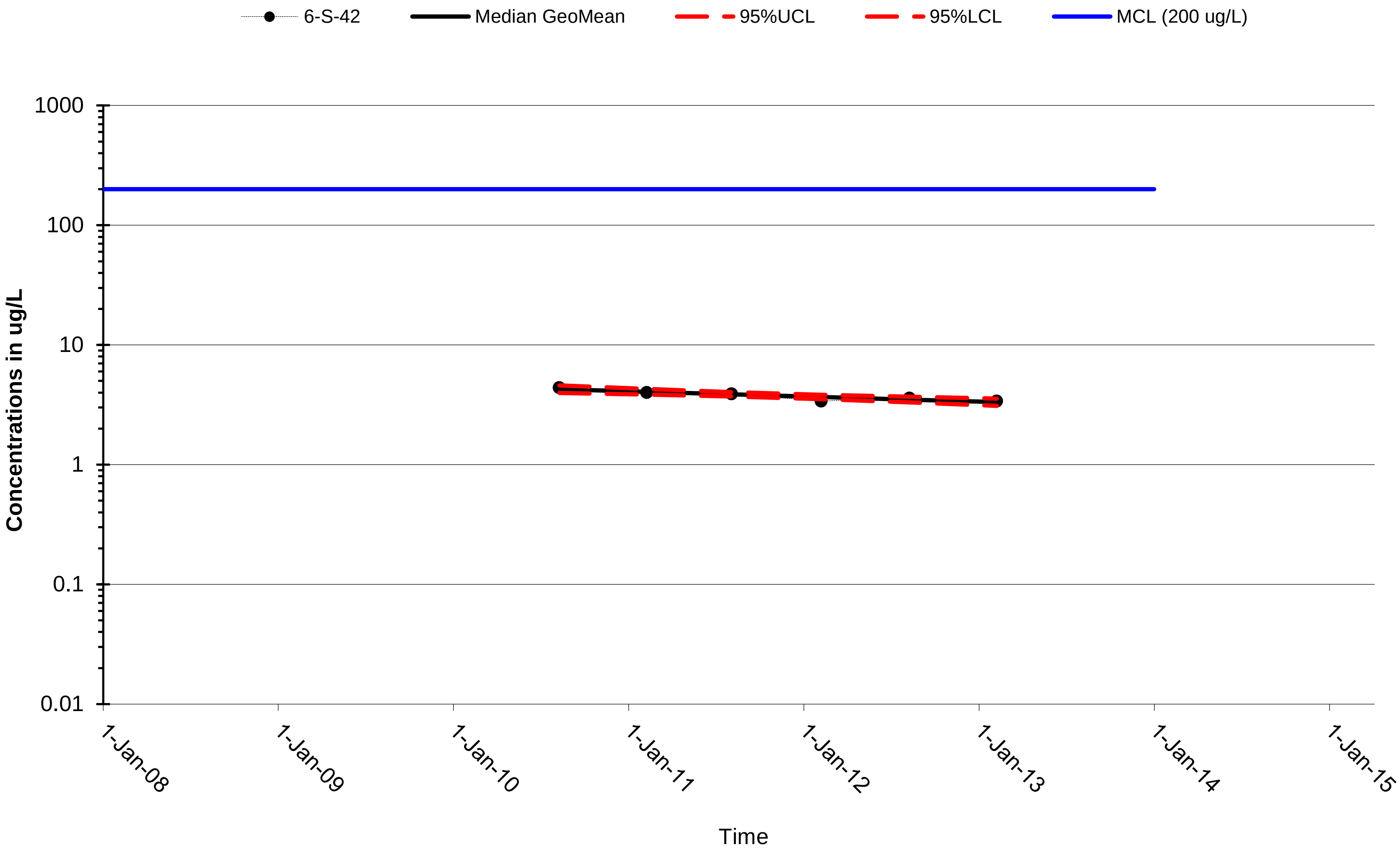

1,1,1-TCA in Downgradient Well
6-S-29
6-S-29
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
Concentrations in ug/L
1000
100
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

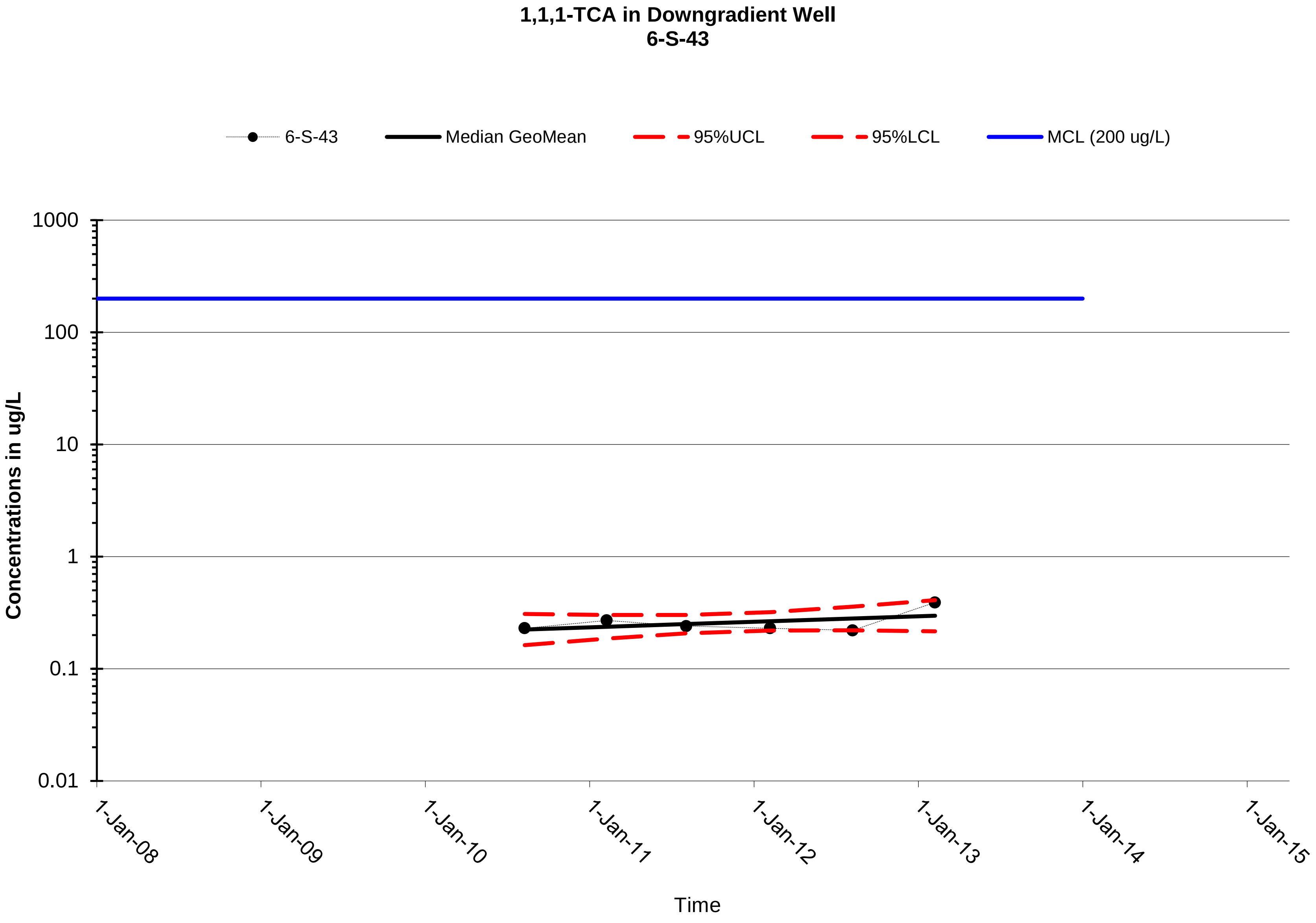

1,1,1-TCA in Downgradient Well
MW-9
MW-9
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
1000
100
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

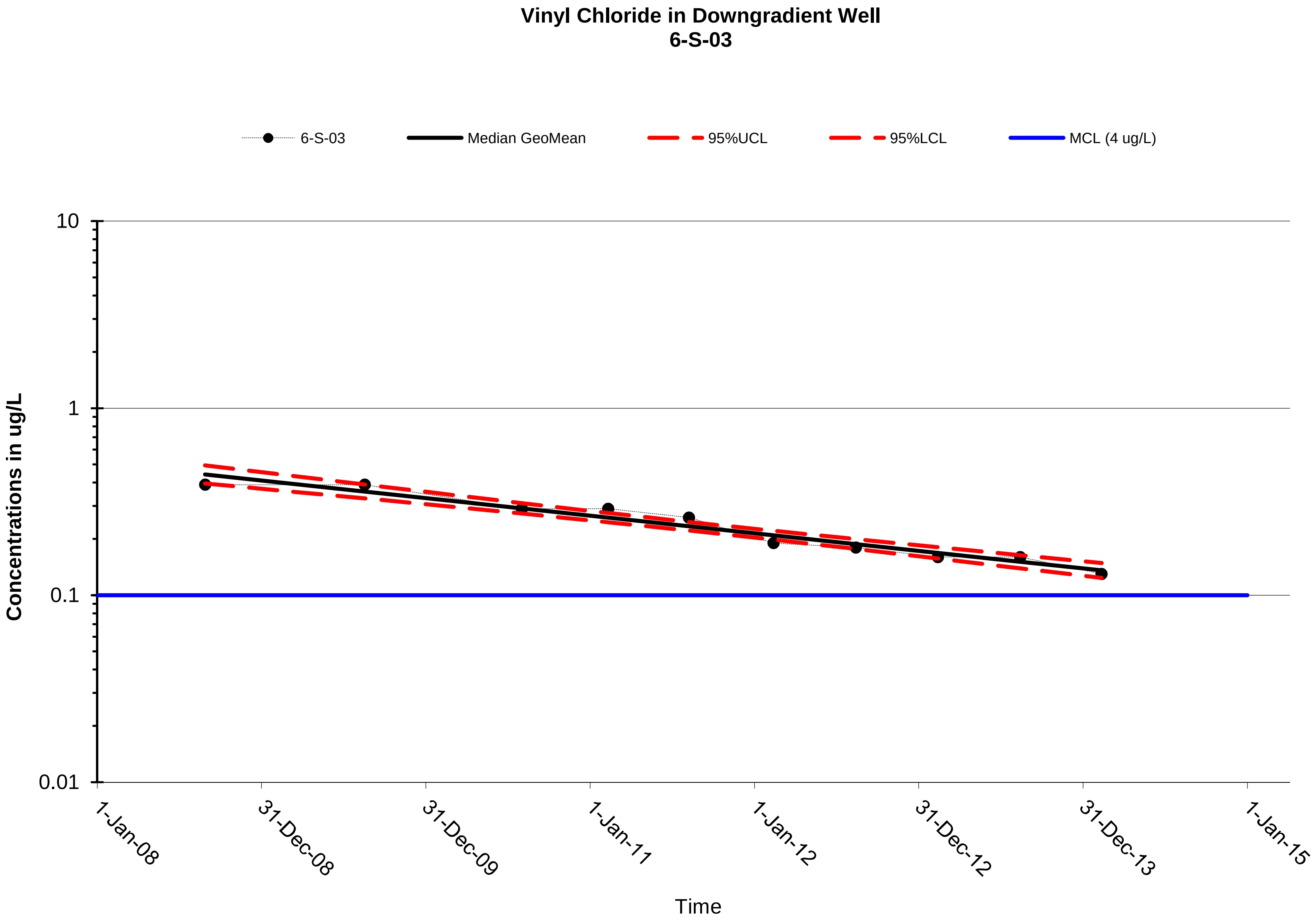
## 1,1,1-TCA in Downgradient Well
## 6-S-41

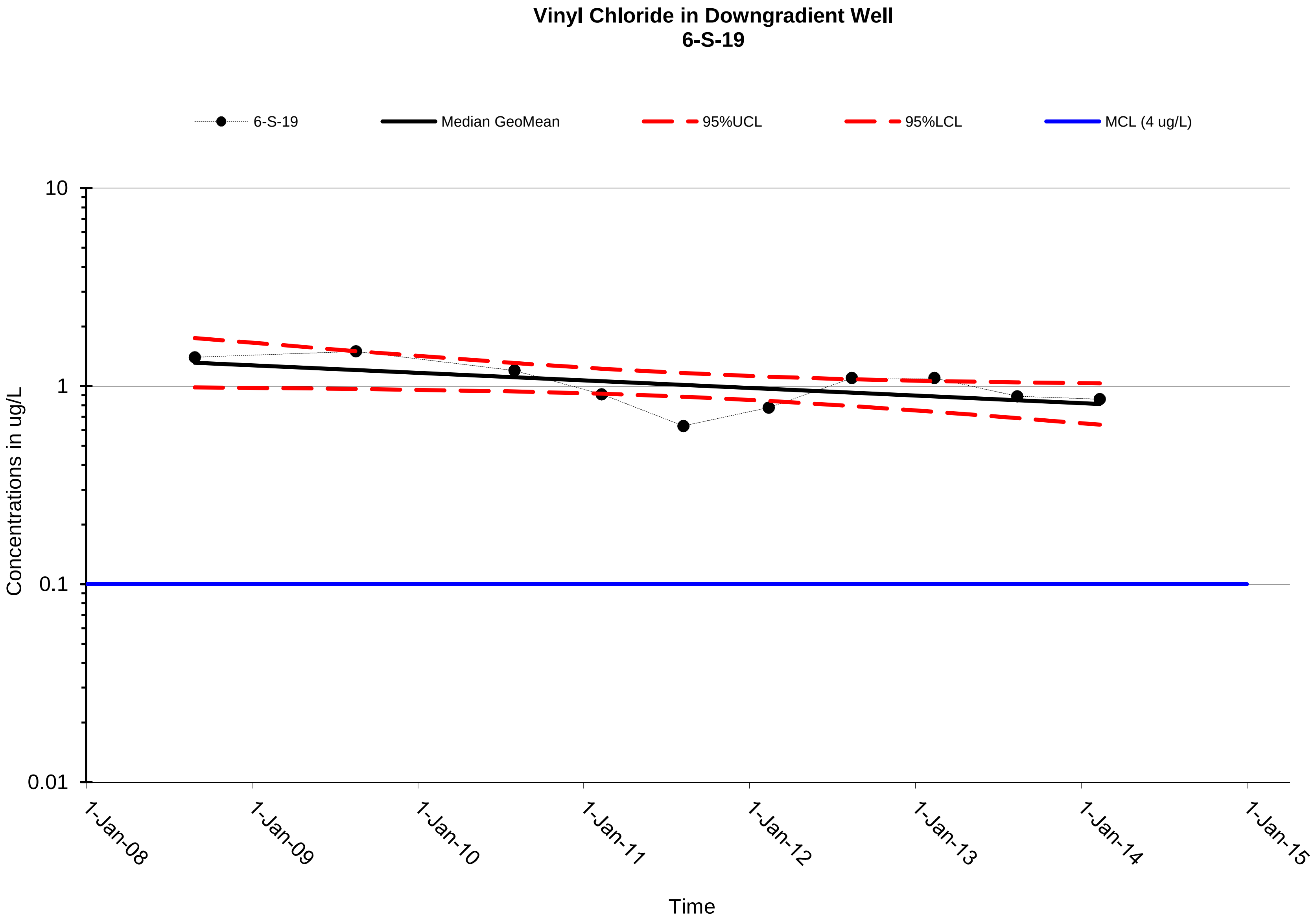


## 1,1,1-TCA in Downgradient Well
## 6-S-42

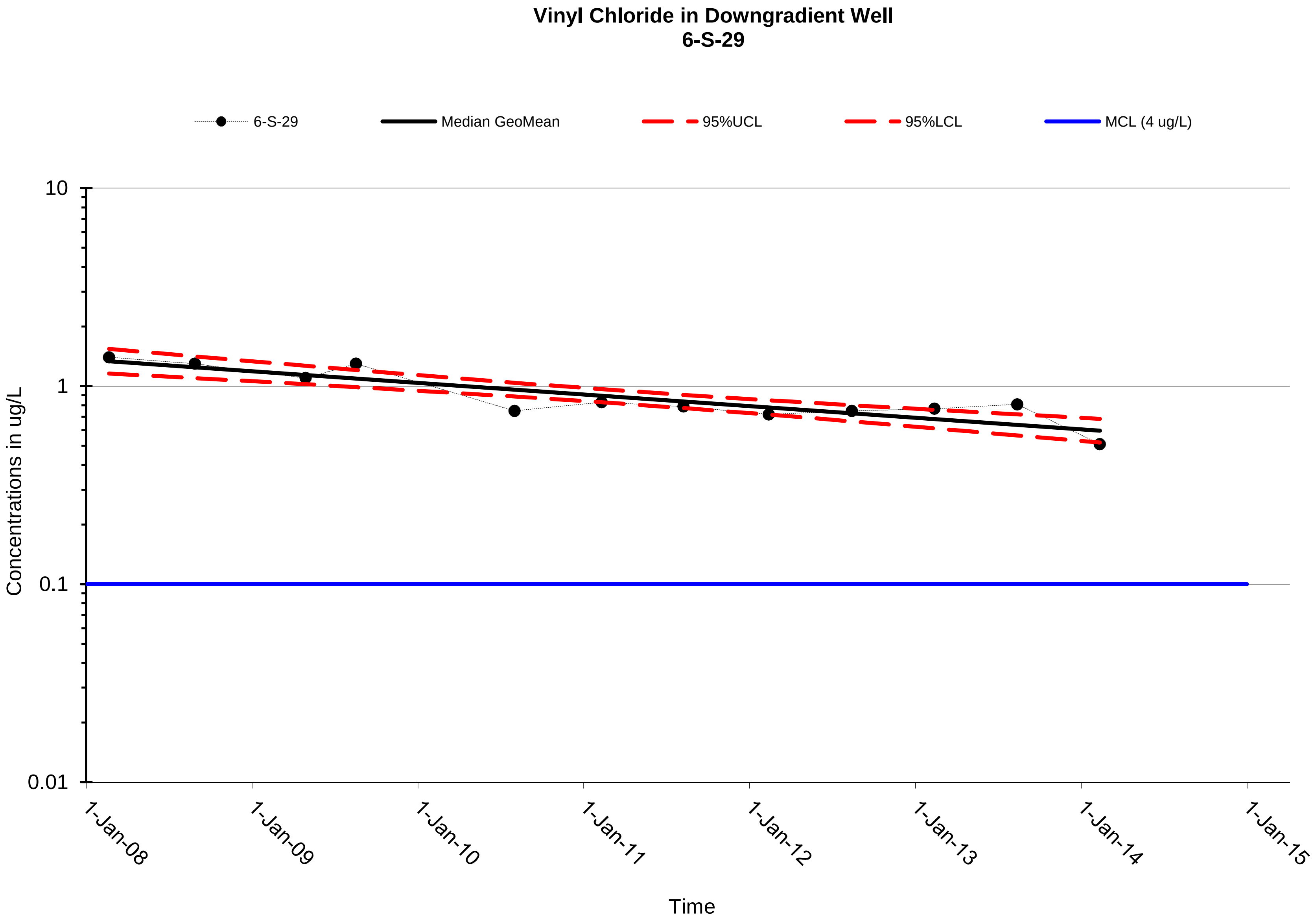



1,1,1-TCA in Downgradient Well
6-S-43
6-S-43
Median GeoMean
95%UCL
95%LCL
MCL (200 ug/L)
Concentrations in ug/L
1000
100
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

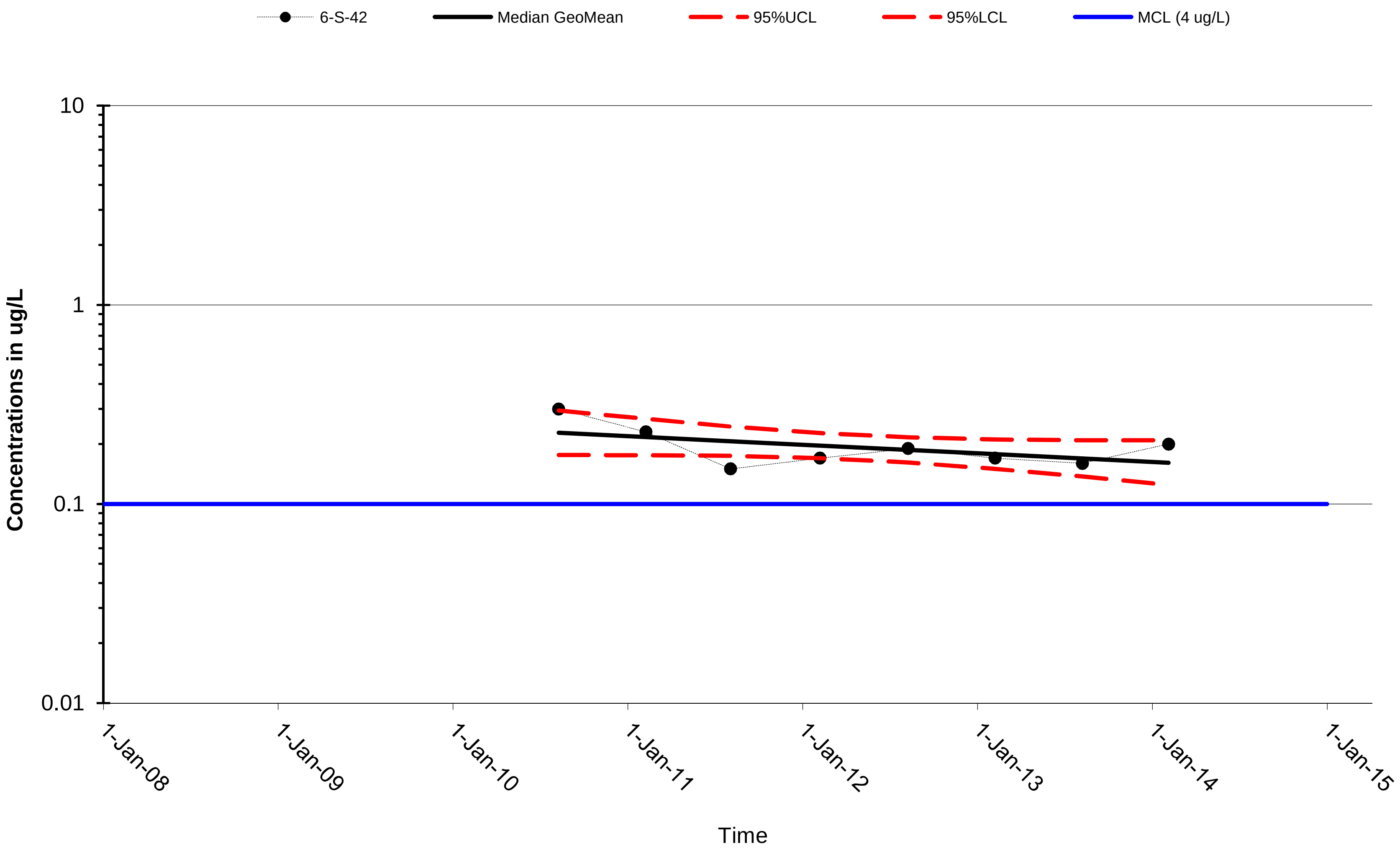

Vinyl Chloride in Downgradient Well
6-S-03
6-S-03
Median GeoMean
95%UCL
95%LCL
MCL (4 ug/L)
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
31-Dec-08
31-Dec-09
1-Jan-11
1-Jan-12
31-Dec-12
31-Dec-13
1-Jan-15
Time



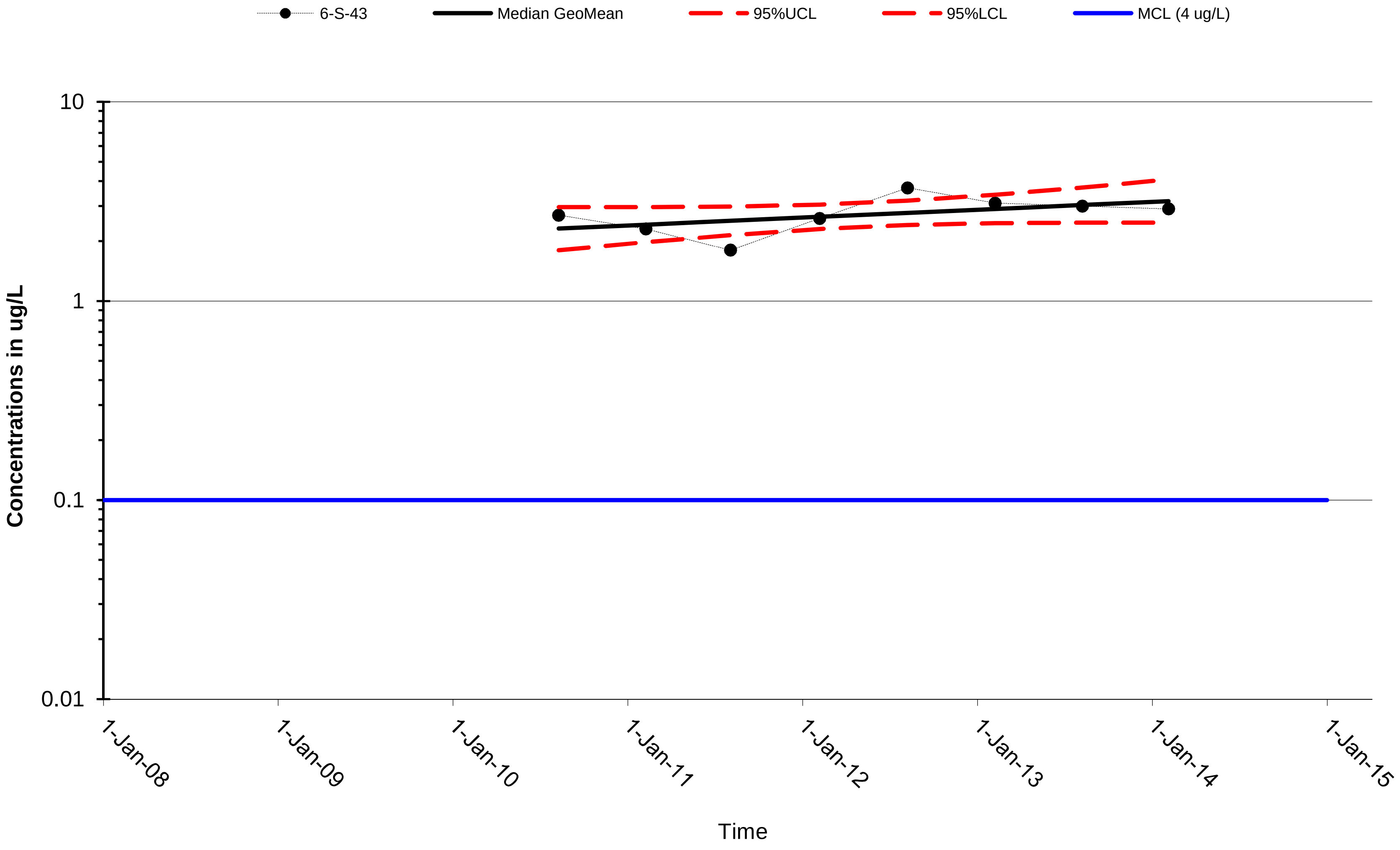
Vinyl Chloride in Downgradient Well
6-S-19
6-S-19
Median GeoMean
95%UCL
95%LCL
MCL (4 ug/L)
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

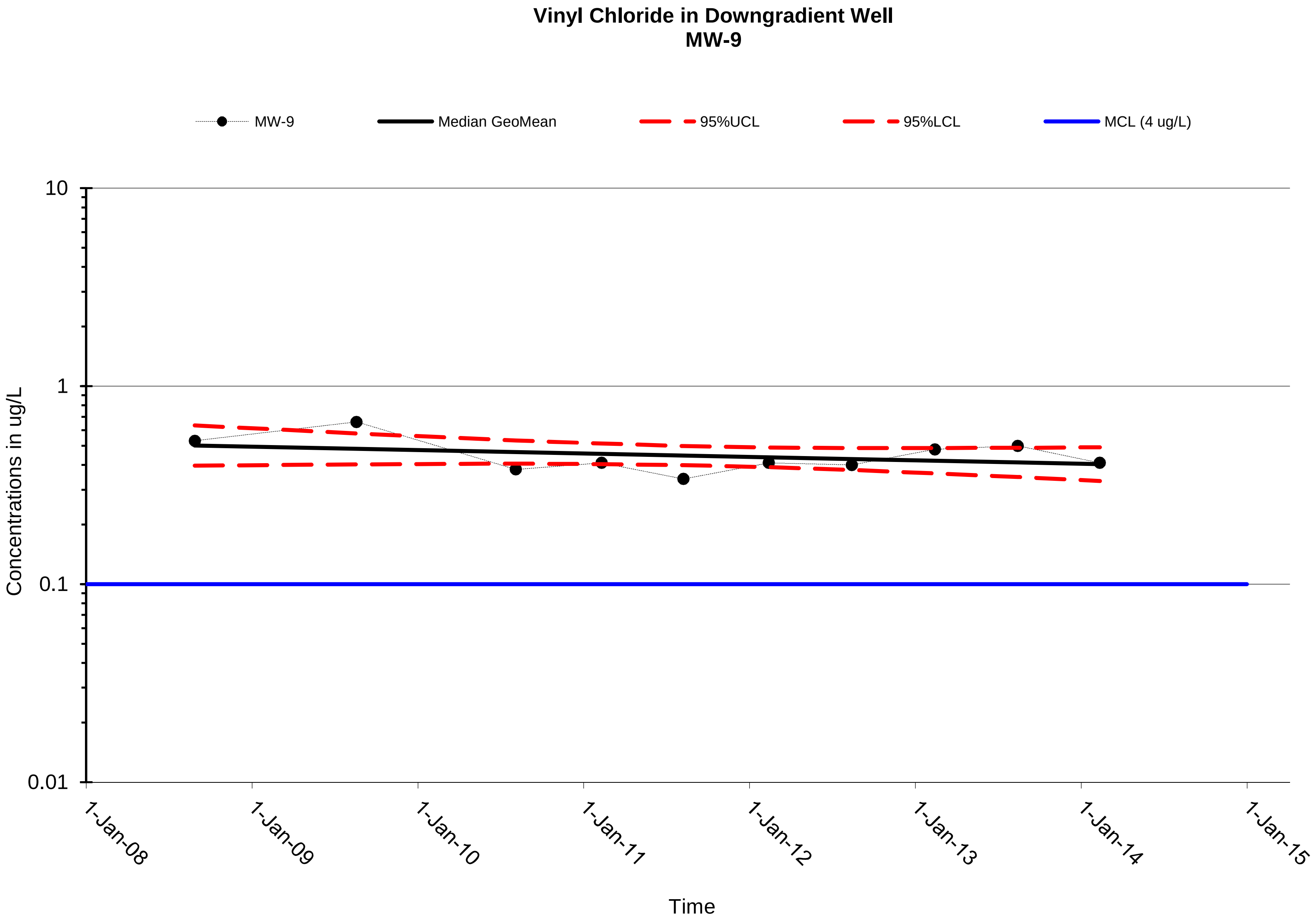

Vinyl Chloride in Downgradient Well
6-S-29
6-S-29
Median GeoMean
95%UCL
95%LCL
MCL (4 ug/L)
Concentrations in ug/L
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

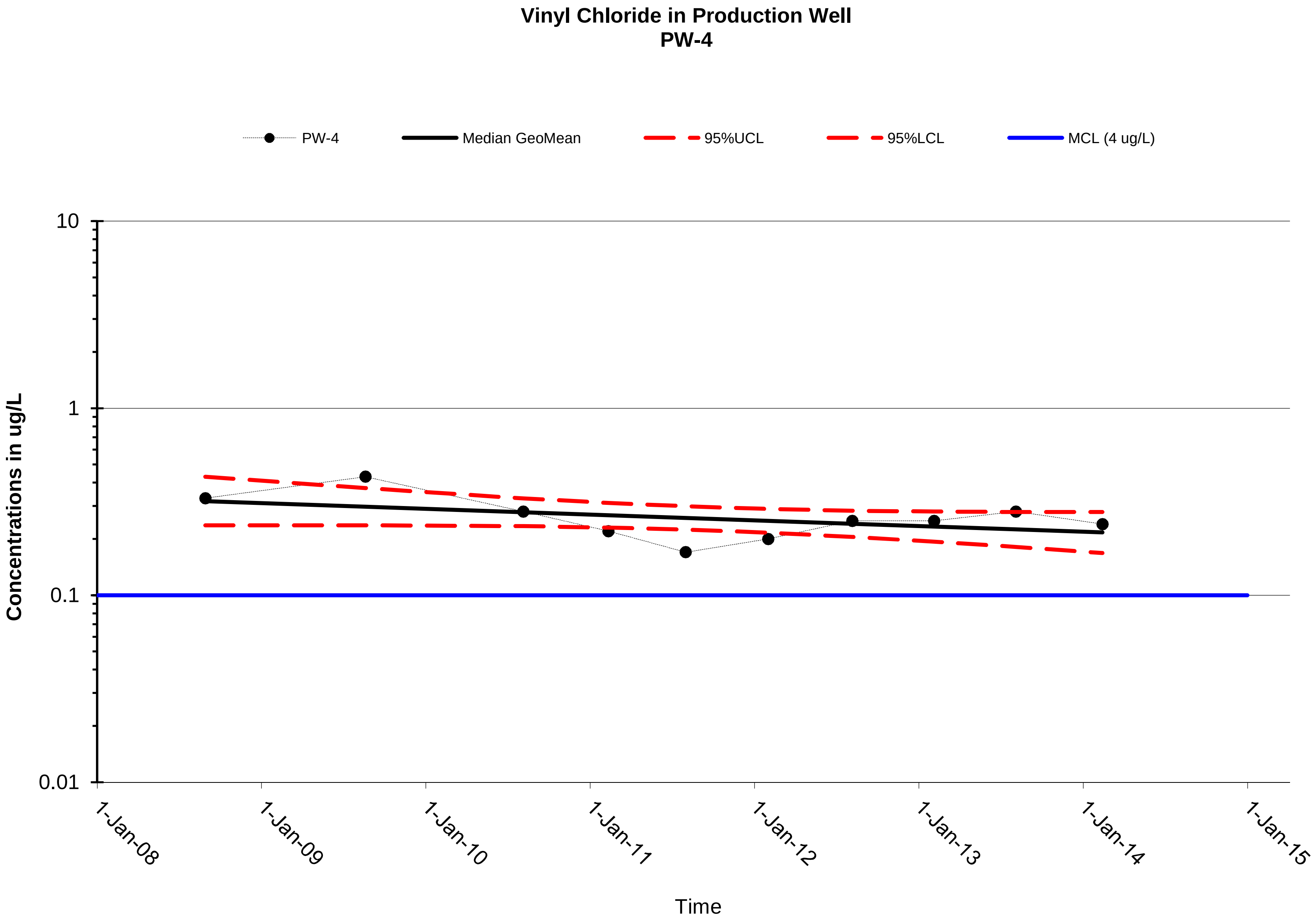
## Vinyl Chloride in Downgradient Well
## 6-S-42



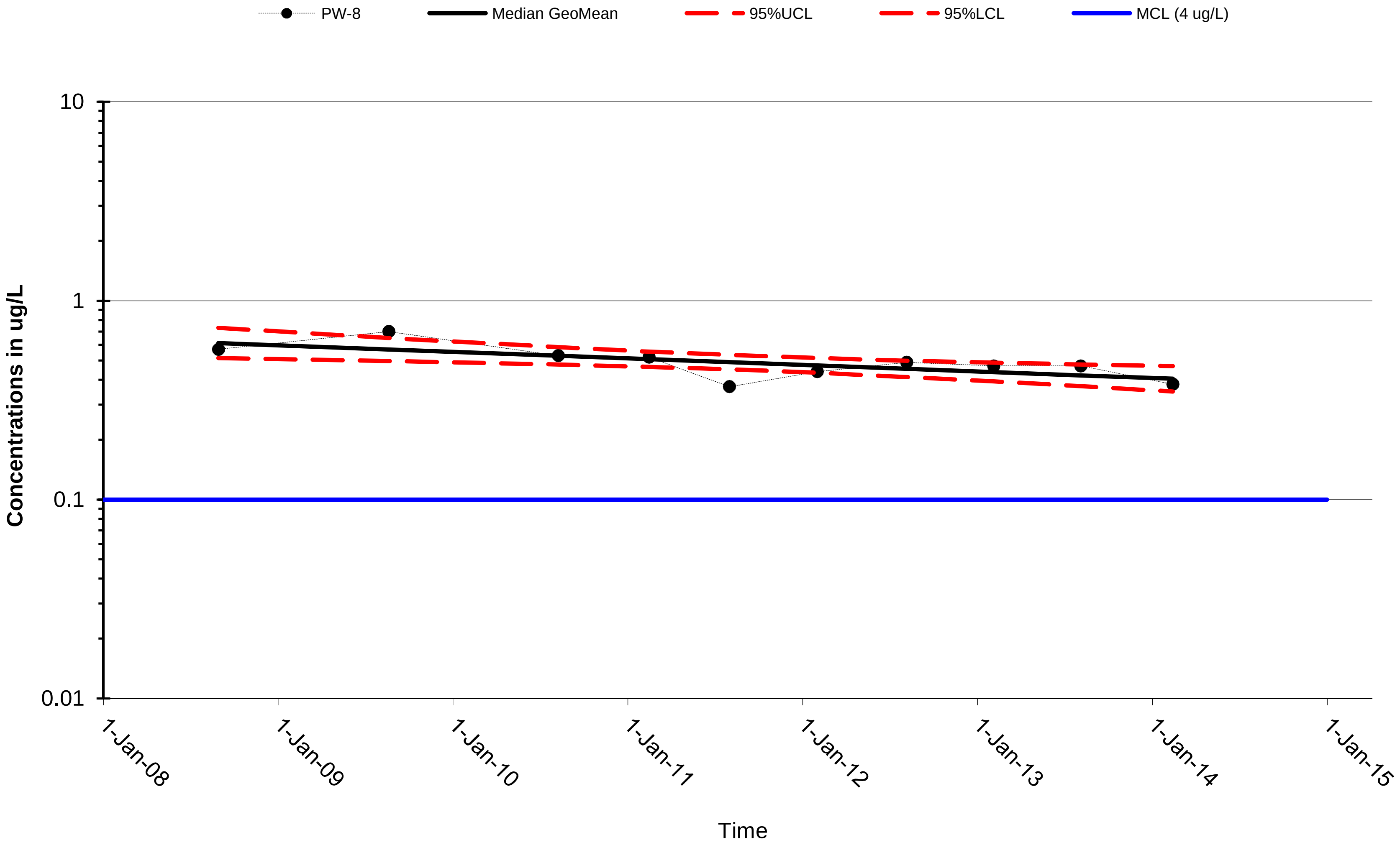
# Vinyl Chloride in Downgradient Well
## 6-S-43

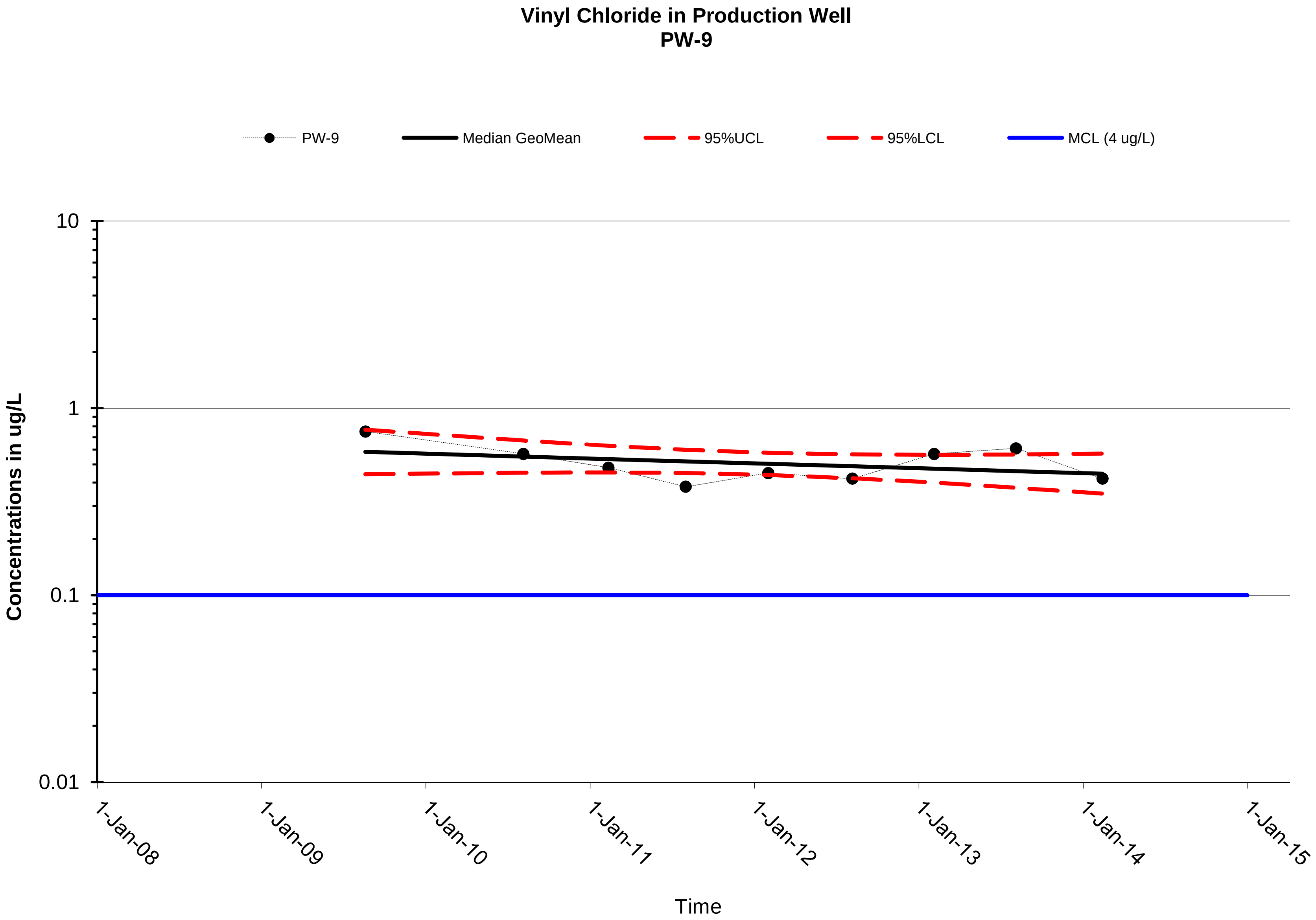



Vinyl Chloride in Downgradient Well
MW-9
MW-9
Median GeoMean
95%UCL
95%LCL
MCL (4 ug/L)
Concentrations in ug/L
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

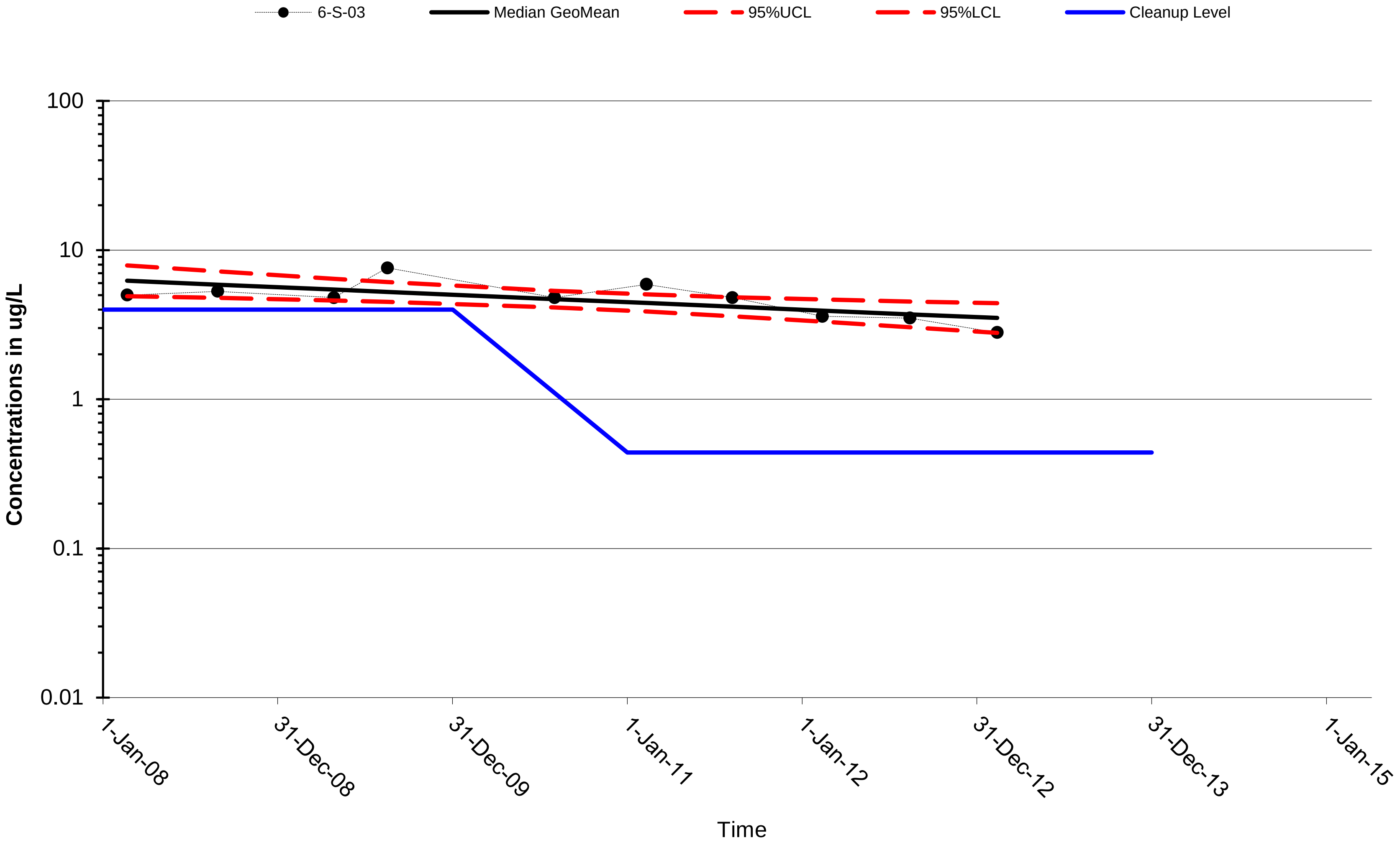

Vinyl Chloride in Production Well
PW-4
PW-4
Median GeoMean
95%UCL
95%LCL
MCL (4 ug/L)
10
1
0.1
0.01
Concentrations in ug/L
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

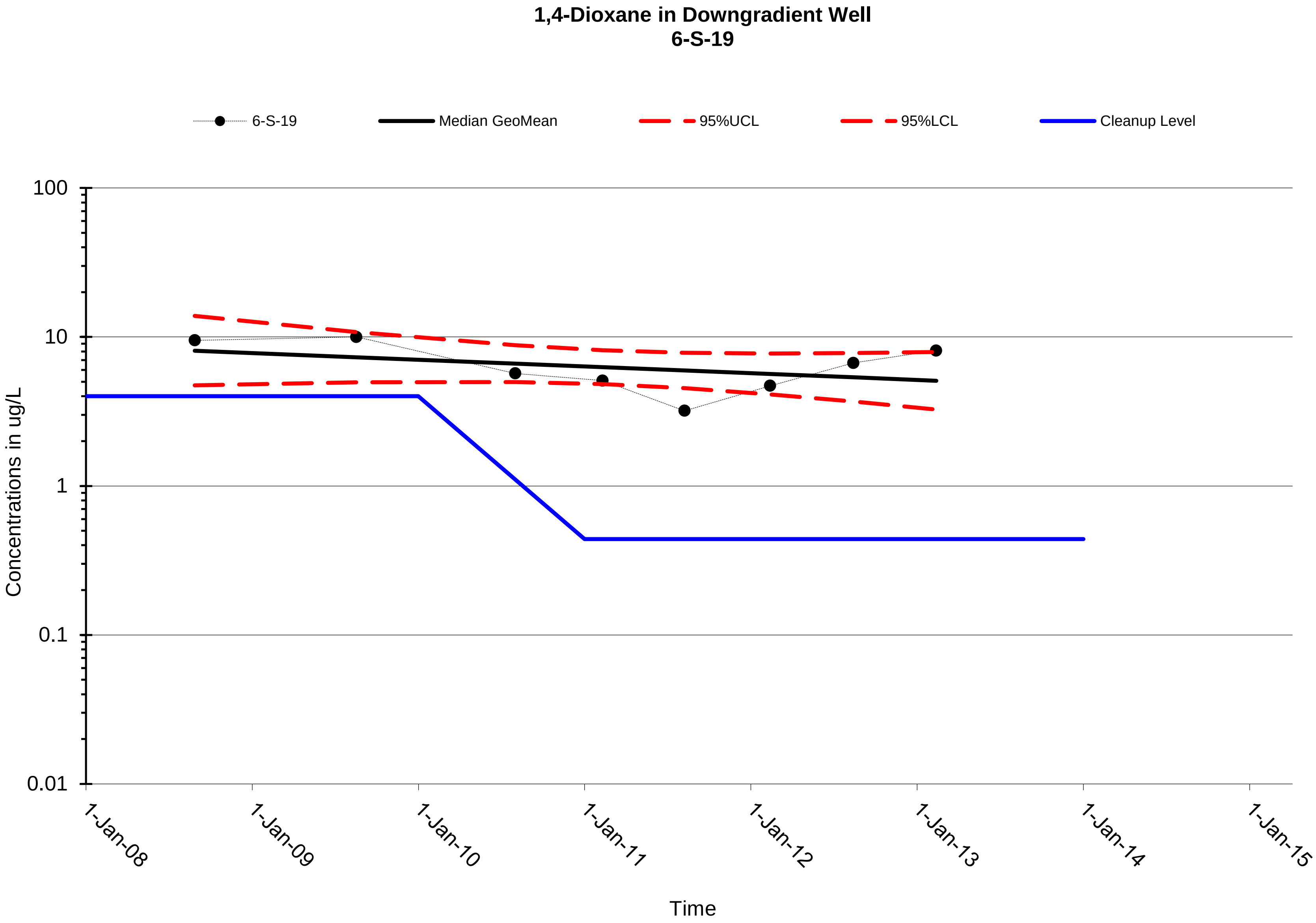
# Vinyl Chloride in Production Well
## PW-8




Vinyl Chloride in Production Well
PW-9
PW-9
Median GeoMean
95%UCL
95%LCL
MCL (4 ug/L)
Concentrations in ug/L
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

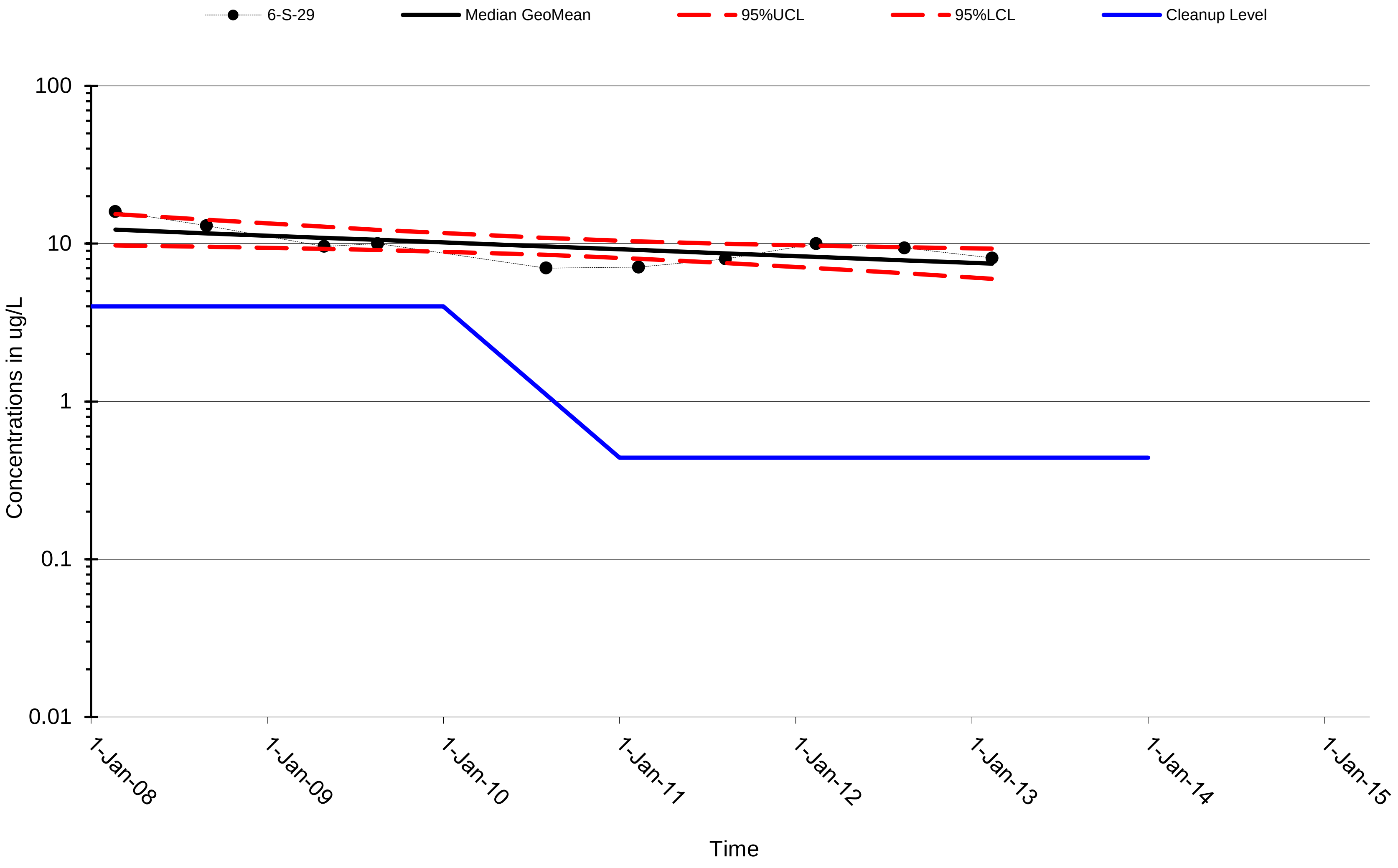
# 1,4-Dioxane in Downgradient Well
## 6-S-03



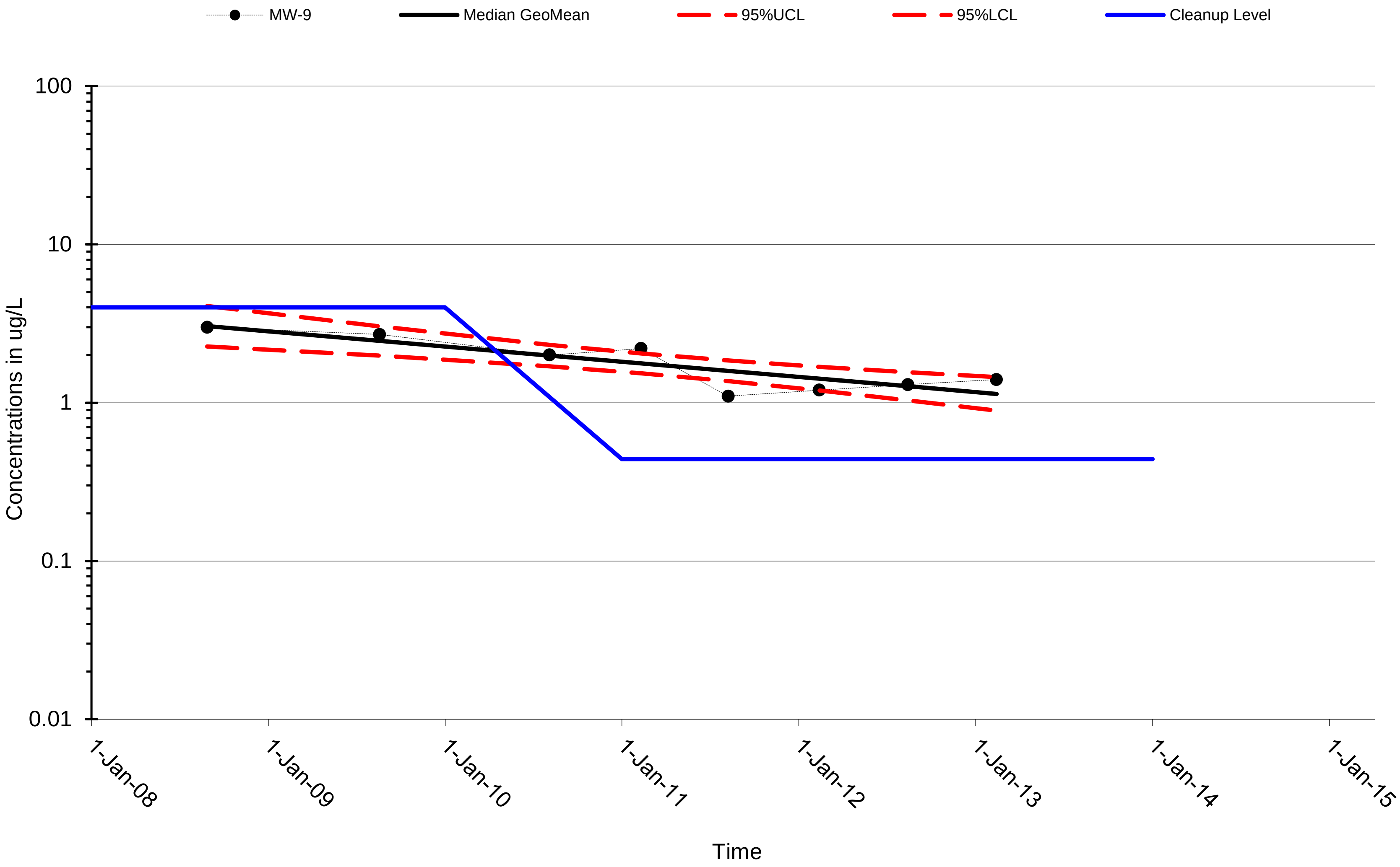


1,4-Dioxane in Downgradient Well
6-S-19

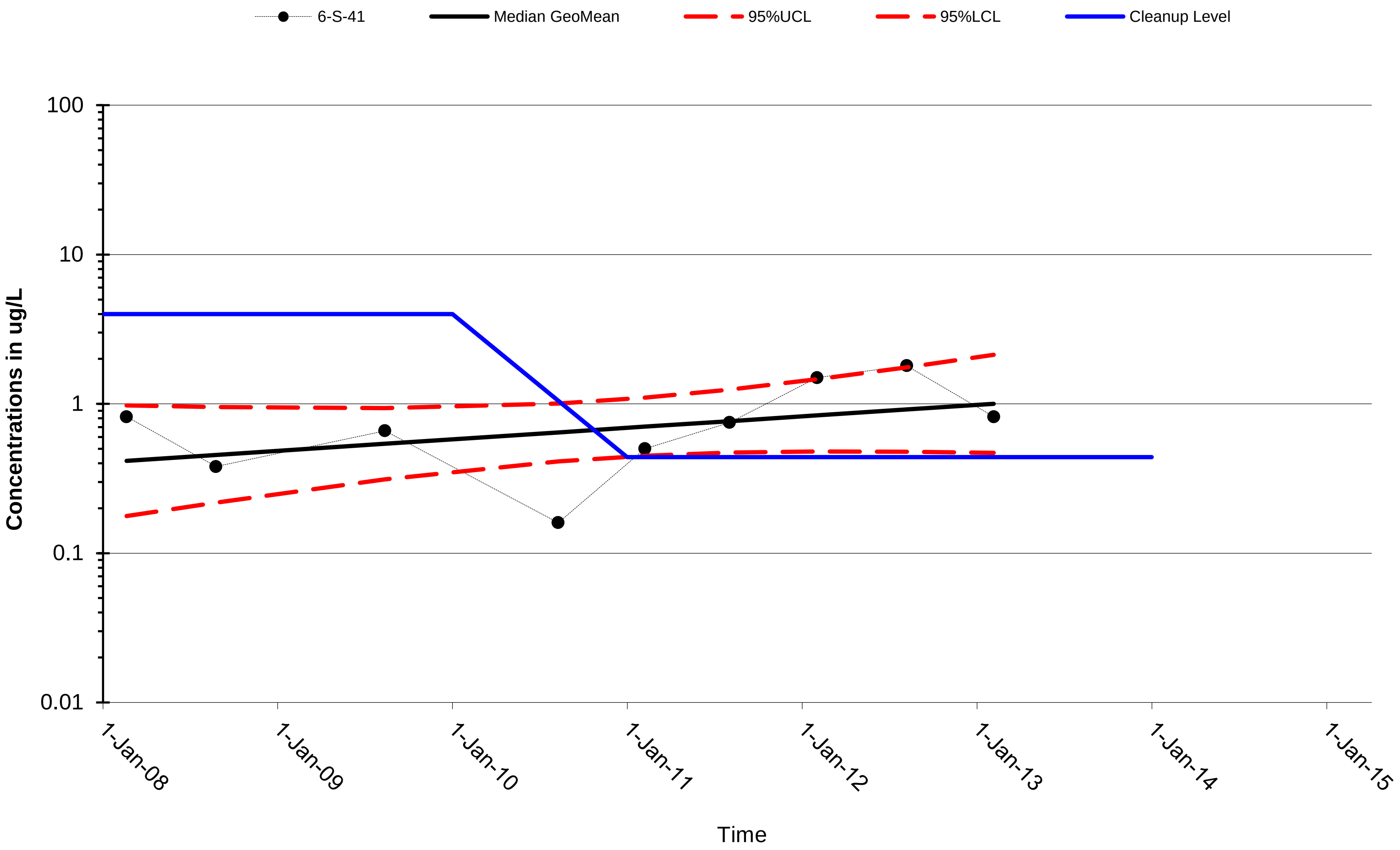
## 1,4-Dioxane in Downgradient Well
## 6-S-29



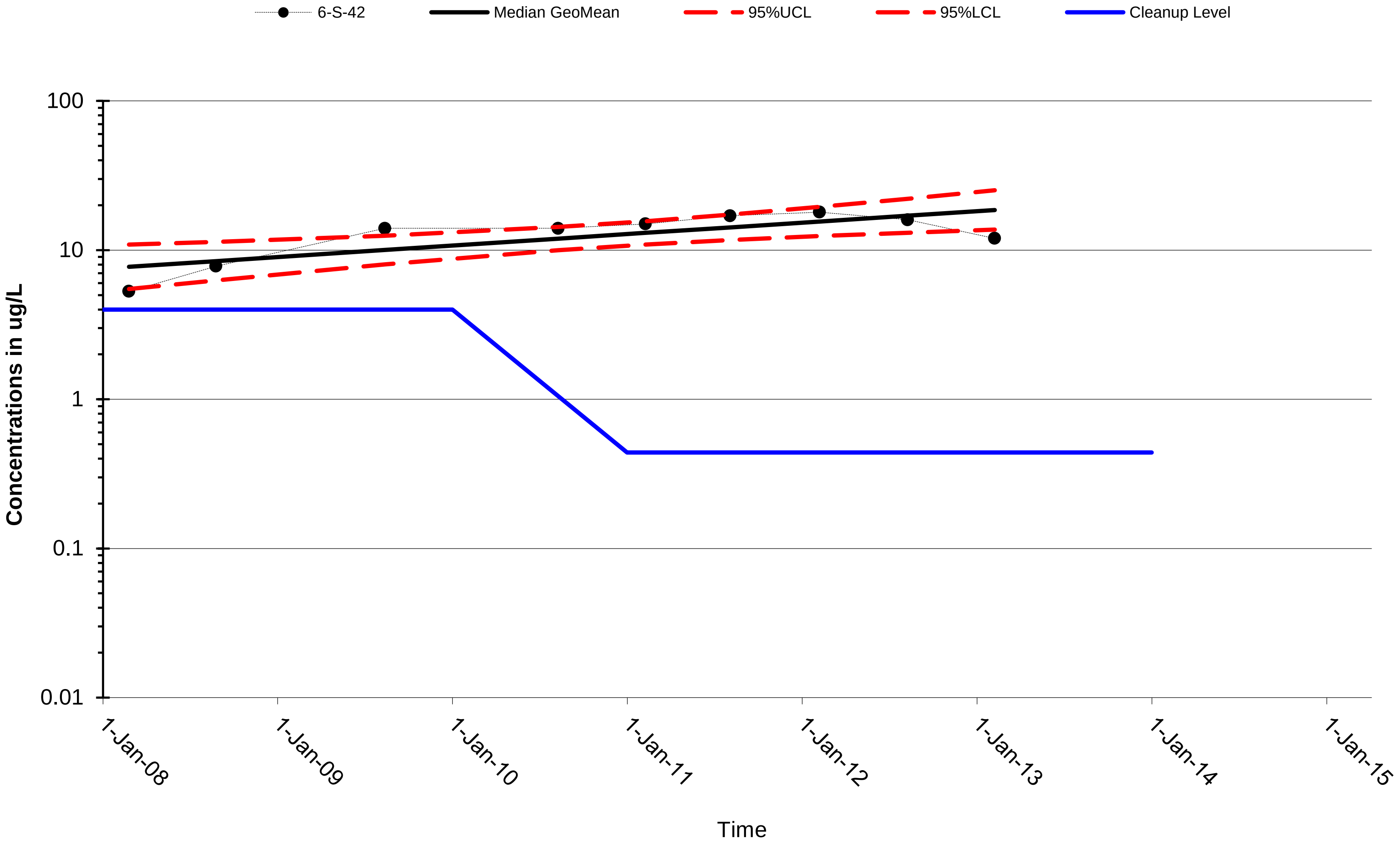
# 1,4-Dioxane in Downgradient Well
## MW-9

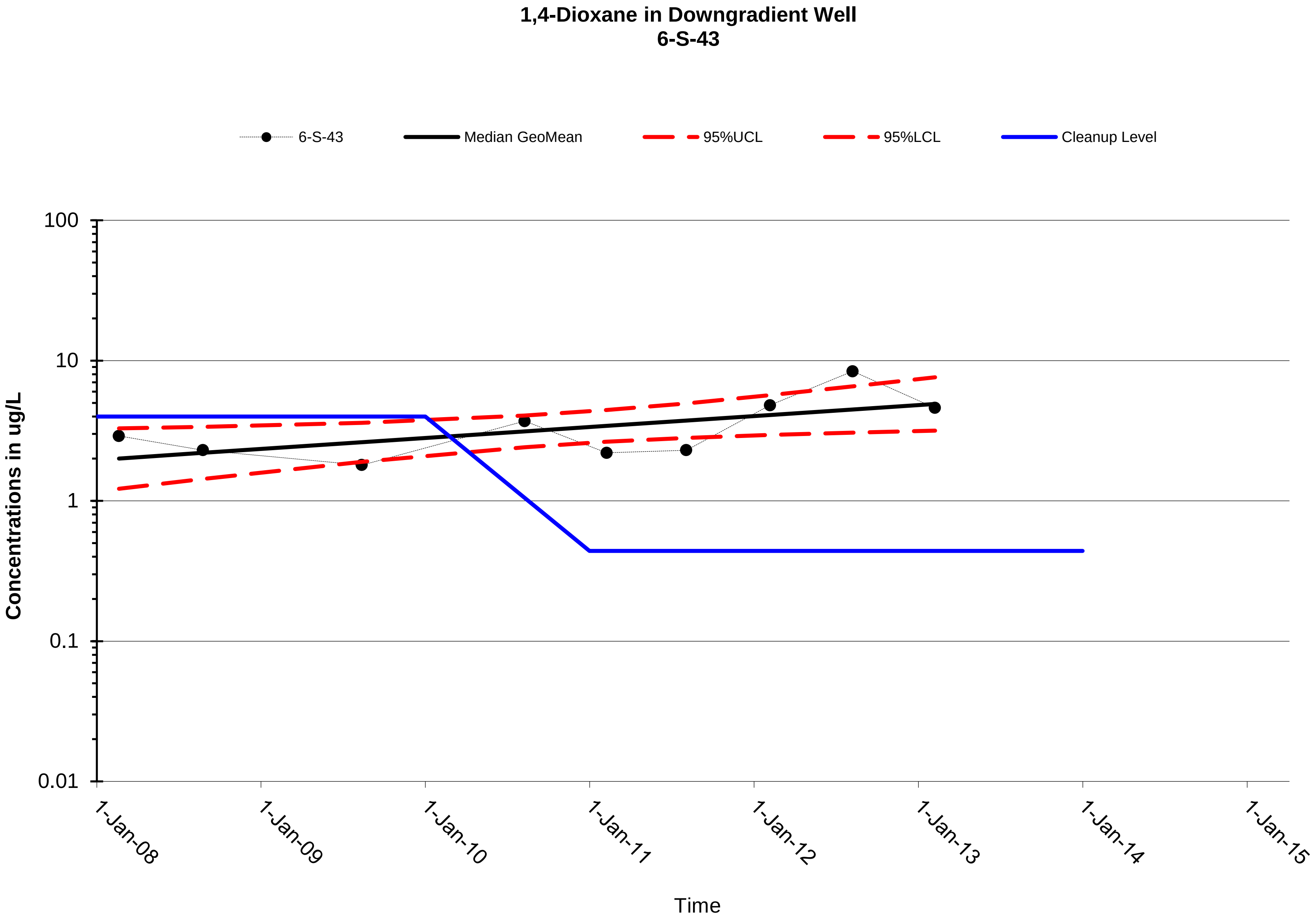


# 1,4-Dioxane in Downgradient Well
## 6-S-41



## 1,4-Dioxane in Downgradient Well
## 6-S-42




1,4-Dioxane in Downgradient Well
6-S-43
6-S-43
Median GeoMean
95%UCL
95%LCL
Cleanup Level
Concentrations in ug/L
100
10
1
0.1
0.01
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
Time

# APPENDIX B

## Area 31 Monitoring

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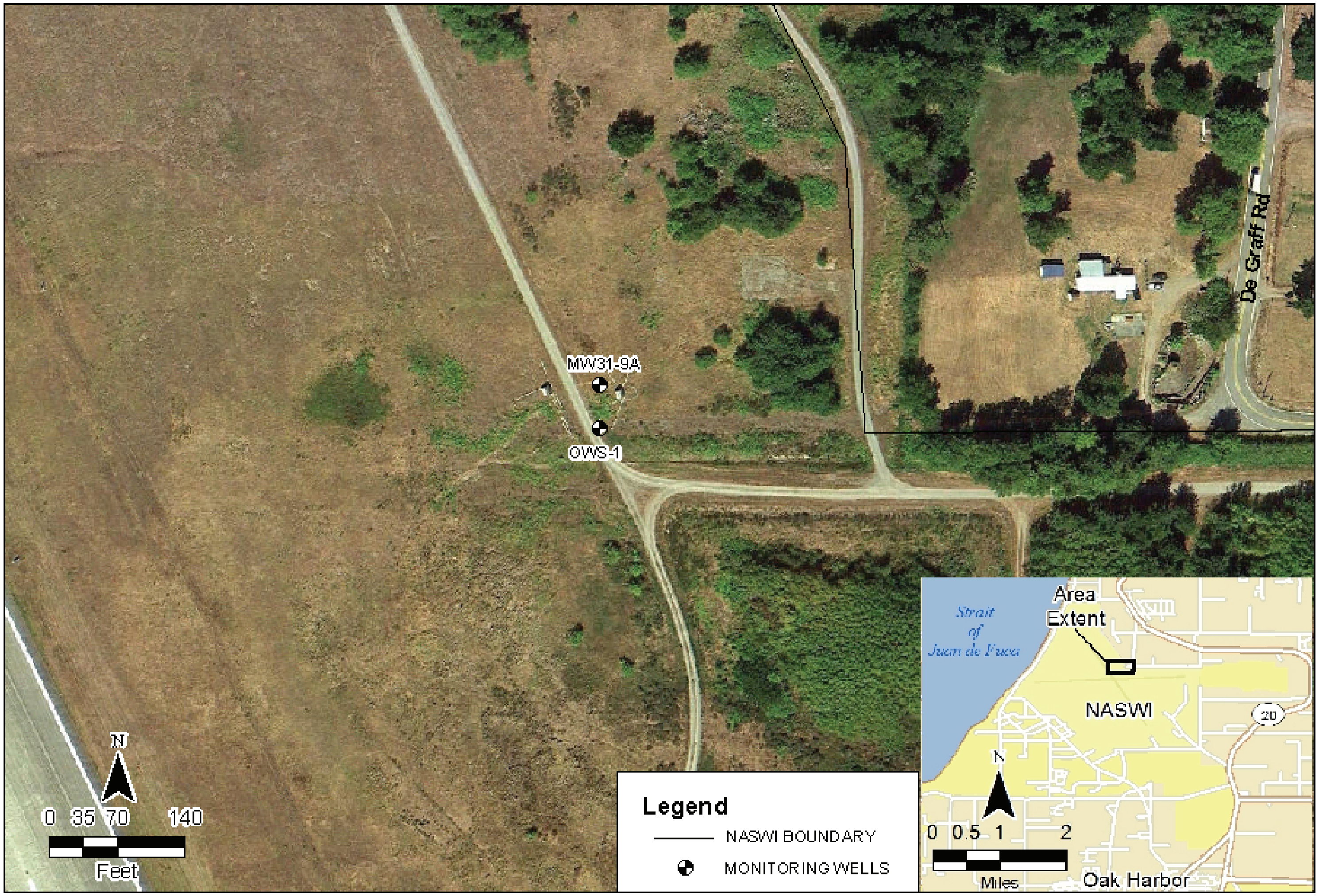

* Copy of Figure 1-1 from *Annual 2012-2013 Groundwater Long-Term Monitoring for OU 5 Area 1*, *Appendix A* (U.S. Navy 2013d)

| | | |
|---|---|---|
| **U.S. NAVY** | **Figure B-1***<br>**Area 31 Moniroing Well Locations** | Delivery Order 0066<br>NAS Whidbey<br>Whidbey Island, WA<br>FOURTH<br>FIVE-YEAR REVIEW |

## **Table B-1*** Area 31 Monitoring Well Sample Results, Cumulative Summary

| **Well** | **Sample** | **Date** | **pH** | **Diesel Range Organics (DRO) µg/L** | **Gasoline Range Organics (GRO) µg/L** | **Residual Range Organics (RRO) µg/L** | **Benzene VOC 8260 µg/L** | **Naphthalene VOC 8260 µg/L** | **Vinyl Chloride VOC 8260 µg/L** | **Manganese (Dissolved) µg/L** | **Manganese (Total)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Cleanup** | **Levels** | **1,000** | **1,000** | **1,000** | **5** | **320** | **0.1** | **142** | |
| **MW31-9A** | GM-07-154 | 3/1/2007 | 6.41 | **8,700 Y** | **3,900 Y** | 560 L | NA | NA | NA | NA | |
| | GM-07-257 | 5/15/2007 | 6.37 | **15,000 Y** | **4,200 Y** | 450 J | **190 D** | 74 D | **0.61** | **9,670** | |
| | GM-07-341 | 8/22/2007 | 6.45 | **11,000 Y** | **4,300 Y** | 520 J | NA | NA | NA | NA | |
| | GM-09-102 | 4/27/2009 | 6.39 | NA | NA | NA | NA | NA | NA | 5.3 | |
| | GM-10-153 | 8/11/2010 | 6.33 | **17,000 Y** | **3,300 DY** | ND (800)$^{UJ}$ | **150 D** | 120 D | **0.34** | **8,180** | **8,280** |
| | GM-11-156 | 8/1/2011 | 6.74 | **24,000 Y** | **2,800 J** | 770 L | **92 D** | 110 D | 0.09 J | **5,230** | **5,380** |
| | GM-12-252 | 8/16/2012 | 6.35 | **11,000 YJ** | **4,100 Y** | 720 L | **70 D** | 140 D | 0.09 J | **5,700 J** | **5,630 J** |
| **OWS-1** | GM-07-150 | 3/1/2007 | 6.52 | **1,300 Y** | 820 Y | 110 J | NA | NA | NA | NA | |
| | GM-07-253 | 5/15/2007 | 6.39 | **1,200 Y** | 640 Y | 68 J | **11** | 4.5 | **0.42 J** | **3,400** | |
| | GM-07-337 | 8/22/2007 | 6.47 | **2,800 Y** | **1,200 Y** | 150 J | NA | NA | NA | NA | |
| | GM-10-152 | 8/11/2010 | 6.28 | **2,500 Y** | **2,000 DY** | ND (540)* | **65** | 150 D | **0.80** | **5,210** | **5,360** |
| | GM-11-158 | 8/1/2011 | 6.76 | **6,400 Y** | **2,200 Y** | 390 J | **35** | 85 D | **0.16** | **4,920** | **4,920** |
| | GM-12-253 | 8/16/2012 | 6.35 | **5,100 YJ** | **1,400 Y** | 300 J | **78 D** | 110 D | **0.19 J** | **4,130 J** | **4,280 J** |

*Notes:*

**Bold text** indicates an exceedance of cleanup levels.

D – diluted

J – Estimated value; compound is detected but below quantitation limit or qualified as estimated due to a quality control outlier.

L – The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.

µg/L – microgram per liter

ND ( )* - indicated parameter was not detected at the quantitation limit in parenthesis.

ND ( )$^{UJ}$ - indicated parameter was not detected at the elevated detection limit indicated in parenthesis.

VOC – volatile organic compound

Y – The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.

* Copy of Table 2-3 from *Annual 2012-2013 Groundwater Long-Term Monitoring for OU 5 Area 1*, *Appendix A* (U.S. Navy 2013d)

# APPENDIX C

## Site Inspection Results Checklist

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# Site Inspection Checklist
# OU 1, Area 5
# NAS Whidbey Island
# Page 1 of 3

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 1, Area 5, Highway 20, Hoffman landfill | **Date of inspection:**<br>18 March 2013 |
| **Location and Region:** Oak Harbor, WA, R10 | **EPA ID:**<br>WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50's, cloudy, windy |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other Limited Groundwater Monitoring - Complete
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

Not Applicable

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
Remarks Fencing around perimeter of station is in good shape.

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map **X** N/A
Remarks .Signs erected at relevant locations

### C. Institutional Controls (ICs)

## Site Inspection Checklist
## OU 1, Area 5
## NAS Whidbey Island
## Page 2 of 3

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting, on-site contractor
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone (Name) RPM (Title) (360) 396-1030 (Phone no.)

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes **X**☐ No N/A
Violations have been reported ☐ Yes **X**☐ No N/A
Other problems or suggestions: ☐None

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

**D. General**

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks

2. **Land use changes on site** ☐ N/A
Remarks None

3. **Land use changes off site** ☐ N/A
Remarks None

### VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

### VII. LANDFILL COVERS ☐ Applicable X N/A

### VIII. MONITORING ☐ Applicable X N/A

### X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

### XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

## Site Inspection Checklist
## OU 1, Area 5
## NAS Whidbey Island

| | |
|---|---|
| | Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br>Monitoring was the final remedy and monitoring was conducted and terminated prior to the current five-year review period. |
| **B.** | **Adequacy of O&M** |
| | Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br>Monitoring was the final remedy and monitoring was conducted and terminated prior to the current five-year review period. As a result, no operation and maintenance was necessary. |
| **C.** | **Early Indicators of Potential Remedy Problems** |
| | Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br>None. |
| **D.** | **Opportunities for Optimization** |
| | Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br>None |

# Site Inspection Checklist
# OU 1, Area 6
# NAS Whidbey Island
# Page 1 of 9

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:** OU 1, Area 6 Landfill | **Date of inspection:** 22, 26, and 27 March, 2013 and 18 April, 2013 |
| **Location and Region:** Oak Harbor, WA, R10 | **EPA ID:** WA5170090059 |
| **Agency, office, or company leading the five-year review:** U.S. Navy | **Weather/temperature:** varied |

**Remedy Includes**: (Check all that apply)

**X** Landfill cover/containment
**X** Access controls
**X** Institutional controls
**X** Groundwater pump and treatment
☐ Surface water collection and treatment
☐ Other________________________________________________
________________________________________________
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

| | | | |
|---|---|---|---|
| **X** O&M manual | **X** Readily available | **X** Up to date | ☐ N/A |
| **X** As-built drawings | **X** Readily available | **X** Up to date | ☐ N/A |
| **X** Maintenance logs | **X** Readily available | **X** Up to date | ☐ N/A |

Remarks________________________________________________
________________________________________________

2.

| | | | |
|---|---|---|---|
| **Site-Specific Health and Safety Plan** | **X** Readily available | **X** Up to date | ☐ N/A |
| **X** Contingency plan/emergency response plan | **X** Readily available | **X** Up to date | ☐ N/A |

Remarks________________________________________________
________________________________________________

3.

| | | | |
|---|---|---|---|
| **O&M and OSHA Training Records** | ☐**X** Readily available | **X** Up to date | ☐ N/A |

Remarks________________________________________________
________________________________________________

4. **Permits and Service Agreements**

| | | | |
|---|---|---|---|
| ☐ Air discharge permit | ☐ Readily available | ☐ Up to date | **X** N/A |
| ☐ Effluent discharge | ☐ Readily available | ☐ Up to date | **X** N/A |
| ☐ Waste disposal, POTW | ☐ Readily available | ☐ Up to date | **X** N/A |
| ☐ Other permits______________________ | ☐ Readily available | ☐ Up to date | **X** N/A |

Remarks No permits required.

6. **Groundwater Monitoring Records** **X** Readily available **X** Up to date ☐ N/A
Remarks:

7. **Leachate Extraction Records** ☐ Readily available ☐ Up to date **X** N/A
Remarks________________________________________

8. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date **X** N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date **X** N/A
Remarks________________________________________

9. **Daily Access/Security Logs** **X** Readily available **X** Up to date ☐ N/A
Remarks Site is located within a fenced area of the installation.

## IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house **X** Contractor for Federal Facility
☐ Other________________________________________

2. **O&M Cost Records**
☐ Readily available **X** Up to date
**X** Funding mechanism/agreement in place
Original O&M cost estimate $799,000 ☐ Breakdown attached

Average annual O&M (including monitoring) is approximately $750,000

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: None

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
Remarks Fencing is secure and in good condition.

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Signs are present and in good condition.

**C. Institutional Controls (ICs)**

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting, on-site contractor
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes **X**☐ No N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks________________________________________

**D. General**

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks

2. **Land use changes on site** ☐ N/A
Remarks None

3. **Land use changes off site** ☐ N/A
Remarks Operations at a gravel quarry just beyond the northwest corner of the controlled area excavated beyond the permit limits and threatened the slope stability along this section of the controlled area. Navy is working with appropriate state agency to address the issue.

## VI. GENERAL SITE CONDITIONS

**A. Roads** **X** Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map **X** Roads adequate ☐ N/A
Remarks________________________________________

**B. Other Site Conditions**

Remarks None

## VII. LANDFILL COVERS **X** Applicable ☐ N/A

### A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent______________ Depth 1.5 to 2 feet
Remarks Settlement was noted during the previous five-year review period which has not worsened during this review period.

2. **Cracks** ☐ Location shown on site map **X** Cracking not evident
Lengths____________ Widths___________ Depths__________
Remarks______________________________________________________________________

3. **Erosion** ☐ Location shown on site map **X** Erosion not evident
Areal extent______________ Depth____________
Remarks______________________________________________________________________

4. **Holes** ☐ Location shown on site map **X** Holes not evident
Areal extent______________ Depth____________
Remarks______________________________________________________________________

5. **Vegetative Cover** **X** Grass **X** Cover properly established **X** No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks Grass is mowed and pesticides are sprayed as needed for deep-rooted weeds (Lupine and Scotts Broom).

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks Armoring is limited and in good shape.

7. **Bulges** ☐ Location shown on site map **X** Bulges not evident
Areal extent______________ Height____________
Remarks______________________________________________________________________

8. **Wet Areas/Water Damage** **X** Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent______________
☐ Ponding ☐ Location shown on site map Areal extent______________
☐ Seeps ☐ Location shown on site map Areal extent______________
☐ Soft subgrade ☐ Location shown on site map Areal extent______________
Remarks______________________________________________________________________

9. **Slope Instability** ☐ Slides ☐ Location shown on site map **X** No evidence of slope instability
Areal extent______________
Remarks______________________________________________________________________

**B. Benches** ☐ Applicable **X** N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

**C. Letdown Channels** ☐ Applicable **X** N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

**D. Cover Penetrations** **X** Applicable ☐ N/A

1. **Gas Vents** ☐ Active **X** Passive
**X** Properly secured/locked **X** Functioning ☐ Routinely sampled
**X** Good condition ☐ Evidence of leakage at penetration
☐ Needs Maintenance ☐ N/A
Remarks____________________________________________________________

2. **Gas Monitoring Probes**
☐ Properly secured/locked G Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance **X** N/A
Remarks____________________________________________________________

3. **Monitoring Wells** (within surface area of landfill)
**X** Properly secured/locked **X** Functioning **X** Routinely sampled **X** Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____________________________________________________________

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance **X** N/A
Remarks____________________________________________________________

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed **X** N/A
Remarks____________________________________________________________

**E. Gas Collection and Treatment** ☐ Applicable **X** N/A

**F. Cover Drainage Layer** **X** Applicable ☐ N/A

1. **Outlet Pipes Inspected** **X** Functioning ☐ N/A
Remarks____________________________________________________________

## Site Inspection Checklist
## OU 1, Area 6
## NAS Whidbey Island

2. **Outlet Rock Inspected** **X** Functioning ☐ N/A
Remarks____________________________________________
____________________________________________

**G. Detention/Sedimentation Ponds** **X** Applicable ☐ N/A

1. **Siltation** Areal extent______________ Depth____________
☐ N/A **X** Siltation not evident
Remarks____________________________________________
____________________________________________

2. **Erosion** Areal extent______________ Depth____________
**X** Erosion not evident
Remarks____________________________________________
____________________________________________

3. **Outlet Works** **X** Functioning ☐ N/A
Remarks____________________________________________
____________________________________________

4. **Dam** ☐ Functioning **X** N/A
Remarks____________________________________________
____________________________________________

**H. Retaining Walls** ☐ Applicable **X** N/A

**I. Perimeter Ditches/Off-Site Discharge** **X** Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map **X** Siltation not evident
Areal extent______________ Depth____________
Remarks____________________________________________
____________________________________________

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
**X** Vegetation does not impede flow
Areal extent______________ Type____________
Remarks____________________________________________
____________________________________________

3. **Erosion** ☐ Location shown on site map **X** Erosion not evident
Areal extent______________ Depth____________
Remarks____________________________________________
____________________________________________

4. **Discharge Structure** **X** Functioning ☐ N/A
Remarks____________________________________________
____________________________________________

### VIII. VERTICAL BARRIER WALLS ☐ Applicable **X** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent______________ Depth____________
Remarks________________________________________________________________________
________________________________________________________________________________

2. **Performance Monitoring** Type of monitoring__________________________
☐ Performance not monitored
Frequency_______________________________ ☐ Evidence of breaching
Head differential__________________________
Remarks________________________________________________________________________
________________________________________________________________________________

### C. Treatment System **X** Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
**X** Air stripping ☐ Carbon adsorbers
**X** Filters Pre-treatment filters
**X** Additive (*e.g.*, chelation agent, flocculent) Periodic wash of air-stripper tower with muriatic acid
☐ Others_________________________________________________________________________
**X** Good condition ☐ Needs Maintenance
**X** Sampling ports properly marked and functional
**X** Sampling/maintenance log displayed and up to date
**X** Equipment properly identified
**X** Quantity of groundwater treated annually Approximately 86 million gallons
**X** Quantity of surface water treated annually None
Remarks Overall the system appears to be well maintained.

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A **X** Good condition ☐ Needs Maintenance
Remarks________________________________________________________________________
________________________________________________________________________________

3. **Tanks, Vaults, Storage Vessels**
☐ N/A **X** Good condition ☐ Proper secondary containment ☐ Needs Maintenance
Remarks________________________________________________________________________
________________________________________________________________________________

4. **Discharge Structure and Appurtenances**
☐ N/A **X** Good condition ☐ Needs Maintenance
Remarks________________________________________________________________________
________________________________________________________________________________

5. **Treatment Building(s)**
☐ N/A **X** Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks________________________________________________________________________
________________________________________________________________________________

6. **Monitoring Wells** (pump and treatment remedy)
**X** Properly secured/locked **X** Functioning **X** Routinely sampled **X** Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks______________________________________________________________________________
________________________________________________________________________________________

**D. Monitoring Data**

1. Monitoring Data
**X** Is routinely submitted on time **X** Is of acceptable quality

2. Monitoring data suggests:
**X** Groundwater plume is effectively contained **X** Contaminant concentrations are declining

**D. Monitored Natural Attenuation**

1. **Monitoring Wells** (natural attenuation remedy)
**X** Properly secured/locked **X** Functioning Routinely sampled **X** Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks__Most but not all wells were relocated and found secure in good condition. About 5 wells could not be relocated. One was inside the secure perimeter, but beyond the landfill. The remainder were on adjacent non-Navy properties to the west.

# Site Inspection Checklist
# OU 1, Area 6
# NAS Whidbey Island
Page 9 of 9

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

## XI. OVERALL OBSERVATIONS

### A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy appears to be functioning as designed with periodic maintenance required outside of routine O&M. For example, biofouling has long been an issue. The discharge pipeline and a section of transport line from the extraction wells to the treatment system are frequently cleaned out due to fouling.

### B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M is adequate.

### C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

COCs continue to extend off of the southwestern corner of the site in groundwater. Maintenance of the target flow and target draw down in well PW-5 is critical to ensuring that the extent of COCs in groundwater does not expand. No other issues documented.

### D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Continue discussions with EPA to determine optimal groundwater monitoring program.

# Site Inspection Checklist
# OU 2, Area 2
# NAS Whidbey Island

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 2, Area 2 (Former Landfill) | **Date of inspection:**<br>20 March 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:** WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50's, breeze, windy |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other Groundwater monitoring
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house
☐ PRP in-house
☐ Federal Facility in-house
☐ Other________________________________________________
☐ Contractor for State
**X** Contractor for PRP
☐ Contractor for Federal Facility

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $0 ☐ Breakdown attached

Approximately $7,000 is spent on monitoring and reporting every 5 years.

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: None

## Site Inspection Checklist
## OU 2, Area 2
## NAS Whidbey Island
## Page 2 of 4

### V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks______________________________________________________________________
_____________________________________________________________________________

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Signs identifying the site are in good condition (see photos)

### C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks IC Failure was noted December 6, 2013. Navy reported the failure to U.S. EPA and conducted a thorough investigation. Navy presented results of investigation, root cause analysis, planned responses, and LUC program upgrades on January 22, 2014. EPA was very satisfied with Navy response.

### D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks______________________________________________________________________
_____________________________________________________________________________

2. **Land use changes on site** N/A
Remarks: On December 16, 2014, the NAVFAC Northwest Technical Representative (NTR) discovered that a utility cable or pipe was recently trenched and buried along the road that crossing through OU 2, Area 2. See box 2 for Navy response.

## Site Inspection Checklist
## OU 2, Area 2
## NAS Whidbey Island

3. **Land use changes off site** **X** N/A
Remarks_ No observed
________________________________________________________________

### VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

**B. Other Site Conditions**

Remarks Native vegetation and trees have overgrown the site

### VII. LANDFILL COVERS ☐ Applicable **X** N/A

### VIII. MONITORING ☐ Applicable ☐ N/A

**D. Monitoring Data**

1. Monitoring Data
**X** Is routinely submitted on time **X** Is of acceptable quality

2. Monitoring data suggests:
**X** Groundwater plume is effectively contained ☐ Contaminant concentrations are stable or declining

### X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

### XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
The selected remedy has been implemented. Monitoring is conducted on a five-year basis. The need for continued monitoring at subsequent five-year period is based on current monitoring results.

# Site Inspection Checklist
# OU 2, Area 2
# NAS Whidbey Island

## B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

None

## C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None

## D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

It is recommended based on its location and usability that well N2-7S be decommissioned. Groundwater monitoring should be conducted during the next 5-year review period at locations 3-MW-2, N2-3, N2-6C, N2-8, N2-9, and N3-12 for total and dissolved arsenic and manganese. Based on the 5 years of monitoring data, monitoring for vinyl chloride should be terminated at all locations except well N3-12. Monitoring for vinyl chloride should be conducted during the next 5-year review period at well N3-12. Vinyl chloride analysis should be conducted using SIM or other analytical method capable of producing a reporting limit less than the RG of 1 µg/L.

# Site Inspection Checklist
# OU 2, Area 3
# NAS Whidbey Island
## Page 1 of 4

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 2, Area 3 | **Date of inspection:**<br>18 March 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50's, cloudy, windy |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other Groundwater monitoring

☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house
☐ PRP in-house
☐ Federal Facility in-house
☐ Other______________________________________________

☐ Contractor for State
**X** Contractor for PRP
☐ Contractor for Federal Facility

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $0 ☐ Breakdown attached

Approximately $7,000 is spent on monitoring and reporting every 5 years.

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: None

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks____________________________________________

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Signage in good condition

### C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks____________________________________________

### D. General

1. **Vandalism/trespassing** ☐ Location shown on site map No vandalism evident
Remarks None

2. **Land use changes on site** **X** N/A
Remarks____________________________________________

3. **Land use changes off site** **X** N/A
Remarks____________________________________________

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

**B. Other Site Conditions**

Remarks Native vegetation and trees have overgrown the site and the access road.

## VII. LANDFILL COVERS ☐ Applicable **X** N/A

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
The selected remedy has been implemented. Monitoring is conducted on a five-year basis. The need for continued monitoring at subsequent five-year periods is based on current monitoring results.

| | |
|---|---|
| **B.** | **Adequacy of O&M** |
| | Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br>O&M is adequate. |
| **C.** | **Early Indicators of Potential Remedy Problems** |
| | Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br>None. |
| **D.** | **Opportunities for Optimization** |
| | Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br>It is recommended based on its location and usability that well N2-7S be decommissioned. Groundwater monitoring should be conducted during the next 5-year review period at locations 3-MW-2, N2-3, N2-6C, N2-8, N2-9, and N3-12 for total and dissolved arsenic and manganese. Based on the 5 years of monitoring data, monitoring for vinyl chloride should be terminated at all locations except well N3-12. Monitoring for vinyl chloride should be conducted during the next 5-year review period at well N3-12. Vinyl chloride analysis should be conducted using SIM or other analytical method capable of producing a reporting limit less than the RG of 1 µg/L. |

# Site Inspection Checklist
# OU 2, Area 4
# NAS Whidbey Island
Page 1 of 4

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 2, Area 4 | **Date of inspection:**<br>18 March 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50's, cloudy, windy |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other Groundwater monitoring
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house
☐ PRP in-house
☐ Federal Facility in-house
☐ Other________________________________________________________________________________
______________________________________________________________________________
☐ Contractor for State
**X** Contractor for PRP
☐ Contractor for Federal Facility

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $0 ☐ Breakdown attached

Approximately $7,000 is spent on monitoring and reporting every 5 years.

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: None

# Site Inspection Checklist
# OU 2, Area 4
# NAS Whidbey Island
Page 2 of 4

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Signage in good condition

### C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

### D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks

2. **Land use changes on site** **X** N/A
Remarks

3. **Land use changes off site** **X** N/A
Remarks

# Site Inspection Checklist
# OU 2, Area 4
# NAS Whidbey Island
Page 3 of 4

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

**B. Other Site Conditions**

Remarks Native vegetation and trees have overgrown the site

## VII. LANDFILL COVERS ☐ Applicable **X** N/A

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Soil excavation remedy has been implemented. Monitoring is conducted on a five-year basis. The need for continued monitoring at subsequent five-year periods is based on current monitoring results.

**B. Adequacy of O&M**

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
Current O&M practices are adequate

**C. Early Indicators of Potential Remedy Problems**

| | |
|---|---|
| | Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br>None |
| **D.** | **Opportunities for Optimization** |
| | Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br>None |

# Site Inspection Checklist
# OU 2, Area 29
# NAS Whidbey Island
## Page 1 of 3

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 2, Area 29 | **Date of inspection:**<br>21 March 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50's, cloudy, breeze |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other <u>Groundwater monitoring</u>
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house
☐ PRP in-house
☐ Federal Facility in-house
☐ Other______________________________________________
☐ Contractor for State
**X** Contractor for PRP
☐ Contractor for Federal Facility

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate <u>$0</u> ☐ Breakdown attached

Approximately $7,000 is spent on monitoring and reporting every 5 years.

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: <u>None</u>

# Site Inspection Checklist
# OU 2, Area 29
# NAS Whidbey Island
Page 2 of 3

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map Gates secured ☐ N/A
Remarks Fencing beginning to rust. Gates not secured. Access gate found laying on ground on 17 December 2013 during the 5-year groundwater sampling event. Navy is aware and working to repair the gate.

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Signage in good condition.

### C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Every 5 years
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

### D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks

2. **Land use changes on site** **X** N/A
Remarks

## Site Inspection Checklist
## OU 2, Area 29
## NAS Whidbey Island
## Page 3 of 3

3. **Land use changes off site** **X** N/A

Remarks______________________________________________________________________

_____________________________________________________________________________

### VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

**B. Other Site Conditions**

Remarks Native vegetation and trees have overgrown the site

### VII. LANDFILL COVERS ☐ Applicable **X** N/A

### X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

### XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Soil excavation remedy has been implemented. Monitoring is conducted on a five-year basis. The need for continued monitoring at subsequent five-year periods is based on current monitoring results.

**B. Adequacy of O&M**

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
Current O&M practices are adequate

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.
None

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
None

# Site Inspection Checklist
# OU 3, Area 16
# NAS Whidbey Island
# Page 1 of 4

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 3, Area 16 | **Date of inspection:**<br>14 April 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>60's, began drizzling, breeze |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
X Access controls
X Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
Other

☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house
☐ PRP in-house
☐ Federal Facility in-house
☐ Other________________________________________________________________________

☐ Contractor for State
X Contractor for PRP
☐ Contractor for Federal Facility

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $0 ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: None

# Site Inspection Checklist
# OU 3, Area 16
# NAS Whidbey Island
# Page 2 of 4

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

**A. Fencing**

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks

**B. Other Access Restrictions**

1. **Signs and other security measures** ☐ Location shown on site map **X**☐ N/A
Remarks .

**C. Institutional Controls (ICs)**

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

**D. General**

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks

2. **Land use changes on site** **X** N/A
Remarks

3. **Land use changes off site** **X** N/A
Remarks

# Site Inspection Checklist
# OU 3, Area 16
# NAS Whidbey Island

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

**B. Other Site Conditions**

Remarks

## VII. LANDFILL COVERS ☐ Applicable X N/A

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

**B. Adequacy of O&M**

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
Current O&M practices are adequate

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
None

# Site Inspection Checklist
OU 3, Area 16
NAS Whidbey Island
Page 4 of 4

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Based on the 2014 results summarized, it is recommended that sediment in the catch basin at location 16-2 be sampled once during the next five years for TPH in the diesel and residual ranges, lead, and 2-methylnaphthalene. This will enable the Navy to determine if additional catch basin cleanout is warranted. Sediment monitoring should be discontinued for TPH in the gasoline range, arsenic, phenanthrene, benzo[k]fluoranthene, and dibenz(a,h)anthracene.

# Site Inspection Checklist
# OU 4, Area 48
# NAS Whidbey Island
# Page 1 of 3

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 4, Area 48 | **Date of inspection:**<br>20 March 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA6170090058 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50's, cloudy, windy |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other Soil Excavation
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**
☐ State in-house
☐ PRP in-house
**X** Federal Facility in-house
☐ Contractor for State
☐ Contractor for PRP
☐ Contractor for Federal Facility
☐ Other________________________________________

2. **O&M Cost Records**
☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $0 ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: None

# Site Inspection Checklist
# OU 4, Area 48
# NAS Whidbey Island
Page 2 of 3

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map **X** N/A
Remarks

### C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

### D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks

2. **Land use changes on site** **X** N/A
Remarks

3. **Land use changes off site** **X** N/A
Remarks

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

**B. Other Site Conditions**

Remarks Native vegetation has grown at the site

## VII. LANDFILL COVERS ☐ Applicable **X** N/A

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

None

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Soil excavation remedy has been implemented. No monitoring was required during this five-year review period.

**B. Adequacy of O&M**

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
Not Applicable

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.
None

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
None

# Site Inspection Checklist
# OU 4, Area 49
# NAS Whidbey Island
# Page 1 of 3

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 4, Area 49 | **Date of inspection:**<br>20 March 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA6170090058 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50’s, cloudy, windy |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other Soil Excavation
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house
☐ PRP in-house
**X** Federal Facility in-house
☐ Contractor for State
☐ Contractor for PRP
☐ Contractor for Federal Facility
☐ Other________________________________________________

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $0 ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: None

# Site Inspection Checklist
# OU 4, Area 49
# NAS Whidbey Island
# Page 2 of 3

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map **X** N/A
Remarks

### C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

### D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks

2. **Land use changes on site** **X** N/A
Remarks

3. **Land use changes off site** **X** N/A
Remarks

# Site Inspection Checklist
# OU 4, Area 49
# NAS Whidbey Island
# Page 3 of 3

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

**B. Other Site Conditions**

Remarks Native vegetation has grown at the site

## VII. LANDFILL COVERS ☐ Applicable **X** N/A

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

None

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Soil excavation remedy has been implemented. No monitoring was required during this five-year review period.

**B. Adequacy of O&M**

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
Not Applicable

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.
None

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
None

# Site Inspection Checklist
# OU 5, Area 1
# NAS Whidbey Island
# Page 1 of 5

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 5, Area 1 | **Date of inspection:**<br>19 March 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50's, cloudy, breeze |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other <u>Institutional controls and monitoring</u>
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth 5-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

| | | | |
|---|---|---|---|
| ☐ O&M manual | ☐ Readily available | ☐ Up to date | **X** N/A |
| ☐ As-built drawings | ☐ Readily available | ☐ Up to date | **X** N/A |
| ☐ Maintenance logs | ☐ Readily available | ☐ Up to date | **X** N/A |

Remarks________________________________________

2.

| | | | |
|---|---|---|---|
| **Site-Specific Health and Safety Plan** | ☐ Readily available | ☐ Up to date | **X** N/A |
| ☐ Contingency plan/emergency response plan | ☐ Readily available | ☐ Up to date | **X** N/A |

Remarks________________________________________

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date **X** N/A

Remarks________________________________________

4. **Permits and Service Agreements**
☐ Air discharge permit ☐ Readily available ☐ Up to date **X** N/A
☐ Effluent discharge ☐ Readily available ☐ Up to date **X** N/A
☐ Waste disposal, POTW ☐ Readily available ☐ Up to date **X** N/A
☐ Other permits______________________ ☐ Readily available ☐ Up to date **X** N/A
Remarks____________________________________________________________

5. **Gas Generation Records** ☐ Readily available ☐ Up to date **X** N/A
Remarks____________________________________________________________

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date **X** N/A
Remarks____________________________________________________________

7. **Groundwater Monitoring Records** ☐ Readily available ☐ Up to date **X** N/A
Remarks____________________________________________________________

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date **X** N/A
Remarks____________________________________________________________

9. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date **X** N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date **X** N/A
Remarks____________________________________________________________

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☐ N/A
Remarks____________________________________________________________

## IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☐ PRP in-house **X** Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other____________________________________________________________

2. **O&M Cost Records**
☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $0 ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: None

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks____________________________________________________________

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks: Signage is in good condition.

### C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X** ☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X**☐ ICs are adequate ICs are inadequate ☐ N/A
Remarks Erosion along the shoreline has been repaired by placing a new seawall. Seawall construction was completed during 2012.

### D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks____________________________________________________________

2. **Land use changes on site** **X** N/A
Remarks____________________________________________________________

3. **Land use changes off site** **X** N/A
Remarks________________________________________________________________________
________________________________________________________________________________

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

**B. Other Site Conditions**

Remarks

## VII. LANDFILL COVERS ☐ Applicable X N/A

## VIII. MONITORING ☐ Applicable X N/A

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

None

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
A new seawall was constructed in 2012 to provide enhanced protection of the Area 1 landfill. It is recommended that the seawall be extended south another 200 feet to protect the south end of the Area 1 landfill from further erosive actions. There are small sections of the newly constructed seawall where the riprap boulders have shifted and underlying rock blankets are becoming exposed. A seawall erosion monitoring program is recommended to be established. If erosion rates increase significantly or material that could pose a threat to human health and the environment is exposed, additional action may be warranted.

**B. Adequacy of O&M**

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
The bluff demarking the western extent of the landfilled area should be monitored for erosion. Otherwise, O&M is adequate.

**C. Early Indicators of Potential Remedy Problems**

| | |
|---|---|
| | Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.<br>Erosion along the southwestern section of the landfill could expose material that poses a threat to human health or the environment.  Regular visual monitoring should be conducted to monitor this erosion and what materials are exposed. |
| **D.** | **Opportunities for Optimization** |
| | Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br>It is recommended that a seawall erosion monitoring program be implemented. |

# Site Inspection Checklist
## OU 5, Area 31
## NAS Whidbey Island
## Page 1 of 3

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 5, Area 31 | **Date of inspection:**<br>14 April 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>60’s, sunny, breeze |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
Other

☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house
☐ PRP in-house
☐ Federal Facility in-house
☐ Other_______________________________________________________________________________

☐ Contractor for State
Contractor for PRP
☐ Contractor for Federal Facility

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $ ☐ Breakdown attached

## Site Inspection Checklist
## OU 5, Area 31
## NAS Whidbey Island
## Page 2 of 3

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons:

**V. ACCESS AND INSTITUTIONAL CONTROLS** **X** Applicable ☐ N/A

**A. Fencing**

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks____________________________________________

__________________________________________________

**B. Other Access Restrictions**

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Signage in good condition

**C. Institutional Controls (ICs)**

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X** ☐ No N/A
Reports are verified by the lead agency ☐ Yes **X** ☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks____________________________________________

__________________________________________________

__________________________________________________

**D. General**

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks____________________________________________

__________________________________________________

2. **Land use changes on site** **X** N/A
Remarks____________________________________________

__________________________________________________

# Site Inspection Checklist
# OU 5, Area 31
# NAS Whidbey Island

3. **Land use changes off site** **X** N/A
Remarks______________________________________________________________________
______________________________________________________________________________

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

## VII. LANDFILL COVERS ☐ Applicable **X** N/A

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

**B. Adequacy of O&M**

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
None

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
None

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
None

# Site Inspection Checklist
# OU 5, Area 52
# NAS Whidbey Island
# Page 1 of 3

## I. SITE INFORMATION

| | |
|---|---|
| **Site name:**<br>OU 5, Area 52 | **Date of inspection:**<br>19 March 2013 |
| **Location and Region:**<br>Oak Harbor, WA, R10 | **EPA ID:**<br>WA5170090059 |
| **Agency, office, or company leading the five-year review:**<br>U.S. Navy | **Weather/temperature:**<br>50's, cloudy, breeze |

**Remedy Includes**: (Check all that apply)

☐ Landfill cover/containment
**X** Access controls
**X** Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
**X** Other Product Recovery

☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

**Attachments:** ☐ Inspection team roster attached ☐ Site map attached

## II. INTERVIEWS (Check all that apply)

Please see Appendix D of the Fourth Five-Year Review

## III. ON-SITE DOCUMENTS & RECORDS VERIFIED

Not Applicable

## IV. O&M COSTS

1. **O&M Organization**

☐ State in-house
☐ PRP in-house
☐ Federal Facility in-house
☐ Other________________________________________

☐ Contractor for State
**X** Contractor for PRP
☐ Contractor for Federal Facility

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate $32,000/year ☐ Breakdown attached

Current annual O&M $0.

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons:

## V. ACCESS AND INSTITUTIONAL CONTROLS **X** Applicable ☐ N/A

### A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **X** N/A
Remarks

### B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Signage in good condition

### C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **X** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting
Frequency Annual
Responsible party/agency U.S. Navy
Contact Sherri Rone RPM (360) 396-1030
Name Title Phone no.

Reporting is up-to-date ☐ Yes **X**☐ No N/A
Reports are verified by the lead agency ☐ Yes **X**☐ No N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **X** N/A
Violations have been reported ☐ Yes ☐ No **X** N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** **X** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

### D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **X** No vandalism evident
Remarks

2. **Land use changes on site** **X** N/A
Remarks

# Site Inspection Checklist
# OU 5, Area 52
# NAS Whidbey Island
Page 3 of 3

3. **Land use changes off site** **X** N/A
Remarks______________________________________________________________________
______________________________________________________________________________

## VI. GENERAL SITE CONDITIONS

**A. Roads** ☐ Applicable **X** N/A

## VII. LANDFILL COVERS ☐ Applicable **X** N/A

## X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

Product recovery by skimming was implemented at the site from 12/96 to 6/07. System operation terminated with EPA concurrence.

## XI. OVERALL OBSERVATIONS

**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Remedy implementation is complete and RAOs have been met.

**B. Adequacy of O&M**

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
Remedy implementation is complete and RAOs have been met. Management and maintenance of ICs is adequate.

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
None

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
None

# APPENDIX D

## Interview Responses

# INTERVIEW RECORD FOR FIVE-YEAR REVIEW
## Type 1 Interview – Navy Personnel
## Naval Air Station Whidbey Island
## Oak Harbor, Washington

**Individual Contacted:** Brent Jones
**Title:**
**Organization:** TetraTech
**Telephone:** (360)425-7863
**E-mail:** brent.jones@tteci.com
**Address:**

**Contact made by:** Nicole Rangel
**Response type:** e-mail
**Date:** 12/10/13

## Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate "none" after "response."

1. Please describe your degree of familiarity with the Naval Air Station Whidbey Island (NASWI), the Records of Decision (RODs) for OUs 1, 2, 3, 4, and 5, the implementation of the remedies at these operable units, the monitoring and maintenance that has taken place since implementation of the remedies, and recommendations made during the third five-year review finalized in 2009.

   **Response:** I am familiar with all the Whidbey RODs. Since 1994, I have supported the Navy with implementing the environmental requirements specified in these RODs. The Navy has implemented most all the remedial actions required in these RODs to the written satisfaction/approval of the stakeholders involved; including EPA and Ecology. Recognizing that several completed RAs were to be followed by additional environmental monitoring to ensure the effectiveness of the remedy, the Navy has also implemented a substantial long term monitoring (LTM) and operations (LTO) program. These on-going LTM/O programs provide detailed documentation of the Navy's environmental commitment and continuing long term compliance with these RODs. Throughout the recently LTM/O process, the Navy has worked very closely with the agencies to revise these RODs (2007 Explanation of significant differences; current second ESD in process) where additional IC and LUC definitions; requested by the agencies, were included in these RODs. I firmly believe the Navy's aggressive pursuit of implementing these ROD required RA's has resulted in their ability to propose delisting of most all sites north of Ault field Road. The Navy is diligent with implementing the 5-year review recommendations and has only had a few instances where any requested environmental response was delayed; usually due to funding limitations.

2. What is your overall impression of remedy operation at the five operable units at NASWI since the last five-year review?

   **Response:** I believe all RAs are complete as documented in the first three five year reviews and that all five are either at an approved Delisted state (Sites in OU-3 and 4) or, the required LTM/O and associated ICs/LUCs actively being implemented. I also believe, as pertaining to OU-1, 2 , and 5, all sites north of Ault field road should also be considered for Delisting from the NPL as the LUCs are in place and prior LTM/O monitoring and reporting has provided sufficient data to support NFAs.

3. Have there been any significant changes in site conditions, remedy operations, or station operations since the last five-year review?

   **Response:** Related to the five RODs, no, not that I am aware. Since the last five year review, the Navy continues to work with the agencies to address an emerging contaminant at Area 6. All stakeholders have been thoroughly briefed about the progress on this in the numerous RAB meetings that have included its discussion.

4. To the best of your knowledge, does the landfill cap and groundwater control action at OU 1, Area 6 effectively meet the goals stated in the ROD to:

   - Reduce concentrations of contaminants in shallow groundwater
   - Prevent further spread of contaminants in shallow groundwater
   - Reduce the potential risk to existing and future groundwater users
   - Minimize infiltration of rainwater into the landfill to prevent leachate generation and migration to groundwater
   - Prevent stormwater erosion
   - Prevent migration of contaminants in shallow groundwater to the lower aquifer
   - Prevent exposure of contaminants in subsurface soil and debris in the landfill operations area.

   **Response:** Yes. With the exception of emerging contaminants (which the Navy is currently working with stakeholders to address), the GETR is effectively managing the six ROD-listed contaminants. Concerning rainwater infiltration and stormwater erosion, the Navy has a substantial LTO program at Area 6 which reports annually, the conditions and mitigation to adverse impacts concerning these issues. Also, a separate LUC Inspection program has proven invaluable to the Navy in documenting compliance with their required IC/LUCs as well. Concerning protection of lower aquifer; again, relative to the ROD listed COCs AND emerging contaminants, the Navy confirms annually with the LTM reporting, the successful compliance with protection of the intermediate and deeper aquifer. *This observation is only relative through 2010 as I have not seen recent GW data to continue to support this assessment.*

5. Do you feel that the OU 2 Areas 2/3, 4, and 29 groundwater monitoring that has generally been conducted at five year intervals remains sufficient and necessary for demonstrating that the implemented remedies remain protective at these sites.

   **Response:** Yes. As stated in response to number 2 above, Areas 2/3, and 4 are likely candidates for De-listing. Area 29 could be addressed through 1 additional LTM GW sampling prior to any formal de-listing.

6. Do you feel that recommendations made during the third five-year review have been adequately implemented?

   **Response:** Yes

7. Do you feel that sediment monitoring every five years at OU 3 Area 16 remains adequate and necessary to demonstrate the on-going protectiveness of ecological receptors?

   **Response:** More than adequate. Since 2003, the Navy has expended considerable effort in conducting environmental sampling that has confirmed no recontamination is occurring. Further, the runway ditch complex is managed under other Installation-specific (INRMP/SPCC) environmental protection programs. Unless additional environmental concerns are identified beyond those documented in the prior PA/RI-FS/ROD/RA/LUC Inspection process, this site is also suggested as a candidate for De-Listing. Again, this assessment is based on my current knowledge of potential upgradient sources previously investigated.

8. Are you aware of any on-going sources of contaminants to sediments at OU 3 Area 16?

   **Response:** No, see response above.

9. Are you aware of any prior or pending land use or ownership changes since the signing of the RODs that may impact the effectiveness of any component of the selected remedies for these five OUs?

   **Response:** No.

10. Please describe any requests you have received or are aware of regarding work at NAS Whidbey sites to alter site characteristics that would result in land use or groundwater use which is inconsistent with current land use controls. Are you aware of any use of groundwater from beneath the any of the sites at NAS Whidbey?

    **Response:** I am not aware of any groundwater usage at NASWI that is not currently being evaluated and known to the stakeholders (Golf course well)**.** Not a Navy operational concern, but suggest at some point, compliance review of the gravel quarry operations adjacent to Area 6 to ensure they are compliant with their approved permitting.

11. To the best of your knowledge, do institutional controls and operation and maintenance practices in use at NASWI meet the intent of the RODs regarding limiting the potential for contact with or movement of contaminants left in place?

    **Response:** Yes. The LUC Inspection program is very effective at documenting this.

12. To the best of your knowledge, has the on-going program of environmental monitoring at NASWI following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs and have the recommendations made during the third five-year review been adequately incorporated into the monitoring program? Please indicate the basis for your assessment.

    **Response:** To the best of my knowledge, the recommendations discussed in the 3rd five year review, as they pertain to environmental monitoring, have been successfully implemented. The note above, the one instance where the response was delayed, clean out of a runway ditch catch basin, is currently tasked and being implemented. Basis of my assessment; prior involvement with LUC inspection program and current involvement with catch basin cleaning under **N62470-13-D-8007; Task Order JP01**

13. Are you aware of any community concerns regarding implementation of the remedies at NASWI? If so, please give details.

    **Response:** No, other than what seems to be a typical topic in most every RAB; public general concern that the station activities have impacted their well being. However, Island County Health Department has successfully addressed most of these concerns?

14. What do you see as major accomplishments for CERCLA sites at NAS Whidbey since 2009?

    **Response.** Several:

    **A.** De-list appropriate sites north of Ault field road:

    - **a. For Area 29**, conduct final LTM compliance sampling (Develop DQOs; DQOa=All ROD COCs < CULs De-list, DQOb=Some ROD COCs> CULs, additional assessment warranted),
    - **b. For Area 1**, no additional sampling needed, seawall repair completed, candidate for de-listing.
    - **c. For Area 52**, previously documented having reached “point of diminishing returns for fuel recovery.” Also, other RAs documented complete too, candidate for de-listing.
    - **d. For Area 31,** previously documented having reached “point of diminished returns for fuel recovery.” Per 2001 assessment report and supplemental

LTM sampling since, Document RAs complete, and candidate for de-listing.

**e.** **For Areas 2/3, 4, 5, and 14,** RAs previously documented as complete. LUC Inspections have not identified any additional compliance or environmental issues, candidate for de-listing.

**f.** **For Area 16**, several previous round of "recontamination ditch sampling" completed that confirm no additional re-contamination occurring. Unless new additional upgradient sources of contamination are present that I am not aware of, document cleaning of catch basin 16-2 and proceed with de-listing.

**B.** Seaplane Base: If not already formally documented (which I believe is done already), de-list all sites under OU-4, Seaplane base sites;

**C.** If not already under way, for Area 6, complete response needed for emerging contaminant. Ensure basewide environmental compliance plans cover the compost facility activities.

15. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented to protect human health and the environment at the NASWI?

**Response:** No

16. Please review the attached lists of interviewees for the five-year review. Are there other individuals you feel we should contact? If so, please provide their name, title, and contact information if you have it.

**Response:** I was not provided the list. Therefore, no recommendations.

# INTERVIEW RECORD FOR FIVE-YEAR REVIEW
## Type 2 Interview – Regulatory Agency
## Naval Air Station Whidbey Island
## Oak Harbor, WA

**Individual Contacted:** Marcia Knadle
**Title:** Hydrogeologist
**Organization:** EPA Region 10
**Telephone:** (206) 553-1641
**E-mail:** Knadle.Marcia@epamail.epa.gov
**Address:** 1200 6th Avenue, ECL-115, Seattle, WA 98101

**Contact made by:** Nicole Rangel
**Response type:** e-mail
**Date:** 12/11/13

## Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate “none” after “response.”

1. Please describe your degree of familiarity with the Naval Air Station Whidbey Island (NASWI), the Records of Decision (RODs) for OUs 1, 2, 3, 4, and 5, the implementation of the remedies at these operable units, the monitoring and maintenance that has taken place since implementation of the remedies, and recommendations made during the third five-year review finalized in 2009.

   **Response:** I’ve provided EPA’s hydrogeological technical support for this site since June of 1987. I was involved with characterization of all the OUs, and have been involved with developing the RODs and implementing the remedies at all the sites except OUs 3 and 4. My attention has mainly been focused on the remedy at OU 1 Area 6.

2. What is your overall impression of the remedy operation and maintenance since the third five-year review at the five NASWI operable units? Do you believe that remedy operation, maintenance, and monitoring have been revised in accordance with recommendations made in the third five-year review? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

   **Response:** Monitoring at OU 1 has been revised in accordance with recommendations, but issues with the aging pump and treat system at OU 1 have compromised effectiveness of the remedies in two ways. At least at times, the Area 6 western VOC plume appears to cross the base property boundary to the west and even to the south, most recently because of an extended shut down of PW-5 due to a broken pump. So far no one has tried to develop private property west or south of the western VOC plume for residential use or drill any wells. The VOC plume footprint has very likely remained within the 1000 ft well drilling buffer around the landfill portion of OU 1 during the past 5 years, so as long as Island County enforces that WAC provision, it should remain protective.

However, the extraction system was not designed to capture the 1,4-dioxane (1,4-Dx) plume, which was unrecognized at the time of the ROD and RD/RA. The center of mass of this plume is now located beyond the reach of the extraction system (or any extraction system the navy could build on site), and the plume is clearly expanding to the south. It may eventually extend beyond the 1000 ft well drilling buffer south of the adjacent Oak Harbor landfill, and there are older wells that were drilled before the buffer was established that may be impacted even if it doesn't.

3. To your knowledge, since the RODs were signed have there been any new scientific findings that relate to projecting potential site risks which might call into question the protectiveness of the remedies?

   **Response:** At Area 6 (OU 1), there have been issues with 1,4-Dx) throughout the plumes (in part, because the treatment system doesn't remove it) and apparently migrating southward from the Area 6 landfill. The navy replaced one domestic well at the south end of the 1,4-Dx plume because the recently revised IRIS slope factor made it so that WA State's recalculated MTCA Method B value was exceeded there. In the meantime, new monitoring wells installed along Hwy 20 now monitor groundwater between the landfills and domestic wells to the south and southeast. 1,4-Dx concentrations in some of those monitoring wells are significantly above the Method B value and have been rising, so it's unclear whether additional domestic wells may eventually be impacted.

   The air force has recently recognized that their use of aqueous film forming foams (AFFFs) at fire training areas can result in soil and groundwater contamination with perfluorinated compounds far above the EPA's provisional health advisory levels. This has lead them to initiate a program to re-evaluate risks at all former fire training schools in use since about 1970. The Current Situation Report noted that AFFFs were used at Area 31 (but fortunately none of the other older fire training areas), so the navy should consider the need to address the potential for soil and groundwater contamination there in the upcoming 5YR. Although there is currently no toxicity information in IRIS for these compounds, there will be eventually. The navy should follow the air force's lead and be prepared to respond to eventual risk-based levels as soon as they become available.

4. To the best of your knowledge, are institutional controls and operation and maintenance procedures being utilized at the NASWI consistent with the terms of the RODs and recommendations made during the third five-year review?

   **Response:** There have been a few glitches, but the navy has responded well and kept EPA informed. Another issue that came up is that the maps included in the LUC

ESD didn't match (were often smaller than) the RI maps for the waste areas at several OUs. Why the areas were smaller is unclear, but my understanding is that the maps have now been updated to match those in the RIs.

5. Following signing of the RODs, have there been any complaints, violations, or other incidents related to NASWI installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.

   **Response:** In 2012 I had to respond to requests from local residents to evaluate the use of on-site wells to provide irrigation water to the navy's golf course near OU 2 (and particularly near Area 29) instead of using imported Anacortes water. There were concerns that residential wells would be impacted due to lower water levels and that contamination from Area 29 could be mobilized in such a way that it could flow off site. I sent my evaluation of potential Area 29 impacts to the Island County hydrogeologist (and copied Sherry Rone), concluding that impacts were unlikely. There were no further inquiries in 2013, suggesting that drawdown impacts on local wells haven't been as significant as had been feared.

6. To the best of your knowledge, has the on-going program of environmental monitoring at NASWI following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs? Please indicate the basis for your assessment.

   **Response:** One result of my evaluation of Area 29 was that I realized that the groundwater monitoring at most of the MNA sites is quite sparse and may not be adequate to evaluate plume extent or plume trends effectively at some areas. In addition, some wells that are sampled don't really relate to any plume that may come from the sites and thus may give misleading results. The navy decommissioned a lot of the RI wells over 10 years ago – perhaps too many. Some thought should be given to whether the existing networks need to be improved in order to provide meaningful results. Otherwise, remedy implementation has been good.

7. To the best of your knowledge, have the recommendations made during the third five-year review been adequately implemented? Please indicate the basis for your assessment.

   **Response:** In general, yes. The two major recommendations for OU 1 related to characterization of the Area 55 source to the western VOC plume and evaluation of the 1,4-Dx plume. Remedy optimizations to address these issues were initiated and are still in progress.

8. What do you see as major accomplishments for CERCLA sites at NAS Whidbey since 2009?

   **Response:** The navy has made a good start on re-evaluating the vadose zone source area for the western VOC plume at Area 6. They've also started optimization efforts to address both the western VOC plume and the southern 1,4-Dx plume more effectively, with an agreement that in situ plume treatments should be seriously evaluated through treatability studies. Also, the navy has implemented robust measures to mitigate beach erosion at the Area 1 Landfill, although the bluff armoring may need to be extended southward to address the entire landfill, one of the waste areas that were not fully delineated on the old LUC maps.

9. Are you aware of any community concerns regarding implementation of the remedies at NASWI? If so, please give details.

   **Response:** Beyond the concerns of some local residents about Area 29, no.

10. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented to protect human health and the environment at the Naval Air Station Whidbey Island?

    **Response:** If pump and treat is continued as a site remedy, some way of treating 1,4-Dx ex situ needs to be developed so that it doesn't keep getting recycled through the aquifer.

11. Please review the attached lists of interviewees for the five-year review. Are there other individuals you feel we should contact? If so, please provide their name, title, and contact information if you have it.

    **Response:** None

# INTERVIEW RECORD FOR FIVE-YEAR REVIEW
## Type 2 Interview – Regulatory Agency
## Naval Air Station Whidbey Island
## Oak Harbor, WA

**Individual Contacted:** Nancy Harney
**Title:** Remedial Project Manager
**Organization:** EPA Region 10
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**Address:** 1200 6th Avenue, ECL-115, Seattle, WA 98101

**Contact made by:** Nicole Rangel
**Response type:** e-mail
**Date:** 12/11/13

### Summary of Communication

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   **Response:** I am very familiar with the RODs and the implementation of the remedies—I have some familiarity with monitoring and maintenance, particularly if there is an problem.

2. What is your overall impression of the remedy operation and maintenance since the third five-year review at the five NASWI operable units? Do you believe that remedy operation, maintenance, and monitoring have been revised in accordance with recommendations made in the third five-year review? Do you feel the remedies continue to be effective? Please indicate the basis for your assessment.

   **Response:** Overall, I think the remedies continue to be protective, although the purpose of this five year review is to do an assessment of the current site conditions and determine if the remedies remain protective. EPA has been involved in reviewing monitoring reports and meeting with the Navy to discuss any issues that arise. I am concerned about the repair work that had to be done to the Area 6 pump and treat system and the length of time the system was not operational. I hope the impact of that very necessary repair work was minimal, but that remains to be seen. At the moment, the EPA tracking system is down, so I cannot say whether or not all the recommendations from the $3^{rd}$ five year review have been addressed. That is information the Navy will need look at and evaluate in this 5 year review.

3. To your knowledge, since the RODs were signed have there been any new scientific findings that relate to projecting potential site risks which might call into question the protectiveness of the remedies?

   **Response:** As we have known for quite some time, 1,4-dioxane is a concern at the Area 6 landfill. This contaminant was not known at the time of the ROD. Vapor intrusion is another more recent pathway of concern that was not addressed in the NASWI RODs.

4. To the best of your knowledge, are institutional controls and operation and maintenance procedures being utilized at the NASWI consistent with the terms of the RODs and recommendations made during the third five-year review?

   **Response:** The Navy has made great strides in ensuring that land use controls are maintained and enforced. There have been some problems and remedy failures relating to LUCs, but the Navy is now paying more attention to the land use control plan and its reporting requirements when there are problems. However, the Navy is still experiencing problems with work occurring in areas where LUCs are in place. While some communication strategies have been implemented, it seems the Navy has to figure out better communication strategy within the Navy itself.

5. Following signing of the RODs, have there been any complaints, violations, or other incidents related to NASWI installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.

   **Response:** In 2011 EPA issued a notice of violation to NASWI relating to a failure to report a land use control violation. The Navy responded to the NOV and changed procedures. There were also complaints from nearby residents about the navy's plan to use groundwater to water the golf course. The EPA hydrogeologist responded to community questions.

6. To the best of your knowledge, has the on-going program of environmental monitoring at NASWI following implementation of the remedies been sufficiently thorough and frequent to meet the goals of the RODs? Please indicate the basis for your assessment.

   **Response:** Yes. The Navy RPM is very good at communicating with EPA and reporting any problems or issues. EPA and the Navy meet or talk on a fairly regular basis. EPA reviews and comments on all workplans, sampling plans, reports, and the Navy in general responds to and incorporates EPA's comments and concerns.

7. To the best of your knowledge, have the recommendations made during the third five-year review been adequately implemented? Please indicate the basis for your assessment.

**Response:** The biggest recommendation from the previous 5 year review has to do with the 1,4-dioxane problem at the Area 6 Landfill. The Navy has been working closely with EPA trying to determine the best cleanup approach. Options have been limited. It has become clear that due to challenging site conditions and the lack of real world data, certain treatment options are not implementable, will not be cost effective, and will simply not work. As a result, EPA and the Navy reached an agreement to conduct a treatability study that will be implemented in the next year.

As for all the other recommendations, the EPA tracking system database is currently not operational, so I cannot say whether or not all the recommendations have been adequately implemented. I will work with the Navy to review the recommendations as part of the 4th Five Year Review.

8. What do you see as major accomplishments for CERCLA sites at NAS Whidbey since 2009?

**Response.** The remedies remain protective of human health and the environment. By and large the remedies are successful. There have been a few issues, such as land use control failures, but those did not result in any serious exposures and it led to the Navy improving internal operating procedures. The Area 6 pump and treat system has been an operational challenge, but it has been working and containing the plume. Remedy optimization will really help as will figuring out how best to address the 1,4-dioxane. The repair of the Area 1 landfill at OU5 is a major accomplishment.

9. Are you aware of any community concerns regarding implementation of the remedies at NASWI? If so, please give details.

**Response:** No

10. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented to protect human health and the environment at the Naval Air Station Whidbey Island?

**Response:** EPA just recently was informed about another LUC failure. The Navy RPM followed appropriate notification procedures, but there is a lot of concern about this latest failure. The Navy is going to look into what happened and how to prevent the same thing from happening in the future, but the longterm implementation of LUCs is definitely a concern.

11. Please review the attached lists of interviewees for the five-year review. Are there other individuals you feel we should contact? If so, please provide their name, title, and contact information if you have it.

**Response:** None

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