



Final

**Technical Memorandum:
Nonrepresentative Groundwater Samples
and Influence on Results of Human Health
Risk Assessments for Hunters Point
Shipyard**

**Hunters Point Shipyard
San Francisco, California**

January 18, 2008

Prepared for:
**Base Realignment and Closure
Program Management Office West
San Diego, California**

Prepared by:
**Barajas & Associates, Inc.
839 W. Harbor Drive, Suite 1
San Diego, California 92101
(619) 338-0798**

Prepared under:
**Naval Facilities Engineering Command
Contract Number N68711-03-D-5106
Contract Task Order 005**

BAI.5106.0005.0006

**Technical Memorandum:
Nonrepresentative Groundwater Samples and
Influence on Results of Human Health Risk Assessments
for Hunters Point Shipyard, San Francisco, California**

Contract Task Order 005
Contract Number N68711-03-D-5106

PREPARED FOR:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Program Manager:

V. Saravanan
Saravanan (Eli) Vedagiri, P.E.,
Barajas & Associates, Inc.

Date: 16 JAN 08

Project Manager:

Yolji Ong
Yolji Ong, Tetra Tech EM Inc.

Date: 01-18-08



TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. **N68711-03-D-5106**

Document Control No. **BAI.5106.0005.0006**

TO: **Dane Jensen**
 Code: **BPMOW.DJ**
BRAC PMO West
 1455 Frazee Road, Suite 900
 San Diego, CA 92108-4310

DATE: **01/18/08**
 CTO: **0005**
 LOCATION: **Hunters Point Shipyard,**
San Francisco, California.

FROM: *[Signature]*
Saravanan (Eli) Vedagiri, P.E., Program Manager

DOCUMENT TITLE AND DATE: **Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessment for Hunters Point Shipyard. January 18, 2008**

TYPE: Contractual Deliverable Technical Deliverable (DS) Other (TC)

VERSION: Final (e.g., Draft, Draft Final, Final) REVISION #: NA

ADMIN RECORD: Yes No CATEGORY: Confidential

SCHEDULED DELIVERY DATE: NA ACTUAL DELIVERY DATE: 01/18/08

NUMBER OF COPIES SUBMITTED TO NAVY: O/10C/8E/6CD

O = original transmittal form
 C = copy of transmittal form
 E = enclosure
 CD = compact disc

COPIES TO: (Include Name, Navy Mail Code, and Number of Copies)

- Navy:**
 Cynthia Mafara, CO - O
 Dane Jensen - 1C/1E/1CD
 Keith Forman - 1C/1E/1CD
 Mark Walden - 1C/1E/1CD
 Darren Knight - 1C/1E/1CD
 Sarah Koppel - 1C/1E/1CD
 Diane Silva - 3C/3E/1CD
 Melanie Kito - 1C
 Ralph Pearce - 1C
Distribution List (1C/1E/1CD):
 Mark Ripperda, U.S. EPA
 Tom Lanphar, DTSC

- Distribution List (1C/1E/1CD):**
 Erich Simon, SF Bay RWQCB
 Robert Carr, U.S. EPA
 Daniel Stralka, U.S. EPA
 Karla Brasaemle, Tech Law
 Jim Polisini, DTSC
 Dorinda Shipman, Treadwell & Rollo
 Michael Jacobvitz, MACTEC

- Distribution List (1C/1E):**
 Leon Muhammad

- BAI:**
 File - 1C/1E/1CD
Tetra Tech:
 Steve Hall - 1C/1E/1CD

Date/Time Received



Distribution List (IC/ICD)

Amy Brownell, Dept. of Public Health

Andrea Ruiz. Esquide, Office of City Attorney

Tamara Davidson, Dept. of Public Health

Stan DeSouza, Dept. of Public Health

Nicole Franklin, City of SF

Michael Sharpless, Paul Hastings

Jeff Austin, Lennar BVHP

Sheila Roebuck, Lennar BVHP

Michael McGowan, Arc Ecology

Peter T. Palmer, SFSU

TABLE OF CONTENTS

REVIEW AND APPROVALi

ACRONYMS AND ABBREVIATIONSiii

1.0 INTRODUCTION1

2.0 METHODOLOGY2

3.0 RESULTS4

4.0 REFERENCES5

Attachment

- A Nonrepresentative Groundwater Samples and Influence on HHRA Results for Parcel B
- B Nonrepresentative Groundwater Samples and Influence on HHRA Results for Parcel C
- C Nonrepresentative Groundwater Samples and Influence on HHRA Results for Parcel D
- D Nonrepresentative Groundwater Samples and Influence on HHRA Results for Parcel E
- E Nonrepresentative Groundwater Samples and Influence on HHRA Results for Parcel E-2
- F Responses to Regulatory Agency Comments on the Draft Technical Memorandum:
Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk
Assessments for Hunters Point Shipyard

ACRONYMS AND ABBREVIATIONS

95UCL	95 percent upper confidence limit of arithmetic mean
BCT	Base Realignment and Closure Cleanup Team
COC	Chemical of concern
EPC	Exposure point concentration
HHRA	Human health risk assessment
HPS	Hunters Point Shipyard
MAX	Maximum exposure
Navy	U.S. Department of the Navy
RME	Reasonable maximum exposure
VOC	Volatile organic compound

1.0 INTRODUCTION

This technical memorandum presents the U.S. Department of the Navy's (Navy) evaluation on whether the inclusion of nonrepresentative groundwater sampling results would influence the human health risk assessments (HHRA) for Parcels B, C, D, E, and E-2 at Hunters Point Shipyard (HPS) in San Francisco, California. Based on agreements with the Base Realignment and Closure Cleanup Team (BCT) for HPS, the groundwater data set for each of the HHRA was based on the 12 most recent sampling events for each chemical and each monitoring well. For each parcel, the most recent groundwater sampling event from these 12 events included in the HHRA was based on the most recent validated data available at the time the HHRA was initiated. For Parcel D, the groundwater data set for the HHRA included results through the second quarter (April to June) of monitoring in 2004. For Parcels B, C, and E, the groundwater data set included results through the fourth quarter (October to December) of monitoring in 2004. For Parcel E-2, the groundwater data set included results through the first quarter (January to March) of monitoring during 2005. Groundwater data collected from areas associated with treatability studies, collected either during or following the studies, were not included in the groundwater data sets for any parcel.

Following completion of the draft HHRA for HPS, the BCT identified a potential problem with collection methods for some of the quarterly monitoring samples for HPS. Beginning with the second quarter of 2004 and extending through the fourth quarter of 2005, the groundwater monitoring results in question had been collected from the standpipe of the monitoring well casing, rather than from the well-screen interval. Low-flow sampling is used to collect groundwater monitoring samples at HPS. This method requires that the groundwater pump intake is within the screen interval for the monitoring well. Collection of the sample from the well casing may result in a sample that is a mixture of groundwater and water from the well casing, which may not be representative of groundwater in the water-bearing unit. The water in the well casing may be affected by the well environment, with the oxidation level and bacterial activity varying from the water in the geologic formation, resulting in changes in chemical solubility, degradation rates, and volatility of gases. Uncertainty is associated with chemical concentrations measured in these samples; they may be higher, lower, or similar to chemical concentrations from the proper screen interval.

The BCT voiced concern that samples collected outside of the proper well screen interval may not be representative of groundwater conditions in the water-bearing unit (that is, A-aquifer and B-aquifer), and that inclusion of such data in the HHRA may have influenced the HHRA results for groundwater. As a result, the Navy agreed to evaluate whether inclusion of these samples had influenced the HHRA results.

For purposes of this evaluation, those samples for which the sample pump was placed outside of the proper well screen interval are termed "nonrepresentative samples." Those samples for which the sample pump was placed within the proper well screen interval are termed "representative samples." The Navy will not revise the HHRA to exclude the nonrepresentative samples; the analysis presented in this technical memorandum shows that inclusion of the

nonrepresentative groundwater samples in the HHRAs is unlikely to change the estimated health risks or the chemicals of concern (COC) identified for groundwater at each of the parcels.

The remainder of this technical memorandum discusses the methodology used to evaluate the nonrepresentative samples with respect to the HHRA results, and presents the evaluation findings for each parcel. The evaluation for each parcel is provided in separate attachments to this report to facilitate their inclusion in the uncertainty analysis for each HHRA.

2.0 METHODOLOGY

The groundwater HHRAs for each of the parcels involved the following six steps:

1. Compile the groundwater data set for the HHRA
2. Identify plume- and nonplume-based exposure areas
3. Group groundwater data by each of the identified exposure areas
4. Calculate exposure point concentrations (EPC) for each groundwater data grouping
5. Calculate human health risks associated with exposure to EPCs for groundwater at each exposure area
6. Identify COCs for each exposure area

Chemicals identified as COCs for groundwater were detected at concentrations that are associated with a cancer risk greater than $1E-06$ or a noncancer hazard greater than 1. For HPS, chemicals identified as COCs require remedial action. The exposure pathways for groundwater evaluated in the HHRAs were vapor intrusion (residential and industrial) and construction trench exposure for groundwater in the A-aquifer, and residential domestic use for groundwater in the B-aquifer. Chemicals that were not identified as COCs for groundwater were detected at concentrations that are not associated with a cancer risk greater than $1E-06$ or a noncancer hazard greater than 1, and do not require remedial action.

The BCT agreement to use the 12 most recent sampling events for the groundwater data sets for the HHRAs resulted in a large temporal span for each of the data sets, ending with data from (1) the second quarter of 2004 for Parcel D; (2) the fourth quarter of 2004 for Parcels B, C, and E; and (3) the first quarter of 2005 for Parcel E-2. Nonrepresentative samples were only collected during recent monitoring events, beginning with the second quarter of 2004. As a result, the nonrepresentative groundwater samples included in the HHRAs represent a small subset of the larger groundwater data sets established for each parcel.

EPCs for the HHRAs were calculated for a reasonable maximum exposure (RME) scenario and a maximum exposure (MAX) scenario. For the RME scenario, EPCs were based on 95 percent upper confidence limits of the arithmetic mean (95UCL). For the MAX scenario, EPCs were

based on maximum detected concentrations. Based on regulatory agency comments on the HHRA for Parcel B, the Navy agreed to use results of the MAX scenario to identify COCs for each exposure area (ChaduxTt 2007). This agreement was made to address the regulatory agencies' concern regarding exclusion of nondetected results with elevated sample quantitation limits from the HHRA. Regulatory agency comments are in progress for the HHRA for the remaining parcels; for purposes of this evaluation, it is assumed that use of the MAX scenario to identify COCs will be requested for each parcel. Therefore, an analysis of the influence of the nonrepresentative samples on the HHRA results for the RME scenario is not included in this evaluation.

These two key points — (1) that the nonrepresentative samples are a small subset of the larger groundwater HHRA data sets established for each parcel, and (2) that the EPCs used to characterize risks and identify COCs for each parcel are based on maximum concentrations — allowed for the use of the following methodology to evaluate the influence of nonrepresentative samples on the HHRA results:

- MAX scenario EPCs (that is, maximum concentrations) for each of the HHRA data sets affected by the nonrepresentative samples were compared with maximum concentrations associated with the nonrepresentative sampling results included in the HHRA data set.
- For each chemical, if the MAX scenario EPC was based on a representative sample result, then it was concluded that the nonrepresentative samples did not affect the risk results for that chemical.
- For each chemical, if the MAX scenario EPC was based on the nonrepresentative sampling results, then the chemical was evaluated further. The additional evaluation first consisted of determining if the chemical was identified as a COC in the HHRA.
- If the chemical was identified as a COC in the HHRA, then the nonrepresentative data were segregated from the HHRA data set and further evaluated to determine if the COC status of the chemical would change. This evaluation consisted of determining if the chemical was likely to be identified as a COC regardless of the nonrepresentative samples, or if the chemical was identified as a COC solely based on the nonrepresentative sampling results.

If the chemical was not identified as a COC in the HHRA, then it was concluded that the nonrepresentative samples would not change this result. That is, regardless of the inclusion of nonrepresentative samples in the HHRA data set for the chemical, the chemical is unlikely to be a COC. This conclusion is based on the large temporal span of data used in the HHRA, which resulted in a large number of representative samples that comprised each chemical data set, compared with the small number of nonrepresentative samples contained in the data set, as discussed below.

The methodology for evaluating the influence of nonrepresentative samples on the results of the HHRA focuses on the likelihood that inclusion of the nonrepresentative samples may have resulted in an overestimate of health risks and in the incorrect identification of some chemicals as COCs. It is also possible that chemical concentrations associated with the nonrepresentative samples are lower than concentrations that would have resulted from samples collected from the proper well screen interval, and that risks may have been underestimated or that some chemicals may have been incorrectly excluded as COCs. Risk estimates are directly proportional to EPCs; therefore, an increase in chemical concentrations will also result in an increase in estimated health risks. Likewise, a decrease in chemical concentrations will result in a decrease in estimated health risks.

However, the use of 12 sampling events to comprise the HHRA data sets for each of the parcels and the MAX scenario (that is, maximum concentrations from these sampling events) to identify COCs limits the possibility that risks may have been underestimated. As discussed, the nonrepresentative groundwater samples represent a small subset of the larger groundwater data sets established for each parcel. Of the 12 sampling events used to comprise the HHRA data sets, results of nonrepresentative groundwater samples only affect one sampling event for Parcel D; two sampling events for Parcels B, C, and E; and three sampling events for Parcel E-2. In addition, the nonrepresentative sample results only affected a limited number of wells at each parcel: 2 of 165 wells at Parcel B, 26 of 220 wells at Parcel C, 2 of 68 wells at Parcel D, 3 of 139 wells at Parcel E, and 7 of 43 wells at Parcel E-2. The HHRA data sets, therefore, consist predominantly of representative samples collected from the proper well screen interval, and not the nonrepresentative samples.

3.0 RESULTS

The evaluation for each parcel is presented in the following attachments:

- Attachment A – Parcel B
- Attachment B – Parcel C
- Attachment C – Parcel D
- Attachment D – Parcel E
- Attachment E – Parcel E-2

4.0 REFERENCES

ChaduxTt. 2007. "Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California." December 12.

ATTACHMENT A
NONREPRESENTATIVE GROUNDWATER SAMPLES AND INFLUENCE ON HHRA
RESULTS FOR PARCEL B

Table A-1 Summary of HHRA Data Associated with Nonrepresentative Groundwater Samples,
Parcel B

SUMMARY OF RESULTS FOR PARCEL B

The groundwater data set for the HHRA for Parcel B comprises data collected through the fourth quarter of 2004. Table A-1 lists the sampling locations, sample collection dates, and corresponding water-bearing units (A-aquifer, B-aquifer, or bedrock water-bearing zone [F-WBZ]) associated with the nonrepresentative groundwater samples collected at Parcel B through the fourth quarter of 2004. Also shown in the table is the distance above or below the well screen interval at which the nonrepresentative samples were collected.

Two nonrepresentative groundwater samples were collected from one monitoring well at Parcel B during 2004. However, these two samples were not included in the HHRA data set for groundwater because they are associated with treatability studies at Parcel B. Therefore, the nonrepresentative samples do not influence the HHRA results for Parcel B.

TABLE A-1: SUMMARY OF HHRA DATA ASSOCIATED WITH NONREPRESENTATIVE GROUNDWATER SAMPLES, PARCEL B

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Monitoring Well with Nonrepresentative Sample	Nonrepresentative Sample Collection Date	Water-Bearing Unit	Distance from Proper Well Screen Interval (feet) ^a	Comment
B	IR10MW74A ^b	6/1/2004	A	8.6	Results from these samples are associated with treatability studies and were not included in the HHRA.
B	IR10MW74A ^b	8/30/2004	A	9.1	

Notes:

a Samples collected below the proper well screen interval are shown with a negative distance. Samples collected above the proper well screen interval are indicated with a positive distance.

b Sample was collected from IR10MW74A, but is reported in monitoring reports as collected from IR10MW59A.

A A-aquifer

HHRA Human health risk assessment

ATTACHMENT B
NONREPRESENTATIVE GROUNDWATER SAMPLES AND INFLUENCE ON HHRA
RESULTS FOR PARCEL C

- Table B-1 Summary of HHRA Data Associated with Nonrepresentative Groundwater Samples, Parcel C
- Table B-2 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C1 Plume, B-Aquifer with Potential Hydraulic Communication
- Table B-3 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C1 Plume, B-Aquifer
- Table B-4 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C2 Plume, A-Aquifer
- Table B-5 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C2 Plume, B-Aquifer with Potential Hydraulic Communication
- Table B-6 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C2 Plume, B-Aquifer
- Table B-7 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C2 Plume, Bedrock Water-Bearing Zone
- Table B-8 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C4 Plume, A-Aquifer
- Table B-9 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C4 Plume, B-Aquifer and Bedrock Water-Bearing Zone with Potential Hydraulic Communication
- Table B-10 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C4 Plume, B-Aquifer and Bedrock Water-Bearing Zone
- Table B-11 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, RU-C5 Plume, A-Aquifer
- Table B-12 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, Industrial and Residential Non-Plume Exposure Areas, A-Aquifer
- Table B-13 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel C, Residential Non-Plume Exposure Areas, B-Aquifer
- Table B-14 Evaluation of Chemicals with Maximum Concentrations for HHRA Data Set Based on Nonrepresentative Sample Results, Parcel C

SUMMARY OF RESULTS FOR PARCEL C

The groundwater data set for the HHRA for Parcel C comprises data collected through the fourth quarter of 2004. Table B-1 lists the sampling locations, sample collection dates, and corresponding water-bearing units (A-aquifer, B-aquifer, or F-WBZ) associated with the nonrepresentative groundwater samples collected at Parcel C through the fourth quarter of 2004. For each nonrepresentative sample, Table B-1 also shows the distance above or below the well screen interval at which the nonrepresentative sample was collected, the laboratory analyses for the sample, and the HHRA exposure area and scenarios associated with the location and water-bearing unit of the sample.

Forty-seven nonrepresentative groundwater samples were collected from 26 monitoring wells at Parcel C during 2004. Eleven exposure areas are associated with the nonrepresentative samples: four plume-based areas (Remedial Unit [RU]-C1 plume, RU-C2 plume, RU-C4 plume, and RU-C5 plume) and seven nonplume areas. The seven nonplume areas are AR11 (industrial grid), collocated with 065030 (residential grid); AW10 (industrial grid), collocated with 082027 (residential grid); AY12 (industrial grid), collocated with 088032 (residential grid); and 089021 (residential grid), 095026 (residential grid), 090029 (residential grid), and 100007 (residential grid).

Hydraulic communication is possible between the A-aquifer, B-aquifer, and F-WBZ in several locations across Parcel C. The potential for hydraulic communication at each of the plume and nonplume exposure areas to be influenced by nonrepresentative samples is identified in Table B-1. To account for potential migration of chemicals from the A-aquifer to the B-aquifer or F-WBZ, the HHRA evaluated groundwater exposures at Parcel C under multiple scenarios. For areas where potential hydraulic communication between aquifers was not identified, the data set for the exposure area was based solely on the data set for the aquifer evaluated. For areas where hydraulic communication could occur, the risks were assessed for two scenarios. In the first scenario, the B-aquifer was assumed to be in hydraulic communication with the A-aquifer, and data sets for the A- and B-aquifers were combined ("A+B aquifer") to calculate EPCs. In the second scenario, the B-aquifer was assumed to be isolated and EPCs were based solely on B-aquifer data. In some areas (RU-C4 plume), the F-WBZ is also in communication with the overlying B-aquifer, thus it was included in the combined data sets.

For consistency with the approach used in HHRA, comparisons of the analytical data for the nonrepresentative samples with the groundwater data for the HHRA were made for the same scenarios evaluated in the HHRA. These comparisons are presented in Tables B-2 through B-13. These tables also identify instances where the EPC for the HHRA data set is based on the maximum concentration associated with the nonrepresentative sampling results. For these instances, the tables indicate whether the affected chemical was identified as a COC in the HHRA. Results of the comparisons are discussed below.

RU-C1 Plume

Eleven nonrepresentative samples from the B-aquifer were collected at the RU-C1 plume. Tables B-2 and B-3 present a comparison of the sample results to the HHRA data set for this exposure area. As shown in these tables, maximum concentrations for one chemical (cis-1,2-dichloroethene) were based on nonrepresentative sample results. Further evaluation of this chemical is provided below in the COC evaluation.

RU-C2 Plume

Twelve nonrepresentative samples from the A-aquifer, B-aquifer, and F-WBZ were collected at the RU-C2 plume. Tables B-4 through B-7 present a comparison of the sample results with the HHRA data set for this exposure area. As shown in these tables, maximum concentrations for two chemicals (bromoform and dichlorodifluoromethane) were based on nonrepresentative sample results. Further evaluation of these chemicals is provided below in the COC evaluation.

RU-C4 Plume

Two nonrepresentative samples (one from the A-aquifer and one from the B-aquifer) were collected at the RU-C4 plume. Tables B-8, B-9, and B-10 present a comparison of the sample results with the HHRA data set for this exposure area. As shown in these tables, none of the maximum concentrations for the HHRA data set was based on the nonrepresentative sample results. Therefore, the nonrepresentative samples do not influence the HHRA results for the RU-C4 plume at Parcel C.

RU-C5 Plume

Ten nonrepresentative samples were collected from the A-aquifer at the RU-C5 plume. Table B-11 presents a comparison of the sample results with the HHRA data set for this exposure area. As shown in this table, none of the maximum concentrations for the HHRA data set was based on the nonrepresentative sample results. Therefore, the nonrepresentative samples do not influence the HHRA results for the RU-C5 plume at Parcel C.

Nonplume Exposure Areas

Twelve nonrepresentative samples were collected from 7 nonplume exposure areas at Parcel C (see Table B-1). Tables B-12 and B-13 present a comparison of the nonrepresentative sample results with the HHRA data sets for the nonplume exposure areas associated with these samples. As shown in these tables, maximum concentrations for carbon tetrachloride and chloroform at grid AR11/065030 and total xylene at grid 089021 were based on nonrepresentative sample results. Further evaluation of these chemicals is provided below in the COC evaluation.

Inclusion of nonrepresentative samples does not influence groundwater EPCs in the HHRA for the remaining six nonplume exposure areas. Comparisons for grids 090029 and 100007 are not included in Tables B-12 and B-13 because all analytical results for nonrepresentative samples were nondetected for these grids.

COC Evaluation

Table B-14 provides further evaluation of the six chemicals at Parcel C for which the maximum concentration for the HHRA groundwater data set was based on results from nonrepresentative samples: cis-1,2-dichloroethene at RU-C1; bromoform and dichlorodifluoromethane at RU-C2; carbon tetrachloride and chloroform at grid AR11/065030; and total xylene at grid 089021. Of these six chemicals, only carbon tetrachloride and chloroform in the A-aquifer at the grid AR11/065030 exposure area were identified as COCs in the HHRA for Parcel C.

Table B-14 includes a comparison of the range of detected concentrations associated with the nonrepresentative sample results for carbon tetrachloride and chloroform with the range of concentrations for these chemicals from all wells affected by the nonrepresentative samples, excluding the nonrepresentative sample results. As shown in the table, carbon tetrachloride and chloroform were detected both in the nonrepresentative samples and in the HHRA data set excluding the nonrepresentative samples. Maximum detected concentrations for carbon tetrachloride and chloroform in the HHRA data set for grid AR11/065030 remain unchanged when the nonrepresentative samples are excluded (see Table B-14). This comparison indicates that inclusion of the nonrepresentative samples in the groundwater risk evaluation for the AR11/065030 exposure area does not affect the COC status of these chemicals. That is, carbon tetrachloride and chloroform would be COCs for this exposure area, regardless of the inclusion of the nonrepresentative sampling results; inclusion of nonrepresentative samples in the risk evaluation does not change the HHRA results for this exposure area.

The remaining four chemicals for which maximum concentrations for the HHRA were based on results from nonrepresentative samples (cis-1,2-dichloroethene at RU-C1; bromoform and dichlorodifluoromethane at RU-C2; and total xylene at grid 089021) were not identified as COCs in the HHRA. None of these four chemicals is likely to be a COC, regardless of the inclusion of nonrepresentative samples in the HHRA data set, as discussed below.

- Cis-1,2-dichloroethene (RU-C1, B-aquifer): Twenty-one of 32 samples are representative (11 are nonrepresentative); cis-1,2-dichloroethene was detected in 2 of the 21 representative samples and 1 of the 11 nonrepresentative samples (see Table B-3). The maximum detected concentration from both the representative and nonrepresentative samples did not result in identification of cis-1,2-dichloroethene as a COC. The large proportion of nondetected results from both the representative and nonrepresentative samples indicates that the presence of cis-1,2-dichloroethene is limited at RU-C1. The three nonrepresentative samples were collected in June, September, and November 2004. In addition, the single detected result for cis-1,2-dichloroethene from the nonrepresentative samples was from a single monitoring well sampled during June 2004. Proper methods were used for subsequent sampling of this well during September and November 2004; results for cis-1,2-dichloroethene from these samples were nondetected.

- Bromoform (RU-C2, A-aquifer and A+B-aquifer): For the A-aquifer evaluation, 129 of 132 samples are representative (3 are nonrepresentative); bromoform was detected in 1 of the 129 representative samples and 1 of the 3 nonrepresentative samples (see Table B-4). For the combined A+B-aquifer evaluation, 141 of the 148 samples are representative (7 are nonrepresentative); bromoform was detected in 1 of the 148 representative samples and 1 of the 7 nonrepresentative samples (see Table B-5). The maximum concentration from both the representative and nonrepresentative samples did not result in identification of bromoform as a COC. The large proportion of nondetected results from both the representative and nonrepresentative samples indicates that the presence of bromoform is limited at RU-C2. In addition, the single detected result for bromoform from the nonrepresentative samples was from a single monitoring well sampled during June 2004. Subsequent samples for this well collected in September 2004 (also a nonrepresentative sample) and December 2004 (a properly collected, representative sample) were nondetected for bromoform.
- Dichlorodifluoromethane (RU-C2, B-aquifer): Ten of 14 samples are representative (4 are nonrepresentative); dichlorodifluoromethane was detected in 1 of the 10 representative samples and 2 of the 4 nonrepresentative samples (see Table B-6). The two detections associated with the nonrepresentative samples are from the two most recent sampling events included in the HHRA data set (September and November 2004). The maximum concentration from both the representative and nonrepresentative results did not result in identification of dichlorodifluoromethane as a COC. Most of the sampling results from both the representative and nonrepresentative samples are nondetected, indicating that the presence of dichlorodifluoromethane is limited at RU-C2.
- Total xylene (grid 089021, B-aquifer): One of four samples is representative (three are nonrepresentative); total xylene was not detected in the representative sample but was detected in one of the three nonrepresentative samples (see Table B-13). The single detection of total xylene was collected from a single monitoring well in June 2004. Subsequent samples collected from this well (also nonrepresentative samples) in November and September 2004 yielded nondetected results for total xylene. The concentration associated with the sole detection of total xylene did not result in identification of total xylene as a COC.

TABLE B-1: SUMMARY OF HHRA DATA ASSOCIATED WITH NONREPRESENTATIVE GROUNDWATER SAMPLES, PARCEL C

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Monitoring Well with Nonrepresentative Sample	Nonrepresentative Sample Collection Date	Water-Bearing Unit	Distance from Proper Well Screen Interval (feet) ^a	Laboratory Analysis					HHRA Exposure Area	Communication Between Water-Bearing Units?	HHRA Exposure Scenario(s) ^b	Water-Bearing Units Included in Nonrepresentative Sample Analysis
					Metals	Chromium/Chromium VI	VOCs	SVOCs	Pesticides/PCBs				
C	IR28MW171B	6/2/2004	B	17			✓			RU-C1 plume	Yes	DU	A+B, B
C	IR28MW173B	9/9/2004	B	19.2			✓						
C	IR28MW173B	12/6/2004	B	20			✓						
C	IR28MW255F	6/2/2004	B	9.5			✓						
C	IR28MW309B	6/2/2004	B	7.97			✓						
C	IR28MW309B	9/1/2004	B	7.5			✓						
C	IR28MW353B ^c	6/2/2004	B	14			✓						
C	IR28MW353B	9/1/2004	B	14			✓						
C	IR28MW399B	6/2/2004	B	8.5			✓						
C	IR28MW399B	9/1/2004	B	12.5			✓						
C	IR28MW399B	12/1/2004	B	1.5			✓						
C	IR28MW190F	12/2/2004	A	2			✓		RU-C2 plume	Yes	VI, Trench	A	
C	IR58MW33B	6/18/2004	A	2.81			✓						
C	IR58MW33B	9/7/2004	A	2.9			✓						
C	IR28MW396B	6/4/2004	B	8.6			✓		RU-C2 plume	Yes	DU	A+B, B	
C	IR28MW396B	9/9/2004	B	8.6			✓						
C	IR28MW397B	9/9/2004	B	6.5			✓						
C	IR28MW397B	11/30/2004	B	3.5			✓						
C	IR28MW395F	6/4/2004	F	6.5			✓		RU-C2 plume	No	DU	F	
C	IR28MW395F	9/9/2004	F	7.5			✓						
C	IR58MW31F	6/18/2004	F	19			✓						
C	IR58MW31F	9/9/2004	F	19.5			✓						
C	IR58MW31F	11/23/2004	F	18			✓						
C	IR29MW58F	6/8/2004	A	2.4			✓		RU-C4 plume	Yes	VI, Trench	A	
C	IR28MW394B	9/13/2004	B	12			✓		RU-C4 plume				
C	IR06MW52F	6/7/2004	A	2			✓		RU-C5 plume	No	VI, Trench	A	
C	IR06MW52F	9/10/2004	A	2			✓						
C	IR06MW59A2	6/7/2004	A	2.6			✓						
C	IR06MW59A2	9/10/2004	A	2.6			✓						
C	IR25MW41A	12/1/2004	A	3.5			✓						
C	IR25MW60A2	6/8/2004	A	2.5			✓						
C	IR25MW60A2	9/10/2004	A	2.5			✓						
C	IR25MW61A2	6/8/2004	A	8.06			✓						
C	IR25MW61A2	9/10/2004	A	8			✓						
C	IR25MW61A2 ^e	12/6/2004	A	8			✓						

TABLE B-1: SUMMARY OF HHRA DATA ASSOCIATED WITH NONREPRESENTATIVE GROUNDWATER SAMPLES, PARCEL C (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Monitoring Well with Nonrepresentative Sample	Nonrepresentative Sample Collection Date	Water-Bearing Unit	Distance from Proper Well Screen Interval (feet) ^a	Laboratory Analysis					HHRA Exposure Area	Communication Between Water-Bearing Units?	HHRA Exposure Scenario(s) ^b	Water-Bearing Units Included in Nonrepresentative Sample Analysis
					Metals	Chromium/Chromium VI	VOCs	SVOCs	Pesticides/PCBs				
C	IR06MW54F	9/2/2004	A	4		✓			✓	AR11 / 065030	No	VI, Trench	A
C	IR06MW54F	9/9/2004	A	4		✓	✓		✓				
C	IR58MW25F	6/8/2004	A	1.7		✓	✓			AW10 / 082027	No	VI, Trench	A
C	IR28MW216F	6/3/2004	A	1.3			✓			AY12 / 088032	No	VI, Trench	A
C	IR28MW398B	6/4/2004	B	4.33			✓			089021	No	DU	B
C	IR28MW398B	9/9/2004	B	5.75			✓						
C	IR28MW398B	11/30/2004	B	6.5			✓						
C	IR28MW221B ^c	6/3/2004	B	8			✓			095026	No	DU	B
C	IR28MW221B	9/7/2004	B	9			✓						
C	IR28MW172F	9/9/2004	F	17			✓			090029	No	DU	F
C	IR28MW140F	6/2/2004	F	3.73			✓			100007	No	DU	F
C	IR28MW140F	8/31/2004	F	4			✓						

Notes:

- a Samples collected below the proper well screen interval are shown with a negative distance. Samples collected above the proper well screen interval are indicated with a positive distance.
- b The HHRA evaluated vapor intrusion exposure for residential and industrial scenarios, construction trench exposure for a construction worker, and domestic use exposure for a residential scenario.
- c Duplicate sample collected on the same date was also affected.

- A A-aquifer
- B B-aquifer
- Chromium VI Hexavalent chromium
- DU Domestic use
- F Bedrock water-bearing zone
- HHRA Human health risk assessment
- PCB Polychlorinated biphenyl
- RU Remedial Unit
- SVOC Semivolatile organic compound
- Trench Construction trench
- VI Vapor intrusion
- VOC Volatile organic compound

TABLE B-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C1 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C1 Plume A+B-Aquifer	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/L	1 / 81	2.9E-01	2.9E-01	0 / 11	--	--	No
	1,1-DICHLOROETHANE	µg/L	7 / 239	1.9E-01	3.8E+01	0 / 11	--	--	No
	1,1-DICHLOROETHENE	µg/L	19 / 239	2.3E-01	1.4E+00	0 / 11	--	--	No
	1,2,4-TRICHLOROBENZENE	µg/L	7 / 239	3.2E-01	1.0E+00	0 / 11	--	--	No
	1,2,4-TRIMETHYLBENZENE	µg/L	3 / 34	1.3E+00	1.4E+00	NA	--	--	--
	1,2-DICHLOROBENZENE	µg/L	27 / 239	1.2E-01	1.1E+02	0 / 11	--	--	No
	1,2-DICHLOROETHANE	µg/L	2 / 239	7.6E-01	9.1E-01	0 / 11	--	--	No
	1,2-DICHLOROETHENE (TOTAL)	µg/L	30 / 77	3.0E-01	1.6E+03	NA	--	--	--
	1,3-DICHLOROBENZENE	µg/L	16 / 239	1.9E-01	3.0E+00	0 / 11	--	--	No
	1,4-DICHLOROBENZENE	µg/L	25 / 239	1.3E-01	3.1E+01	0 / 11	--	--	No
	2,4-DIMETHYLPHENOL	µg/L	1 / 88	1.0E+00	1.0E+00	NA	--	--	--
	2-CHLORONAPHTHALENE	µg/L	1 / 88	1.0E+00	1.0E+00	NA	--	--	--
	2-METHYLNAPHTHALENE	µg/L	4 / 88	2.0E+00	1.6E+01	NA	--	--	--
	4,4'-DDT	µg/L	1 / 77	2.0E-02	2.0E-02	NA	--	--	--
	4-METHYL-2-PENTANONE	µg/L	1 / 172	1.4E+00	1.4E+00	NA	--	--	--
	ACENAPHTHENE	µg/L	3 / 88	2.0E+00	3.0E+00	NA	--	--	--
	ACETONE	µg/L	6 / 154	4.3E+00	2.6E+01	NA	--	--	--
	ALDRIN	µg/L	2 / 77	3.3E-02	7.0E-02	NA	--	--	--
	ALUMINUM	µg/L	6 / 82	1.5E+01	1.1E+03	NA	--	--	--
	ANTHRACENE	µg/L	4 / 88	8.0E-01	2.0E+00	NA	--	--	--
	ANTIMONY	µg/L	5 / 81	2.1E-01	5.3E+00	NA	--	--	--
	ARSENIC	µg/L	24 / 80	1.2E+00	2.8E+01	NA	--	--	--
	BARIUM	µg/L	79 / 81	1.8E+01	7.3E+02	NA	--	--	--
	BENZENE	µg/L	64 / 239	1.3E-01	3.7E+01	0 / 11	--	--	No
	BENZO(A)ANTHRACENE	µg/L	1 / 88	2.0E+00	2.0E+00	NA	--	--	--
	BENZO(A)PYRENE	µg/L	1 / 87	2.0E+00	2.0E+00	NA	--	--	--

TABLE B-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C1 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C1 Plume A+B-Aquifer (cont.)	BENZO(B)FLUORANTHENE	µg/L	1 / 87	2.0E+00	2.0E+00	NA	--	--	--
	BENZO(K)FLUORANTHENE	µg/L	1 / 87	1.0E+00	1.0E+00	NA	--	--	--
	BERYLLIUM	µg/L	2 / 81	2.0E-01	3.5E-01	NA	--	--	--
	BETA-BHC	µg/L	1 / 77	3.8E-03	3.8E-03	NA	--	--	--
	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	1 / 88	7.7E+01	7.7E+01	NA	--	--	--
	BROMODICHLOROMETHANE	µg/L	1 / 239	9.0E-01	9.0E-01	0 / 11	--	--	No
	CADMIUM	µg/L	7 / 81	3.5E-01	3.0E+00	NA	--	--	--
	CARBAZOLE	µg/L	2 / 78	3.5E+00	4.0E+00	NA	--	--	--
	CARBON DISULFIDE	µg/L	15 / 195	1.6E-01	1.4E+01	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	1 / 239	3.1E-01	3.1E-01	0 / 11	--	--	No
	CHLOROBENZENE	µg/L	15 / 238	1.0E-01	1.5E+01	0 / 11	--	--	No
	CHLOROETHANE	µg/L	15 / 239	5.2E-01	8.0E+00	0 / 11	--	--	No
	CHLOROFORM	µg/L	32 / 239	1.7E-01	5.3E+01	2 / 11	1.7E-01	1.4E+00	No
	CHROMIUM	µg/L	26 / 89	8.3E-01	2.8E+02	NA	--	--	--
	CHROMIUM VI	µg/L	6 / 40	5.0E+00	2.6E+02	NA	--	--	--
	CHRYSENE	µg/L	1 / 88	2.5E+00	2.5E+00	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	94 / 163	1.5E-01	2.1E+03	1 / 11	7.5E-01	7.5E-01	No
	COBALT	µg/L	43 / 81	4.3E-01	1.7E+01	NA	--	--	--
	COPPER	µg/L	15 / 82	1.7E+00	2.7E+02	NA	--	--	--
	CYCLOHEXANE	µg/L	5 / 27	2.6E-01	1.6E+00	NA	--	--	--
	DICHLORODIFLUOROMETHANE	µg/L	4 / 106	7.9E-01	2.0E+00	0 / 11	--	--	No
	DI-N-BUTYLPHthalATE	µg/L	1 / 88	3.3E+00	3.3E+00	NA	--	--	--
	ETHYLBENZENE	µg/L	18 / 238	1.9E-01	7.7E+01	0 / 11	--	--	No
	FLUORANTHENE	µg/L	4 / 88	6.0E-01	5.5E+00	NA	--	--	--
	FLUORENE	µg/L	2 / 88	1.0E+00	2.0E+00	NA	--	--	--
	IRON	µg/L	25 / 123	1.7E+01	4.4E+04	NA	--	--	--

TABLE B-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C1 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C1 Plume A+B-Aquifer (cont.)	ISOPROPYLBENZENE	µg/L	6 / 61	1.2E-01	3.8E-01	NA	--	--	--
	LEAD	µg/L	11 / 82	8.7E-01	1.5E+01	NA	--	--	--
	M,P-XYLENES	µg/L	2 / 36	7.4E-01	8.8E-01	NA	--	--	--
	MANGANESE	µg/L	85 / 94	2.8E+00	1.9E+03	NA	--	--	--
	MERCURY	µg/L	16 / 100	8.5E-02	5.4E+01	NA	--	--	--
	METHYLCYCLOHEXANE	µg/L	3 / 27	2.2E-01	7.3E-01	NA	--	--	--
	METHYLENE CHLORIDE	µg/L	5 / 239	4.0E-01	1.2E+00	0 / 11	--	--	No
	MOLYBDENUM	µg/L	14 / 81	1.6E+00	6.7E+00	NA	--	--	--
	NAPHTHALENE	µg/L	10 / 119	8.5E-01	4.0E+01	NA	--	--	--
	NICKEL	µg/L	45 / 84	1.5E+00	1.2E+02	NA	--	--	--
	O-XYLENE	µg/L	6 / 36	9.0E-02	6.0E-01	NA	--	--	--
	PENTACHLOROPHENOL	µg/L	1 / 87	5.0E-01	5.0E-01	NA	--	--	--
	PHENANTHRENE	µg/L	8 / 88	1.0E+00	7.5E+00	NA	--	--	--
	PHENOL	µg/L	1 / 88	2.0E+00	2.0E+00	NA	--	--	--
	PYRENE	µg/L	7 / 88	1.0E+00	9.0E+00	NA	--	--	--
	SEC-BUTYLBENZENE	µg/L	1 / 34	4.0E-01	4.0E-01	NA	--	--	--
	SELENIUM	µg/L	8 / 82	1.9E+00	4.1E+01	NA	--	--	--
	SILVER	µg/L	4 / 80	4.0E-01	1.4E+00	NA	--	--	--
	TERT-BUTYL METHYL ETHER	µg/L	41 / 145	1.9E-01	2.5E+01	0 / 11	--	--	No
	TETRACHLOROETHENE	µg/L	94 / 238	1.0E-01	3.8E+02	0 / 11	--	--	No
THALLIUM	µg/L	11 / 78	1.5E+00	1.2E+01	NA	--	--	--	
TOLUENE	µg/L	13 / 238	1.3E-01	2.6E+01	1 / 11	5.8E-01	5.8E-01	No	
TRANS-1,2-DICHLOROETHENE	µg/L	69 / 163	2.1E-01	8.0E+01	0 / 11	--	--	No	
TRICHLOROETHENE	µg/L	120 / 239	1.2E-01	7.4E+02	0 / 11	--	--	No	
TRICHLOROFLUOROMETHANE	µg/L	5 / 106	1.4E-01	3.2E+00	0 / 11	--	--	No	
VANADIUM	µg/L	39 / 81	3.8E-01	1.1E+01	NA	--	--	--	

TABLE B-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C1 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C1 Plume A+B-Aquifer (cont.)	VINYL CHLORIDE	µg/L	91 / 239	2.9E-01	6.6E+02	1 / 11	3.7E-01	3.7E-01	No
	XYLENE (TOTAL)	µg/L	15 / 203	3.4E-01	1.0E+02	0 / 11	--	--	No
	ZINC	µg/L	17 / 83	3.7E+00	1.3E+03	NA	--	--	--

Notes:

- a Data summary shown for the RU-C1 plume is based on B-aquifer data combined with A-aquifer data to address potential hydraulic communication between the A- and B-aquifers.
- b See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- Not applicable
- µg/L Microgram per liter
- BHC Benzene hexachloride
- COPC Chemical of potential concern
- DDT Dichlorodiphenyltrichloroethane
- HHRA Human health risk assessment
- NA Not analyzed
- RU Remedial Unit

TABLE B-3: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C1 PLUME, B-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C1 Plume B-Aquifer	1,2,4-TRICHLOROBENZENE	µg/L	2 / 40	3.5E-01	4.0E-01	0 / 11	--	--	--
	1,2-DICHLOROBENZENE	µg/L	3 / 40	3.0E+01	1.0E+02	0 / 11	--	--	--
	1,3-DICHLOROBENZENE	µg/L	3 / 40	2.0E-01	6.9E-01	0 / 11	--	--	--
	1,4-DICHLOROBENZENE	µg/L	3 / 40	6.6E+00	2.5E+01	0 / 11	--	--	--
	ANTIMONY	µg/L	2 / 11	2.0E+00	5.3E+00	NA	--	--	--
	ARSENIC	µg/L	2 / 11	2.6E+00	2.8E+00	NA	--	--	--
	BARIUM	µg/L	11 / 11	6.6E+01	7.3E+02	NA	--	--	--
	CADMIUM	µg/L	1 / 11	3.7E-01	3.7E-01	NA	--	--	--
	CARBON DISULFIDE	µg/L	1 / 23	2.5E+00	2.5E+00	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	1 / 40	3.1E-01	3.1E-01	0 / 11	--	--	--
	CHLOROBENZENE	µg/L	1 / 40	1.0E-01	1.0E-01	0 / 11	--	--	--
	CHLOROFORM	µg/L	7 / 40	1.7E-01	2.0E+00	2 / 11	1.7E-01	1.4E+00	No
	CHROMIUM	µg/L	1 / 11	5.9E+00	5.9E+00	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	3 / 32	1.5E-01	7.5E-01	1 / 11	7.5E-01	7.5E-01	Yes ^b
	COBALT	µg/L	8 / 11	5.9E-01	5.4E+00	NA	--	--	--
	COPPER	µg/L	2 / 11	2.9E+00	4.0E+00	NA	--	--	--
	ETHYLBENZENE	µg/L	3 / 40	1.9E-01	6.0E-01	0 / 11	--	--	No
	FLUORANTHENE	µg/L	1 / 15	3.0E+00	3.0E+00	NA	--	--	--
	IRON	µg/L	4 / 15	4.3E+01	4.3E+02	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	1 / 8	1.2E-01	1.2E-01	NA	--	--	--
	LEAD	µg/L	1 / 11	2.0E+00	2.0E+00	NA	--	--	--
	M,P-XYLENES	µg/L	1 / 6	7.4E-01	7.4E-01	NA	--	--	--
	MANGANESE	µg/L	11 / 11	3.0E+01	1.5E+03	NA	--	--	--
MOLYBDENUM	µg/L	1 / 11	1.7E+00	1.7E+00	NA	--	--	--	
NICKEL	µg/L	10 / 11	1.6E+01	4.4E+01	NA	--	--	--	
PHENANTHRENE	µg/L	1 / 15	2.9E+00	2.9E+00	NA	--	--	--	

TABLE B-3: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C1 PLUME, B-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C1 Plume B-Aquifer (cont.)	PYRENE	µg/L	1 / 15	3.0E+00	3.0E+00	NA	--	--	--
	SELENIUM	µg/L	3 / 11	4.2E+00	4.6E+00	NA	--	--	--
	TETRACHLOROETHENE	µg/L	3 / 40	1.5E+01	5.5E+01	0 / 11	--	--	No
	THALLIUM	µg/L	1 / 11	3.0E+00	3.0E+00	NA	--	--	--
	TOLUENE	µg/L	2 / 40	5.8E-01	8.7E-01	1 / 11	5.8E-01	5.8E-01	No
	TRICHLOROETHENE	µg/L	5 / 40	5.9E-01	1.5E+01	0 / 11	--	--	No
	TRICHLOROFLUOROMETHANE	µg/L	2 / 26	1.4E-01	3.0E-01	0 / 11	--	--	No
	VANADIUM	µg/L	9 / 11	7.2E-01	1.1E+01	NA	--	--	--
	VINYL CHLORIDE	µg/L	4 / 40	2.9E-01	5.6E-01	1 / 11	3.7E-01	3.7E-01	No
	XYLENE (TOTAL)	µg/L	2 / 35	3.0E+00	5.0E+00	0 / 11	--	--	No
ZINC	µg/L	5 / 12	1.1E+01	8.5E+01	NA	--	--	--	

Notes:

- a See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- b Chemical was not identified as a chemical of concern in the HHRA.
- Not applicable
- µg/L Microgram per liter
- COPC Chemical of potential concern
- HHRA Human health risk assessment
- NA Not analyzed
- RU Remedial Unit

TABLE B-4: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, A-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume A-Aquifer	1,1,1-TRICHLOROETHANE	µg/L	3 / 132	2.9E-01	4.0E+00	0 / 3	--	--	No
	1,1,2,2-TETRACHLOROETHANE	µg/L	1 / 132	6.0E+00	6.0E+00	0 / 3	--	--	No
	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/L	18 / 52	1.4E-01	1.9E+00	0 / 3	--	--	No
	1,1,2-TRICHLOROETHANE	µg/L	1 / 132	2.0E+00	2.0E+00	0 / 3	--	--	No
	1,1-DICHLOROETHANE	µg/L	11 / 132	2.2E-01	7.0E+00	0 / 3	--	--	No
	1,1-DICHLOROETHENE	µg/L	5 / 132	3.7E-01	7.0E+00	1 / 3	3.7E-01	3.7E-01	No
	1,2,3-TRICHLOROBENZENE	µg/L	5 / 35	6.0E-01	1.4E+00	NA	--	--	--
	1,2,4-TRICHLOROBENZENE	µg/L	22 / 132	6.1E-01	3.2E+01	2 / 3	6.9E-01	1.1E+00	No
	1,2,4-TRIMETHYLBENZENE	µg/L	13 / 22	1.8E+00	2.2E+02	NA	--	--	--
	1,2-DICHLOROBENZENE	µg/L	51 / 132	1.1E-01	3.3E+03	2 / 3	2.1E+01	2.3E+01	No
	1,2-DICHLOROETHANE	µg/L	2 / 132	1.8E-01	2.2E-01	0 / 3	--	--	No
	1,2-DICHLOROETHENE (TOTAL)	µg/L	18 / 36	3.0E-01	7.5E+03	NA	--	--	--
	1,2-DICHLOROPROPANE	µg/L	1 / 132	6.0E+00	6.0E+00	0 / 3	--	--	No
	1,3,5-TRIMETHYLBENZENE	µg/L	4 / 22	1.0E+00	2.8E+01	NA	--	--	--
	1,3-DICHLOROBENZENE	µg/L	37 / 131	2.0E-01	3.8E+02	2 / 3	1.3E+00	1.4E+00	No
	1,4-DICHLOROBENZENE	µg/L	51 / 131	1.2E-01	9.4E+02	2 / 3	6.3E+00	6.5E+00	No
	4,4'-DDD	µg/L	2 / 45	1.0E-02	6.0E-02	NA	--	--	--
	4,4'-DDT	µg/L	2 / 45	1.1E-01	5.0E-01	NA	--	--	--
	ACETONE	µg/L	2 / 84	1.7E+01	1.7E+02	NA	--	--	--
	ALUMINUM	µg/L	5 / 32	2.4E+01	7.2E+01	NA	--	--	--
	ARSENIC	µg/L	8 / 32	1.6E+00	4.9E+00	NA	--	--	--
	BARIUM	µg/L	28 / 32	7.3E+00	1.7E+02	NA	--	--	--
	BENZENE	µg/L	26 / 132	2.0E-01	6.4E+01	2 / 3	2.0E-01	2.4E-01	No
	BETA-BHC	µg/L	1 / 45	4.0E-02	4.0E-02	NA	--	--	--
BROMODICHLOROMETHANE	µg/L	4 / 132	1.4E-01	5.0E+00	1 / 3	7.7E-01	7.7E-01	No	
BROMOFORM	µg/L	2 / 132	1.0E+00	1.1E+00	1 / 3	1.1E+00	1.1E+00	Yes ^b	

TABLE B-4: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume A-Aquifer (cont.)	BROMOMETHANE	µg/L	2 / 132	5.0E+00	8.1E+00	0 / 3	--	--	No
	CADMIUM	µg/L	1 / 32	1.7E+00	1.7E+00	NA	--	--	--
	CARBON DISULFIDE	µg/L	6 / 96	4.0E-01	1.2E+01	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	30 / 132	1.6E-01	4.6E+01	1 / 3	1.7E+01	1.7E+01	No
	CHLOROENZENE	µg/L	45 / 132	7.3E-01	9.9E+03	2 / 3	1.3E+01	1.3E+01	No
	CHLOROETHANE	µg/L	8 / 131	2.2E+00	1.5E+01	1 / 3	2.2E+00	2.2E+00	No
	CHLOROFORM	µg/L	54 / 132	3.2E-01	1.0E+02	3 / 3	5.4E-01	8.1E+00	No
	CHLOROMETHANE	µg/L	2 / 132	3.0E+00	3.8E+00	0 / 3	--	--	No
	CHROMIUM	µg/L	15 / 32	7.4E-01	1.9E+01	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	66 / 96	1.9E-01	3.6E+03	2 / 3	1.5E+02	2.3E+02	No
	CIS-1,3-DICHLOROPROPENE	µg/L	1 / 132	4.0E+00	4.0E+00	0 / 3	--	--	No
	COBALT	µg/L	16 / 32	4.6E-01	2.6E+00	NA	--	--	--
	COPPER	µg/L	4 / 32	1.3E+00	4.0E+00	NA	--	--	--
	DELTA-BHC	µg/L	1 / 45	3.0E-03	3.0E-03	NA	--	--	--
	DIBROMOCHLOROMETHANE	µg/L	2 / 132	2.0E-01	3.0E+00	1 / 3	2.0E-01	2.0E-01	No
	DICHLORODIFLUOROMETHANE	µg/L	1 / 71	6.1E-01	6.1E-01	0 / 3	--	--	No
	DIELDRIN	µg/L	3 / 45	6.0E-02	9.0E-02	NA	--	--	--
	ENDOSULFAN SULFATE	µg/L	2 / 45	1.0E-02	2.0E-02	NA	--	--	--
	ENDRIN	µg/L	2 / 45	1.0E-02	2.0E-02	NA	--	--	--
	ENDRIN ALDEHYDE	µg/L	3 / 45	6.0E-02	1.0E-01	NA	--	--	--
	ETHYLBENZENE	µg/L	13 / 132	1.0E-01	2.3E+01	0 / 3	--	--	No
HEPTACHLOR	µg/L	2 / 45	3.0E-03	9.6E-03	NA	--	--	--	
HEPTACHLOR EPOXIDE	µg/L	2 / 44	9.0E-03	9.0E-03	NA	--	--	--	
IRON	µg/L	16 / 58	8.5E+00	5.9E+03	NA	--	--	--	
ISOPROPYLBENZENE	µg/L	8 / 35	1.4E+00	1.5E+01	NA	--	--	--	
M,P-XYLENES	µg/L	4 / 16	2.7E-01	1.5E+01	NA	--	--	--	

TABLE B-4: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume A-Aquifer (cont.)	MANGANESE	µg/L	26 / 33	5.5E+00	2.1E+03	NA	--	--	--
	MERCURY	µg/L	3 / 46	1.3E-01	2.1E-01	NA	--	--	--
	METHYLENE CHLORIDE	µg/L	6 / 132	3.0E-01	7.4E+01	0 / 3	--	--	No
	MOLYBDENUM	µg/L	4 / 32	6.5E-01	4.5E+00	NA	--	--	--
	NAPHTHALENE	µg/L	15 / 58	7.7E-01	1.5E+02	NA	--	--	--
	N-BUTYLBENZENE	µg/L	3 / 22	1.1E+00	6.5E+00	NA	--	--	--
	NICKEL	µg/L	21 / 32	3.3E+00	6.5E+01	NA	--	--	--
	O-XYLENE	µg/L	5 / 16	8.0E-02	7.2E+00	NA	--	--	--
	PARA-ISOPROPYL TOLUENE	µg/L	7 / 22	5.2E-01	1.6E+01	NA	--	--	--
	PROPYLBENZENE	µg/L	7 / 22	4.6E-01	2.7E+01	NA	--	--	--
	SEC-BUTYLBENZENE	µg/L	7 / 22	3.9E-01	4.8E+00	NA	--	--	--
	SELENIUM	µg/L	7 / 32	2.2E+00	9.0E+00	NA	--	--	--
	SILVER	µg/L	1 / 32	7.0E-01	7.0E-01	NA	--	--	--
	STYRENE	µg/L	1 / 96	4.0E+00	4.0E+00	NA	--	--	--
	TERT-BUTYL METHYL ETHER	µg/L	3 / 96	3.1E-01	4.6E-01	0 / 3	--	--	No
	TERT-BUTYLBENZENE	µg/L	1 / 22	4.0E-01	4.0E-01	NA	--	--	--
	TETRACHLOROETHENE	µg/L	73 / 132	1.3E-01	3.1E+01	2 / 3	1.4E+00	2.5E+00	No
	THALLIUM	µg/L	2 / 32	1.7E+00	2.9E+00	NA	--	--	--
	TOLUENE	µg/L	17 / 132	1.8E-01	2.9E+01	0 / 3	--	--	No
	TRANS-1,2-DICHLOROETHENE	µg/L	22 / 96	1.8E-01	1.4E+01	2 / 3	1.1E+00	2.0E+00	No
TRANS-1,3-DICHLOROPROPENE	µg/L	1 / 132	3.0E+00	3.0E+00	0 / 3	--	--	No	
TRICHLOROETHENE	µg/L	98 / 132	1.8E-01	4.0E+01	3 / 3	1.6E+00	3.4E+00	No	
TRICHLOROFLUOROMETHANE	µg/L	38 / 71	2.4E-01	4.0E+02	3 / 3	3.0E-01	5.4E+00	No	
VANADIUM	µg/L	28 / 32	1.8E+00	1.2E+01	NA	--	--	--	

TABLE B-4: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume A-Aquifer (cont.)	VINYL CHLORIDE	µg/L	45 / 132	2.8E-01	1.7E+03	2 / 3	6.7E+01	1.1E+02	No
	XYLENE (TOTAL)	µg/L	14 / 116	2.0E-01	2.2E+01	1 / 3	1.3E+00	1.3E+00	No
	ZINC	µg/L	8 / 32	1.2E+01	4.3E+01	NA	--	--	--

Notes:

a See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.

b Chemical was not identified as a chemical of concern in the HHRA.

-- Not applicable

µg/L Microgram per liter

BHC Benzene hexachloride

COPC Chemical of potential concern

DDD Dichlorodiphenyldichloroethane

DDT Dichlorodiphenyltrichloroethane

HHRA Human health risk assessment

NA Not analyzed

RU Remedial Unit

TABLE B-5: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume A+B Aquifer	1,1,1-TRICHLOROETHANE	µg/L	3 / 148	2.9E-01	4.0E+00	0 / 7	--	--	No
	1,1,2,2-TETRACHLOROETHANE	µg/L	1 / 148	6.0E+00	6.0E+00	0 / 7	--	--	No
	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/L	22 / 60	1.4E-01	2.6E+00	2 / 7	4.0E-01	5.1E-01	No
	1,1,2-TRICHLOROETHANE	µg/L	1 / 148	2.0E+00	2.0E+00	0 / 7	--	--	No
	1,1-DICHLOROETHANE	µg/L	11 / 148	2.2E-01	7.0E+00	0 / 7	--	--	No
	1,1-DICHLOROETHENE	µg/L	5 / 148	3.7E-01	7.0E+00	1 / 7	3.7E-01	3.7E-01	No
	1,2,3-TRICHLOROBENZENE	µg/L	6 / 43	6.0E-01	1.4E+00	NA	--	--	--
	1,2,4-TRICHLOROBENZENE	µg/L	23 / 148	6.1E-01	3.2E+01	2 / 7	6.9E-01	1.1E+00	No
	1,2,4-TRIMETHYLBENZENE	µg/L	17 / 28	1.8E+00	2.2E+02	NA	--	--	--
	1,2-DICHLOROBENZENE	µg/L	56 / 148	1.1E-01	3.3E+03	2 / 7	2.1E+01	2.3E+01	No
	1,2-DICHLOROETHANE	µg/L	2 / 148	1.8E-01	2.2E-01	0 / 7	--	--	No
	1,2-DICHLOROETHENE (TOTAL)	µg/L	18 / 36	3.0E-01	7.5E+03	NA	--	--	--
	1,2-DICHLOROPROPANE	µg/L	1 / 148	6.0E+00	6.0E+00	0 / 7	--	--	No
	1,3,5-TRIMETHYLBENZENE	µg/L	7 / 28	1.0E+00	2.8E+01	NA	--	--	--
	1,3-DICHLOROBENZENE	µg/L	43 / 147	2.0E-01	3.8E+02	2 / 7	1.3E+00	1.4E+00	No
	1,4-DICHLOROBENZENE	µg/L	58 / 147	1.2E-01	9.4E+02	2 / 7	6.3E+00	6.5E+00	No
	4,4'-DDD	µg/L	2 / 45	1.0E-02	6.0E-02	NA	--	--	--
	4,4'-DDT	µg/L	2 / 45	1.1E-01	5.0E-01	NA	--	--	--
	ACETONE	µg/L	3 / 92	1.6E+01	1.7E+02	NA	--	--	--
	ALUMINUM	µg/L	5 / 32	2.4E+01	7.2E+01	NA	--	--	--
	ARSENIC	µg/L	8 / 32	1.6E+00	4.9E+00	NA	--	--	--
	BARIUM	µg/L	28 / 32	7.3E+00	1.7E+02	NA	--	--	--
	BENZENE	µg/L	28 / 148	2.0E-01	6.4E+01	2 / 7	2.0E-01	2.4E-01	No
BETA-BHC	µg/L	1 / 45	4.0E-02	4.0E-02	NA	--	--	--	
BROMODICHLOROMETHANE	µg/L	4 / 148	1.4E-01	5.0E+00	1 / 7	7.7E-01	7.7E-01	No	
BROMOFORM	µg/L	2 / 148	1.0E+00	1.1E+00	1 / 7	1.1E+00	1.1E+00	Yes ^c	

TABLE B-5: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume A+B Aquifer (cont.)	BROMOMETHANE	µg/L	2 / 148	5.0E+00	8.1E+00	0 / 7	--	--	No
	CADMIUM	µg/L	1 / 32	1.7E+00	1.7E+00	NA	--	--	--
	CARBON DISULFIDE	µg/L	7 / 106	4.0E-01	1.2E+01	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	35 / 148	1.6E-01	4.6E+01	3 / 7	4.7E+00	1.7E+01	No
	CHLOROBENZENE	µg/L	51 / 148	7.3E-01	9.9E+03	2 / 7	1.3E+01	1.3E+01	No
	CHLOROETHANE	µg/L	8 / 147	2.2E+00	1.5E+01	1 / 7	2.2E+00	2.2E+00	No
	CHLOROFORM	µg/L	60 / 148	3.2E-01	1.0E+02	5 / 7	5.4E-01	8.1E+00	No
	CHLOROMETHANE	µg/L	2 / 148	3.0E+00	3.8E+00	0 / 7	--	--	No
	CHROMIUM	µg/L	15 / 32	7.4E-01	1.9E+01	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	76 / 112	1.9E-01	3.6E+03	3 / 7	5.0E-01	2.3E+02	No
	CIS-1,3-DICHLOROPROPENE	µg/L	1 / 148	4.0E+00	4.0E+00	0 / 7	--	--	No
	COBALT	µg/L	16 / 32	4.6E-01	2.6E+00	NA	--	--	--
	COPPER	µg/L	4 / 32	1.3E+00	4.0E+00	NA	--	--	--
	DELTA-BHC	µg/L	1 / 45	3.0E-03	3.0E-03	NA	--	--	--
	DIBROMOCHLOROMETHANE	µg/L	2 / 148	2.0E-01	3.0E+00	1 / 7	2.0E-01	2.0E-01	No
	DICHLORODIFLUOROMETHANE	µg/L	4 / 85	2.8E-01	6.1E-01	2 / 7	2.8E-01	6.0E-01	No
	DIELDRIN	µg/L	3 / 45	6.0E-02	9.0E-02	NA	--	--	--
	ENDOSULFAN SULFATE	µg/L	2 / 45	1.0E-02	2.0E-02	NA	--	--	--
	ENDRIN	µg/L	2 / 45	1.0E-02	2.0E-02	NA	--	--	--
	ENDRIN ALDEHYDE	µg/L	3 / 45	6.0E-02	1.0E-01	NA	--	--	--
ETHYLBENZENE	µg/L	15 / 148	1.0E-01	2.3E+01	0 / 7	--	--	No	
HEPTACHLOR	µg/L	2 / 45	3.0E-03	9.6E-03	NA	--	--	--	
HEPTACHLOR EPOXIDE	µg/L	2 / 44	9.0E-03	9.0E-03	NA	--	--	--	
IRON	µg/L	17 / 61	8.5E+00	5.9E+03	NA	--	--	--	
ISOPROPYLBENZENE	µg/L	9 / 43	5.9E-01	1.5E+01	NA	--	--	--	
M,P-XYLENES	µg/L	4 / 18	2.7E-01	1.5E+01	NA	--	--	--	

TABLE B-5: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume A+B Aquifer (cont.)	MANGANESE	µg/L	26 / 33	5.5E+00	2.1E+03	NA	--	--	--
	MERCURY	µg/L	4 / 50	1.3E-01	2.1E-01	NA	--	--	--
	METHYLENE CHLORIDE	µg/L	8 / 148	3.0E-01	7.4E+01	0 / 7	--	--	No
	MOLYBDENUM	µg/L	4 / 32	6.5E-01	4.5E+00	NA	--	--	--
	NAPHTHALENE	µg/L	19 / 64	7.7E-01	1.5E+02	NA	--	--	--
	N-BUTYLBENZENE	µg/L	3 / 28	1.1E+00	6.5E+00	NA	--	--	--
	NICKEL	µg/L	21 / 32	3.3E+00	6.5E+01	NA	--	--	--
	O-XYLENE	µg/L	5 / 18	8.0E-02	7.2E+00	NA	--	--	--
	PARA-ISOPROPYL TOLUENE	µg/L	8 / 28	5.2E-01	1.6E+01	NA	--	--	--
	PROPYLBENZENE	µg/L	8 / 28	4.6E-01	2.7E+01	NA	--	--	--
	SEC-BUTYLBENZENE	µg/L	8 / 28	3.9E-01	4.8E+00	NA	--	--	--
	SELENIUM	µg/L	7 / 32	2.2E+00	9.0E+00	NA	--	--	--
	SILVER	µg/L	1 / 32	7.0E-01	7.0E-01	NA	--	--	--
	STYRENE	µg/L	2 / 106	8.0E-01	4.0E+00	NA	--	--	--
	TERT-BUTYL METHYL ETHER	µg/L	3 / 112	3.1E-01	4.6E-01	0 / 7	--	--	No
	TERT-BUTYLBENZENE	µg/L	1 / 28	4.0E-01	4.0E-01	NA	--	--	--
	TETRACHLOROETHENE	µg/L	81 / 148	1.3E-01	3.1E+01	4 / 7	1.4E+00	2.5E+00	No
	THALLIUM	µg/L	2 / 32	1.7E+00	2.9E+00	NA	--	--	--
	TOLUENE	µg/L	18 / 148	1.8E-01	2.9E+01	0 / 7	--	--	No
	TRANS-1,2-DICHLOROETHENE	µg/L	24 / 112	1.8E-01	1.4E+01	2 / 7	1.1E+00	2.0E+00	No
TRANS-1,3-DICHLOROPROPENE	µg/L	1 / 148	3.0E+00	3.0E+00	0 / 7	--	--	No	
TRICHLOROETHENE	µg/L	110 / 148	1.8E-01	4.0E+01	6 / 7	8.0E-01	4.2E+00	No	
TRICHLOROFUOROMETHANE	µg/L	44 / 85	2.4E-01	4.0E+02	4 / 7	3.0E-01	5.4E+00	No	
VANADIUM	µg/L	28 / 32	1.8E+00	1.2E+01	NA	--	--	--	

TABLE B-5: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume A+B Aquifer (cont.)	VINYL CHLORIDE	µg/L	51 / 148	2.8E-01	1.7E+03	2 / 7	6.7E+01	1.1E+02	No
	XYLENE (TOTAL)	µg/L	16 / 130	2.0E-01	3.1E+01	1 / 7	1.3E+00	1.3E+00	No
	ZINC	µg/L	8 / 32	1.2E+01	4.3E+01	NA	--	--	--

Notes:

- a Data summary shown for the RU-C2 plume is based on B-aquifer data combined with A-aquifer data to address potential hydraulic communication between the A- and B-aquifers.
- b See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- c Chemical was not identified as a chemical of concern in the HHRA.

- Not applicable
- µg/L Microgram per liter
- BHC Hexachlorocyclohexane
- COPC Chemical of potential concern
- DDD Dichlorodiphenyldichloroethane
- DDT Dichlorodiphenyltrichloroethane
- HHRA Human health risk assessment
- NA Not analyzed
- RU Remedial Unit

TABLE B-6: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, B-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume B-Aquifer	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/L	4 / 8	4.0E-01	2.6E+00	2 / 4	4.0E-01	5.1E-01	No
	1,2,3-TRICHLOROBENZENE	µg/L	1 / 8	7.7E-01	7.7E-01	NA	--	--	--
	1,2,4-TRICHLOROBENZENE	µg/L	1 / 16	9.4E-01	9.4E-01	0 / 4	--	--	No
	1,2,4-TRIMETHYLBENZENE	µg/L	4 / 6	8.0E+00	4.8E+01	NA	--	--	--
	1,2-DICHLOROBENZENE	µg/L	5 / 16	9.5E+00	7.9E+01	0 / 4	--	--	No
	1,3,5-TRIMETHYLBENZENE	µg/L	3 / 6	1.8E+00	3.7E+00	NA	--	--	--
	1,3-DICHLOROBENZENE	µg/L	6 / 16	1.9E+00	8.4E+01	0 / 4	--	--	No
	1,4-DICHLOROBENZENE	µg/L	7 / 16	3.7E-01	1.8E+02	0 / 4	--	--	No
	ACETONE	µg/L	1 / 8	1.6E+01	1.6E+01	NA	--	--	--
	BENZENE	µg/L	2 / 16	4.1E-01	9.0E+00	0 / 4	--	--	No
	CARBON DISULFIDE	µg/L	1 / 10	6.0E+00	6.0E+00	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	5 / 16	2.0E+00	1.1E+01	2 / 4	4.7E+00	5.7E+00	No
	CHLOROBENZENE	µg/L	6 / 16	2.1E+00	1.0E+03	0 / 4	--	--	No
	CHLOROFORM	µg/L	6 / 16	6.1E-01	7.3E+00	2 / 4	2.6E+00	3.0E+00	No
	CIS-1,2-DICHLOROETHENE	µg/L	10 / 16	5.0E-01	8.7E+02	1 / 4	5.0E-01	5.0E-01	No
	DICHLORODIFLUOROMETHANE	µg/L	3 / 14	2.8E-01	6.0E-01	2 / 4	2.8E-01	6.0E-01	Yes ^b
	ETHYLBENZENE	µg/L	2 / 16	4.3E-01	1.6E+01	0 / 4	--	--	No
	IRON	µg/L	1 / 3	1.0E+01	1.0E+01	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	1 / 8	5.9E-01	5.9E-01	NA	--	--	--
	MERCURY	µg/L	1 / 4	1.8E-01	1.8E-01	NA	--	--	--
	METHYLENE CHLORIDE	µg/L	2 / 16	6.6E-01	2.1E+01	0 / 4	--	--	No
	NAPHTHALENE	µg/L	4 / 6	2.6E+00	4.2E+01	NA	--	--	--
	PARA-ISOPROPYL TOLUENE	µg/L	1 / 6	6.2E-01	6.2E-01	NA	--	--	--
PROPYLBENZENE	µg/L	1 / 6	7.4E-01	7.4E-01	NA	--	--	--	
SEC-BUTYLBENZENE	µg/L	1 / 6	5.5E-01	5.5E-01	NA	--	--	--	
STYRENE	µg/L	1 / 10	8.0E-01	8.0E-01	NA	--	--	--	

TABLE B-6: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, B-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume B-Aquifer (cont.)	TETRACHLOROETHENE	µg/L	8 / 16	1.7E+00	4.6E+00	2 / 4	1.7E+00	1.7E+00	No
	TOLUENE	µg/L	1 / 16	2.0E-01	2.0E-01	0 / 4	--	--	No
	TRANS-1,2-DICHLOROETHENE	µg/L	2 / 16	5.2E-01	8.3E-01	0 / 4	--	--	No
	TRICHLOROETHENE	µg/L	12 / 16	3.0E-01	2.8E+01	3 / 4	8.0E-01	4.2E+00	No
	TRICHLOROFLUOROMETHANE	µg/L	6 / 14	5.7E-01	1.6E+01	1 / 4	5.7E-01	5.7E-01	No
	VINYL CHLORIDE	µg/L	6 / 16	9.7E+00	8.4E+01	0 / 4	--	--	No
	XYLENE (TOTAL)	µg/L	2 / 14	1.3E+00	3.1E+01	0 / 4	--	--	No

Notes:

- a See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- b Chemical was not identified as a chemical of concern in the HHRA.
- Not applicable
- µg/L Microgram per liter
- COPC Chemical of potential concern
- HHRA Human health risk assessment
- NA Not analyzed
- RU Remedial Unit

TABLE B-7: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C2 PLUME, BEDROCK WATER-BEARING ZONE

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C2 Plume F-WBZ	1,4-DICHLOROBENZENE	µg/L	1 / 9	2.2E-01	2.2E-01	0 / 5	--	--	No
	CARBON DISULFIDE	µg/L	1 / 3	7.4E-01	7.4E-01	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	4 / 9	1.1E+00	5.4E+00	3 / 5	1.1E+00	2.3E+00	No
	CHLOROFORM	µg/L	4 / 9	1.8E+00	2.7E+00	3 / 5	1.8E+00	2.2E+00	No
	DICHLORODIFLUOROMETHANE	µg/L	1 / 8	2.7E-01	2.7E-01	0 / 5	--	--	No
	TRICHLOROFLUOROMETHANE	µg/L	4 / 8	3.2E-01	7.1E-01	3 / 5	3.2E-01	5.4E-01	No

Notes:

a See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.

-- Not applicable

µg/L Microgram per liter

COPC Chemical of potential concern

F-WBZ Bedrock water-bearing zone

HHRA Human health risk assessment

NA Not analyzed

RU Remedial Unit

TABLE B-8: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, A-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume A-Aquifer	1,1,2,2-TETRACHLOROETHANE	µg/L	1 / 188	1.2E+02	1.2E+02	0 / 1	--	--	No
	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/L	11 / 77	2.2E-01	6.3E+00	0 / 1	--	--	No
	1,1,2-TRICHLOROETHANE	µg/L	12 / 188	2.0E-01	1.7E+02	0 / 1	--	--	No
	1,1-DICHLOROETHANE	µg/L	2 / 188	1.6E+00	2.0E+00	0 / 1	--	--	No
	1,1-DICHLOROETHENE	µg/L	5 / 188	3.0E-01	4.7E+00	0 / 1	--	--	No
	1,2,3-TRICHLOROPROPANE	µg/L	2 / 78	1.0E+00	1.6E+01	0 / 1	--	--	No
	1,2,4-TRICHLOROBENZENE	µg/L	2 / 187	7.7E-01	7.0E+00	0 / 1	--	--	No
	1,2-DICHLOROBENZENE	µg/L	16 / 187	9.0E-02	1.9E+02	0 / 1	--	--	No
	1,2-DICHLOROETHANE	µg/L	20 / 195	1.7E-01	1.5E+02	0 / 1	--	--	No
	1,2-DICHLOROETHENE (TOTAL)	µg/L	11 / 56	6.0E-01	2.2E+01	NA	--	--	--
	1,2-DICHLOROPROPANE	µg/L	5 / 188	2.0E-01	3.9E+00	0 / 1	--	--	No
	1,3-DICHLOROBENZENE	µg/L	5 / 187	1.0E-01	2.0E+00	0 / 1	--	--	No
	1,4-DICHLOROBENZENE	µg/L	13 / 187	1.5E-01	4.9E+01	0 / 1	--	--	No
	2-HEXANONE	µg/L	1 / 103	4.0E-01	4.0E-01	NA	--	--	--
	2-METHYLNAPHTHALENE	µg/L	3 / 61	7.5E+00	4.8E+01	NA	--	--	--
	4,4'-DDD	µg/L	1 / 55	5.0E-02	5.0E-02	0 / 1	--	--	No
	4,4'-DDE	µg/L	1 / 55	6.0E-03	6.0E-03	0 / 1	--	--	No
	ACENAPHTHENE	µg/L	5 / 61	2.0E+00	5.0E+00	NA	--	--	--
	ACETONE	µg/L	4 / 132	8.1E+00	6.9E+03	NA	--	--	--
	ALUMINUM	µg/L	4 / 49	1.1E+02	2.6E+04	NA	--	--	--
	ANTHRACENE	µg/L	1 / 61	2.0E+00	2.0E+00	NA	--	--	--
	ANTIMONY	µg/L	8 / 48	2.0E+00	1.0E+01	NA	--	--	--
	ARSENIC	µg/L	19 / 56	1.5E+00	2.0E+01	NA	--	--	--
	BARIUM	µg/L	48 / 48	8.3E+00	4.2E+02	NA	--	--	--
	BENZENE	µg/L	15 / 188	1.0E-01	6.4E+00	0 / 1	--	--	No
	BENZO(A)ANTHRACENE	µg/L	1 / 61	4.0E+00	4.0E+00	NA	--	--	--

TABLE B-8: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume A-Aquifer (cont.)	BENZO(A)PYRENE	µg/L	1 / 61	3.0E+00	3.0E+00	NA	--	--	--
	BENZO(B)FLUORANTHENE	µg/L	1 / 61	4.0E+00	4.0E+00	NA	--	--	--
	BENZO(K)FLUORANTHENE	µg/L	1 / 61	1.0E+00	1.0E+00	NA	--	--	--
	BERYLLIUM	µg/L	1 / 48	7.3E-01	7.3E-01	NA	--	--	--
	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	1 / 61	3.6E+01	3.6E+01	NA	--	--	--
	BROMODICHLOROMETHANE	µg/L	3 / 188	3.0E-01	4.5E-01	0 / 1	--	--	No
	BROMOMETHANE	µg/L	2 / 188	4.0E-01	7.5E-01	0 / 1	--	--	No
	CADMIUM	µg/L	2 / 48	1.8E-01	9.1E-01	NA	--	--	--
	CARBAZOLE	µg/L	3 / 58	6.0E+00	1.1E+01	NA	--	--	--
	CARBON DISULFIDE	µg/L	12 / 152	2.0E-01	2.1E+01	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	47 / 195	2.0E-01	5.2E+02	0 / 1	--	--	No
	CHLOROBENZENE	µg/L	8 / 188	1.3E-01	3.0E+00	0 / 1	--	--	No
	CHLOROETHANE	µg/L	1 / 188	5.2E+00	5.2E+00	0 / 1	--	--	No
	CHLOROFORM	µg/L	93 / 195	9.0E-02	1.0E+03	0 / 1	--	--	No
	CHLOROMETHANE	µg/L	2 / 188	3.0E-01	4.0E-01	0 / 1	--	--	No
	CHROMIUM	µg/L	11 / 53	1.5E+00	2.7E+02	NA	--	--	--
	CHROMIUM VI	µg/L	3 / 31	1.0E+01	3.7E+01	NA	--	--	--
	CHRYSENE	µg/L	1 / 61	4.0E+00	4.0E+00	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	74 / 143	1.2E-01	2.6E+03	0 / 1	--	--	No
	CIS-1,3-DICHLOROPROPENE	µg/L	1 / 188	4.0E-01	4.0E-01	0 / 1	--	--	No
	COBALT	µg/L	19 / 48	4.1E-01	3.3E+01	NA	--	--	--
	COPPER	µg/L	13 / 49	2.1E+00	3.7E+01	NA	--	--	--
	DIBENZOFURAN	µg/L	1 / 61	4.2E-01	4.2E-01	NA	--	--	--
DIBROMOCHLOROMETHANE	µg/L	3 / 188	2.0E-01	3.9E-01	0 / 1	--	--	No	
DICHLORODIFLUOROMETHANE	µg/L	1 / 109	2.2E-01	2.2E-01	0 / 1	--	--	No	
DIELDRIN	µg/L	2 / 55	8.1E-03	5.5E-02	1 / 1	8.1E-03	8.1E-03	No	

TABLE B-8: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume A-Aquifer (cont.)	ETHYLBENZENE	µg/L	1 / 188	1.9E-01	1.9E-01	0 / 1	--	--	No
	FLUORANTHENE	µg/L	3 / 61	1.0E-01	8.0E+00	NA	--	--	--
	FLUORENE	µg/L	3 / 61	1.0E+00	4.0E+00	NA	--	--	--
	HEPTACHLOR EPOXIDE	µg/L	1 / 54	2.5E-02	2.5E-02	0 / 1	--	--	No
	IRON	µg/L	40 / 88	1.1E+01	3.4E+04	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	1 / 71	1.8E+00	1.8E+00	NA	--	--	--
	LEAD	µg/L	2 / 48	5.5E-01	9.3E+00	NA	--	--	--
	M,P-XYLENES	µg/L	2 / 20	2.3E-01	3.7E-01	NA	--	--	--
	MANGANESE	µg/L	53 / 61	2.0E+00	1.1E+04	NA	--	--	--
	MERCURY	µg/L	14 / 71	1.9E-01	3.9E+00	NA	--	--	--
	METHYLENE CHLORIDE	µg/L	7 / 188	7.5E-01	2.7E+02	0 / 1	--	--	No
	MOLYBDENUM	µg/L	26 / 51	1.8E+00	3.6E+02	NA	--	--	--
	NAPHTHALENE	µg/L	6 / 101	1.7E+00	2.9E+01	NA	--	--	--
	NICKEL	µg/L	32 / 49	1.4E+00	3.8E+02	NA	--	--	--
	N-NITROSODIPHENYLAMINE	µg/L	1 / 61	6.4E+00	6.4E+00	NA	--	--	--
	O-XYLENE	µg/L	2 / 20	1.3E-01	1.8E-01	NA	--	--	--
	PHENANTHRENE	µg/L	3 / 61	3.0E+00	1.0E+01	NA	--	--	--
	PYRENE	µg/L	3 / 61	2.0E-01	1.0E+01	NA	--	--	--
	SELENIUM	µg/L	12 / 48	1.7E+00	1.9E+01	NA	--	--	--
	SILVER	µg/L	1 / 48	2.1E+00	2.1E+00	NA	--	--	--
TERT-BUTYL METHYL ETHER	µg/L	3 / 135	2.5E-01	6.9E-01	0 / 1	--	--	No	
TETRACHLOROETHENE	µg/L	51 / 195	1.5E-01	2.6E+02	0 / 1	--	--	No	
THALLIUM	µg/L	8 / 47	1.0E-01	1.4E+01	NA	--	--	--	
TOLUENE	µg/L	10 / 188	2.0E-01	1.6E+00	0 / 1	--	--	No	
TRANS-1,2-DICHLOROETHENE	µg/L	13 / 143	1.6E-01	9.8E+00	0 / 1	--	--	No	
TRICHLOROETHENE	µg/L	121 / 195	1.6E-01	7.6E+04	0 / 1	--	--	No	

TABLE B-8: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume A-Aquifer (cont.)	TRICHLOROFLUOROMETHANE	µg/L	19 / 109	4.8E-01	1.5E+01	0 / 1	--	--	No
	VANADIUM	µg/L	39 / 48	7.8E-01	7.2E+01	NA	--	--	--
	VINYL CHLORIDE	µg/L	13 / 195	2.8E-01	4.4E+02	0 / 1	--	--	No
	XYLENE (TOTAL)	µg/L	2 / 170	5.5E-01	7.1E-01	0 / 1	--	--	No
	ZINC	µg/L	9 / 49	5.3E+00	1.1E+02	NA	--	--	--

Notes:

- a See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- Not applicable
- µg/L Microgram per liter
- COPC Chemical of potential concern
- DDD Dichlorodiphenyldichloroethane
- DDE Dichlorodiphenyldichloroethene
- HHRA Human health risk assessment
- NA Not analyzed
- RU Remedial Unit

TABLE B-9: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, B-AQUIFER AND BEDROCK WATER-BEARING ZONE WITH POTENTIAL HYDRAULIC COMMUNICATION

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume A+B+F-WBZ	1,1,2,2-TETRACHLOROETHANE	µg/L	1 / 237	1.2E+02	1.2E+02	0 / 2	--	--	No
	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/L	12 / 100	2.2E-01	6.3E+00	0 / 2	--	--	No
	1,1,2-TRICHLOROETHANE	µg/L	15 / 237	2.0E-01	1.7E+02	0 / 2	--	--	No
	1,1-DICHLOROETHANE	µg/L	3 / 237	1.6E+00	4.0E+00	0 / 2	--	--	No
	1,1-DICHLOROETHENE	µg/L	6 / 237	3.0E-01	6.2E+00	0 / 2	--	--	No
	1,2,3-TRICHLOROPROPANE	µg/L	2 / 106	1.0E+00	1.6E+01	0 / 2	--	--	No
	1,2,4-TRICHLOROBENZENE	µg/L	3 / 236	7.7E-01	7.0E+00	0 / 2	--	--	No
	1,2-DICHLOROBENZENE	µg/L	19 / 236	9.0E-02	1.9E+02	0 / 2	--	--	No
	1,2-DICHLOROETHANE	µg/L	23 / 244	1.7E-01	1.7E+02	0 / 2	--	--	No
	1,2-DICHLOROETHENE (TOTAL)	µg/L	11 / 62	6.0E-01	2.2E+01	NA	--	--	--
	1,2-DICHLOROPROPANE	µg/L	7 / 237	2.0E-01	3.9E+00	0 / 2	--	--	No
	1,3-DICHLOROBENZENE	µg/L	5 / 236	1.0E-01	2.0E+00	0 / 2	--	--	No
	1,4-DICHLOROBENZENE	µg/L	14 / 236	1.5E-01	4.9E+01	0 / 2	--	--	No
	2,4,6-TRICHLOROPHENOL	µg/L	1 / 68	2.6E+01	2.6E+01	NA	--	--	--
	2-BUTANONE	µg/L	1 / 160	3.6E+04	3.6E+04	NA	--	--	--
	2-HEXANONE	µg/L	1 / 119	4.0E-01	4.0E-01	NA	--	--	--
	2-METHYLNAPHTHALENE	µg/L	3 / 67	7.5E+00	4.8E+01	NA	--	--	--
	4,4'-DDD	µg/L	1 / 61	5.0E-02	5.0E-02	0 / 1	--	--	No
	4,4'-DDE	µg/L	1 / 61	6.0E-03	6.0E-03	0 / 1	--	--	No
	4-METHYL-2-PENTANONE	µg/L	1 / 171	1.8E+03	1.8E+03	NA	--	--	--
	ACENAPHTHENE	µg/L	5 / 67	2.0E+00	5.0E+00	NA	--	--	--
	ACETONE	µg/L	11 / 161	4.2E+00	2.2E+05	NA	--	--	--
	ALPHA-BHC	µg/L	1 / 61	8.0E-02	8.0E-02	0 / 1	--	--	No
	ALUMINUM	µg/L	4 / 54	1.1E+02	2.6E+04	NA	--	--	--
	ANTHRACENE	µg/L	1 / 67	2.0E+00	2.0E+00	NA	--	--	--
	ANTIMONY	µg/L	9 / 53	2.0E+00	1.0E+01	NA	--	--	--

TABLE B-9: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, B-AQUIFER AND BEDROCK WATER-BEARING ZONE WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume A+B+F-WBZ (cont.)	ARSENIC	µg/L	19 / 62	1.5E+00	2.0E+01	NA	--	--	--
	BARIUM	µg/L	53 / 53	8.3E+00	4.2E+02	NA	--	--	--
	BENZENE	µg/L	20 / 237	1.0E-01	8.1E+03	0 / 2	--	--	No
	BENZO(A)ANTHRACENE	µg/L	1 / 67	4.0E+00	4.0E+00	NA	--	--	--
	BENZO(A)PYRENE	µg/L	1 / 66	3.0E+00	3.0E+00	NA	--	--	--
	BENZO(B)FLUORANTHENE	µg/L	1 / 66	4.0E+00	4.0E+00	NA	--	--	--
	BENZO(K)FLUORANTHENE	µg/L	1 / 66	1.0E+00	1.0E+00	NA	--	--	--
	BERYLLIUM	µg/L	1 / 53	7.3E-01	7.3E-01	NA	--	--	--
	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	1 / 67	3.6E+01	3.6E+01	NA	--	--	--
	BROMODICHLOROMETHANE	µg/L	3 / 237	3.0E-01	4.5E-01	0 / 2	--	--	No
	BROMOMETHANE	µg/L	2 / 237	4.0E-01	7.5E-01	0 / 2	--	--	No
	CADMIUM	µg/L	2 / 53	1.8E-01	9.1E-01	NA	--	--	--
	CARBAZOLE	µg/L	3 / 64	6.0E+00	1.1E+01	NA	--	--	--
	CARBON DISULFIDE	µg/L	15 / 186	2.0E-01	2.1E+01	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	75 / 244	2.0E-01	5.2E+02	0 / 2	--	--	No
	CHLOROBENZENE	µg/L	8 / 237	1.3E-01	3.0E+00	0 / 2	--	--	No
	CHLOROETHANE	µg/L	1 / 237	5.2E+00	5.2E+00	0 / 2	--	--	No
	CHLOROFORM	µg/L	123 / 244	9.0E-02	1.0E+03	0 / 2	--	--	No
	CHLOROMETHANE	µg/L	2 / 237	3.0E-01	4.0E-01	0 / 2	--	--	No
	CHROMIUM	µg/L	13 / 58	1.5E+00	2.7E+02	NA	--	--	--
	CHROMIUM VI	µg/L	4 / 43	1.0E+01	3.7E+01	NA	--	--	--
	CHRYSENE	µg/L	1 / 67	4.0E+00	4.0E+00	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	96 / 186	1.2E-01	2.6E+03	0 / 2	--	--	No
CIS-1,3-DICHLOROPROPENE	µg/L	1 / 237	4.0E-01	4.0E-01	0 / 2	--	--	No	
COBALT	µg/L	21 / 53	4.1E-01	3.3E+01	NA	--	--	--	
COPPER	µg/L	14 / 54	1.2E+00	3.7E+01	NA	--	--	--	

TABLE B-9: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, B-AQUIFER AND BEDROCK WATER-BEARING ZONE WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume A+B+F-WBZ (cont.)	DIBENZOFURAN	µg/L	1 / 67	4.2E-01	4.2E-01	NA	--	--	--
	DIBROMOCHLOROMETHANE	µg/L	3 / 237	2.0E-01	3.9E-01	0 / 2	--	--	No
	DIBROMOMETHANE	µg/L	1 / 106	2.5E-01	2.5E-01	0 / 2	--	--	No
	DICHLORODIFLUOROMETHANE	µg/L	1 / 145	2.2E-01	2.2E-01	0 / 2	--	--	No
	DIELDRIN	µg/L	2 / 61	8.1E-03	5.5E-02	1 / 1	8.1E-03	8.1E-03	No
	ETHYLBENZENE	µg/L	3 / 237	1.9E-01	2.0E+02	0 / 2	--	--	No
	FLUORANTHENE	µg/L	3 / 67	1.0E-01	8.0E+00	NA	--	--	--
	FLUORENE	µg/L	3 / 67	1.0E+00	4.0E+00	NA	--	--	--
	HEPTACHLOR EPOXIDE	µg/L	1 / 60	2.5E-02	2.5E-02	0 / 1	--	--	No
	IRON	µg/L	46 / 103	1.1E+01	3.4E+04	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	3 / 92	1.2E-01	1.1E+03	NA	--	--	--
	LEAD	µg/L	2 / 53	5.5E-01	9.3E+00	NA	--	--	--
	M,P-XYLENES	µg/L	3 / 25	2.3E-01	2.1E+00	NA	--	--	--
	MANGANESE	µg/L	58 / 67	2.0E+00	1.1E+04	NA	--	--	--
	MERCURY	µg/L	19 / 88	1.9E-01	3.9E+00	NA	--	--	--
	METHYLENE CHLORIDE	µg/L	12 / 237	7.5E-01	1.2E+03	0 / 2	--	--	No
	MOLYBDENUM	µg/L	26 / 56	1.8E+00	3.6E+02	NA	--	--	--
	NAPHTHALENE	µg/L	6 / 120	1.7E+00	2.9E+01	NA	--	--	--
	NICKEL	µg/L	35 / 54	1.4E+00	3.8E+02	NA	--	--	--
	N-NITROSODIPHENYLAMINE	µg/L	1 / 67	6.4E+00	6.4E+00	NA	--	--	--
	O-XYLENE	µg/L	3 / 25	1.3E-01	1.1E+00	NA	--	--	--
	PHENANTHRENE	µg/L	3 / 67	3.0E+00	1.0E+01	NA	--	--	--
	PYRENE	µg/L	3 / 67	2.0E-01	1.0E+01	NA	--	--	--
	SELENIUM	µg/L	12 / 53	1.7E+00	1.9E+01	NA	--	--	--
SILVER	µg/L	1 / 53	2.1E+00	2.1E+00	NA	--	--	--	
TERT-BUTYL METHYL ETHER	µg/L	3 / 178	2.5E-01	6.9E-01	0 / 2	--	--	No	

TABLE B-9: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, B-AQUIFER AND BEDROCK WATER-BEARING ZONE WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume A+B+F-WBZ (cont.)	TETRACHLOROETHENE	µg/L	56 / 244	1.5E-01	2.6E+02	0 / 2	--	--	No
	THALLIUM	µg/L	9 / 52	1.0E-01	1.4E+01	NA	--	--	--
	TOLUENE	µg/L	12 / 237	2.0E-01	3.7E+02	0 / 2	--	--	No
	TRANS-1,2-DICHLOROETHENE	µg/L	15 / 186	1.6E-01	9.8E+00	0 / 2	--	--	No
	TRICHLOROETHENE	µg/L	154 / 244	1.6E-01	7.6E+04	0 / 2	--	--	No
	TRICHLOROFLUOROMETHANE	µg/L	24 / 145	4.7E-01	1.5E+01	0 / 2	--	--	No
	VANADIUM	µg/L	42 / 53	6.9E-01	7.2E+01	NA	--	--	--
	VINYL CHLORIDE	µg/L	16 / 244	2.8E-01	4.4E+02	0 / 2	--	--	No
	XYLENE (TOTAL)	µg/L	4 / 214	5.5E-01	1.8E+02	1 / 2	5.7E-01	5.7E-01	No
ZINC	µg/L	9 / 54	5.3E+00	1.1E+02	NA	--	--	--	

Notes:

- a Data summary shown for the RU-C4 plume is based on B-aquifer and F WBZ data combined with A-aquifer data to address potential hydraulic communication between the A- and B-aquifers and F-WBZ.
- b See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- Not applicable
- µg/L Microgram per liter
- BHC Benzene hexachloride
- COPC Chemical of potential concern
- DDD Dichlorodiphenyldichloroethane
- DDE Dichlorodiphenyldichloroethene
- F-WBZ Bedrock water-bearing zone
- HHRA Human health risk assessment
- NA Not analyzed
- RU Remedial Unit

TABLE B-10: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, B-AQUIFER AND BEDROCK WATER-BEARING ZONE

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume B+F-WBZ	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/L	1 / 23	2.6E+00	2.6E+00	0 / 1	--	--	No
	1,1,2-TRICHLOROETHANE	µg/L	3 / 49	1.0E+00	1.0E+01	0 / 1	--	--	No
	1,1-DICHLOROETHANE	µg/L	1 / 49	4.0E+00	4.0E+00	0 / 1	--	--	No
	1,1-DICHLOROETHENE	µg/L	1 / 49	6.2E+00	6.2E+00	0 / 1	--	--	No
	1,2,4-TRICHLOROBENZENE	µg/L	1 / 49	4.1E+00	4.1E+00	0 / 1	--	--	No
	1,2-DICHLOROBENZENE	µg/L	3 / 49	1.7E-01	2.6E+00	0 / 1	--	--	No
	1,2-DICHLOROETHANE	µg/L	3 / 49	1.1E+02	1.7E+02	0 / 1	--	--	No
	1,2-DICHLOROPROPANE	µg/L	2 / 49	8.3E-01	3.8E+00	0 / 1	--	--	No
	1,4-DICHLOROBENZENE	µg/L	1 / 49	1.9E-01	1.9E-01	0 / 1	--	--	No
	2,4,6-TRICHLOROPHENOL	µg/L	1 / 6	2.6E+01	2.6E+01	NA	--	--	--
	2-BUTANONE	µg/L	1 / 27	3.6E+04	3.6E+04	NA	--	--	--
	4-METHYL-2-PENTANONE	µg/L	1 / 30	1.8E+03	1.8E+03	NA	--	--	--
	ACETONE	µg/L	7 / 29	4.2E+00	2.2E+05	NA	--	--	--
	ALPHA-BHC	µg/L	1 / 6	8.0E-02	8.0E-02	NA	--	--	--
	ANTIMONY	µg/L	1 / 5	3.8E+00	3.8E+00	NA	--	--	--
	BARIUM	µg/L	5 / 5	6.3E+01	1.5E+02	NA	--	--	--
	BENZENE	µg/L	5 / 49	2.3E-01	8.1E+03	0 / 1	--	--	No
	CARBON DISULFIDE	µg/L	3 / 34	2.0E-01	2.6E-01	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	28 / 49	2.6E-01	2.0E+02	0 / 1	--	--	No
	CHLOROFORM	µg/L	30 / 49	2.0E-01	5.0E+02	0 / 1	--	--	No
	CHROMIUM	µg/L	2 / 5	1.3E+01	1.7E+01	NA	--	--	--
	CHROMIUM VI	µg/L	1 / 12	1.2E+01	1.2E+01	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	22 / 43	1.6E-01	6.2E+02	0 / 1	--	--	No
COBALT	µg/L	2 / 5	1.1E+00	1.8E+00	NA	--	--	--	
COPPER	µg/L	1 / 5	1.2E+00	1.2E+00	NA	--	--	--	
DIBROMOMETHANE	µg/L	1 / 28	2.5E-01	2.5E-01	0 / 1	--	--	No	

TABLE B-10: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, B-AQUIFER AND BEDROCK WATER-BEARING ZONE (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C4 Plume B+F-WBZ (cont.)	ETHYLBENZENE	µg/L	2 / 49	4.5E-01	2.0E+02	0 / 1	--	--	No
	IRON	µg/L	6 / 15	1.5E+01	2.0E+03	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	2 / 21	1.2E-01	1.1E+03	NA	--	--	--
	M,P-XYLENES	µg/L	1 / 5	2.1E+00	2.1E+00	NA	--	--	--
	MANGANESE	µg/L	5 / 6	2.4E+00	1.9E+03	NA	--	--	--
	MERCURY	µg/L	5 / 17	2.0E-01	8.7E-01	NA	--	--	--
	METHYLENE CHLORIDE	µg/L	5 / 49	6.8E+00	1.2E+03	0 / 1	--	--	No
	NICKEL	µg/L	3 / 5	1.4E+00	6.5E+00	NA	--	--	--
	O-XYLENE	µg/L	1 / 5	1.1E+00	1.1E+00	NA	--	--	--
	TETRACHLOROETHENE	µg/L	5 / 49	2.0E-01	2.5E+02	0 / 1	--	--	No
	THALLIUM	µg/L	1 / 5	2.2E+00	2.2E+00	NA	--	--	--
	TOLUENE	µg/L	2 / 49	2.8E-01	3.7E+02	0 / 1	--	--	No
	TRANS-1,2-DICHLOROETHENE	µg/L	2 / 43	2.1E-01	1.8E+00	0 / 1	--	--	No
	TRICHLOROETHENE	µg/L	33 / 49	2.0E-01	8.7E+03	0 / 1	--	--	No
	TRICHLOROFUOROMETHANE	µg/L	5 / 36	4.7E-01	7.2E+00	0 / 1	--	--	No
	VANADIUM	µg/L	3 / 5	6.9E-01	2.1E+01	NA	--	--	--
VINYL CHLORIDE	µg/L	3 / 49	3.2E-01	3.6E+01	0 / 1	--	--	No	
XYLENE (TOTAL)	µg/L	2 / 44	5.7E-01	1.8E+02	1 / 1	5.7E-01	5.7E-01	No	

TABLE B-10: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C4 PLUME, B-AQUIFER AND BEDROCK WATER-BEARING ZONE (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Notes:

- a Data summary shown for the RU-C4 plume is based on B-aquifer combined with F-WBZ data to address hydraulic communication between the B-aquifer and F-WBZ.
- b See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- Not applicable
- µg/L Microgram per liter
- BHC Hexachlorocyclohexane
- COPC Chemical of potential concern
- F-WBZ Bedrock water-bearing zone
- HHRA Human health risk assessment
- NA Not analyzed
- RU Remedial Unit

TABLE B-11: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C5 PLUME, A-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C5 Plume A-Aquifer	1,1,1-TRICHLOROETHANE	µg/L	5 / 284	1.4E-01	7.2E+02	0 / 10	--	--	No
	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/L	20 / 162	4.4E-01	1.4E+02	0 / 10	--	--	No
	1,1-DICHLOROETHANE	µg/L	10 / 284	1.7E-01	8.0E+00	0 / 10	--	--	No
	1,1-DICHLOROETHENE	µg/L	17 / 284	1.4E-01	4.2E+01	0 / 10	--	--	No
	1,2,3-TRICHLOROBENZENE	µg/L	2 / 77	5.0E-01	5.6E-01	NA	--	--	--
	1,2,4-TRICHLOROBENZENE	µg/L	22 / 280	4.5E-01	2.0E+02	0 / 10	--	--	No
	1,2,4-TRIMETHYLBENZENE	µg/L	7 / 36	3.4E+00	9.3E+01	NA	--	--	--
	1,2-DICHLOROBENZENE	µg/L	79 / 286	2.7E-01	6.2E+04	0 / 10	--	--	No
	1,2-DICHLOROETHANE	µg/L	59 / 284	3.0E-01	1.5E+05	0 / 10	--	--	No
	1,2-DICHLOROETHENE (TOTAL)	µg/L	25 / 79	1.5E+00	5.7E+04	NA	--	--	--
	1,2-DICHLOROPROPANE	µg/L	16 / 284	2.0E+00	3.5E+02	0 / 10	--	--	No
	1,3,5-TRIMETHYLBENZENE	µg/L	4 / 36	7.9E-01	2.2E+01	NA	--	--	--
	1,3-DICHLOROBENZENE	µg/L	20 / 286	2.1E-01	6.3E+02	0 / 10	--	--	No
	1,4-DICHLOROBENZENE	µg/L	61 / 286	2.2E-01	1.5E+04	0 / 10	--	--	No
	1,6,7-TRIMETHYLNAPHTHALENE	µg/L	2 / 2	4.0E-01	4.0E-01	NA	--	--	--
	1-METHYLNAPHTHALENE	µg/L	2 / 2	1.5E-02	4.0E+00	NA	--	--	--
	1-METHYLPHENANTHRENE	µg/L	2 / 2	1.0E-02	5.0E-02	NA	--	--	--
	2,4,5-TRICHLOROPHENOL	µg/L	1 / 135	5.7E-01	5.7E-01	NA	--	--	--
	2,4-DICHLOROPHENOL	µg/L	4 / 150	1.7E+00	3.7E+01	NA	--	--	--
	2,4-DIMETHYLPHENOL	µg/L	18 / 150	8.0E+00	1.6E+04	NA	--	--	--
	2,4-DINITROTOLUENE	µg/L	1 / 161	4.9E+03	4.9E+03	NA	--	--	--
	2,6-DIMETHYLNAPHTHALENE	µg/L	2 / 2	2.0E-01	2.0E+00	NA	--	--	--
	2-BUTANONE	µg/L	3 / 213	7.0E-01	2.9E+01	NA	--	--	--
2-CHLORONAPHTHALENE	µg/L	1 / 160	1.0E+00	1.0E+00	NA	--	--	--	
2-CHLOROPHENOL	µg/L	2 / 155	1.0E+00	2.4E+01	NA	--	--	--	
2-METHYLNAPHTHALENE	µg/L	33 / 170	4.5E-01	9.2E+02	NA	--	--	--	

TABLE B-11: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C5 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C5 Plume A-Aquifer (cont.)	2-METHYLPHENOL	µg/L	11 / 149	3.5E-01	3.8E+03	NA	--	--	--
	3,4-METHYLPHENOL	µg/L	2 / 12	3.8E+02	3.2E+03	NA	--	--	--
	4,4'-DDE	µg/L	3 / 39	7.5E-03	3.4E-02	NA	--	--	--
	4,4'-DDT	µg/L	4 / 39	9.4E-03	6.0E-02	NA	--	--	--
	4-METHYL-2-PENTANONE	µg/L	1 / 169	9.0E+00	9.0E+00	NA	--	--	--
	4-METHYLPHENOL	µg/L	12 / 138	1.5E+00	9.1E+03	NA	--	--	--
	ACENAPHTHENE	µg/L	57 / 174	1.0E-01	9.1E+01	NA	--	--	--
	ACENAPHTHYLENE	µg/L	8 / 174	6.5E-02	2.0E+00	NA	--	--	--
	ACETONE	µg/L	9 / 164	4.3E+00	2.1E+03	NA	--	--	--
	ACETOPHENONE	µg/L	3 / 12	2.0E+00	1.8E+01	NA	--	--	--
	ALDRIN	µg/L	1 / 39	8.5E-03	8.5E-03	NA	--	--	--
	ALPHA-BHC	µg/L	2 / 39	1.5E-02	2.0E-02	NA	--	--	--
	ALPHA-CHLORDANE	µg/L	5 / 39	7.9E-03	1.0E-02	NA	--	--	--
	ALUMINUM	µg/L	13 / 102	1.6E+01	4.5E+03	NA	--	--	--
	ANTHRACENE	µg/L	25 / 174	7.4E-02	6.0E+00	NA	--	--	--
	ANTIMONY	µg/L	15 / 101	2.1E+00	4.0E+01	NA	--	--	--
	ARSENIC	µg/L	73 / 144	1.5E+00	1.4E+01	NA	--	--	--
	BARIUM	µg/L	98 / 101	8.9E+00	9.2E+02	NA	--	--	--
	BENZENE	µg/L	78 / 288	1.2E-01	4.0E+02	0 / 10	--	--	No
	BENZO(A)ANTHRACENE	µg/L	6 / 174	1.0E-02	3.1E+00	NA	--	--	--
	BENZO(A)PYRENE	µg/L	1 / 173	2.1E-01	2.1E-01	NA	--	--	--
	BENZO(B)FLUORANTHENE	µg/L	1 / 173	5.5E-02	5.5E-02	NA	--	--	--
	BENZOIC ACID	µg/L	2 / 72	1.0E+01	1.5E+01	NA	--	--	--
	BERYLLIUM	µg/L	11 / 146	1.3E-01	1.1E+00	NA	--	--	--
	BETA-BHC	µg/L	4 / 39	5.0E-03	2.0E-02	NA	--	--	--
	BIPHENYL	µg/L	4 / 14	1.0E-01	1.0E+01	NA	--	--	--

TABLE B-11: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C5 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C5 Plume A-Aquifer (cont.)	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	2 / 160	1.0E+00	3.2E+01	NA	--	--	--
	BROMODICHLOROMETHANE	µg/L	3 / 284	5.6E+00	1.3E+02	0 / 10	--	--	No
	BUTYLBENZYLPHTHALATE	µg/L	1 / 160	6.0E+00	6.0E+00	NA	--	--	--
	CADMIUM	µg/L	6 / 102	3.3E-01	6.4E+00	NA	--	--	--
	CARBAZOLE	µg/L	15 / 88	3.0E-01	7.5E+00	NA	--	--	--
	CARBON DISULFIDE	µg/L	11 / 199	2.4E-01	1.7E+01	NA	--	--	--
	CHLOROBENZENE	µg/L	37 / 284	2.2E-01	2.3E+03	0 / 10	--	--	No
	CHLOROETHANE	µg/L	10 / 284	1.5E+01	8.1E+01	0 / 10	--	--	No
	CHLOROFORM	µg/L	15 / 284	2.0E-01	3.9E+01	4 / 10	2.0E-01	1.1E+00	No
	CHLOROMETHANE	µg/L	1 / 284	4.0E-01	4.0E-01	0 / 10	--	--	No
	CHROMIUM	µg/L	21 / 148	6.7E-01	9.9E+01	NA	--	--	--
	CHROMIUM VI	µg/L	8 / 127	7.1E+00	1.2E+02	NA	--	--	--
	CHRYSENE	µg/L	4 / 175	1.5E-02	2.0E+02	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	104 / 226	1.6E-01	5.8E+04	2 / 10	4.5E-01	5.3E-01	No
	COBALT	µg/L	35 / 101	1.1E+00	8.9E+01	NA	--	--	--
	COPPER	µg/L	30 / 102	1.0E+00	5.8E+01	NA	--	--	--
	CYANIDE	µg/L	1 / 1	7.6E-01	7.6E-01	NA	--	--	--
	CYCLOHEXANE	µg/L	1 / 67	5.1E-01	5.1E-01	NA	--	--	--
	DELTA-BHC	µg/L	6 / 39	1.8E-03	2.5E-02	NA	--	--	--
	DIBENZOFURAN	µg/L	38 / 161	1.0E+00	3.3E+01	NA	--	--	--
	DIBENZOTHIOPHENE	µg/L	2 / 2	9.0E-02	1.0E-01	NA	--	--	--
	DICHLORODIFLUOROMETHANE	µg/L	4 / 192	1.7E+00	4.2E+00	0 / 10	--	--	No
	DIELDRIN	µg/L	2 / 39	5.5E-03	6.0E-02	NA	--	--	--
DIETHYLPHTHALATE	µg/L	2 / 160	5.5E+00	1.0E+01	NA	--	--	--	
DI-N-BUTYLPHTHALATE	µg/L	1 / 160	9.0E-01	9.0E-01	NA	--	--	--	
ENDOSULFAN SULFATE	µg/L	1 / 39	7.5E-02	7.5E-02	NA	--	--	--	

TABLE B-11: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C5 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C5 Plume A-Aquifer (cont.)	ENDRIN	µg/L	3 / 39	4.1E-03	1.0E-02	NA	--	--	--
	ENDRIN ALDEHYDE	µg/L	3 / 39	7.0E-03	2.0E-02	NA	--	--	--
	ENDRIN KETONE	µg/L	2 / 37	7.5E-03	1.0E-01	NA	--	--	--
	ETHYLBENZENE	µg/L	23 / 288	2.7E-01	1.5E+01	0 / 10	--	--	No
	FLUORANTHENE	µg/L	31 / 174	2.0E-01	1.9E+01	NA	--	--	--
	FLUORENE	µg/L	41 / 174	2.0E-01	1.3E+02	NA	--	--	--
	GAMMA-BHC (LINDANE)	µg/L	2 / 39	1.0E-02	1.0E-02	NA	--	--	--
	GAMMA-CHLORDANE	µg/L	4 / 39	4.3E-03	1.1E-02	NA	--	--	--
	HEPTACHLOR	µg/L	2 / 39	1.3E-03	1.3E-02	NA	--	--	--
	HEPTACHLOR EPOXIDE	µg/L	3 / 37	2.0E-03	3.0E-02	NA	--	--	--
	HEPTACHLOR EPOXIDE A	µg/L	1 / 2	5.5E-02	5.5E-02	NA	--	--	--
	HEXACHLOROETHANE	µg/L	1 / 160	7.0E+00	7.0E+00	NA	--	--	--
	IRON	µg/L	77 / 129	2.0E+01	5.5E+05	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	12 / 105	1.1E-01	4.4E+00	NA	--	--	--
	LEAD	µg/L	11 / 99	1.3E+00	1.7E+01	NA	--	--	--
	M,P-XYLENES	µg/L	3 / 31	1.1E+00	2.8E+01	NA	--	--	--
	MANGANESE	µg/L	106 / 110	6.9E-01	1.0E+04	NA	--	--	--
	MERCURY	µg/L	12 / 119	7.0E-02	8.0E+00	NA	--	--	--
	METHOXYCHLOR	µg/L	1 / 39	8.4E-03	8.4E-03	NA	--	--	--
	METHYLCYCLOHEXANE	µg/L	1 / 67	7.2E-01	7.2E-01	NA	--	--	--
	METHYLENE CHLORIDE	µg/L	10 / 284	3.0E-01	2.0E+02	0 / 10	--	--	No
	MOLYBDENUM	µg/L	19 / 82	1.8E+00	3.6E+01	NA	--	--	--
	NAPHTHALENE	µg/L	52 / 198	5.5E-02	3.7E+02	NA	--	--	--
NICKEL	µg/L	55 / 106	2.3E+00	2.6E+02	NA	--	--	--	
O-XYLENE	µg/L	5 / 31	1.1E-01	1.6E+01	NA	--	--	--	
PARA-ISOPROPYL TOLUENE	µg/L	3 / 36	2.0E+00	3.4E+01	NA	--	--	--	

TABLE B-11: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RU-C5 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
RU-C5 Plume A-Aquifer (cont.)	PENTACHLOROPHENOL	µg/L	3 / 151	6.5E-01	6.1E+03	NA	--	--	--
	PHENANTHRENE	µg/L	49 / 175	8.0E-02	5.9E+02	NA	--	--	--
	PHENOL	µg/L	9 / 150	1.5E+00	2.3E+03	NA	--	--	--
	PYRENE	µg/L	28 / 174	1.0E-01	1.1E+01	NA	--	--	--
	SELENIUM	µg/L	10 / 98	3.0E+00	6.4E+01	NA	--	--	--
	SILVER	µg/L	2 / 101	7.3E-01	1.1E+00	NA	--	--	--
	STYRENE	µg/L	1 / 199	7.9E+00	7.9E+00	NA	--	--	--
	TERT-BUTYL METHYL ETHER	µg/L	11 / 183	1.9E-01	7.1E+00	0 / 10	--	--	No
	TETRACHLOROETHENE	µg/L	65 / 284	1.8E-01	7.2E+04	0 / 10	--	--	No
	THALLIUM	µg/L	13 / 101	1.6E+00	5.3E+01	NA	--	--	--
	TOLUENE	µg/L	44 / 288	1.2E-01	6.6E+01	2 / 10	3.5E-01	5.2E-01	No
	TRANS-1,2-DICHLOROETHENE	µg/L	52 / 226	1.4E-01	2.4E+03	0 / 10	--	--	No
	TRICHLOROETHENE	µg/L	108 / 284	1.8E-01	1.8E+04	1 / 10	9.8E-01	9.8E-01	No
	TRICHLOROFLUOROMETHANE	µg/L	17 / 192	2.5E-01	5.9E+03	0 / 10	--	--	No
	VANADIUM	µg/L	52 / 101	1.1E+00	5.7E+01	NA	--	--	--
	VINYL CHLORIDE	µg/L	97 / 284	4.0E-01	6.6E+03	0 / 10	--	--	No
	XYLENE (TOTAL)	µg/L	29 / 264	3.4E-01	1.5E+02	0 / 10	--	--	No
ZINC	µg/L	38 / 102	3.6E+00	2.3E+02	NA	--	--	--	

Notes:

a See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.

--	Not applicable	DDT	Dichlorodiphenyltrichloroethane
µg/L	Microgram per liter	HHRA	Human health risk assessment
BHC	Benzene hexachloride	NA	Not analyzed
COPC	Chemical of potential concern	RU	Remedial Unit
DDE	Dichlorodiphenyldichloroethene		

TABLE B-12: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, INDUSTRIAL AND RESIDENTIAL NON-PLUME EXPOSURE AREAS, A-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area ^a	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
AR11, 065030	ANTIMONY	µg/L	1/3	3.6E+00	3.6E+00	NA	--	--	--
	BARIUM	µg/L	3/3	3.8E+01	5.0E+01	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	4/7	2.4E+00	4.2E+00	1/1	4.2E+00	4.2E+00	Yes ^c
	CHLOROFORM	µg/L	3/7	2.2E+00	2.5E+00	1/1	2.5E+00	2.5E+00	Yes ^c
	CHROMIUM	µg/L	7/8	5.2E+01	7.6E+01	2/2	6.7E+01	7.0E+01	No
	CHROMIUM VI	µg/L	5/5	5.0E+01	7.0E+01	2/2	5.0E+01	6.0E+01	No
	COPPER	µg/L	3/3	1.9E+00	5.4E+00	NA	--	--	--
	HEPTACHLOR EPOXIDE	µg/L	1/7	3.0E-02	3.0E-02	0/2	--	--	No
	MANGANESE	µg/L	1/3	5.1E+00	5.1E+00	NA	--	--	--
	VANADIUM	µg/L	2/3	1.4E+00	1.5E+00	NA	--	--	--
ZINC	µg/L	1/3	4.8E+01	4.8E+01	NA	--	--	--	
AW10, 082027	ARSENIC	µg/L	3/5	2.6E+00	3.9E+00	NA	--	--	--
	BARIUM	µg/L	4/5	9.3E+00	1.8E+01	NA	--	--	--
	CHROMIUM	µg/L	10/10	3.6E+01	6.9E+01	1/1	5.8E+01	5.8E+01	No
	CHROMIUM VI	µg/L	7/7	3.0E+01	6.0E+01	1/1	5.4E+01	5.4E+01	No
	COPPER	µg/L	1/5	3.1E+00	3.1E+00	NA	--	--	--
	IRON	µg/L	1/5	2.4E+01	2.4E+01	NA	--	--	--
	MANGANESE	µg/L	1/5	3.5E+00	3.5E+00	NA	--	--	--
	MERCURY	µg/L	1/5	1.6E-01	1.6E-01	NA	--	--	--
	SELENIUM	µg/L	1/5	6.5E+00	6.5E+00	NA	--	--	--
	VANADIUM	µg/L	4/4	2.7E+00	4.7E+00	NA	--	--	--
ZINC	µg/L	1/5	1.5E+01	1.5E+01	NA	--	--	--	
AY12, 088032	1,2-DICHLOROETHANE	µg/L	2/9	2.0E-01	3.3E-01	0/1	--	--	No
	1,4-DICHLOROBENZENE	µg/L	1/9	8.4E-01	8.4E-01	0/1	--	--	No
	ARSENIC	µg/L	1/3	1.2E+00	1.2E+00	NA	--	--	--
	BARIUM	µg/L	3/3	4.9E+02	7.3E+02	NA	--	--	--
	CHLOROFORM	µg/L	2/9	2.9E-01	4.3E-01	1/1	2.9E-01	2.9E-01	No
	CHROMIUM	µg/L	1/3	7.0E+00	7.0E+00	NA	--	--	--
	CIS-1,2-DICHLOROETHENE	µg/L	6/6	6.3E+00	1.6E+01	1/1	7.0E+00	7.0E+00	No
	COPPER	µg/L	1/3	1.2E+01	1.2E+01	NA	--	--	--
	IRON	µg/L	1/5	2.2E+01	2.2E+01	NA	--	--	--
	TERT-BUTYL METHYL ETHER	µg/L	1/6	2.2E-01	2.2E-01	0/1	--	--	No
	TRANS-1,2-DICHLOROETHENE	µg/L	6/6	4.6E-01	7.0E-01	1/1	6.0E-01	6.0E-01	No
TRICHLOROETHENE	µg/L	6/9	1.0E+00	2.6E+00	1/1	2.1E+00	2.1E+00	No	

TABLE B-12: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, INDUSTRIAL AND RESIDENTIAL NON-PLUME EXPOSURE AREAS, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area ^a	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
AY12, 089032	TRICHLOROFLUOROMETHANE	µg/L	4 / 4	3.2E-01	4.7E-01	1 / 1	3.2E-01	3.2E-01	No
(cont.)	VANADIUM	µg/L	3 / 3	3.7E+00	5.8E+00	NA	--	--	--
	ZINC	µg/L	1 / 3	1.8E+01	1.8E+01	NA	--	--	--

Notes:

- a The industrial exposure area (grid) is listed first, followed by the corresponding residential exposure area.
 - b See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
 - c Chemical was identified as a chemical of concern in the HHRA.
- Not applicable
 µg/L Microgram per liter
 COPC Chemical of potential concern
 HHRA Human health risk assessment
 NA Not analyzed

TABLE B-13: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL C, RESIDENTIAL NON-PLUME EXPOSURE AREAS, B-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
089021	ACETONE	µg/L	1 / 2	1.2E+02	1.2E+02	NA	--	--	--
	CARBON DISULFIDE	µg/L	1 / 2	2.5E+00	2.5E+00	NA	--	--	--
	TRICHLOROFLUOROMETHANE	µg/L	1 / 4	5.8E-01	5.8E-01	0 / 3	--	--	No
	XYLENE (TOTAL)	µg/L	1 / 4	5.8E-01	5.8E-01	1 / 3	5.8E-01	5.8E-01	Yes ^b
095026	BENZENE	µg/L	1 / 3	2.4E-01	2.4E-01	0 / 2	--	--	No
	TRICHLOROETHENE	µg/L	3 / 3	2.0E-01	2.2E-01	2 / 2	2.0E-01	2.0E-01	No

Notes:

a See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.

b Chemical was not identified as a chemical of concern in the HHRA.

-- Not applicable

µg/L Microgram per liter

COPC Chemical of potential concern

HHRA Human health risk assessment

NA Not analyzed

TABLE B-14: EVALUATION OF CHEMICALS WITH MAXIMUM CONCENTRATIONS FOR HHRA DATA SET BASED ON NONREPRESENTATIVE SAMPLE RESULTS, PARCEL C

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Exposure Area	Water-Bearing Unit	Chemical ^a	COC	Unit	Data Summary for Nonrepresentative Samples ^b			HHRA Data Summary for Monitoring Wells Affected by Nonrepresentative Sampling, Excluding Nonrepresentative Sample Results		
						Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration
c	RU-C1 Plume	B	CIS-1,2-DICHLOROETHENE	No	µg/L						
	RU-C2 Plume	A	BROMOFORM	No	µg/L						
		A+B	BROMOFORM	No	µg/L						
		B	DICHLORODIFLUOROMETHANE	No	µg/L						
	AR11, 065030	A	CARBON TETRACHLORIDE	Yes	µg/L	1 / 1	4.2E+00	4.2E+00	3 / 6	2.4E+00	4.2E+00 ^c
			CHLOROFORM	Yes	µg/L	1 / 1	2.5E+00	2.5E+00	2 / 6	2.2E+00	2.5E+00 ^c
	089021	B	XYLENE (TOTAL)	No	µg/L						

Notes:

[Shaded Box] Data summary is not provided for chemicals that were not identified as COCs in the HHRA.

- a The chemicals listed are those for which the maximum concentration in the HHRA data set is based on nonrepresentative sample results.
- b See Table B-1 for sampling locations, dates, and analyses associated with the nonrepresentative samples.
- c Maximum detected concentrations for carbon tetrachloride and chloroform are associated with two samples. One of these samples is representative, the other is nonrepresentative; both samples have the same analytical results for these chemicals. For this reason, when the nonrepresentative sample is removed from the HHRA data set for these chemicals, the maximum concentration does not change.

µg/L Microgram per liter
A A-aquifer
B B-aquifer
COC Chemical of concern
HHRA Human health risk assessment
RU Remedial Unit

ATTACHMENT C
NONREPRESENTATIVE GROUNDWATER SAMPLES AND INFLUENCE ON HHRA
RESULTS FOR PARCEL D

Table C-1 Summary of HHRA Data Associated with Nonrepresentative Groundwater Samples,
Parcel D

SUMMARY OF RESULTS FOR PARCEL D

The groundwater data set for the HHRA for Parcel D comprises data collected through the second quarter of 2004. Table C-1 lists the sampling locations, sample collection dates, and corresponding water-bearing units (A-aquifer, B-aquifer, or F-WBZ) associated with the nonrepresentative groundwater samples collected at Parcel D through the second quarter of 2004. For each nonrepresentative sample, Table C-1 also shows the distance above or below the well screen interval at which the nonrepresentative sample was collected, the laboratory analyses for the sample, and the HHRA exposure area and scenarios associated with the location and water-bearing unit of the sample.

Two nonrepresentative groundwater samples were collected from two monitoring wells at Parcel D during 2004. All analytical results for these two samples were nondetected. Therefore, the nonrepresentative samples do not influence the HHRA results for Parcel D.

TABLE C-1: SUMMARY OF HHRA DATA ASSOCIATED WITH NONREPRESENTATIVE GROUNDWATER SAMPLES, PARCEL D

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Monitoring Well with Nonrepresentative Sample	Nonrepresentative Sample Collection Date	Water-Bearing Unit	Distance from Proper Well Screen Interval (feet) ^a	Laboratory Analysis					HHRA Exposure Area	Communication Between Water-Bearing Units?	HHRA Exposure Scenario(s) ^b	Water-Bearing Units Included in Nonrepresentative Sample Analysis
					Metals	Chromium/Chromium VI	VOCs	SVOCs	Pesticides/PCBs				
D	IR09MW54B	6/9/2004	A	6		✓				AT22 / 073064	No	VI, Trench	A
D	IR71MW12B	6/10/2004	B	35			✓			IR-71 plume	No	DU	B

Notes:

- a Samples collected below the proper well screen interval are shown with a negative distance. Samples collected above the proper well screen interval are indicated with a positive distance.
- b The HHRA evaluated vapor intrusion exposure for residential and industrial scenarios, construction trench exposure for a construction worker, and domestic use exposure for a residential scenario.

- A A-aquifer
- B B-aquifer
- Chromium VI Hexavalent chromium
- DU Domestic use
- HHRA Human health risk assessment
- PCB Polychlorinated biphenyl
- SVOC Semivolatile organic compound
- Trench Construction trench
- VI Vapor intrusion
- VOC Volatile organic compound

ATTACHMENT D
NONREPRESENTATIVE GROUNDWATER SAMPLES AND INFLUENCE ON HHRA
RESULTS FOR PARCEL E

Table D-1 Summary of HHRA Data Associated with Nonrepresentative Groundwater Samples, Parcel E

Table D-2 Comparison of Analytical Data for Nonrepresentative Samples to HHRA
Data Set: Parcel E, IR-02 Northwest VOC Plume, B-Aquifer

Table D-3 Comparison of Analytical Data for Nonrepresentative Samples to HHRA
Data Set: Parcel E, IR-03 VOC Plume, B-Aquifer

Table D-4 Comparison of Analytical Data for Nonrepresentative Samples to HHRA
Data Set: Parcel E, Residential Non-Plume Exposure Areas, B-Aquifer

Table D-5 Evaluation of Chemicals with Maximum Concentrations for HHRA Data Set Based
on Nonrepresentative Sample Results, Parcel E

SUMMARY OF RESULTS FOR PARCEL E

The groundwater data set for the HHRA for Parcel E comprises data collected through the fourth quarter of 2004. Table D-1 lists the sampling locations, sample collection dates, and corresponding water-bearing units (A-aquifer, B-aquifer, or F-WBZ) associated with the nonrepresentative groundwater samples collected at Parcel D through the fourth quarter of 2004. For each nonrepresentative sample, Table D-1 also shows the distance above or below the well screen interval at which the nonrepresentative sample was collected, the laboratory analyses for the sample, and the HHRA exposure area and scenarios associated with the location and water-bearing unit of the sample.

Six nonrepresentative groundwater samples were collected from three monitoring wells at Parcel E during 2004. Three exposure areas are associated with the nonrepresentative samples: two plume-based areas (IR-02 Northwest volatile organic compound [VOC] plume and IR-03 VOC plume) and one nonplume area (071079 [residential grid]). Tables D-2, D-3, and D-4 present, for each of these exposure areas, a comparison of the analytical data for the nonrepresentative samples with the groundwater data for the HHRA. These tables also identify instances where the EPC for the HHRA data set is based on the maximum concentration associated with the nonrepresentative sampling results. For these instances, the tables indicate whether the affected chemical was identified as a COC in the HHRA. Results of the comparisons are discussed below.

IR-02 Northwest VOC Plume

Nonrepresentative samples for the IR-02 Northwest VOC plume were collected from the B-aquifer. Table D-2 presents a comparison of the sample results with the HHRA data set for this exposure area. As shown in the table, none of the maximum concentrations for the HHRA data set was based on the nonrepresentative sample results. Therefore, the nonrepresentative samples do not influence the HHRA results for the IR-02 Northwest VOC Plume at Parcel E.

IR-03 VOC Plume

Nonrepresentative samples for the IR-03 VOC plume were collected from the B-aquifer. Table D-3 presents a comparison of these sample results to the HHRA data set for this exposure area. As shown in the table, maximum concentrations for four chemicals (aluminum, chromium, lead, and nickel) were based on nonrepresentative sample results. Further evaluation of these chemicals is provided below in the COC evaluation.

Grid 071079

Nonrepresentative samples for grid 071079 were collected from the B-aquifer. Table D-4 presents a comparison of these sample results to the HHRA data set for this exposure area. As shown in the table, maximum concentrations for two chemicals (cis-1,2-dichloroethene and vinyl

chloride) were based on nonrepresentative sample results. Further evaluation of these chemicals is provided below in the COC evaluation.

COC Evaluation

Table D-5 provides further evaluation of the six chemicals at Parcel E for which the maximum concentration for the HHRA groundwater data set was based on results from nonrepresentative samples. Of the six chemicals, only vinyl chloride in the B-aquifer at the grid 071079 exposure area was identified as a COC in the HHRA for Parcel E.

Table D-5 includes a comparison of the range of detected concentrations associated with the nonrepresentative sample results for vinyl chloride with the range of concentrations for vinyl chloride from all wells affected by the nonrepresentative samples, excluding the nonrepresentative sample results. As shown in the table, vinyl chloride was only detected once in the nine groundwater samples for this exposure area. Six of these results are from representative samples, and three are from nonrepresentative samples; the sole detected result for vinyl chloride was based on results from a nonrepresentative sample. This comparison shows that vinyl chloride may have been incorrectly identified as a COC for grid 071079, and that inclusion of the nonrepresentative samples in the HHRA for Parcel E may have resulted in an overestimate of health risks for grid 071079. Vinyl chloride was not detected in any of the six representative samples. The detected result was associated with a nonrepresentative result from the September 2004 sampling event; a subsequent sampling result from November 2004 (also a nonrepresentative sample) was nondetected for vinyl chloride. Inclusion of the nonrepresentative samples in the HHRA data set for Parcel E resulted in a total cancer risk of $3.1E-04$ for grid 071079. The chemical-specific risk for vinyl chloride is $4.1E-05$, and comprises 13 percent of the total risk calculated for this grid.

The remaining five chemicals for which maximum concentrations in the HHRA were based on results from nonrepresentative samples (aluminum, chromium, lead, and nickel at IR-03 and cis-1,2-dichloroethene at grid 071079) were not identified as COCs in the HHRA. None of these five chemicals is likely to be a COC, regardless of the inclusion of the nonrepresentative samples in the HHRA data set, as discussed below.

- Aluminum, chromium, lead, and nickel (IR-03, B-aquifer): For each of these metals, six samples are representative (two are nonrepresentative). Of the six representative samples, aluminum and lead were detected in three samples, and chromium and nickel were detected in one sample (see Table D-3). Each of these metals was detected in one of the two nonrepresentative samples. Detections of these metals in the nonrepresentative samples are associated with a single monitoring well, and were based on results from the June and September 2004 sampling events. During a subsequent sampling event in November 2004, the well was sampled properly, and results for each of these metals were nondetected.

- Cis-1,2-Dichloroethene (grid 071079, B-aquifer): Three of six samples are representative (three are nonrepresentative); cis-1,2-dichloroethene was not detected in any of the representative samples but was detected in one of the nonrepresentative samples (see Table D-4). Cis-1,2-dichloroethene was not identified as a COC based on this single detection. The single detection of cis-1,2-dichloroethene was from a nonrepresentative sample collected from a single monitoring well in September 2004. A subsequent sample collected from this well (also a nonrepresentative sample) in November 2004 yielded a nondetected result for cis-1,2-dichloroethene. In addition, the low frequency of detection and lack of detections in the representative data set indicate that the presence of cis-1,2-dichloroethene at this exposure area is questionable.

TABLE D-1: SUMMARY OF HHRA DATA ASSOCIATED WITH NONREPRESENTATIVE GROUNDWATER SAMPLES, PARCEL E

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Monitoring Well with Nonrepresentative Sample	Nonrepresentative Sample Collection Date	Water-Bearing Unit	Distance from Proper Well Screen Interval (feet) ^a	Laboratory Analysis					HHRA Exposure Area	Communication Between Water-Bearing Units?	HHRA Exposure Scenario(s) ^b	Water-Bearing Units Included in Nonrepresentative Sample Analysis
					Metals	Chromium/Chromium VI	VOCs	SVOCs	Pesticides/PCBs				
E	IR02MW127B	9/7/2004	B	14			✓	✓	✓	IR-02 NW VOC plume	No	DU	B
E	IR03MW373B	6/15/2004	B	31.23	✓		✓	✓	✓	IR-03 VOC plume	No	DU	B
E	IR03MW373B	9/14/2004	B	31	✓		✓	✓	✓				
E	IR36MW123B	6/16/2004	B	15			✓			71079	No	DU	B
E	IR36MW123B	9/15/2004	B	15			✓						
E	IR36MW123B	11/23/2004	B	20			✓						

Notes:

- a Samples collected below the proper well screen interval are shown with a negative distance. Samples collected above the proper well screen interval are indicated with a positive distance.
- b The HHRA evaluated vapor intrusion exposure for residential and industrial scenarios, construction trench exposure for a construction worker, and domestic use exposure for a residential scenario.

- B B-aquifer
- Chromium VI Hexavalent chromium
- DU Domestic use
- HHRA Human health risk assessment
- IR Installation Restoration
- Pest/PCB Pesticide / polychlorinated biphenyl
- SVOC Semivolatile organic compound
- VOC Volatile organic compound

TABLE D-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E, IR-02 NORTHWEST VOC PLUME, B-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
IR-02 NW VOC Plume	ARSENIC	µg/L	1 / 3	2.1E+00	2.1E+00	NA	--	--	--
	BARIUM	µg/L	3 / 3	9.7E+01	1.1E+02	NA	--	--	--
	CADMIUM	µg/L	1 / 3	3.2E+00	3.2E+00	NA	--	--	--
	IRON	µg/L	5 / 5	2.1E+03	4.8E+03	NA	--	--	--
	LEAD	µg/L	2 / 3	1.8E+00	8.2E+00	NA	--	--	--
	MANGANESE	µg/L	3 / 3	2.3E+03	2.3E+03	NA	--	--	--
	MOLYBDENUM	µg/L	1 / 3	5.0E+00	5.0E+00	NA	--	--	--
	TOLUENE	µg/L	3 / 9	1.6E-01	7.4E-01	1 / 1	7.1E-01	7.1E-01	No
	TRICHLOROFUOROMETHANE	µg/L	1 / 5	2.3E-01	2.3E-01	0 / 1	--	--	No
ZINC	µg/L	1 / 3	7.8E+00	7.8E+00	NA	--	--	--	

Notes:

- a See Table D-1 for sample locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- Not applicable
- µg/L Microgram per liter
- COPC Chemical of potential concern
- HHRA Human health risk assessment
- IR Installation Restoration
- NA Not analyzed
- NW Northwest
- VOC Volatile organic compound

TABLE D-3: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E, IR-03 VOC PLUME, B-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
IR-03 VOC Plume	1,2,4-TRICHLOROBENZENE	µg/L	1 / 10	3.4E-01	3.4E-01	0 / 2	--	--	No
	ALUMINUM	µg/L	3 / 8	1.7E+01	2.7E+01	1 / 2	2.7E+01	2.7E+01	Yes ^b
	ANTIMONY	µg/L	2 / 8	7.1E-01	1.6E+00	0 / 2	--	--	No
	ARSENIC	µg/L	5 / 8	3.8E+00	6.2E+00	0 / 2	--	--	No
	BARIUM	µg/L	8 / 8	7.6E+00	4.8E+01	2 / 2	7.6E+00	7.9E+00	No
	CADMIUM	µg/L	1 / 8	5.6E+00	5.6E+00	0 / 2	--	--	No
	CALCIUM	µg/L	5 / 5	1.2E+04	1.4E+04	NA	--	--	--
	CHROMIUM	µg/L	1 / 8	1.7E+01	1.7E+01	1 / 2	1.7E+01	1.7E+01	Yes ^b
	COPPER	µg/L	2 / 8	5.2E+00	6.4E+00	0 / 2	--	--	No
	IRON	µg/L	4 / 5	2.1E+01	7.2E+01	NA	--	--	--
	LEAD	µg/L	3 / 8	4.1E-02	1.9E+00	1 / 2	1.9E+00	1.9E+00	Yes ^b
	MAGNESIUM	µg/L	5 / 5	1.2E+04	1.3E+04	NA	--	--	--
	MANGANESE	µg/L	7 / 8	1.9E+00	4.4E+02	1 / 2	8.3E+00	8.3E+00	No
	NICKEL	µg/L	1 / 8	4.6E+00	4.6E+00	1 / 2	4.6E+00	4.6E+00	Yes ^b
	POTASSIUM	µg/L	4 / 5	2.2E+03	5.6E+03	NA	--	--	--
	SODIUM	µg/L	5 / 5	1.1E+05	1.9E+05	NA	--	--	--
	TETRACHLOROETHENE	µg/L	1 / 10	1.6E-01	1.6E-01	0 / 2	--	--	No
	TOLUENE	µg/L	1 / 10	1.6E-01	1.6E-01	0 / 2	--	--	No
	TRICHLOROETHENE	µg/L	1 / 10	1.3E-01	1.3E-01	0 / 2	--	--	No
ZINC	µg/L	4 / 8	3.6E+00	4.8E+01	0 / 2	--	--	No	

Notes:

a See Table D-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.

b Chemical was not identified as a chemical of concern in the HHRA.

-- Not applicable

µg/L Microgram per liter

COPC Chemical of potential concern

HHRA Human health risk assessment

IR Installation Restoration

NA Not analyzed

VOC Volatile organic compound

TABLE D-4: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E, RESIDENTIAL NON-PLUME EXPOSURE AREAS, B-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
71079	Arsenic	µg/L	1 / 3	1.4E+00	1.4E+00	NA	--	--	--
	Barium	µg/L	3 / 3	9.2E+01	9.9E+01	NA	--	--	--
	Chromium	µg/L	3 / 3	1.3E+01	1.8E+01	NA	--	--	--
	Copper	µg/L	1 / 3	8.2E+00	8.2E+00	NA	--	--	--
	Iron	µg/L	2 / 3	3.0E+01	4.0E+01	NA	--	--	--
	Manganese	µg/L	3 / 3	9.8E+01	2.2E+02	NA	--	--	--
	Nickel	µg/L	1 / 3	1.6E+00	1.6E+00	NA	--	--	--
	Selenium	µg/L	1 / 3	2.7E+00	2.7E+00	NA	--	--	--
	Silver	µg/L	1 / 3	6.8E-01	6.8E-01	NA	--	--	--
	Vanadium	µg/L	2 / 3	2.2E+00	3.0E+00	NA	--	--	--
	Zinc	µg/L	1 / 3	2.0E+01	2.0E+01	NA	--	--	--
	1,2-Dichlorobenzene	µg/L	1 / 9	8.7E+00	8.7E+00	0 / 3	--	--	No
	1,4-Dichlorobenzene	µg/L	1 / 9	2.2E+00	2.2E+00	0 / 3	--	--	No
	cis-1,2-Dichloroethene	µg/L	1 / 6	6.1E-01	6.1E-01	1 / 3	6.1E-01	6.1E-01	Yes ^b
	Tetrachloroethene	µg/L	1 / 9	6.1E+00	6.1E+00	0 / 3	--	--	No
	Toluene	µg/L	1 / 9	1.1E-01	1.1E-01	0 / 3	--	--	No
	Trichloroethene	µg/L	1 / 9	3.5E-01	3.5E-01	0 / 3	--	--	No
Vinyl Chloride	µg/L	1 / 9	1.3E+00	1.3E+00	1 / 3	1.3E+00	1.3E+00	Yes ^c	

Notes:

- a See Table D-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- b Chemical was not identified as a chemical of concern in the HHRA.
- c Chemical was identified as a chemical of concern in the HHRA.
- Not applicable
- µg/L Microgram per liter
- COPC Chemical of potential concern
- HHRA Human health risk assessment
- NA Not analyzed

TABLE D-5: EVALUATION OF CHEMICALS WITH MAXIMUM CONCENTRATIONS FOR HHRA DATA SET BASED ON NONREPRESENTATIVE SAMPLE RESULTS, PARCEL E

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Exposure Area	Water-Bearing Unit	Chemical ^a	COC	Units	Data Summary for Nonrepresentative Samples ^b			HHRA Data Summary for Monitoring Wells Affected by Nonrepresentative Sampling, Excluding Nonrepresentative Sample Results		
						Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration
E	IR-03 Plume	B	ALUMINUM	No	µg/L						
			CHROMIUM	No	µg/L						
			LEAD	No	µg/L						
			NICKEL	No	µg/L						
	071079	B	CIS-1,2-DICHLOROETHENE	No	µg/L						
			VINYL CHLORIDE ^c	Yes	µg/L	1 / 3	1.3E+00	1.3E+00	0 / 6	--	--

Notes:



Data summary is not provided for chemicals that were not identified as COCs in the HHRA.

- a The chemicals listed are those for which the maximum concentration in the HHRA data set is based on nonrepresentative sample results.
- b See Table D-1 for sampling locations, dates, and analyses associated with the nonrepresentative samples.
- c The only detection of this chemical is associated with results for nonrepresentative samples.

µg/L Microgram per liter
 B B-aquifer
 COC Chemical of concern
 HHRA Human health risk assessment

ATTACHMENT E
NONREPRESENTATIVE GROUNDWATER SAMPLES AND INFLUENCE ON HHRA
RESULTS FOR PARCEL E-2

Table E-1 Summary of HHRA Data Associated with Nonrepresentative Groundwater Samples, Parcel E-2

Table E-2 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel E-2 Plume, A-Aquifer

Table E-3 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel E-2 Plume, B-Aquifer with Potential Hydraulic Communication

Table E-4 Comparison of Analytical Data for Nonrepresentative Samples to HHRA Data Set: Parcel E-2 Plume, B-Aquifer

Table E-5 Evaluation of Chemicals with Maximum Concentrations for HHRA Data Set Based on Nonrepresentative Sample Results, Parcel E-2

SUMMARY OF RESULTS FOR PARCEL E-2

The groundwater data set for the HHRA for Parcel E-2 comprises data collected through the first quarter of 2005. Table E-1 lists the sampling locations, sample collection dates, and corresponding water-bearing units (A-aquifer, B-aquifer, or F-WBZ) associated with the nonrepresentative groundwater samples collected at Parcel E-2 through the first quarter of 2005. For each nonrepresentative sample, Table E-1 also shows the distance above or below the well screen interval at which the nonrepresentative sample was collected, the laboratory analyses for the sample, and the HHRA exposure area and scenarios associated with the location and water-bearing unit of the sample.

Sixteen nonrepresentative groundwater samples were collected from seven monitoring wells at Parcel E-2 from the second quarter of 2004 through the first quarter of 2005. Only one groundwater exposure area was identified for Parcel E-2: the Parcel E-2 plume. Nonrepresentative samples were collected from both the A- and B-aquifers of this plume.

Hydraulic communication is possible between the A- and B-aquifers at Parcel E-2. To account for potential migration of chemicals from the A-aquifer to the B-aquifer, the HHRA evaluated groundwater exposures at Parcel E-2 under three scenarios. In the first scenario, the A-aquifer was assumed to be isolated, and EPCs were based solely on A-aquifer data. In the second scenario, the B-aquifer was assumed to be in hydraulic communication with the A-aquifer, and data sets for the A- and B-aquifers were combined to calculate EPCs. In the third scenario, the B-aquifer was assumed to be isolated and EPCs were based solely on B-aquifer data. For consistency with the approach used in HHRA, comparisons of the analytical data for the nonrepresentative samples with the groundwater data for the HHRA were made for the same scenarios evaluated in the HHRA. These comparisons are presented in Tables E-2, E-3, and E-4. These tables also identify instances where the EPC for the HHRA data set is based on the maximum concentration associated with the nonrepresentative sampling results. For these instances, the tables indicate whether the affected chemical was identified as a COC in the HHRA. Results of the comparisons are discussed below.

The HHRA for Parcel E-2 will be revised to include groundwater monitoring results collected through the second or third quarter of monitoring for 2007. This evaluation will be updated as part of the revised HHRA to include an analysis of nonrepresentative groundwater sampling results for the 2007 monitoring quarters.

A-Aquifer

Table E-2 presents a comparison of the nonrepresentative sample results for the A-aquifer with the A-aquifer data set used in the HHRA for this exposure area. As shown in the table, none of the maximum concentrations for the A-aquifer data set for the HHRA was based on the nonrepresentative sample results. Therefore, the nonrepresentative samples do not influence the HHRA results for A-aquifer at Parcel E-2.

B-Aquifer with Potential Hydraulic Communication

Table E-3 presents a comparison of the nonrepresentative sample results for the combined A- and B-aquifer data set with the combined aquifer data set used in the HHRA for this exposure area. As shown in the table, maximum concentrations for three chemicals (1,2,3-trichloropropane, bromomethane, and chlorpyrifos) were based on nonrepresentative sample results. Further evaluation of these chemicals is provided below in the COC evaluation.

B-Aquifer

Table E-4 presents a comparison of the nonrepresentative sample results for the B-aquifer data set with the B-aquifer data set used in the HHRA for this exposure area. As shown in the table, maximum concentrations for six chemicals (1,2,3-trichloropropane, arsenic, bromomethane, chloroethane, chlorpyrifos, and total xylene) were based on nonrepresentative sample results. Further evaluation of these chemicals is provided below in the COC evaluation.

COC Evaluation

Table E-5 provides further evaluation of the six chemicals at Parcel E for which maximum concentration for the HHRA groundwater data set was based on results from nonrepresentative samples. Of the six chemicals, only 1,2,3-trichloropropane (A-aquifer and combined A+B-aquifer scenarios) and arsenic (B-aquifer scenario) were identified as COCs in the HHRA for Parcel E.

Table E-5 includes a comparison of the range of concentrations associated with the nonrepresentative sample results for 1,2,3-trichloropropane and arsenic with the range of concentrations for these chemicals from all wells affected by the nonrepresentative samples, excluding the nonrepresentative sample results. As shown in the table, for the combined A+B-aquifer scenario, 1,2,3-trichloropropane was only detected once in 110 samples. Of these 110 samples, 94 of the results are from representative samples, and sixteen are from nonrepresentative samples; the sole detected result for 1,2,3-trichloropropane was based on results from a nonrepresentative sample. For the B-aquifer scenario, 1,2,3-trichloropropane was only detected once in 34 samples. Nineteen of the results are from representative samples, and 15 are from nonrepresentative samples; consistent with the A+B-aquifer scenario, the sole detected result for 1,2,3-trichloropropane was based on a result from a nonrepresentative sample. The single detection of 1,2,3-trichloropropane was an estimated result below the laboratory reporting limit, and was based on a nonrepresentative sample collected during the July 2004 sampling event. Samples collected from the same well in September 2004 (also a nonrepresentative sample) and December 2004 (sample was collected properly) yielded nondetected results for this chemical. This comparison shows that the presence of 1,2,3-trichloropropane in groundwater at Parcel E-2 is questionable. 1,2,3-Trichloropropane may have been incorrectly identified as a COC for Parcel E-2, and health risks for this parcel may have been overestimated based on inclusion of the nonrepresentative samples in the HHRA for Parcel E-2. However, the degree to which health risks may have been overestimated is relatively insignificant, compared with the overall risks estimated for exposure to groundwater at Parcel E-2. The chemical-specific cancer risk estimated for exposure to 1,2,3-trichloropropane

from domestic use of groundwater was $9.8E-05$. This cancer risk only constitutes 1.1 percent of the total cancer risk estimated for domestic use of groundwater at Parcel E.2

Arsenic was identified as a COC for the B-aquifer. Forty-two of the 56 samples for arsenic are representative (14 are nonrepresentative). Arsenic was detected in 22 of the 42 representative samples and eight of the 14 nonrepresentative samples. Table E-5 provides a comparison of the arsenic results from the nonrepresentative samples with arsenic results from wells affected by nonrepresentative samples, excluding the nonrepresentative sample results. This comparison shows that maximum concentrations of arsenic do not differ significantly between the representative and nonrepresentative samples (less than a factor of two). In addition, both maximum concentrations exceeded the groundwater risk-based concentration (RBC) for arsenic of 0.007 microgram per liter for domestic use exposure. Therefore, the inclusion of nonrepresentative samples in the groundwater data set for Parcel E-2 did not change the COC status of arsenic; regardless of the inclusion of the nonrepresentative sample results, concentrations of arsenic exceed risk-based concentrations.

The remaining four chemicals for which maximum concentrations for the HHRA were based on results from nonrepresentative samples (bromomethane, chloroethane, chlorpyrifos, and total xylene) were not identified as COCs in the HHRA. None of these chemicals is likely to be a COC, regardless of the inclusion of nonrepresentative samples in the HHRA data set, as discussed below.

- Bromomethane (A+B-aquifer, B-aquifer): For the A+B-aquifer scenario, 262 of the 278 samples are representative (16 are nonrepresentative); bromomethane was detected in 1 of the 262 representative samples and 1 of the 16 nonrepresentative samples (see Table E-3). For the B-aquifer scenario, 49 of the 64 samples is representative (15 are nonrepresentative); bromomethane was detected in none of the representative samples and 1 of the 15 nonrepresentative samples (see Table E-4). The large proportion of nondetected results from both the representative and nonrepresentative samples indicates that the presence of bromomethane in groundwater at Parcel E-2 is limited. In addition, the single detection of bromomethane in the nonrepresentative samples was collected from a single monitoring well during September 2004. During a subsequent sampling event in December 2004, the well was sampled properly, and bromomethane was nondetected.
- Chloroethane (B-aquifer): Forty-nine of the 64 samples are representative (15 are nonrepresentative); chloroethane was detected in none of the representative samples and 1 of the 15 nonrepresentative samples (see Table E-4). The single detection of chloroethane was an estimate result below the laboratory reporting limit and did not result in identification of chloroethane as a COC. All other results from both the representative and nonrepresentative samples are nondetected, indicating that the presence of chloroethane in groundwater at Parcel E-2 is questionable. The single detection of chloroethane in the nonrepresentative samples was collected from a single monitoring well during July 2004. Subsequent sampling occurred at this well in September 2004 (also a nonrepresentative sample) and December 2004 (sample was collected properly); results for chloroethane for these subsequent samples were nondetected.

- Chlorpyrifos (A+B-aquifer, B-aquifer): For the A+B-aquifer scenario, 105 of the 120 samples are representative (15 are nonrepresentative); chlorpyrifos was detected in none of the representative samples and 3 of the 15 nonrepresentative samples (see Table E-3). For the B-aquifer scenario, 24 of the 38 samples are representative (14 are nonrepresentative); chlorpyrifos was detected in none of the representative samples and 3 of the 14 nonrepresentative samples (see Table E-4). Two of these three detections were estimated results below the laboratory reporting limit. The single nonrepresentative result that exceeded the laboratory reporting limit was collected from a single monitoring well during March 2005. The HHRA data set does not include subsequent sampling results for this well, so a comparison with subsequent results for this well cannot be made. The limited detections of chlorpyrifos in the nonrepresentative samples did not result in identification of this chemical as a COC. Almost all of the results from both the representative and nonrepresentative samples are nondetected.
- Total xylene (B-aquifer): Thirty-nine of the 54 samples are representative (15 are nonrepresentative); total xylene was detected in 2 of the 39 representative samples and 3 of the 15 nonrepresentative samples (see Table E-4). The three detections of total xylene from the nonrepresentative samples are associated with samples collected from a single monitoring well during July 2004, September 2004, and November 2004. A subsequent sample collected from this well in March 2005 (also a nonrepresentative sample) yielded a nondetected result for total xylene. All detected results were estimated results below the laboratory reporting limit. In addition, the majority of the sampling results are nondetected, indicating that the presence of total xylene is limited at this exposure area.

TABLE E-1: SUMMARY OF HHRA DATA ASSOCIATED WITH NONREPRESENTATIVE GROUNDWATER SAMPLES, PARCEL E-2
 Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Monitoring Well with Nonrepresentative Sample	Nonrepresentative Sample Collection Date	Water-Bearing Unit	Distance from Proper Well Screen Interval (feet) ^a	Laboratory Analysis					HHRA Exposure Area	Communication Between Water-Bearing Units?	HHRA Exposure Scenario(s) ^b	Water-Bearing Units Included in Nonrepresentative Sample Analysis
					Metals	Chromium/Chromium VI	VOCs	SVOCs	Pesticides/PCBs				
E-2	IR01MW366A	11/30/2004	A	23.28	✓		✓	✓	✓	E-2 plume	Yes	Trench	A
E-2	IR01MW09B	9/9/2004	B	12	✓		✓	✓	✓	E-2 plume	Yes	DU	A+B, B
E-2	IR01MW09B	11/19/2004	B	4.4	✓		✓	✓	✓				
E-2	IR01MW09B	3/1/2005	B	4.4	✓		✓	✓	✓				
E-2	IR01MW366B	7/8/2004	B	8	✓		✓	✓	✓				
E-2	IR01MW366B	9/16/2004	B	8	✓		✓	✓	✓				
E-2	IR01MW366B	3/2/2005	B	10	✓		✓	✓	✓				
E-2	IR01MW403B	7/8/2004	B	2.5	✓		✓	✓	✓				
E-2	IR01MW403B	9/17/2004	B	3	✓		✓	✓	✓				
E-2	IR01MW47B	9/15/2004	B	10	✓		✓	✓	✓				
E-2	IR01MW47B	12/1/2004	B	10	✓		✓	✓	✓				
E-2	IR01MW53B	6/29/2004	B	8.3	✓		✓	✓	✓				
E-2	IR01MWLF4B	7/9/2004	B	4.5	✓		✓	✓	✓				
E-2	IR01MWLF4B	9/16/2004	B	4.5	✓		✓	✓	✓				
E-2	IR01MWLF4B	12/1/2004	B	8	✓		✓	✓	✓				
E-2	IR01MWLF4B	3/3/2005	B	18	✓		✓	✓	✓				

Notes:

- a Samples collected below the proper well screen interval are shown with a negative distance. Samples collected above the proper well screen interval are indicated with a positive distance.
- b The HHRA evaluated vapor intrusion exposure for residential and industrial scenarios, construction trench exposure for a construction worker, and domestic use exposure for a residential scenario.
- A A-aquifer
- B B-aquifer
- Chromium VI Hexavalent chromium
- DU Domestic use
- HHRA Human health risk assessment
- PCB Polychlorinated biphenyl
- SVOC Semivolatile organic compound
- Trench Construction trench
- VOC Volatile organic compound

TABLE E-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, A-AQUIFER

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration or HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A-Aquifer	1,1,1-TRICHLOROETHANE	µg/L	10 / 214	2.1E+01	1.5E+02	0 / 1	--	--	No
	1,1,2,2-TETRACHLOROETHANE	µg/L	1 / 213	2.3E+00	2.3E+00	0 / 1	--	--	No
	1,1-DICHLOROETHANE	µg/L	25 / 214	1.0E-01	5.0E+01	0 / 1	--	--	No
	1,1-DICHLOROETHENE	µg/L	10 / 214	2.0E+01	4.4E+01	0 / 1	--	--	No
	1,2,4-TRICHLOROBENZENE	µg/L	2 / 220	3.2E-01	5.2E-01	0 / 1	--	--	No
	1,2,4-TRIMETHYLBENZENE	µg/L	2 / 3	1.8E+00	3.7E+00	NA	--	--	--
	1,2-DICHLOROBENZENE	µg/L	16 / 218	9.0E-02	6.7E+00	0 / 1	--	--	No
	1,2-DICHLOROETHANE	µg/L	10 / 214	1.8E-01	1.8E+00	0 / 1	--	--	No
	1,2-DICHLOROETHENE (TOTAL)	µg/L	8 / 87	8.0E-01	9.0E+00	NA	--	--	--
	1,3,5-TRIMETHYLBENZENE	µg/L	2 / 3	8.0E-01	1.1E+00	NA	--	--	--
	1,3-DICHLOROBENZENE	µg/L	25 / 218	1.6E-01	1.3E+01	0 / 1	--	--	No
	1,4-DICHLOROBENZENE	µg/L	47 / 218	1.1E-01	1.6E+01	0 / 1	--	--	No
	2,4-DIMETHYLPHENOL	µg/L	15 / 191	1.0E-01	2.4E+01	0 / 1	--	--	No
	2-BUTANONE	µg/L	1 / 103	4.0E+00	4.0E+00	NA	--	--	--
	2-CHLOROPHENOL	µg/L	1 / 191	7.0E-02	7.0E-02	0 / 1	--	--	No
	2-HEXANONE	µg/L	2 / 120	2.5E+00	3.0E+00	NA	--	--	--
	2-METHYLNAPHTHALENE	µg/L	22 / 194	2.0E-01	2.2E+01	0 / 1	--	--	No
	2-METHYLPHENOL	µg/L	4 / 191	4.0E-01	8.0E+00	0 / 1	--	--	No
	2-NITROPHENOL	µg/L	1 / 194	2.3E+00	2.3E+00	0 / 1	--	--	No
	4,4'-DDD	µg/L	3 / 177	1.2E-02	2.8E-02	0 / 1	--	--	No
	4,4'-DDE	µg/L	3 / 177	6.4E-03	2.2E-02	0 / 1	--	--	No
	4,4'-DDT	µg/L	9 / 177	7.1E-03	1.3E-01	0 / 1	--	--	No
	4-CHLORO-3-METHYLPHENOL	µg/L	1 / 191	1.4E+01	1.4E+01	0 / 1	--	--	No
4-METHYL-2-PENTANONE	µg/L	3 / 102	1.9E+00	2.6E+01	NA	--	--	--	
4-METHYLPHENOL	µg/L	21 / 191	1.3E+00	3.0E+01	0 / 1	--	--	No	
4-NITROPHENOL	µg/L	1 / 191	7.5E+00	7.5E+00	0 / 1	--	--	No	
ACENAPHTHENE	µg/L	25 / 194	3.3E-01	2.8E+01	0 / 1	--	--	No	

TABLE E-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration or HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A-Aquifer (cont.)	ACENAPHTHYLENE	µg/L	8 / 194	2.7E-01	2.0E+00	0 / 1	--	--	No
	ACETONE	µg/L	1 / 118	6.6E+01	6.6E+01	NA	--	--	--
	ALPHA-CHLORDANE	µg/L	2 / 177	9.8E-03	3.0E-02	0 / 1	--	--	No
	ALUMINUM	µg/L	45 / 190	1.7E+01	1.8E+05	1 / 1	2.9E+02	2.9E+02	No
	ANTHRACENE	µg/L	4 / 194	2.0E-01	3.5E+00	0 / 1	--	--	No
	ANTIMONY	µg/L	79 / 188	1.7E-01	2.9E+02	1 / 1	2.8E+01	2.8E+01	No
	AROCLOR-1242	µg/L	8 / 183	3.5E+00	4.0E+01	0 / 1	--	--	No
	AROCLOR-1254	µg/L	9 / 183	1.0E-01	5.3E+00	0 / 1	--	--	No
	AROCLOR-1260	µg/L	38 / 183	1.0E-01	3.7E+01	0 / 1	--	--	No
	ARSENIC	µg/L	116 / 198	8.0E-01	2.1E+02	1 / 1	4.7E+00	4.7E+00	No
	BARIUM	µg/L	195 / 196	1.6E+01	7.5E+03	1 / 1	2.8E+02	2.8E+02	No
	BENZENE	µg/L	83 / 214	1.6E-01	4.4E+01	0 / 1	--	--	No
	BENZO(A)ANTHRACENE	µg/L	8 / 194	2.0E-01	8.7E+00	0 / 1	--	--	No
	BENZO(A)PYRENE	µg/L	5 / 192	1.4E+00	3.5E+00	0 / 1	--	--	No
	BENZO(B)FLUORANTHENE	µg/L	5 / 192	1.5E+00	6.0E+00	0 / 1	--	--	No
	BENZO(G,H,I)PERYLENE	µg/L	3 / 192	1.4E+00	3.0E+00	0 / 1	--	--	No
	BENZO(K)FLUORANTHENE	µg/L	1 / 192	1.1E+00	1.1E+00	0 / 1	--	--	No
	BENZOIC ACID	µg/L	7 / 179	1.5E+00	2.2E+01	0 / 1	--	--	No
	BENZYL ALCOHOL	µg/L	1 / 150	7.5E-01	7.5E-01	0 / 1	--	--	No
	BERYLLIUM	µg/L	15 / 188	2.7E-01	5.1E+00	0 / 1	--	--	No
	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	1 / 194	3.1E+00	3.1E+00	0 / 1	--	--	No
	BROMOMETHANE	µg/L	1 / 214	3.8E-01	3.8E-01	0 / 1	--	--	No
	CADMIUM	µg/L	24 / 191	4.0E-01	4.8E+01	0 / 1	--	--	No
	CARBAZOLE	µg/L	1 / 44	5.3E-01	5.3E-01	NA	--	--	--
	CARBON DISULFIDE	µg/L	20 / 141	1.9E-01	9.8E+00	NA	--	--	--
	CHLOROBENZENE	µg/L	52 / 213	1.2E-01	2.4E+01	0 / 1	--	--	No
	CHLOROETHANE	µg/L	15 / 214	2.1E-01	1.0E+01	0 / 1	--	--	No

TABLE E-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration or HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A-Aquifer (cont.)	CHLOROFORM	µg/L	8 / 214	1.7E-01	2.4E+00	0 / 1	--	--	No
	CHLOROMETHANE	µg/L	3 / 214	2.0E-01	4.0E-01	0 / 1	--	--	No
	CHROMIUM	µg/L	89 / 193	5.2E-01	2.8E+03	1 / 1	2.1E+01	2.1E+01	No
	CHRYSENE	µg/L	14 / 194	1.0E-01	1.0E+01	0 / 1	--	--	No
	CIS-1,2-DICHLOROETHENE	µg/L	25 / 127	1.2E-01	5.0E+01	0 / 1	--	--	No
	COBALT	µg/L	91 / 187	5.6E-01	5.3E+02	1 / 1	5.6E+00	5.6E+00	No
	COPPER	µg/L	68 / 194	1.5E+00	1.6E+04	1 / 1	1.2E+03	1.2E+03	No
	CYANIDE	µg/L	14 / 135	1.4E+00	8.0E+01	0 / 1	--	--	No
	CYCLOHEXANE	µg/L	10 / 38	2.1E-01	2.4E+00	NA	--	--	--
	DELTA-BHC	µg/L	1 / 177	1.0E-02	1.0E-02	0 / 1	--	--	No
	DIAZINON	µg/L	2 / 82	2.0E-01	5.0E-01	0 / 1	--	--	No
	DIBENZ(A,H)ANTHRACENE	µg/L	1 / 192	1.3E+00	1.3E+00	0 / 1	--	--	No
	DIBENZOFURAN	µg/L	14 / 194	3.6E-01	1.7E+01	0 / 1	--	--	No
	DIELDRIN	µg/L	2 / 177	1.5E-02	1.3E-01	0 / 1	--	--	No
	DIETHYLPHTHALATE	µg/L	2 / 194	1.0E+01	2.5E+01	0 / 1	--	--	No
	DI-N-BUTYLPHTHALATE	µg/L	1 / 194	2.5E+01	2.5E+01	0 / 1	--	--	No
	ENDOSULFAN I	µg/L	1 / 177	3.0E-02	3.0E-02	0 / 1	--	--	No
	ENDOSULFAN II	µg/L	4 / 177	1.6E-02	8.0E-02	0 / 1	--	--	No
	ENDOSULFAN SULFATE	µg/L	2 / 177	1.5E-02	4.0E-02	0 / 1	--	--	No
	ENDRIN	µg/L	4 / 177	8.0E-03	1.0E-01	0 / 1	--	--	No
	ENDRIN ALDEHYDE	µg/L	3 / 103	2.0E-02	6.1E-02	0 / 1	--	--	No
	ENDRIN KETONE	µg/L	1 / 147	7.0E-02	7.0E-02	0 / 1	--	--	No
	ETHYLBENZENE	µg/L	39 / 213	1.4E-01	2.5E+01	0 / 1	--	--	No
	FLUORANTHENE	µg/L	14 / 194	5.0E-01	1.3E+01	0 / 1	--	--	No
FLUORENE	µg/L	26 / 194	3.4E-01	1.8E+01	0 / 1	--	--	No	
GAMMA-BHC (LINDANE)	µg/L	3 / 177	8.0E-03	3.0E-02	0 / 1	--	--	No	
GAMMA-CHLORDANE	µg/L	5 / 177	9.0E-03	8.0E-02	0 / 1	--	--	No	

TABLE E-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration or HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A-Aquifer (cont.)	HEPTACHLOR	µg/L	8 / 177	6.0E-03	1.0E+00	0 / 1	--	--	No
	HEPTACHLOR EPOXIDE	µg/L	2 / 147	9.0E-03	6.6E-02	0 / 1	--	--	No
	HEPTACHLOR EPOXIDE A	µg/L	3 / 30	7.0E-03	3.7E-02	NA	--	--	--
	HEPTACHLOR EPOXIDE B	µg/L	3 / 30	5.1E-03	1.5E-02	NA	--	--	--
	INDENO(1,2,3-CD)PYRENE	µg/L	3 / 192	8.1E-01	3.0E+00	0 / 1	--	--	No
	IRON	µg/L	99 / 138	1.1E+01	3.3E+05	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	19 / 41	7.0E-02	6.0E+01	NA	--	--	--
	LEAD	µg/L	64 / 195	4.6E-02	6.5E+03	1 / 1	6.7E+00	6.7E+00	No
	M,P-XYLENES	µg/L	14 / 41	2.5E-01	1.1E+01	NA	--	--	--
	MANGANESE	µg/L	187 / 187	4.0E-01	9.7E+03	1 / 1	1.5E+03	1.5E+03	No
	MERCURY	µg/L	25 / 193	1.0E-01	3.3E+02	1 / 1	1.4E+01	1.4E+01	No
	METHYLCYCLOHEXANE	µg/L	7 / 38	3.0E-01	2.1E+00	NA	--	--	--
	MOLYBDENUM	µg/L	32 / 113	1.1E+00	4.0E+01	NA	--	--	--
	NAPHTHALENE	µg/L	41 / 194	3.0E-01	1.9E+02	0 / 1	--	--	No
	NICKEL	µg/L	134 / 199	1.9E+00	6.3E+03	1 / 1	1.2E+01	1.2E+01	No
	N-NITROSODIPHENYLAMINE	µg/L	5 / 194	2.9E+00	6.0E+00	0 / 1	--	--	No
	O-XYLENE	µg/L	16 / 41	1.1E-01	4.8E+00	NA	--	--	--
	PENTACHLOROPHENOL	µg/L	2 / 191	2.0E+00	6.0E+00	0 / 1	--	--	No
	PHENANTHRENE	µg/L	22 / 194	3.0E-01	3.9E+01	0 / 1	--	--	No
	PHENOL	µg/L	34 / 191	8.0E-01	1.2E+02	0 / 1	--	--	No
	PROPYLBENZENE	µg/L	2 / 3	4.0E-01	8.0E-01	NA	--	--	--
	PYRENE	µg/L	13 / 194	9.0E-01	1.5E+01	0 / 1	--	--	No
	SEC-BUTYLBENZENE	µg/L	1 / 3	1.0E+00	1.0E+00	NA	--	--	--
SELENIUM	µg/L	16 / 178	2.2E+00	2.1E+01	0 / 1	--	--	No	
SILVER	µg/L	12 / 190	2.7E-01	8.6E+00	0 / 1	--	--	No	
TERT-BUTYL METHYL ETHER	µg/L	16 / 127	8.0E-02	1.7E+00	0 / 1	--	--	No	
TETRACHLOROETHENE	µg/L	20 / 213	1.3E-01	6.2E+01	0 / 1	--	--	No	

TABLE E-2: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, A-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration or HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A-Aquifer (cont.)	THALLIUM	µg/L	3 / 179	2.1E-02	1.2E-01	0 / 1	--	--	No
	TOLUENE	µg/L	46 / 213	1.0E-01	7.0E+00	0 / 1	--	--	No
	TRANS-1,2-DICHLOROETHENE	µg/L	11 / 127	2.3E-01	7.2E+00	0 / 1	--	--	No
	TRICHLOROETHENE	µg/L	21 / 214	1.2E-01	4.4E+02	0 / 1	--	--	No
	TRICHLOROFUOROMETHANE	µg/L	1 / 114	3.9E-01	3.9E-01	0 / 1	--	--	No
	VANADIUM	µg/L	64 / 114	1.3E+00	5.5E+02	NA	--	--	--
	VINYL CHLORIDE	µg/L	12 / 214	3.6E-01	4.2E+00	0 / 1	--	--	No
	XYLENE (TOTAL)	µg/L	46 / 172	2.3E-01	1.6E+02	0 / 1	--	--	No
ZINC	µg/L	58 / 197	1.9E+00	6.8E+03	1 / 1	2.4E+02	2.4E+02	No	

Notes:

a See Table E-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.

- Not applicable
- µg/L Microgram per liter
- BHC Benzene hexachloride
- COPC Chemical of potential concern
- DDD Dichlorodiphenyldichloroethane
- DDE Dichlorodiphenyldichloroethene
- DDT Dichlorodiphenyltrichloroethane
- HHRA Human health risk assessment
- NA Not analyzed

TABLE E-3: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A+B-Aquifer	1,1,1-TRICHLOROETHANE	µg/L	10 / 278	2.1E+01	1.5E+02	0 / 16	--	--	No
	1,1,2,2-TETRACHLOROETHANE	µg/L	1 / 277	2.3E+00	2.3E+00	0 / 16	--	--	No
	1,1-DICHLOROETHANE	µg/L	25 / 278	1.0E-01	5.0E+01	0 / 16	--	--	No
	1,1-DICHLOROETHENE	µg/L	10 / 278	2.0E+01	4.4E+01	0 / 16	--	--	No
	1,2,3-TRICHLOROPROPANE	µg/L	1 / 110	5.5E-01	5.5E-01	1 / 16	5.5E-01	5.5E-01	Yes ^c
	1,2,4-TRICHLOROBENZENE	µg/L	3 / 284	3.2E-01	5.2E-01	0 / 16	--	--	No
	1,2,4-TRIMETHYLBENZENE	µg/L	5 / 6	1.1E+00	3.7E+00	NA	--	--	--
	1,2-DICHLOROBENZENE	µg/L	17 / 282	9.0E-02	6.7E+00	0 / 16	--	--	No
	1,2-DICHLOROETHANE	µg/L	15 / 278	1.3E-01	3.5E+00	2 / 16	3.0E+00	3.3E+00	No
	1,2-DICHLOROETHENE (TOTAL)	µg/L	8 / 105	8.0E-01	9.0E+00	NA	--	--	--
	1,3,5-TRIMETHYLBENZENE	µg/L	5 / 6	4.0E-01	1.1E+00	NA	--	--	--
	1,3-DICHLOROBENZENE	µg/L	25 / 282	1.6E-01	1.3E+01	0 / 16	--	--	No
	1,4-DICHLOROBENZENE	µg/L	47 / 282	1.1E-01	1.6E+01	0 / 16	--	--	No
	2,4-DIMETHYLPHENOL	µg/L	16 / 250	1.0E-01	2.4E+01	0 / 16	--	--	No
	2-BUTANONE	µg/L	1 / 129	4.0E+00	4.0E+00	NA	--	--	--
	2-CHLOROPHENOL	µg/L	1 / 250	7.0E-02	7.0E-02	0 / 16	--	--	No
	2-HEXANONE	µg/L	2 / 151	2.5E+00	3.0E+00	NA	--	--	--
	2-METHYLNAPHTHALENE	µg/L	28 / 256	2.0E-01	2.2E+01	3 / 16	2.2E+00	8.7E+00	No
	2-METHYLPHENOL	µg/L	4 / 250	4.0E-01	8.0E+00	0 / 16	--	--	No
	2-NITROPHENOL	µg/L	1 / 256	2.3E+00	2.3E+00	0 / 16	--	--	No
	4,4'-DDD	µg/L	3 / 235	1.2E-02	2.8E-02	0 / 16	--	--	No
	4,4'-DDE	µg/L	4 / 235	6.4E-03	2.2E-02	0 / 16	--	--	No
	4,4'-DDT	µg/L	9 / 235	7.1E-03	1.3E-01	0 / 16	--	--	No
	4-CHLORO-3-METHYLPHENOL	µg/L	1 / 250	1.4E+01	1.4E+01	0 / 16	--	--	No
	4-METHYL-2-PENTANONE	µg/L	3 / 128	1.9E+00	2.6E+01	NA	--	--	--
	4-METHYLPHENOL	µg/L	22 / 250	1.3E+00	3.0E+01	0 / 16	--	--	No
	4-NITROPHENOL	µg/L	1 / 250	7.5E+00	7.5E+00	0 / 16	--	--	No
ACENAPHTHENE	µg/L	29 / 256	3.3E-01	2.8E+01	0 / 16	--	--	No	
ACENAPHTHYLENE	µg/L	8 / 256	2.7E-01	2.0E+00	0 / 16	--	--	No	
ACETONE	µg/L	1 / 139	6.6E+01	6.6E+01	NA	--	--	--	

TABLE E-3: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A+B-Aquifer (cont.)	ALPHA-CHLORDANE	µg/L	2 / 235	9.8E-03	3.0E-02	0 / 16	--	--	No
	ALUMINUM	µg/L	60 / 248	1.7E+01	1.8E+05	6 / 15	4.1E+01	5.2E+02	No
	ANTHRACENE	µg/L	4 / 256	2.0E-01	3.5E+00	0 / 16	--	--	No
	ANTIMONY	µg/L	97 / 245	1.7E-01	2.9E+02	7 / 15	2.6E+00	3.2E+01	No
	AROCLOR-1242	µg/L	8 / 239	3.5E+00	4.0E+01	0 / 15	--	--	No
	AROCLOR-1254	µg/L	9 / 239	1.0E-01	5.3E+00	0 / 15	--	--	No
	AROCLOR-1260	µg/L	38 / 239	1.0E-01	3.7E+01	0 / 15	--	--	No
	ARSENIC	µg/L	146 / 254	8.0E-01	2.1E+02	9 / 15	2.8E+00	2.8E+01	No
	BARIUM	µg/L	251 / 252	8.9E+00	7.5E+03	15 / 15	9.8E+00	2.8E+02	No
	BENZENE	µg/L	91 / 278	1.6E-01	4.4E+01	2 / 16	6.2E-01	1.3E+00	No
	BENZO(A)ANTHRACENE	µg/L	9 / 256	2.0E-01	8.7E+00	0 / 16	--	--	No
	BENZO(A)PYRENE	µg/L	6 / 254	8.3E-01	3.5E+00	0 / 16	--	--	No
	BENZO(B)FLUORANTHENE	µg/L	7 / 254	6.1E-01	6.0E+00	0 / 16	--	--	No
	BENZO(G,H,I)PERYLENE	µg/L	3 / 254	1.4E+00	3.0E+00	0 / 16	--	--	No
	BENZO(K)FLUORANTHENE	µg/L	2 / 254	1.1E+00	1.2E+00	0 / 16	--	--	No
	BENZOIC ACID	µg/L	7 / 238	1.5E+00	2.2E+01	0 / 16	--	--	No
	BENZYL ALCOHOL	µg/L	1 / 202	7.5E-01	7.5E-01	0 / 16	--	--	No
	BERYLLIUM	µg/L	18 / 244	2.7E-01	5.1E+00	0 / 15	--	--	No
	BETA-BHC	µg/L	1 / 235	3.8E-02	3.8E-02	0 / 16	--	--	No
	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	2 / 256	3.1E+00	1.6E+02	0 / 16	--	--	No
	BROMOMETHANE	µg/L	2 / 278	3.8E-01	2.3E+00	1 / 16	2.3E+00	2.3E+00	Yes ^d
	CADMIUM	µg/L	31 / 249	4.0E-01	4.8E+01	0 / 15	--	--	No
	CARBAZOLE	µg/L	3 / 54	3.6E-01	5.3E-01	NA	--	--	--
	CARBON DISULFIDE	µg/L	22 / 174	1.9E-01	9.8E+00	NA	--	--	--
	CARBON TETRACHLORIDE	µg/L	1 / 278	3.0E+00	3.0E+00	0 / 16	--	--	No
	CHLOROBENZENE	µg/L	53 / 277	1.2E-01	2.4E+01	0 / 16	--	--	No
CHLOROETHANE	µg/L	16 / 278	2.1E-01	1.0E+01	1 / 16	3.0E-01	3.0E-01	No	
CHLOROFORM	µg/L	16 / 278	1.7E-01	4.4E+00	5 / 16	3.8E-01	1.6E+00	No	
CHLOROMETHANE	µg/L	3 / 278	2.0E-01	4.0E-01	0 / 16	--	--	No	

TABLE E-3: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A+B-Aquifer (cont.)	CHLORPYRIFOS	µg/L	3 / 120	3.2E-02	1.3E-01	3 / 15	3.2E-02	1.3E-01	Yes ^d
	CHROMIUM	µg/L	103 / 250	5.2E-01	2.8E+03	3 / 15	6.2E+00	2.1E+01	No
	CHROMIUM VI	µg/L	1 / 125	1.3E+02	1.3E+02	NA	--	--	--
	CHRYSENE	µg/L	15 / 256	1.0E-01	1.0E+01	0 / 16	--	--	No
	CIS-1,2-DICHLOROETHENE	µg/L	30 / 173	1.2E-01	5.0E+01	0 / 16	--	--	No
	COBALT	µg/L	106 / 243	5.6E-01	5.3E+02	7 / 15	7.0E-01	5.6E+00	No
	COPPER	µg/L	87 / 250	1.1E+00	1.6E+04	5 / 15	1.1E+00	1.2E+03	No
	CYANIDE	µg/L	17 / 186	1.4E+00	8.0E+01	2 / 14	5.4E+00	7.3E+00	No
	CYCLOHEXANE	µg/L	11 / 45	2.1E-01	2.4E+00	NA	--	--	--
	DELTA-BHC	µg/L	1 / 235	1.0E-02	1.0E-02	0 / 16	--	--	No
	DIAZINON	µg/L	2 / 120	2.0E-01	5.0E-01	0 / 15	--	--	No
	DIBENZ(A,H)ANTHRACENE	µg/L	1 / 254	1.3E+00	1.3E+00	0 / 16	--	--	No
	DIBENZOFURAN	µg/L	17 / 256	3.6E-01	1.7E+01	0 / 16	--	--	No
	DIELDRIN	µg/L	2 / 235	1.5E-02	1.3E-01	0 / 16	--	--	No
	DIETHYLPHTHALATE	µg/L	2 / 256	1.0E+01	2.5E+01	0 / 16	--	--	No
	DI-N-BUTYLPHTHALATE	µg/L	1 / 256	2.5E+01	2.5E+01	0 / 16	--	--	No
	ENDOSULFAN I	µg/L	1 / 235	3.0E-02	3.0E-02	0 / 16	--	--	No
	ENDOSULFAN II	µg/L	4 / 235	1.6E-02	8.0E-02	0 / 16	--	--	No
	ENDOSULFAN SULFATE	µg/L	2 / 235	1.5E-02	4.0E-02	0 / 16	--	--	No
	ENDRIN	µg/L	4 / 235	8.0E-03	1.0E-01	0 / 16	--	--	No
	ENDRIN ALDEHYDE	µg/L	3 / 143	2.0E-02	6.1E-02	0 / 16	--	--	No
	ENDRIN KETONE	µg/L	1 / 197	7.0E-02	7.0E-02	0 / 16	--	--	No
	ETHYLBENZENE	µg/L	45 / 277	1.4E-01	2.5E+01	1 / 16	2.4E-01	2.4E-01	No
	FLUORANTHENE	µg/L	17 / 256	3.0E-01	1.3E+01	0 / 16	--	--	No
	FLUORENE	µg/L	30 / 256	3.4E-01	1.8E+01	0 / 16	--	--	No
	GAMMA-BHC (LINDANE)	µg/L	3 / 235	8.0E-03	3.0E-02	0 / 16	--	--	No
	GAMMA-CHLORDANE	µg/L	5 / 235	9.4E-03	8.0E-02	0 / 16	--	--	No
	HEPTACHLOR	µg/L	8 / 235	6.7E-03	1.0E+00	0 / 16	--	--	No
HEPTACHLOR EPOXIDE	µg/L	2 / 197	9.0E-03	6.6E-02	0 / 16	--	--	No	
HEPTACHLOR EPOXIDE A	µg/L	3 / 38	7.0E-03	3.7E-02	NA	--	--	--	

TABLE E-3: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A+B-Aquifer (cont.)	HEPTACHLOR EPOXIDE B	µg/L	3 / 38	5.1E-03	1.5E-02	NA	--	--	--
	INDENO(1,2,3-CD)PYRENE	µg/L	3 / 254	8.1E-01	3.0E+00	0 / 16	--	--	No
	IRON	µg/L	118 / 169	1.1E+01	3.3E+05	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	20 / 51	7.0E-02	6.0E+01	NA	--	--	--
	LEAD	µg/L	79 / 251	4.6E-02	6.5E+03	5 / 15	2.4E+00	1.1E+01	No
	M,P-XYLENES	µg/L	18 / 51	2.5E-01	1.1E+01	NA	--	--	--
	MANGANESE	µg/L	243 / 243	4.0E-01	9.7E+03	15 / 15	3.1E+00	2.7E+03	No
	MERCURY	µg/L	26 / 249	1.0E-01	3.3E+02	1 / 15	1.4E+01	1.4E+01	No
	METHYLCYCLOHEXANE	µg/L	8 / 45	2.0E-01	2.1E+00	NA	--	--	--
	MOLYBDENUM	µg/L	35 / 137	1.1E+00	4.0E+01	NA	--	--	--
	NAPHTHALENE	µg/L	48 / 256	3.0E-01	1.9E+02	3 / 16	2.7E+00	7.7E+00	No
	NICKEL	µg/L	148 / 255	1.3E+00	6.3E+03	5 / 15	3.7E+00	1.2E+01	No
	N-NITROSODIPHENYLAMINE	µg/L	5 / 256	2.9E+00	6.0E+00	0 / 16	--	--	No
	O-XYLENE	µg/L	20 / 51	1.1E-01	4.8E+00	NA	--	--	--
	PENTACHLOROPHENOL	µg/L	2 / 250	2.0E+00	6.0E+00	0 / 16	--	--	No
	PHENANTHRENE	µg/L	26 / 256	3.0E-01	3.9E+01	0 / 16	--	--	No
	PHENOL	µg/L	34 / 250	8.0E-01	1.2E+02	0 / 16	--	--	No
	PROPYLBENZENE	µg/L	3 / 6	2.0E-01	8.0E-01	NA	--	--	--
	PYRENE	µg/L	17 / 256	7.0E-01	1.5E+01	0 / 16	--	--	No
	SEC-BUTYLBENZENE	µg/L	1 / 6	1.0E+00	1.0E+00	NA	--	--	--
	SELENIUM	µg/L	17 / 231	2.2E+00	2.1E+01	0 / 15	--	--	No
	SILVER	µg/L	12 / 246	2.7E-01	8.6E+00	0 / 15	--	--	No
	TERT-BUTYL METHYL ETHER	µg/L	16 / 173	8.0E-02	1.7E+00	0 / 16	--	--	No
	TETRACHLOROETHENE	µg/L	21 / 277	1.3E-01	6.2E+01	0 / 16	--	--	No
	THALLIUM	µg/L	4 / 232	2.1E-02	2.0E-01	0 / 15	--	--	No
	TOLUENE	µg/L	58 / 277	1.0E-01	7.0E+00	2 / 16	7.6E-01	8.3E-01	No
	TRANS-1,2-DICHLOROETHENE	µg/L	11 / 173	2.3E-01	7.2E+00	0 / 16	--	--	No
	TRANS-1,3-DICHLOROPROPENE	µg/L	1 / 278	6.7E-01	6.7E-01	0 / 16	--	--	No
TRICHLOROETHENE	µg/L	30 / 278	1.2E-01	4.4E+02	0 / 16	--	--	No	
TRICHLOROFLUOROMETHANE	µg/L	1 / 155	3.9E-01	3.9E-01	0 / 16	--	--	No	

TABLE E-3: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, B-AQUIFER WITH POTENTIAL HYDRAULIC COMMUNICATION (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set ^a			Data Summary for Nonrepresentative Samples ^b			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 A+B-Aquifer (cont.)	VANADIUM	µg/L	72 / 138	1.3E+00	5.5E+02	NA	--	--	--
	VINYL CHLORIDE	µg/L	12 / 278	3.6E-01	4.2E+00	0 / 16	--	--	No
	XYLENE (TOTAL)	µg/L	51 / 226	2.2E-01	1.6E+02	3 / 16	2.2E-01	2.2E+00	No
	ZINC	µg/L	69 / 253	1.9E+00	6.8E+03	1 / 15	2.4E+02	2.4E+02	No

Notes:

- a Data summary shown for the Parcel E-2 plume is based on B-aquifer data combined with A-aquifer data to address potential hydraulic communication between the A- and B-aquifers.
- b See Table E-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- c Chemical was identified as a chemical of concern in the HHRA.
- d Chemical was not identified as a chemical of concern in the HHRA.
- Not applicable
- µg/L Microgram per liter
- BHC Benzene hexachloride
- COPC Chemical of potential concern
- DDD Dichlorodiphenyldichloroethane
- DDE Dichlorodiphenyldichloroethene
- DDT Dichlorodichloroethane
- HHRA Human health risk assessment
- NA Not analyzed

TABLE E-4: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, B-AQUIFER
 Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 B-Aquifer	1,2,3-TRICHLOROPROPANE	µg/L	1 / 34	5.5E-01	5.5E-01	1 / 15	5.5E-01	5.5E-01	Yes ^b
	1,2,4-TRICHLOROBENZENE	µg/L	1 / 64	5.0E-01	5.0E-01	0 / 15	--	--	No
	1,2,4-TRIMETHYLBENZENE	µg/L	3 / 3	1.1E+00	2.2E+00	NA	--	--	--
	1,2-DICHLOROBENZENE	µg/L	1 / 64	9.0E-02	9.0E-02	0 / 15	--	--	No
	1,2-DICHLOROETHANE	µg/L	5 / 64	1.3E-01	3.5E+00	2 / 15	3.0E+00	3.3E+00	No
	1,3,5-TRIMETHYLBENZENE	µg/L	3 / 3	4.0E-01	7.0E-01	NA	--	--	--
	2,4-DIMETHYLPHENOL	µg/L	1 / 59	2.0E+00	2.0E+00	0 / 15	--	--	No
	2-METHYLNAPHTHALENE	µg/L	6 / 62	1.0E+00	1.3E+01	3 / 15	2.2E+00	8.7E+00	No
	4,4'-DDE	µg/L	1 / 58	1.1E-02	1.1E-02	0 / 15	--	--	No
	4-METHYLPHENOL	µg/L	1 / 59	3.0E+00	3.0E+00	0 / 15	--	--	No
	ACENAPHTHENE	µg/L	4 / 62	2.0E+00	1.2E+01	0 / 15	--	--	No
	ALUMINUM	µg/L	15 / 58	2.5E+01	4.0E+03	5 / 14	4.1E+01	5.2E+02	No
	ANTIMONY	µg/L	18 / 57	2.5E-01	9.6E+01	6 / 14	2.6E+00	3.2E+01	No
	ARSENIC	µg/L	30 / 56	1.3E+00	2.8E+01	8 / 14	2.8E+00	2.8E+01	Yes ^c
	BARIUM	µg/L	56 / 56	8.9E+00	4.2E+02	14 / 14	9.8E+00	2.0E+02	No
	BENZENE	µg/L	8 / 64	4.6E-01	4.1E+00	2 / 15	6.2E-01	1.3E+00	No
	BENZO(A)ANTHRACENE	µg/L	1 / 62	9.0E-01	9.0E-01	0 / 15	--	--	No
	BENZO(A)PYRENE	µg/L	1 / 62	8.3E-01	8.3E-01	0 / 15	--	--	No
	BENZO(B)FLUORANTHENE	µg/L	2 / 62	6.1E-01	1.0E+00	0 / 15	--	--	No
	BENZO(K)FLUORANTHENE	µg/L	1 / 62	1.2E+00	1.2E+00	0 / 15	--	--	No
	BERYLLIUM	µg/L	3 / 58	2.8E-01	1.2E+00	0 / 14	--	--	No
	BETA-BHC	µg/L	1 / 58	3.8E-02	3.8E-02	0 / 15	--	--	No
	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	1 / 62	1.6E+02	1.6E+02	0 / 15	--	--	No
	BROMOMETHANE	µg/L	1 / 64	2.3E+00	2.3E+00	1 / 15	2.3E+00	2.3E+00	Yes ^c
	CADMIUM	µg/L	7 / 58	4.0E-01	8.0E+00	0 / 14	--	--	No
	CARBAZOLE	µg/L	2 / 10	3.6E-01	4.0E-01	NA	--	--	--
	CARBON DISULFIDE	µg/L	2 / 33	3.0E+00	3.0E+00	NA	--	--	--
CARBON TETRACHLORIDE	µg/L	1 / 64	3.0E+00	3.0E+00	0 / 15	--	--	No	
CHLOROBENZENE	µg/L	1 / 64	4.4E-01	4.4E-01	0 / 15	--	--	No	
CHLOROETHANE	µg/L	1 / 64	3.0E-01	3.0E-01	1 / 15	3.0E-01	3.0E-01	Yes ^c	

TABLE E-4: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, B-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 B-Aquifer (cont.)	CHLOROFORM	µg/L	8 / 64	3.8E-01	4.4E+00	5 / 15	3.8E-01	1.6E+00	No
	CHLORPYRIFOS	µg/L	3 / 38	3.2E-02	1.3E-01	3 / 14	3.2E-02	1.3E-01	Yes ^c
	CHROMIUM	µg/L	14 / 57	2.5E+00	8.0E+01	2 / 14	6.2E+00	6.9E+00	No
	CHROMIUM VI	µg/L	1 / 21	1.3E+02	1.3E+02	NA	--	--	--
	CHRYSENE	µg/L	1 / 62	1.2E+00	1.2E+00	0 / 15	--	--	No
	CIS-1,2-DICHLOROETHENE	µg/L	5 / 46	2.1E-01	8.0E-01	0 / 15	--	--	No
	COBALT	µg/L	15 / 56	7.0E-01	1.3E+01	6 / 14	7.0E-01	2.0E+00	No
	COPPER	µg/L	19 / 56	1.1E+00	1.2E+01	4 / 14	1.1E+00	3.1E+00	No
	CYANIDE	µg/L	3 / 51	5.4E+00	2.0E+01	2 / 13	5.4E+00	7.3E+00	No
	CYCLOHEXANE	µg/L	1 / 7	5.5E-01	5.5E-01	NA	--	--	--
	DIBENZOFURAN	µg/L	3 / 62	3.0E+00	8.0E+00	0 / 15	--	--	No
	ETHYLBENZENE	µg/L	6 / 64	2.4E-01	1.0E+00	1 / 15	2.4E-01	2.4E-01	No
	FLUORANTHENE	µg/L	3 / 62	3.0E-01	7.0E+00	0 / 15	--	--	No
	FLUORENE	µg/L	4 / 62	8.0E-01	7.0E+00	0 / 15	--	--	No
	IRON	µg/L	19 / 31	1.9E+01	7.6E+03	NA	--	--	--
	ISOPROPYLBENZENE	µg/L	1 / 10	9.0E-02	9.0E-02	NA	--	--	--
	LEAD	µg/L	15 / 56	7.9E-02	1.4E+01	4 / 14	2.4E+00	1.1E+01	No
	M,P-XYLENES	µg/L	4 / 10	2.9E+00	5.7E+00	NA	--	--	--
	MANGANESE	µg/L	56 / 56	3.1E+00	4.2E+03	14 / 14	3.1E+00	2.7E+03	No
	MERCURY	µg/L	1 / 56	3.6E-01	3.6E-01	0 / 14	--	--	No
	METHYLCYCLOHEXANE	µg/L	1 / 7	2.0E-01	2.0E-01	NA	--	--	--
	MOLYBDENUM	µg/L	3 / 24	6.4E+00	1.7E+01	NA	--	--	--
	NAPHTHALENE	µg/L	7 / 62	3.0E-01	3.7E+01	3 / 15	2.7E+00	7.7E+00	No
	NICKEL	µg/L	14 / 56	1.3E+00	7.6E+01	4 / 14	3.7E+00	6.1E+00	No
	O-XYLENE	µg/L	4 / 10	1.2E+00	2.3E+00	NA	--	--	--
	PHENANTHRENE	µg/L	4 / 62	6.0E-01	9.0E+00	0 / 15	--	--	No
PROPYLBENZENE	µg/L	1 / 3	2.0E-01	2.0E-01	NA	--	--	--	
PYRENE	µg/L	4 / 62	7.0E-01	5.2E+00	0 / 15	--	--	No	
SELENIUM	µg/L	1 / 53	1.0E+01	1.0E+01	0 / 14	--	--	No	
TETRACHLOROETHENE	µg/L	1 / 64	2.3E-01	2.3E-01	0 / 15	--	--	No	

TABLE E-4: COMPARISON OF ANALYTICAL DATA FOR NONREPRESENTATIVE SAMPLES TO HHRA DATA SET: PARCEL E-2 PLUME, B-AQUIFER (Continued)

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Exposure Area	COPC Evaluated in HHRA	Unit	Data Summary for HHRA Data Set			Data Summary for Nonrepresentative Samples ^a			Maximum Concentration for HHRA Data Set Based on Nonrepresentative Data Set?
			Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration	
Parcel E-2 B-Aquifer (cont.)	THALLIUM	µg/L	1 / 53	2.0E-01	2.0E-01	0 / 14	--	--	No
	TOLUENE	µg/L	12 / 64	1.2E-01	1.6E+00	2 / 15	7.6E-01	8.3E-01	No
	TRANS-1,3-DICHLOROPROPENE	µg/L	1 / 64	6.7E-01	6.7E-01	0 / 15	--	--	No
	TRICHLOROETHENE	µg/L	9 / 64	1.8E-01	3.2E+01	0 / 15	--	--	No
	VANADIUM	µg/L	8 / 24	5.2E+00	2.0E+01	NA	--	--	--
	XYLENE (TOTAL)	µg/L	5 / 54	2.2E-01	2.2E+00	3 / 15	2.2E-01	2.2E+00	Yes ^c
	ZINC	µg/L	11 / 56	7.4E+00	5.5E+01	0 / 14	--	--	No

Notes:

- a See Table E-1 for sampling locations, dates, and analyses associated with the nonrepresentative groundwater samples.
- b Chemical was identified as a chemical of concern in the HHRA.
- c Chemical was not identified as a chemical of concern in the HHRA.
- Not applicable
- µg/L Microgram per liter
- BHC Benzene hexachloride
- COPC Chemical of potential concern
- DDE Dichlorodiphenyldichloroethene
- HHRA Human health risk assessment
- NA Not analyzed

TABLE E-5: EVALUATION OF CHEMICALS WITH MAXIMUM CONCENTRATIONS FOR HHRA DATA SET BASED ON NONREPRESENTATIVE SAMPLE RESULTS, PARCEL E-2

Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard

Parcel	Exposure Area	Water-Bearing Unit	Chemical ^a	COC	Units	Data Summary for Nonrepresentative Samples ^b			HHRA Data Summary for Monitoring Wells Affected by Nonrepresentative Sampling, Excluding Nonrepresentative Sample Results		
						Detection Frequency	Minimum Concentration	Maximum Concentration	Detection Frequency	Minimum Concentration	Maximum Concentration
E-2	E-2 Plume	A+B	1,2,3-TRICHLOROPROPANE ^c	Yes	µg/L	1 / 16	5.5E-01	5.5E-01	0 / 13	--	--
			BROMOMETHANE	No	µg/L						
			CHLORPYRIFOS	No	µg/L						
		B	1,2,3-TRICHLOROPROPANE ^c	Yes	µg/L	1 / 15	5.5E-01	5.5E-01	0 / 11	--	--
			ARSENIC	Yes	µg/L	8 / 14	2.8E+00	2.8E+01	12 / 21	1.3E+00	1.6E+01
			BROMOMETHANE	No	µg/L						
			CHLOROETHANE	No	µg/L						
			CHLORPYRIFOS	No	µg/L						
			XYLENE (TOTAL)	No	µg/L						

Notes:



Data summary is not provided for chemicals that were not identified as COCs in the HHRA.

a The chemicals listed are those for which the maximum concentration in the HHRA data set is based on nonrepresentative sample results.

b See Table E-1 for sampling locations, dates, and analyses associated with the nonrepresentative samples.

c The only detection of this chemical is associated with results for nonrepresentative samples.

-- Not applicable

µg/L Microgram per liter

A A-aquifer

B B-aquifer

COC Chemical of concern

HHRA Human health risk assessment

**ATTACHMENT F
RESPONSES TO REGULATORY AGENCY COMMENTS ON THE DRAFT
TECHNICAL MEMORANDUM: NONREPRESENTATIVE GROUNDWATER
SAMPLES AND INFLUENCE ON RESULTS OF HUMAN HEALTH RISK
ASSESSMENTS FOR HUNTERS POINT SHIPYARD**

TABLE F-1: RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT TECHNICAL MEMORANDUM: NONREPRESENTATIVE GROUNDWATER SAMPLES AND INFLUENCE ON RESULTS OF HUMAN HEALTH RISK ASSESSMENTS FOR HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, SEPTEMBER 28, 2007

The table below contains the responses to comments received from the San Francisco Regional Water Quality Control Board (Water Board) on the “Draft Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard, San Francisco, California,” dated September 28, 2007. The comments were submitted by Erich Simon (Water Board) on October 19, 2007.

No.	Comment	Response
General Comments		
1.	This memo sufficiently summarizes the impacts of the identified nonrepresentative groundwater sample results on previous human health risk assessments (HHRAs) and justifies the decision to not make any changes to impacted HHRAs.	<ul style="list-style-type: none"> No response necessary.
2.	This memo does not address how the representative groundwater sample results may have impacted decisions made based on potential impacts to the bay or ecological risk assessments. Please provide a justification for why these other potential impacts have not been addressed. This may be an issue for the BCT to resolve.	<ul style="list-style-type: none"> The Navy assumes that the comment refers to nonrepresentative groundwater samples, rather than representative groundwater samples. The methodology developed and agreed to by the Hunters Point Shipyard (HPS) Base Realignment and Closure Cleanup Team (BCT) for evaluation of the nonrepresentative groundwater samples was limited to evaluation of the influence of the nonrepresentative samples on the human health risk assessments (HHRA) for HPS (Navy 2007¹). The nonrepresentative sample results did not affect any decisions made on potential impacts to the bay or ecological risk assessments. The Navy’s groundwater monitoring program for HPS will monitor plumes identified in the feasibility studies for each parcel; this monitoring will address potential impacts to San Francisco Bay, including potential ecological risks associated with groundwater migration to the bay. The technical memorandum (TM) was not revised as a result of this comment.
3.	The inclusion of the nonrepresentative groundwater samples in remedial investigations and feasibility studies may have influenced decisions to remove groundwater wells and/or constituents of potential concern from further consideration. Please discuss how the nonrepresentative groundwater samples may have influenced these decisions. Furthermore, please discuss how any representative groundwater samples obtained	<ul style="list-style-type: none"> The Navy identified one well (IR09MW54B at Parcel D) associated with the nonrepresentative samples for removal from the groundwater monitoring program at HPS. The decision to exclude this well from further monitoring was not based on the results of the nonrepresentative samples, but was based on reevaluation of monitoring data needs for Parcel D, in anticipation of removal of the Parcel D sewer drain.

¹ Navy. 2007. Meeting Minutes, Hunters Point Shipyard Base Realignment and Closure Cleanup Team. May 22.

TABLE F-1: RESPONSES TO COMMENTS FROM THE WATER BOARD (Continued)

No.	Comment	Response
3. (cont.)	subsequent to the nonrepresentative groundwater samples will be used to confirm previous decisions and inform future remedial efforts.	<ul style="list-style-type: none"> • The Navy's evaluation of the influence of nonrepresentative groundwater samples on the results of the HHRAs for HPS shows that the nonrepresentative samples have negligible impacts on the HHRAs, and justifies the decision not to revise the HHRAs. Therefore, further assessment, such as evaluation of analytical results for subsequently obtained representative groundwater samples, is not necessary. • The TM was not revised as a result of this comment.
Specific Comments		
1.	Attachment D – Page D-2 – Middle Paragraph – Please briefly discuss if any vinyl chloride results for grid 071079 were obtained from representative samples collected after November 2004. If so, please discuss whether these results are consistent with previous representative samples (non-detect) or have elevated concentrations.	<ul style="list-style-type: none"> • The methodology developed and agreed to by the BCT for evaluation of the nonrepresentative groundwater samples focuses on influence of the samples on the HHRAs for HPS (Navy 2007²). The HHRA for Parcel E (discussed in Attachment D of the TM) evaluated groundwater data collected through the fourth quarter of monitoring for 2004. Evaluation of results from samples collected subsequent to 2004 was not part of the scope of the evaluation. However, the Navy reviewed vinyl chloride results for 10 separate groundwater sampling events for monitoring well IR36MW123B (located at grid 071079), collected during the first quarter 2005 through the third quarter 2007. Analytical results for all 10 samples indicated no detections of vinyl chloride; these results are consistent with the results for previous representative samples for vinyl chloride. • The TM was not revised as a result of this comment.
2.	Attachment E-Page E-2-Bottom Paragraph – This paragraph indicates that Table E-5 shows that 1,2,3-trichloropropane was detected once in 110 samples, with 104 results from representative samples and 16 results from nonrepresentative samples. First, these numbers don't add up correctly. Please resolve this discrepancy. Second, Table E-5 doesn't include the 110 sample number, as referred to in this paragraph. Table E-3 does indicate that 110 samples were used in the human health risk assessment data set, of which 16 samples were nonrepresentative samples. Please resolve this discrepancy as well.	<ul style="list-style-type: none"> • The paragraph in Attachment E that discusses 1,2,3-trichloropropane (TCP) was revised to show the correct number of representative samples (94 samples, rather than 104) for TCP. • The purpose of Table E-5 is to summarize the analytical results for nonrepresentative samples included in the HHRA for those chemicals for which the maximum concentration-based (or MAX scenario) exposure point concentration in the HHRA was based on a nonrepresentative sample. Table E-5 shows, for the subset of samples that consist of the nonrepresentative samples, the chemical detection frequency and minimum and maximum concentrations of the nonrepresentative samples. Sixteen samples are shown on Table E-5 for TCP because 16 nonrepresentative samples are associated with the HHRA data set for TCP. Table E-5 was not revised as a result of this comment.

² Navy. 2007. Meeting Minutes, Hunters Point Shipyard Base Realignment and Closure Cleanup Team. May 22.

TABLE F-2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT TECHNICAL MEMORANDUM: NONREPRESENTATIVE GROUNDWATER SAMPLES AND INFLUENCE ON RESULTS OF HUMAN HEALTH RISK ASSESSMENTS FOR HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA SEPTEMBER 28, 2007

The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC) on the “Draft Technical Memorandum: Nonrepresentative Groundwater Samples and Influence on Results of Human Health Risk Assessments for Hunters Point Shipyard, San Francisco, California, dated September 28, 2007. The comments were submitted by Thomas Lanphar (DTSC) on November 6, 2007.

No.	Comment	Response
1.	Review of risk calculations and conclusions is deferred to the Human and Ecological Risk Division (HERD).	<ul style="list-style-type: none"> No response required.
2a.	<p>Section 2 Methodology: Fundamental concerns regarding TM methodology are discussed below.</p> <p>Page 2 says (fourth paragraph): “Nonrepresentative samples were only collected during recent monitoring events, beginning with the second quarter of 2004”. However, this statement may not be correct if depths of samples were not reviewed for all sampling events. For example, for earliest events of the base wide groundwater program (BGMP), field sampling sheets (with depths of samples) were not provided with groundwater monitoring reports. Consequently, the tables (prepared by DTSC) which identified unrepresentative samples were not complete: this fact was stated in footnotes to the tables and in comments.</p> <p>The representativeness of samples from events which were not reviewed has not been demonstrated and should not be presumed.</p> <p>Recommendations</p> <ul style="list-style-type: none"> i) Clarify whether the TM evaluation relied primarily on the tables provided by DTSC or whether the entire HHRA data set was reviewed for nonrepresentativeness. ii) If the entire HHRA data set has not been reviewed by the Navy, please conduct such a review and identify all samples as either representative or nonrepresentative. Revise the TM, as needed. iii) Revise the language on page 2 (and elsewhere), as needed. iv) The Navy agreed to use data qualifiers to flag nonrepresentative samples. After reviewing all data for representativeness, please provide a complete flagged HHRA groundwater data set. 	<ul style="list-style-type: none"> (i) through (iii) Prior to evaluating the influence on the human health risk assessment (HHRA) results, the Navy reviewed the entire HHRA groundwater data set for Hunters Point Shipyard (HPS) for representativeness. Representativeness was assessed by comparing the location of the monitoring well pump with the screening interval for the well. If the pump was placed within the well screen interval, then the sample was determined to be representative. If the pump was placed in a location outside of the well screen interval, then the sample was determined to be potentially nonrepresentative. This methodology for determining nonrepresentative samples was discussed with the BCT during the May 2007 BCT meeting (Navy 2007³). The technical memorandum (TM) was revised to clarify how nonrepresentative samples were identified for the evaluation. (iv) Groundwater samples identified as nonrepresentative will be flagged in the Navy’s HPS database. The TM contains tables that list all of the samples identified as nonrepresentative (see Tables A-1, B-1, C-1, D-1, and E-1). In addition, the TM summarizes analytical results associated with the nonrepresentative samples (detection frequency and minimum and maximum detections). For purposes of this TM, it is not efficient to reproduce the entire HHRA data set with flags, as these data sets are thousands of pages in length. Each of the HHRAs for HPS already contains an attachment that lists all of the groundwater analytical data used in the HHRA. Tables A-1, B-1, C-1, D-1, and E-1 in the TM can be cross-referenced with the data attachments in the HHRAs to identify the specific analytical results associated with each nonrepresentative sample.

³ Navy. 2007. Meeting Minutes, Hunters Point Shipyard Base Realignment and Closure Cleanup Team. May 22.

TABLE F-2: RESPONSES TO COMMENTS FROM DTSC (Continued)

No.	Comment	Response
2b.	<p>Page 3, Second bullet says: “For each chemical, if the MAX [maximum] scenario EPC [exposure point concentration] was not based on the nonrepresentative sampling results, then it was concluded that the nonrepresentative samples did not affect the risks for that chemical.” This logic is faulty, if the status of all samples has not been determined (as discussed above). In any case, the statement on page 3 should be phrased as follows: “For each chemical, if the MAX scenario EPC was based on a representative sample, then it was concluded that the nonrepresentative samples did not affect the risks for that chemical.”</p> <p><u>Recommendation</u> Change page 3 second bullet as indicated. Revise the TM, as needed.</p>	<ul style="list-style-type: none"> As discussed in the response to DTSC specific comment 2a, the Navy reviewed the groundwater data sets for the HPS HHRA for representativeness. The second bullet on page 3 was revised to use DTSC’s suggested phrasing for the bullet.
2c.	<p>Page 4 (first paragraph) says: “It is also possible that chemical concentrations associated with the nonrepresentative samples are lower than would have resulted from samples collected from the proper well screen interval, and that risks may have been underestimated or that some chemicals may have been incorrectly excluded as COCs [chemicals of concern]...However, the use of 12 sampling events to comprise the HHRA data sets for each of the parcels and the MAX scenario...to identify COCs limits the possibility that risks may have been underestimated.”</p> <p>DTSC agrees with the first sentence in the quote. However, the logic of the last sentence is questionable because, in many cases, multiple samples from a specific well were collected from the same (or similar) incorrect interval. That is, multiple sampling events did not reduce uncertainty since samples were incorrectly collected during multiple events. And, as noted above, samples not reviewed with respect to representativeness cannot be presumed to be representative.</p> <p>To evaluate whether risks may have been underestimated or COCs not identified, the entire HHRA data set from each critical well (i.e., well with MAX results used in the HHRA) should be evaluated.</p> <p><u>Recommendation</u></p> <p>i) After the entire data set is reviewed with respect to representativeness (Comment 1), please evaluate each critical well with respect to whether risks may have been underestimated or COCs not identified. Revise TM text and tables to include critical well evaluations.</p>	<ul style="list-style-type: none"> As discussed in the response to DTSC specific comment 2a, the Navy reviewed the groundwater data sets for the HPS HHRA for representativeness. The methodology developed and agreed to by the BCT for evaluation of the nonrepresentative groundwater samples focuses on influence of the samples on the HHRA for HPS. As discussed with the BCT, the evaluation would compare maximum concentrations associated with nonrepresentative samples with exposure point concentrations (EPC) used in the HHRA (Navy 2007⁴). The methodology was not intended to evaluate the entire HHRA data set for all of the critical wells (that is, the monitoring wells associated with maximum concentration-based [MAX scenario] EPCs). The TM was not revised as a result of this comment.

⁴ Navy. 2007. Meeting Minutes, Hunters Point Shipyard Base Realignment and Closure Cleanup Team. May 22.

TABLE F-2: RESPONSES TO COMMENTS FROM DTSC (Continued)

No.	Comment	Response
2d.	<p>Definition of Nonrepresentative. The TM definition of nonrepresentative includes only those samples which were collected outside screened intervals. However, other factors contributed to nonrepresentativeness during sampling events, as noted in previous comments. These factors included: elevated dissolved oxygen (which results in biased results for volatile compounds and metals), elevated pH, oxidation-reduction potentials (ORP) inconsistent with dissolved oxygen concentrations, and elevated turbidity. Also, well condition has been an ongoing concern, including wells purged dry.</p> <p>Recommendations</p> <p>i) For critical wells, please evaluate other factors related to sample representativeness, and discuss any associated uncertainties.</p> <p>ii) For critical wells with nonrepresentative samples, evaluate nearby wells. For example, if results from nearby wells are representative and similar to the nonrepresentative results from critical wells used in the HHRA, then the results of the HHRA may not be unduly impacted by nonrepresentative samples.</p>	<ul style="list-style-type: none"> • (i) and (ii) Please see the response to DTSC specific comment 2a. The methodology developed and agreed to by the BCT to assess representativeness of groundwater samples used in the HHRA was limited to review of the location of the monitoring well pump with respect to the screening interval for the well (Navy 2007⁵). The objective of this evaluation was not to exhaustively evaluate all potential factors (for example, dissolved oxygen, pH, and turbidity) that may or may not affect the representativeness of samples. • The TM was not revised as a result of this comment.
2e.	<p>Site characterization and conceptual site model (CSM)</p> <p>i) A large percentage of samples collected from the B-aquifer and the F-aquifer are nonrepresentative. Moreover, the B-Aquifer has in general not been fully characterized, as noted in previous comments. For example, with respect to Parcel D, the following comment was provided on the Parcel D Feasibility Study Report:</p> <p>“Three B-aquifer wells are installed in Parcel D. From these wells, very few samples were collected in the B-Aquifer. For metals and VOCs, only one to three samples were analyzed (except 4 samples were analyzed for Cr, CrVI and Ni) (Tables 2-22 and 2-23). One to six samples were analyzed for water quality criteria (Table 2-24). Generally, from each well, at least eight quarters would be required for site characterization. The lack of data is shown as empty squares on Figure 3-10.”</p> <p>Recommendations</p> <p>(1) For critical wells, please evaluate the effect of nonrepresentative samples vis a vis adequacy of characterization and the CSM for each area used for risk assessment.</p> <p>(2) Discuss whether the data set of representative samples is sufficient for characterization. Discuss uncertainties of incomplete characterization.</p>	<ul style="list-style-type: none"> • (i)(1) and (i)(2) Please see the response to DTSC specific comments 2a and 2c. The objective of the TM was solely to evaluate the influence of the nonrepresentative samples on the HHRAs for HPS; evaluation of data sufficiency for site characterization was outside of the scope of this evaluation. • (ii)(1) Use of vertical extrapolation to identify exposure areas for the B-aquifer was based on the methodology agreed to by the U.S. Environmental Protection Agency (EPA), DTSC, and Navy during meetings in 2003 and 2004. The BCT has not commented on this methodology for the HHRAs for HPS, including the HHRA for the Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment (TMSRA) (ChaduxTt 2007⁶) and the HHRA for the Final Revised Feasibility Study for Parcel D (SulTech 2007⁷). Therefore, the Navy considers this approach to be acceptable to the BCT, and further evaluation of this approach is not needed. Please refer to the groundwater risk figures contained in the HHRAs for HPS for figures that show exposure areas based on vertical extrapolation. All plume-based exposure areas for the B-aquifer in Parcels D, E, and E-2 and for the B-aquifer and bedrock water-bearing zone in Parcel C are based on vertical extrapolation from the A-aquifer. Vertical extrapolation of plume boundaries for the A-aquifer to the B-aquifer was not necessary for Parcel B because monitoring wells are not collocated located in the B-aquifer at this parcel.

⁵ Navy. 2007. Meeting Minutes, Hunters Point Shipyard Base Realignment and Closure Cleanup Team. May 22.

⁶ ChaduxTt. 2007. "Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California." December 12.

⁷ SulTech. 2007. "Final Revised Feasibility Study for Parcel D, Hunters Point Shipyard, San Francisco, California." November 30.

TABLE F-2: RESPONSES TO COMMENTS FROM DTSC (Continued)

No.	Comment	Response
2e. (cont.)	<p>ii) Vertical extrapolation of A-Aquifer results to the B-Aquifer is not an accepted approach, except when supported by the CSM (e.g., at locations where A- and B- aquifers are not separated by an aquitard).</p> <p>Recommendation</p> <p>(1) Discuss uncertainties related to the vertical extrapolation from A-aquifer to B-aquifer on HHRA results. Provide a figure showing areas where vertical extrapolation was used: indicate COCs affected.</p> <p>iii) Treatability study (TS) wells were not included in the HHRA and are excluded from consideration in the TM. However, if results from the TS well exceed the MAX value used in the HHRA, then risks may be underestimated or COCs not identified. Consequently, some TS wells should be evaluated and discussed in the TM.</p> <p>Recommendation</p> <p>Evaluate results of TS wells. If results exceed MAX values used in the COC, please discuss whether risks may be underestimated or COCs not identified.</p>	<ul style="list-style-type: none"> (iii)(1) The HHRAs for HPS excluded analytical data collected from monitoring wells associated with treatability studies. This methodology was agreed to by the EPA, DTSC, and Navy during meetings in 2003 and 2004. The BCT has not commented on this methodology for the HHRAs for HPS, including the HHRA for the Final Parcel B TMSRA (ChaduxTt 2007⁸) and the HHRA for the Final Revised Feasibility Study for Parcel D (SulTech 2007⁹). Therefore, the Navy considers this approach to be acceptable to the BCT. As discussed, the evaluation of nonrepresentative groundwater samples focused on evaluation of the influence of these samples on the HHRAs. Further evaluation is not required to address treatability study data because these data were not included in the HHRAs. The TM was not revised as a result of this comment.
3a.	<p>Attachments: Parcel-specific information is presented in Attachments A through E. Some preliminary comments are provided below for Parcels B and D.</p> <p>Preliminary comments depend on responses to Comment 2 (above) — and so, they should be considered as conditional. Detailed comments may be provided after responses to Comment 2 are reviewed. Michelle Dalrymple, PG was the principal reviewer for groundwater for Parcels C, E and E-2. Detailed analysis of Parcels C, E and E-2 is deferred to Ms. Dalrymple.</p> <p>a) Attachment A: Nonrepresentative Groundwater Samples and Influence on HHRA Results for Parcel B</p> <p>Recommendations</p> <p>i) The text (page A-1) says that two samples were collected from two wells: but, only one well (IR10MW59A) is listed on Table A-1. Footnote b of Table A-1 says that samples were actually collected from well IR10MW74A but were “reported in monitoring reports as collected from IR10MW59A.” This error should not be propagated. Please correct Table A-1 to include IR10MW74A in the second column as a “Monitoring Well with Nonrepresentative Sample.” Revise footnote b accordingly.</p>	<ul style="list-style-type: none"> (i) Page A-1 of Attachment A was revised to state that two nonrepresentative samples were collected from one monitoring well at Parcel B during 2004. Table A-1 was revised so that monitoring well IR10MW74A is listed as the sampled well, rather than well IR10MW59A. Based on this change, revision to footnote (b) of Table A-1 was not needed. (ii) The “Distance Above Proper Well Screen Interval” was revised to reflect the screen interval for well IR10MW74A. (iii) and (iv) The nonrepresentative samples collected from well IR10MW74A are associated with treatability studies. As discussed in the response to DTSC specific comment 2e, treatability study data were not included in the HHRA. Therefore, further evaluation of analytical results for IR10MW74A is not necessary.

⁸ ChaduxTt. 2007. “Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California.” December 12.

⁹ SulTech. 2007. “Final Revised Feasibility Study for Parcel D, Hunters Point Shipyard, San Francisco, California.” November 30.

TABLE F-2: RESPONSES TO COMMENTS FROM DTSC (Continued)

No.	Comment	Response
3a. (cont.)	<p>ii) Include the screened interval for IR10MW74A on Table A-1 and adjust the fifth column ("Distance from Proper Well Screen Interval").</p> <p>iii) IR10MW74A samples were collected 14.5 to 22.5 feet below the screened interval for IR10MW59A, which indicates that the samples were collected from a deeper aquifer. Include the maximum concentration of IR10MW74A and discuss the relevance of IR10MW74A concentrations in the deeper aquifer.</p> <p>iv) Include maximum concentration of TS wells (including IR10MW59A) for all COCs, including all volatile organic compounds (VOCs) and VOC degradation products. Compare concentrations to the MAXs used in the HHRA.</p> <p>According to the DTSC table dated April 29, 2007, several wells with one or more samples collected outside screened intervals were not included on TM Table A-1, including: IR07MW21A1(R), IR07MW24A(R), IR07MW26A(R), IR07MW28A, IR10MW59A (22Q), IR26MW49A (no screened interval provided) and IR26MW50A (no screened interval provided), as well as dry well IR06MW42A. Please evaluate all wells with any samples collected outside screened intervals.</p>	<ul style="list-style-type: none"> • (v) Based on the Navy's evaluation, only two groundwater samples used in the HHRA for Parcel B may be potentially nonrepresentative. These samples are associated with well IR10MW74A, and are listed in Table A-1 of the TM. Data collected from wells IR07MW21A1(R), IR07MW24A(R), IR07MW26A(R), IR07MW28A, and IR06MW42A were not identified as nonrepresentative. Data not associated with nonrepresentative samples do not require further evaluation. Groundwater data evaluated in the HHRA for Parcel B were limited to data collected through the fourth quarter of 2004; therefore, data collected from well IR10MW59A during the second quarter of 2005 and wells IR26MW49A and IR26MW50A (both installed after 2004) were not included in the HHRA and do not require evaluation in the TM.
3b.	<p>b) Attachment C: Nonrepresentative Groundwater Samples and Influence on HHRA Results for Parcel D</p> <p>i) With respect to nonrepresentative samples collected from two Parcel D wells, page C-1 says: "All analytical results were nondetected. Therefore, the nonrepresentative samples do not influence the HHRA results for Parcel D." This logic is faulty. If nondetects were used to determine low risk or to eliminate COCs, then clearly, the nonrepresentative samples have influenced the HHRA. Moreover, low (or nondetected) concentrations per se do not demonstrate either representativeness or nonrepresentativeness.</p> <p>Recommendation</p> <p>(1) Please provide more thorough analysis. For example, IR71MW12B is the only deeper well under the shallow VOC plume at IR71. Compare the nonrepresentative results from IR71MW12B with representative results from the same well (if any exist). Discuss the impact on HHRA and site characterization at IR71 if no other deeper well results are available in the immediate vicinity. Provide a similar analysis for hexavalent chromium at IR09MW59B.</p>	<ul style="list-style-type: none"> • (i)(1) EPCs for groundwater in the HHRAs for HPS were based on detected results only. The MAX scenario EPC was based on the maximum detected concentration for each groundwater exposure area. Therefore, nondetected results, whether from representative or nonrepresentative samples, did not influence the EPCs used in the HHRAs. • (ii) Please see the response to DTSC specific comment 2e(i). • (iii) The nonrepresentative samples listed in Table A-1 for wells IR09MW54B and IR09MW37A are associated with groundwater monitoring for the second quarter of 2004. Groundwater data evaluated in the HHRA for Parcel D were limited to data collected through this quarter. Evaluation of third quarter 2004 results for these two wells is not necessary because the HHRA only included data through the second quarter of 2004. • The TM was not revised as a result of this comment.

TABLE F-2: RESPONSES TO COMMENTS FROM DTSC (Continued)

No.	Comment	Response
3b. (cont.)	ii) Regarding characterization of the B-aquifer, see Comment 2 e i. iii) According to the DTSC table dated April 26, 2006, two samples collected outside screened intervals were not included on Table A-1, including: IR09MW54B (for 2Q and 3Q, but only one date provided on Table C-1) and IR71MW12B (for 2Q and 3Q, but only one date provided on Table C-1), as well as dry well IR09MW37A. Please correct Table C-1 and the text as needed.	(see above)