N62578.AR.002804
NCBC DAVISVILLE
5090.3a

APPENDIX E FOR FORTHCOMING FEASIBILITY STUDY ASSENDUM SITE 16 WITH TRANSMITTAL NCBC DAVISVILLE RI
2/19/2013
NAVFAC MIDLANT

Bombrisk, Belinda

From: Sinagoga, Lee Ann
Sent: Tuesday, February 19, 2013 2:27 PM
To: Taybron-Currie, Sharon
Cc: Bombrisk, Belinda
Subject: FW: FS addendum, Appendix E trigger values
Attachments: NCBC Davis Site 16_FSA App E_2_19_2013.pdf

Categories: Projects

Hi Sharon,

Please make sure this E-mail and attachment is added to file for Davisville WE 51.

Also, please make sure that a hard copy and a CD of this is sent to NIRIS RDM (Belinda - 2nd floor).

Thanks much for your time and support,

Lee Ann

Lee Ann Sinagoga | Department Manager/Chemistry & Risk Assessment
Direct: 412.921.8887 | Main: 412.921.7090 | Fax: 412.921.4040 leeann.sinagoga@tetratech.com

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-----Original Message-----
From: Dale, Jeffrey M CIV NAVFAC MIDLANT, EV [mailto:jeffrey.m.dale@navy.mil]
Sent: Tuesday, February 19, 2013 2:05 PM
To: williams.christine@epamail.epa.gov; Richard Gottlieb
Cc: Barney, David A CIV NAVFACHQ, BRAC PMO; Sinagoga, Lee Ann
Subject: FS addendum, Appendix E trigger values

Christine and Richard

Attached is Appendix E of the forthcoming FS Addendum for Site 16. This provides the rational and selection of trigger values (concentration of
contaminants) that would trigger actions that Navy would undertake to ensure protectiveness of receptors in the Allen Harbor.

The FS Addendum and Proposed Plan were put on hold during the BCT, but Christine requested an early copy of this to allow for review.

Jeff

APPENDIX E

HUMAN HEALTH AND ECOLOGICAL TRIGGER CONCENTRATIONS

APPENDIX E

TRIGGER CONCENTRATIONS FOR POTENTIAL INSTALLATION OF BIO-BARRIER AT ALLEN HARBOR SHORELINE

The groundwater alternative presented in this Feasibility Study Addendum (FSA) includes a bio-barrier component which would be installed (if necessary) to protect human or ecological receptors in Allen Harbor. The bio-barrier is planned as a contingency component only at this time because trichloroethene (TCE) and its degradation products (e.g., cis-1,2-dichloroethene, vinyl chloride) have not been detected in the surface waters or sediments of Allen Harbor at concentrations that would result in unacceptable risks to either human or ecological receptors. This appendix calculates these trigger values, and memorializes the decision making process to evaluate the need for the contingent remedy.

In aggregate, the chlorinated volatile organic chemical (VOC) data for the Site 16 monitoring wells, the piezometers in Allen Harbor, and the surface water/sediments of Allen Harbor indicate a significant attenuation in TCE concentrations from the Site 16 source areas to the surface waters and sediments in Allen Harbor. (Please see attached figures/tables from Phase III Remedial Investigation [RI] Report [March 2009] and Data Package Report for the 2010 Feasibility Study Support Field Investigation at Installation Restoration Program Site 16 [November, 2010].) (**See Attachment A).**

More significantly, the TCE concentrations detected in the groundwater samples collected from piezometers advanced in Allen Harbor or from the groundwater monitoring wells abutting Allen Harbor do not exceed the relevant EPA screening levels for ecological protection (**see Attachment B**). The Navy, USEPA, and RIDEM have discussed these screening levels in the past.

An attenuation factor for TCE in the intermediate/deep groundwater along the shoreline discharging to the Allen Harbor surface water was developed based on the existing data set. The attenuation factor was based on the ratio of measured concentrations, without predictive equations using retardation factors. The wells along the shoreline with the highest CVOC concentrations are in the MW16-05 cluster (concentrations range from approximately 500 to approximately 1,200 µg/L). TCE was not detected in any of the surface water samples collected from Allen Harbor. This results in a 500:1 attenuation. To be conservative, this was reduced to a ratio of 100:1 (or a 99 percent attenuation). Thus, the trigger levels calculated for long-term monitoring plan for Site 16 will be the ***lower*** of either:

- The ecological screening level multiplied by a factor of 100; or
- The human health number multiplied by a factor of 100.

The screening levels and trigger levels for the predominant Site 16 VOCs (and degradation products) are shown below in **Table 1**, with the ***lower*** trigger level presented in **bold**. The supporting documentation is provided in **Attachment B.**

Table 1

Screening Levels/Trigger Levels for Site 16 VOCs (µg/L)

Contaminant	Human Health Screening Level	Trigger Level Based on Human Health	Ecological Screening Level	Trigger Level Based on the Ecological Screening Level
Trichloroethene	35	***3,500***	1,940	194,000
Cis-1,2-Dichloroethene	1,160	116,000	680	***68,000***
Trans-1,2-Dichloroethene	11,600	1,160,000	680	***68,000***
Vinyl Chloride (1)	2	***200***	930	93,000
1,1-Dichloroethene	27,600	2,760,000	2240	***224,000***
1,2-Dichloroethane	59.7	***5970***	1130	113,000
Benzene	38.5	***3,850***	110	11,000
Tetrachloroethene	1,140	114,000	45	***4,500***

1) The Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) is recommended as the basis of the screening level because the risk based concentration for the lifelong receptor is less than the SDWA MCL (Please see Attachment B).

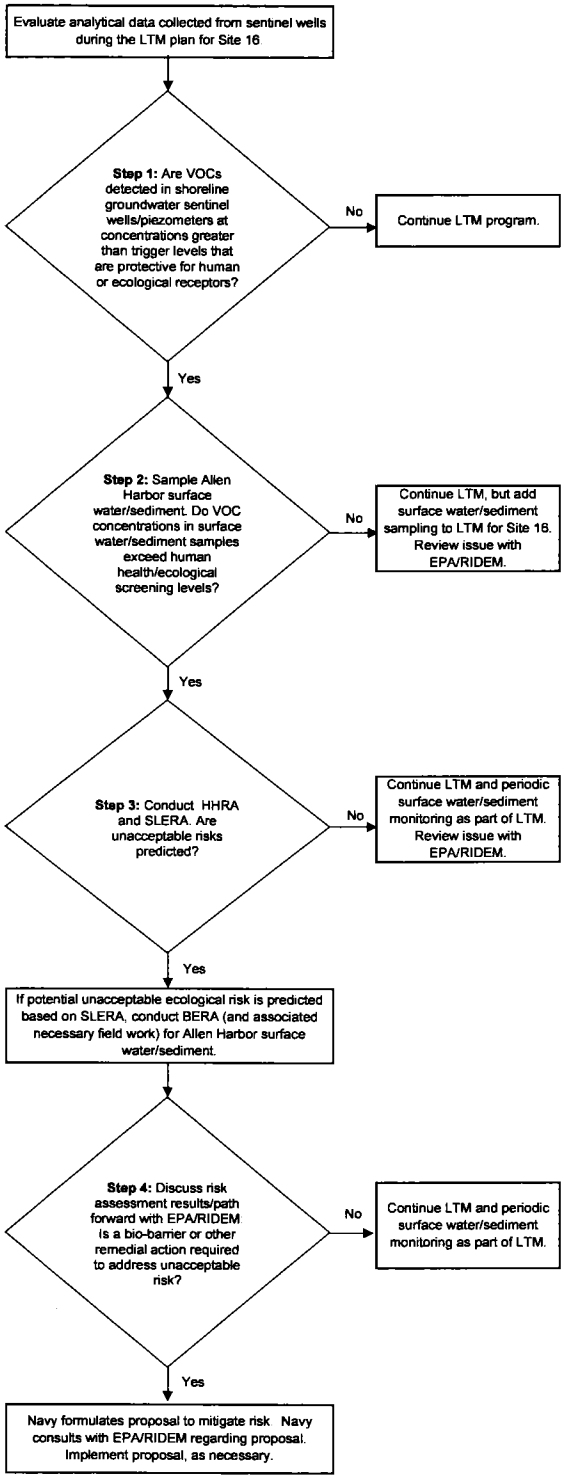
The bio-barrier would be further evaluated for possible installation if the Site 16 CVOC concentrations detected for sentinel wells along Allen Harbor exceed these trigger concentrations. The decision to ultimately install the bio-barrier would be made in consultation with EPA and RIDEM, and would evaluate chemical concentrations detected in the actual surface waters and sediments of the Harbor at the time the exceedances of trigger levels in the sentinel wells were noted. Analytical data collected from sentinel wells during the long-term monitoring (LTM) plan for Site 16 will be evaluated as follows:

- **Step 1:** Are VOCs detected in shoreline groundwater sentinel wells/piezometers at concentrations greater than trigger levels that are protective for human or ecological receptors?
    - **No (Continue LTM program).**
    - **Yes (Go to Step 2)**
- **Step 2:** Sample Allen Harbor surface water/sediment. Do VOC concentrations in surface water/sediment samples exceed human health/ecological screening levels?
    - **No (Continue LTM, but, add surface water/sediment sampling to LTM for Site 16. Review issue with EPA/RIDEM.)**
    - **Yes (Go to Step 3).**
- **Step 3**: Conduct human health and screening level ecological risk assessments (SLERA). Are unacceptable risks predicted?
    - **No (Continue LTM and periodic surface water/sediment monitoring as part of LTM. Review issue with EPA/RIDEM.)**
    - **Yes (If potential unacceptable ecological risk is predicted based on SLERA, conduct Baseline Ecological Risk Assessment [BERA] [and associated necessary field work] for Allen Harbor surface water/sediment.) (Go to Step 4).**

- **Step 4:** Discuss risk assessment results/path forward with EPA/RIDEM: Is a bio-barrier or other remedial action required to address unacceptable risk?
    - **No (Continue LTM and periodic surface water/sediment monitoring as part of LTM).**
    - **Yes (Navy formulates proposal to mitigate risk. Navy consults with EPA/RIDEM regarding proposal. Implement proposal, as necessary.)**

FIGURE 1

DECISION DIAGRAM



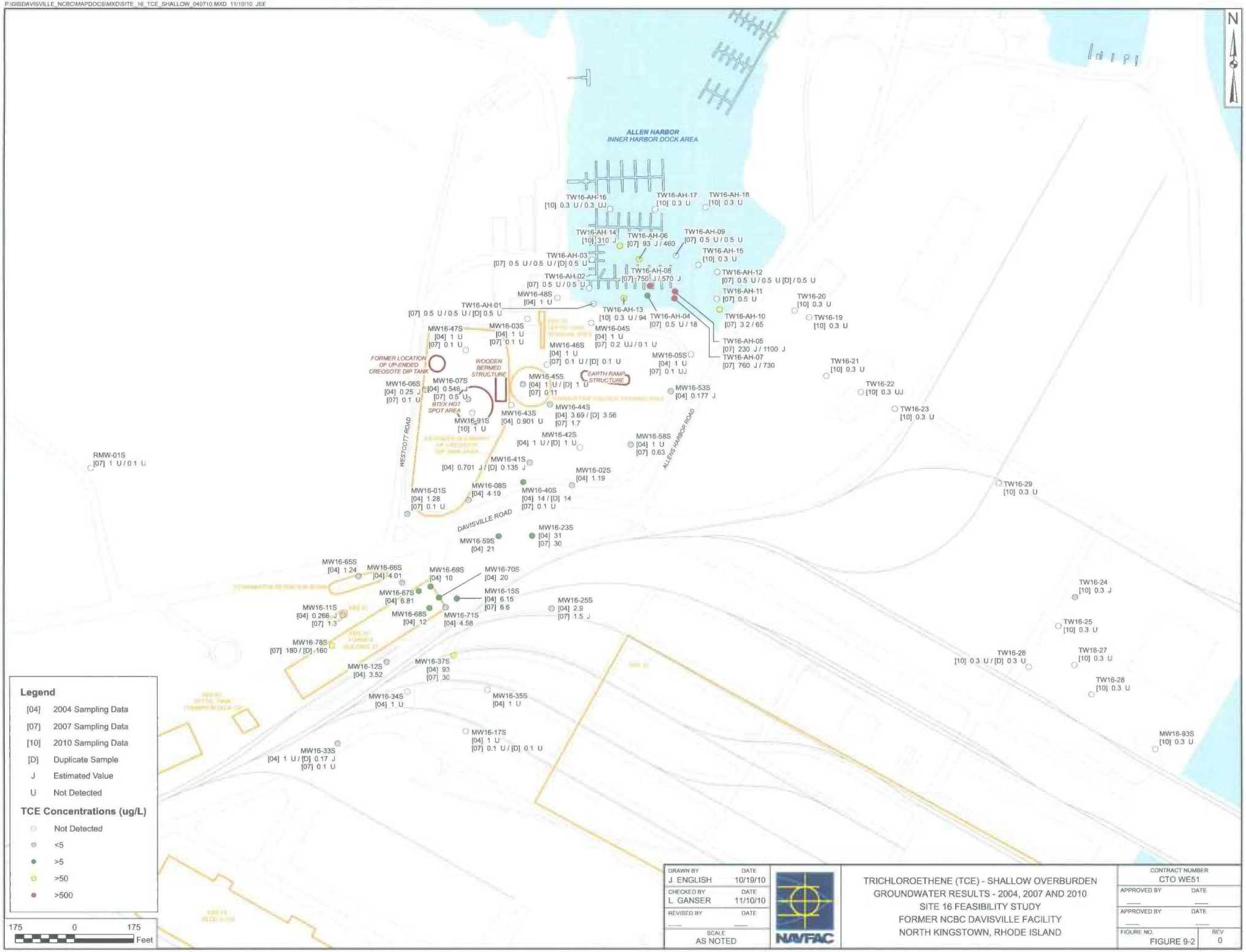
KEY

BERA = Baseline Ecological Risk Assessment
EPA = United States Environmental Protection Agency
HHRA = Human Health Risk Assessment
LTM = Long-Term Monitoring
RIDEM = Rhode Island Department of Environmental Management
SLERA = Screening Level Ecological Risk Assessment
VOC = Volatile Organic Compound

ATTACHMENT A

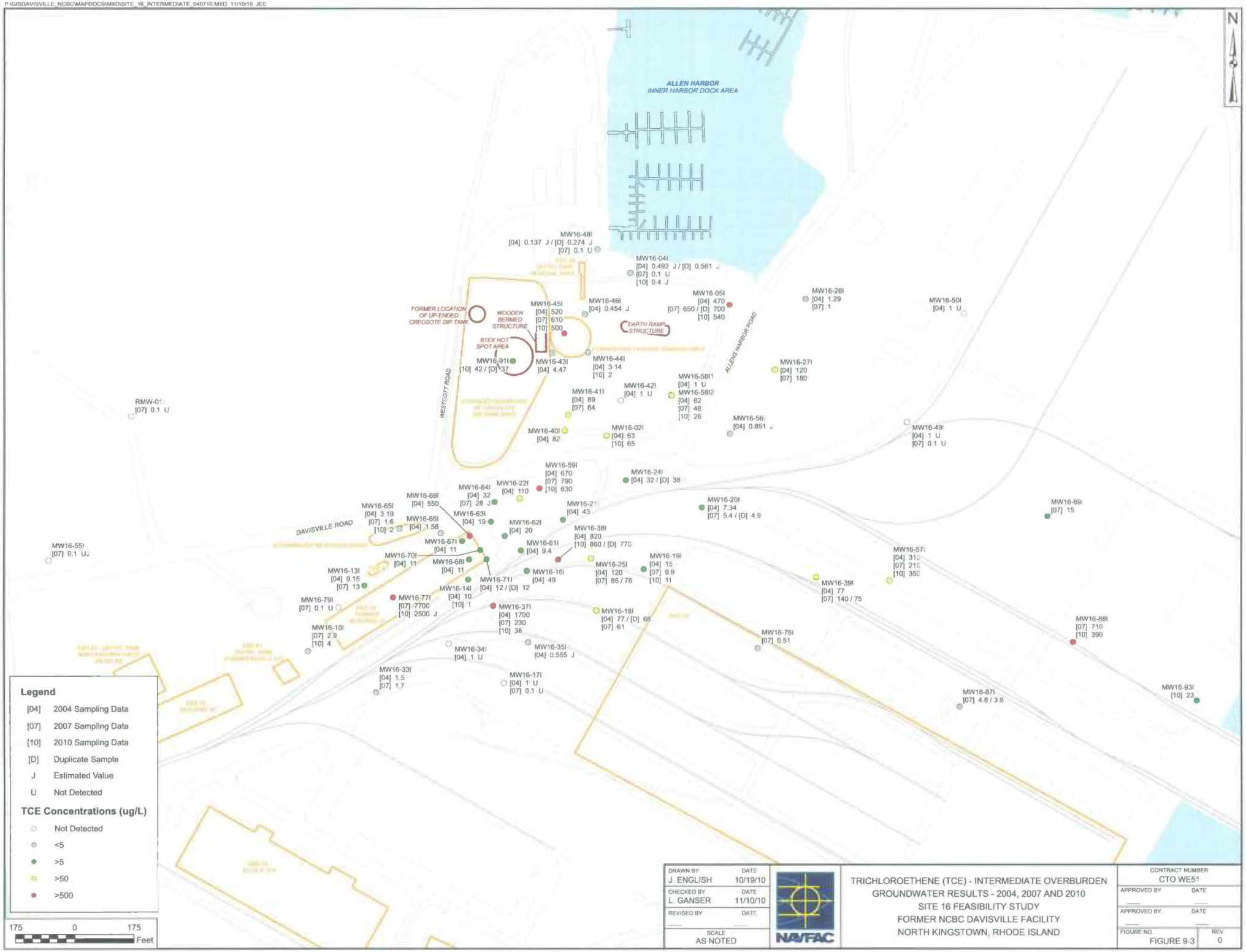
SELECT VOC DATA FOR NCBC DAVISVILLE SITE 16

P:\GIS\DAVISVILLE_NCBC\MAPDOCS\MXD\SITE_16_TCE_SHALLOW_040710.MXD 11/10/10 JEE



DRAWN BY J. ENGLISH	DATE 10/19/10	TRICHLOROETHENE (TCE) - SHALLOW OVERBURDEN GROUNDWATER RESULTS - 2004, 2007 AND 2010 SITE 16 FEASIBILITY STUDY FORMER NCBC DAVISVILLE FACILITY NORTH KINGSTOWN, RHODE ISLAND	CONTRACT NUMBER CTO WE51
CHECKED BY L. GANSER	DATE 11/10/10		APPROVED BY / DATE
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED		NAVFAC	FIGURE NO. FIGURE 9-2 / REV 0

P:\GIS\DAVISVILLE_NCBC\MAPDOCS\MXD\SITE_16_INTERMEDIATE_040710.MXD 11/10/10 JEE



DRAWN BY	DATE
J. ENGLISH	10/19/10
CHECKED BY	DATE
L. GANSER	11/10/10
REVISED BY	DATE
SCALE	
AS NOTED	

NAVFAC

TRICHLOROETHENE (TCE) - INTERMEDIATE OVERBURDEN
GROUNDWATER RESULTS - 2004, 2007 AND 2010
SITE 16 FEASIBILITY STUDY
FORMER NCBC DAVISVILLE FACILITY
NORTH KINGSTOWN, RHODE ISLAND

CONTRACT NUMBER	
CTO WE51	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO	REV
FIGURE 9-3	0

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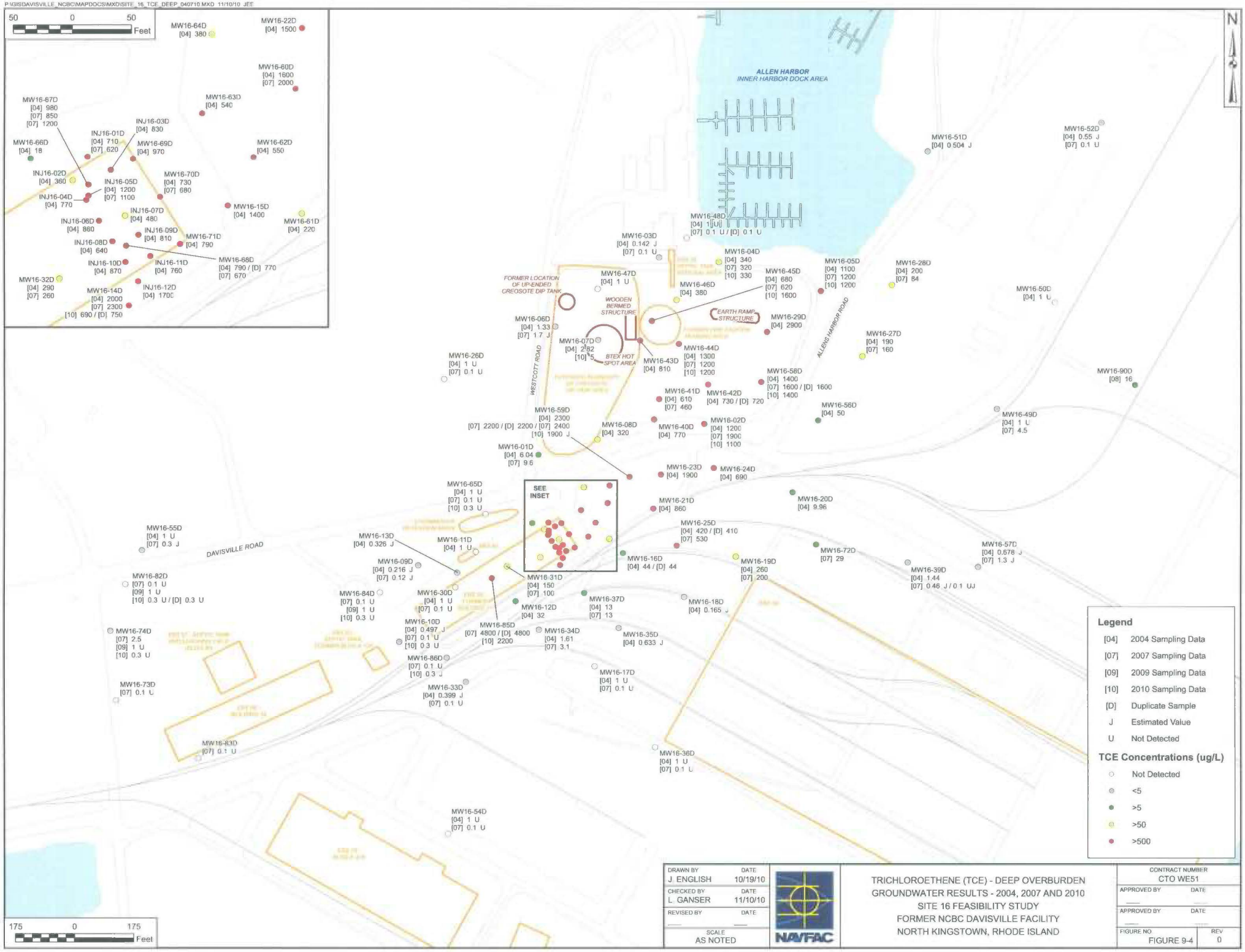
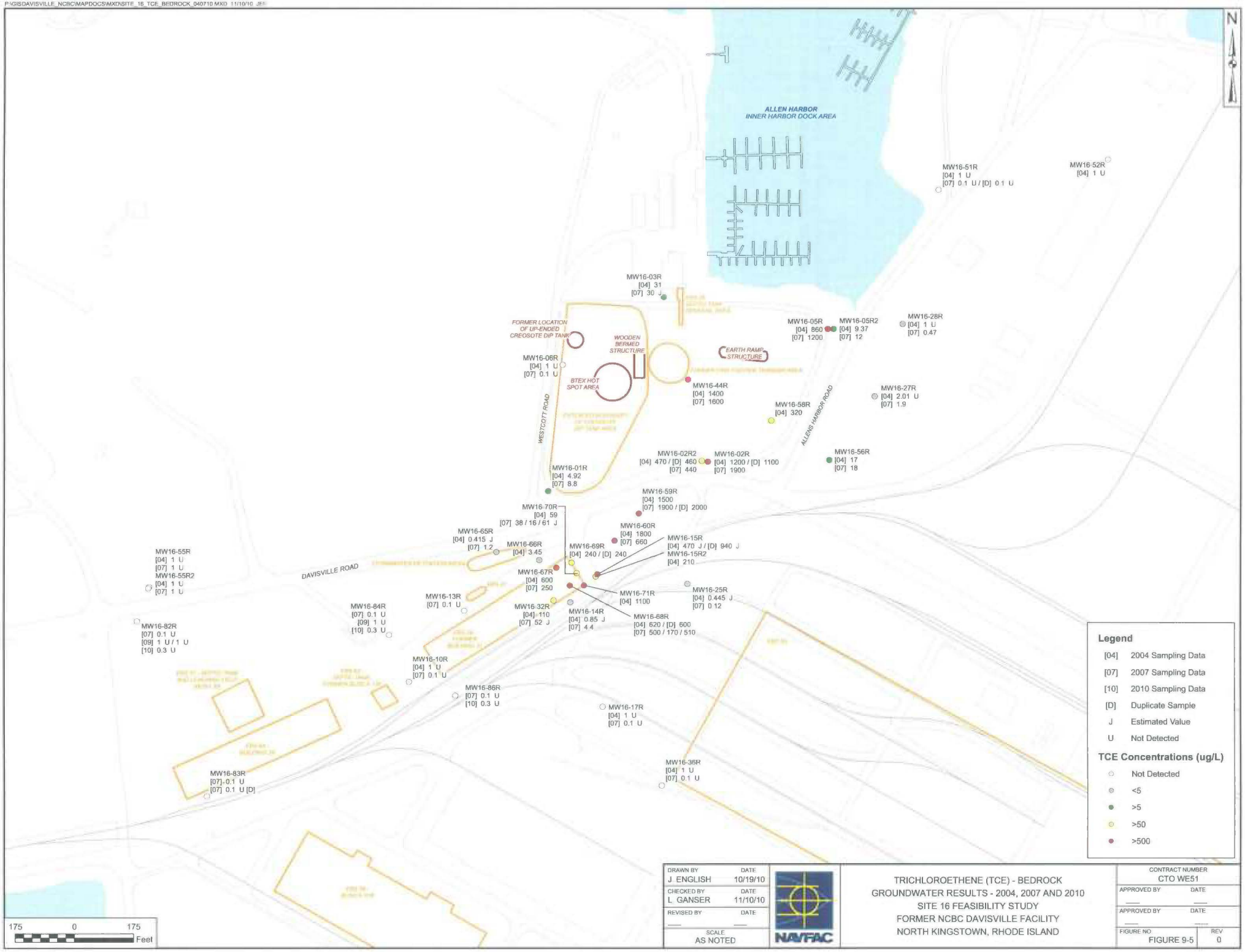


DRAWN BY J. ENGLISH	DATE 10/19/10	NAVFAC	TRICHLOROETHENE (TCE) - DEEP OVERBURDEN GROUNDWATER RESULTS - 2004, 2007 AND 2010 SITE 16 FEASIBILITY STUDY FORMER NCBC DAVISVILLE FACILITY NORTH KINGSTOWN, RHODE ISLAND
CHECKED BY L. GANSER	DATE 11/10/10		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NUMBER	CTO WE51
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO	FIGURE 9-4
REV	0

P:\GIS\DAVISVILLE_NCBC\MAPDOCS\MXD\SITE_16_TCE_BEDROCK_040710.MXD 11/10/10 JEN



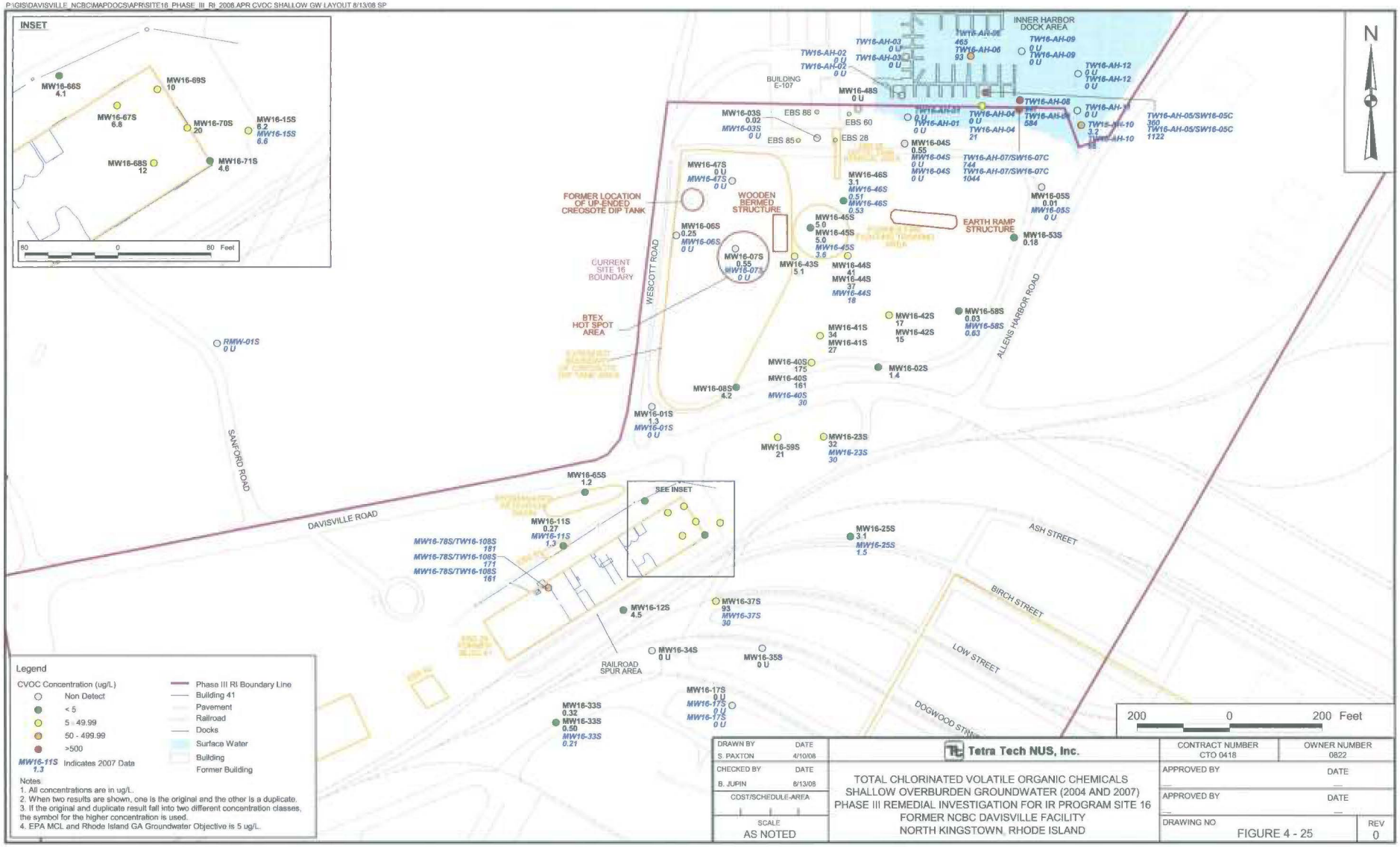
DRAWN BY	DATE
J. ENGLISH	10/19/10
CHECKED BY	DATE
L. GANSER	11/10/10
REVISED BY	DATE
—	—
SCALE	
AS NOTED	

NAVFAC

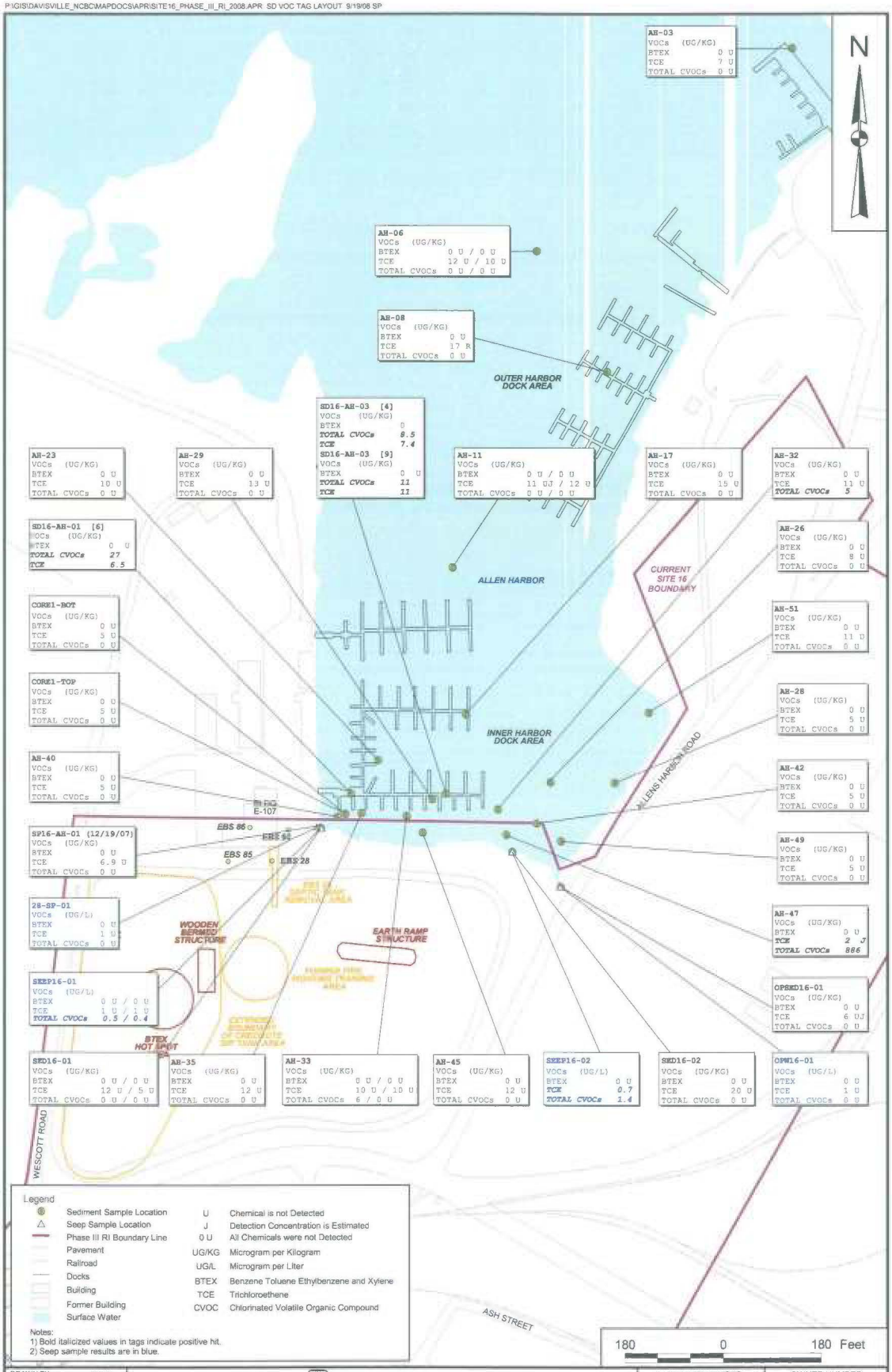
TRICHLOROETHENE (TCE) - BEDROCK
GROUNDWATER RESULTS - 2004, 2007 AND 2010
SITE 16 FEASIBILITY STUDY
FORMER NCBC DAVISVILLE FACILITY
NORTH KINGSTOWN, RHODE ISLAND

CONTRACT NUMBER	
CTO WE51	
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
FIGURE NO	REV
FIGURE 9-5	0

P:\GIS\DAVISVILLE_NCBC\MAPDOCS\APR\SITE16_PHASE_III_RI_2006.APR CVOC SHALLOW GW LAYOUT 8/13/06 SP



P:\GIS\DAVISVILLE_NCBC\MAPDOCS\APR\SITE16_PHASE_III_RI_2008.APR SD VOC TAG LAYOUT 9/19/08 SP



Legend

	Sediment Sample Location	U	Chemical is not Detected
	Seep Sample Location	J	Detection Concentration is Estimated
	Phase III RI Boundary Line	0 U	All Chemicals were not Detected
	Pavement	UG/KG	Microgram per Kilogram
	Railroad	UG/L	Microgram per Liter
	Docks	BTEX	Benzene Toluene Ethylbenzene and Xylene
	Building	TCE	Trichloroethene
	Former Building	CVOC	Chlorinated Volatile Organic Compound
	Surface Water		

Notes:
1) Bold italicized values in tags indicate positive hit.
2) Seep sample results are in blue.

DRAWN BY	DATE	Tetra Tech NUS, Inc.	CONTRACT NUMBER	OWNER NUMBER
S. PAXTON	4/03/08		CTO 0418	0822
CHECKED BY	DATE	TOTAL CHLORINATED VOLATILE ORGANIC RESULTS FOR SEDIMENT AND SEEP SAMPLES PHASE III REMEDIAL INVESTIGATION FOR IR PROGRAM SITE 16 FORMER NCBC DAVISVILLE FACILITY NORTH KINGSTOWN, RHODE ISLAND	APPROVED BY	DATE
B. JUPIN	9/19/08			
COST/SCHEDULE-AREA			APPROVED BY	DATE
SCALE			DRAWING NO.	REV
AS NOTED			FIGURE 4 - 31	0

2010
GW from
Piezometers

TABLE 1

2010 GROUNDWATER SAMPLES FROM ALLEN HARBOR POSITIVE RESULTS
SITE 16 FEASIBILITY STUDY
FORMER NCBC DAVISVILLE FACILITY
NORTH KINGSTOWN, RHODE ISLAND
PAGE 1 OF 2

LOCATION	TW16-AH-13		TW16-AH-14	TW16-AH-15
SAMPLE ID	TW16-AH-13-0001	TW16-AH-13-0910	TW16-AH-14-0001	TW16-AH-15-0001
SAMPLE DATE	20100624	20100625	20100624	20100625
PROBLEM CODE	3	3	3	3
AREA	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR
SAMPLE CODE	NORMAL	NORMAL	NORMAL	NORMAL
MATRIX	GW	GW	GW	GW
TOP DEPTH (FT)	0	9	0	0
BOTTOM DEPTH (FT)	1	10	1	1
VOLATILES (UG/L)				
1,1-DICHLOROETHENE	0.4 U	0.4 U	0.7 J	0.4 U
2-BUTANONE	1 U	1 U	1 U	8
ACETONE	7	2 J	2 J	42
BTEX	0 U	0 U	0.8	1
CARBON DISULFIDE	0.3 J	0.2 U	0.3 J	0.5 J
CIS-1,2-DICHLOROETHENE	0.4 J	2	4	0.2 U
TOLUENE	0.3 U	0.3 U	0.8 J	1
TOTAL CHLORINATED VOCS	0.4	96	315	0 U
TRANS-1,2-DICHLOROETHENE	0.2 U	0.2 U	0.2 U	0.2 U
TRICHLOROETHENE	0.3 U	94	310 J	0.3 U
VINYL CHLORIDE	0.2 U	0.2 U	0.2 U	0.2 U
FIELD SCREENING (UNITLESS)				
COLOR-TEC[1]	0.1-LL-200	2.5-M-200	7.5-L-100	ND

TABLE

2010 GROUNDWATER SAMPLES FROM ALLEN HARBOR POSITIVE RESULTS
SITE 16 FEASIBILITY STUDY
FORMER NCBC DAVISVILLE FACILITY
NORTH KINGSTOWN, RHODE ISLAND

LOCATION	TW16-AH-16		TW16-AH-17	TW16-AH-18
SAMPLE ID	TW16-AH-16-0001	TW16-AH-16-0405	TW16-AH-17-0001	TW16-AH-18-0001
SAMPLE DATE	20100623	20100623	20100623	20100622
PROBLEM CODE	3	3	3	3
AREA	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR
SAMPLE CODE	NORMAL	NORMAL	NORMAL	NORMAL
MATRIX	GW	GW	GW	GW
TOP DEPTH (FT)	0	4	0	0
BOTTOM DEPTH (FT)	1	5	1	1
VOLATILES (UG/L)				
1,1-DICHLOROETHENE	0.4 U	0.4 UJ	0.4 U	0.4 UJ
2-BUTANONE	1 U	1 UJ	1 U	1 U
ACETONE	**9**	6 UJ	**4 J**	2 U
BTEX	0 U	**2**	0 U	0 U
CARBON DISULFIDE	0.2 U	0.2 UJ	0.2 U	0.2 U
CIS-1,2-DICHLOROETHENE	0.2 U	**18 J**	0.2 U	0.2 U
TOLUENE	0.3 U	**2 J**	0.3 U	0.3 U
TOTAL CHLORINATED VOCS	0 U	**19.2**	0 U	0 U
TRANS-1,2-DICHLOROETHENE	0.2 U	**0.8 J**	0.2 U	0.2 U
TRICHLOROETHENE	0.3 U	0.3 UJ	0.3 U	0.3 U
VINYL CHLORIDE	0.2 U	**0.4 J**	0.2 U	0.2 U
FIELD SCREENING (UNITLESS)				
COLOR-TEC[1]	**0.05-LL-200**	**0.3-LL-100**	ND	ND

GW and SW from Allen Harbor 2007

TABLE 2

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN ALLEN HARBOR WATER SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND
PAGE 1 OF 4

Investigation	10	10	10	10	10	10	10	10
Location	TW16-AH-01	TW16-AH-01	TW16-AH-01	TW16-AH-02	TW16-AH-02	TW16-AH-03	TW16-AH-03	TW16-AH-03
Sample Number	TW16-AH-01-0305	TW16-AH-01-0810	TW16-AH-01-0810-D	TW16-AH-02-0305	TW16-AH-02-0810	TW16-AH-03-0305	TW16-AH-03-0810	TW16-AH-03-0810-D
Sample Date	20070807	20070807	20070807	20070807	20070807	20070809	20070809	20070809
Samle Code	NORMAL	ORIG	DUP	NORMAL	NORMAL	NORMAL	ORIG	DUP
Depth Range (feet)	3 - 5	8 - 10	8 - 10	3 - 5	8 - 10	3 - 5	8 - 10	8 - 10
Matrix	GW	GW	GW	GW	GW	GW	GW	GW
Duplicate			TW16-AH-01-0810					TW16-AH-03-0810
Area	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR
Volatile Organic Compounds (ug/L)								
1,1-Dichloroethene	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U
Benzene	0.5 U	0.5 U	0.5 U	0.5 U	**1.4**	**3.2**	0.5 U	0.5 U
BTEX	0 U	0 U	0 U	0 U	**1.4**	**4.7**	0 U	0 U
cis-1,2-Dichloroethene	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
Methyl Tert-Butyl Ether	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	**1.4**
Toluene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	**1.5**	0.33 U	0.33 UJ
Total Chlorinated VOCs	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U
Miscellaneous Parameters								
Turbidity	**4.45**	**6.8**		**9.43**	**90.4**	**3.77**	**4.55**	

TABLE 2

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN ALLEN HARBOR WATER SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND
PAGE 2 OF 4

Investigation	10	10	10	10	10	10	10	10
Location	TW16-AH-04	TW16-AH-04	SW16-AH-05S	TW16-AH-05/SW16-05C	TW16-AH-05/SW16-05C	TW16-AH-05/SW16-05C	TW16-AH-06	TW16-AH-06
Sample Number	TW16-AH-04-0305	TW16-AH-04-0810	SW16-AH-05S-081107	TW16-AH-05-0305	TW16-AH-05-0810	SW16-AH-05C-081107	TW16-AH-06-0305	TW16-AH-06-0810
Sample Date	20070807	20070807	20070811	20070808	20070808	20070811	20070810	20070810
Samle Code	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
Depth Range (feet)	3 - 5	8 - 10	Above Sediments	3 - 5	8 - 10	Above Sediments	3 - 5	8 - 10
Matrix	GW	GW	SW	GW	GW	SW	GW	GW
Duplicate								
Area	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR
Volatile Organic Compounds (ug/L)								
1,1-Dichloroethene	0.76 U	0.76 U	0.1 U	0.76 U	0.76 U	0.1 U	0.76 U	0.76 U
Benzene	0.5 U	0.5 U	0.1 U	0.5 U	0.5 U	0.1 U	0.5 U	0.5 U
BTEX	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
cis-1,2-Dichloroethene	0.53 U	**3**	0.53 U	**130**	**20**	0.53 U	0.53 U	**5**
Methyl Tert-Butyl Ether	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U
Toluene	0.33 U	0.33 UJ	0.33 UJ	0.33 U	0.33 U	0.33 UJ	0.33 UJ	0.33 UJ
Total Chlorinated VOCs	0 U	**21**	0 U	**360**	**1122**	0 U	**93**	**465**
trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	0.5 U	**18**	0.1 U	**230 J**	**1100 J**	0.1 U	**93 J**	**460**
Vinyl Chloride	0.51 U	0.51 U	0.1 U	0.51 U	**2**	0.1 U	0.51 U	0.51 U
Miscellaneous Parameters								
Turbidity	**7.2**	**115**		**20.3**	**151**		**147**	**212**

TABLE 2

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN ALLEN HARBOR WATER SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND
PAGE 3 OF 4

Investigation	10	10	10	10	10	10	10	10
Location	SW16-AH-07S	TW16-AH-07/SW16-07C	TW16-AH-07/SW16-07C	TW16-AH-08	TW16-AH-08	TW16-AH-09	TW16-AH-09	TW16-AH-10
Sample Number	SW16-AH-07S-081107	TW16-AH-07-0305	TW16-AH-07-0810	TW16-AH-08-0305	TW16-AH-08-0810	TW16-AH-09-0305	TW16-AH-09-0810	TW16-AH-10-0305
Sample Date	20070811	20070809	20070809	20070809	20070809	20070811	20070811	20070809
Samle Code	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
Depth Range (feet)	Above Sediments	3 - 5	8 - 10	3 - 5	8 - 10	3 - 5	8 - 10	3 - 5
Matrix	SW	GW	GW	GW	GW	GW	GW	GW
Duplicate								
Area	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR
Volatile Organic Compounds (ug/L)								
1,1-Dichloroethene	0.1 U	**2.5**	**1**	**1.7**	0.76 U	0.76 U	0.76 U	0.76 U
Benzene	0.1 U	**1.3**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BTEX	0 U	**1.3**	0 U	0 U	0 U	0 U	0 U	0 U
cis-1,2-Dichloroethene	0.53 U	**280 J**	**13**	**190**	**14**	0.53 U	0.53 U	0.53 U
Methyl Tert-Butyl Ether	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U
Toluene	0.33 UJ	0.33 U	0.33 UJ	0.33 U	0.33 U	0.33 UJ	0.33 UJ	0.33 UJ
Total Chlorinated VOCs	0 U	**1044.4**	**744**	**946.8**	**584**	0 U	0 U	**3.2**
trans-1,2-Dichloroethene	0.5 U	**1.9**	0.5 U	**1.3**	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	0.1 U	**760 J**	**730**	**750 J**	**570 J**	0.5 U	0.5 U	**3.2**
Vinyl Chloride	0.1 U	0.51 U	0.51 U	**3.8**	0.51 U	0.51 U	0.51 U	0.51 U
Miscellaneous Parameters								
Turbidity	**4.1**		**4.89**	**43.8**	**9.3**	**23.8**	**30.4**	**71.2**

TABLE 2

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN ALLEN HARBOR WATER SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND
PAGE 4 OF 4

Investigation	10	10	10	10	10
Location	TW16-AH-10	TW16-AH-11	TW16-AH-12	TW16-AH-12	TW16-AH-12
Sample Number	TW16-AH-10-0810	TW16-AH-11-0810	TW16-AH-12-0305	TW16-AH-12-0305-D	TW16-AH-12-0810
Sample Date	20070809	20070807	20070810	20070810	20070810
Samle Code	NORMAL	NORMAL	ORIG	DUP	NORMAL
Depth Range (feet)	8 - 10	8 - 10	3 - 5	3 - 5	8 - 10
Matrix	GW	GW	GW	GW	GW
Duplicate				TW16-AH-12-0305	
Area	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR
Volatile Organic Compounds (ug/L)					
1,1-Dichloroethene	0.76 U	0.76 U	0.76 U	0.76 U	0.76 U
Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BTEX	0 U	0 U	0 U	0 U	0 U
cis-1,2-Dichloroethene	**1.1**	0.53 U	0.53 U	0.53 U	0.53 U
Methyl Tert-Butyl Ether	0.71 U	0.71 U	0.71 U	0.71 U	0.71 U
Toluene	0.33 UJ	0.33 U	0.33 UJ	0.33 UJ	0.33 UJ
Total Chlorinated VOCs	**66.1**	0 U	0 U	0 U	0 U
trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	**65**	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U
Miscellaneous Parameters					
Turbidity	**3.8**	**57.8**	**46.7**		**9.54**

TABLE 3

Older Seep Samples

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN SEEP SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND

Investigation	**03**	**05**	**05**	**05**	**05**
Location	**28-SP-01**	**OPW16-01**	**SEEP16-01**	**SEEP16-01**	**SEEP16-02**
Sample Number	**28-SP01-NGW-101598**	**OPW16-01-NWG-032201**	**SEEP16-01-NWG-032101**	**SEEP16-01-NWG-032101-D**	**SEEP16-02-NWG-032601**
Sample Code	**NORMAL**	**NORMAL**	**ORIG**	**DUP**	**NORMAL**
Sample Date	**10/15/1998**	**3/22/2001**	**3/21/2001**	**3/21/2001**	**3/26/2001**
Volatile Organic Compounds (ug/L)					
Acetone	5 U	**0.9 J**	5 UJ	5 UJ	5 UJ
cis-1,2-Dichloroethene		2 U	2 U	2 U	**0.7**
Total 1,2-Dichloroethene	1 U	2 U	2 U	2 U	**0.7**
Total Chlorinated VOCs[1]	0 U	0 U	**0.5**	**0.4**	**1.4**
Trichloroethene	1 U	1 U	1 U	1 U	**0.7**
Vinyl Chloride	1 U	2 U	**0.5 J**	**0.4**	2 U

Investigation Description:
03 - EBS Phase II Follow-On Addendum Sampling
05 - Stage II Phase I RI Sampling Event

Qualifiers:
J - Estimated value.
U - Non-detected result.
UJ - Non-detected result is estimated.

Sample Code Description:
NORMAL - One sample was collected at this location.
ORIG - First of two samples collected at this location.
DUP - Second of two samples collected at this location.

Footnotes:
1 - The calculation of the Total PAHs is defined in Section 4. "0U" indicates that this chemical group was not detected in the sample analyzed.
2 - A concentration that is shaded exceeds the criteria presented in the table.
3 - A blank cell indicates that the sample was not analyzed for the target analyte.

2010 SW from Allen Harbor

TABLE 4

POSITIVE RESULTS FOR SURFACE WATER FROM ALLEN HARBOR
SITE 16 FEASIBILITY STUDY
FORMER NCBC DAVISVILLE FACILITY
NORTH KINGSTOWN, RHODE ISLAND

LOCATION	SW16-AH-08	SW16-AH-09			SW16-AH-10	SW16-AH-11	SW16-AH-12	SW16-AH-13
SAMPLE ID	SW16-AH-08-062610	SW16-AH-09-062610	SW16-AH-09-062610-AVG	SW16-AH-09-062610-D	SW16-AH-10-062610	SW16-AH-11-062610	SW16-AH-12-062610	SW16-AH-13-062610
SAMPLE DATE	20100626	20100626	20100626	20100626	20100626	20100626	20100626	20100626
PROBLEM CODE	3	3	3	3	3	3	3	3
AREA	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR	ALLEN HARBOR
SAMPLE CODE	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
MATRIX	SW	SW	SW	SW	SW	SW	SW	SW
DEPTH (FT)	9.81	11.5	11.5	11.5	9.83	24.1	12.8	7.32
TEMPORARY WELL CO-LOCATED	TW16-AH-13	TW16-AH-14	TW16-AH-14	TW16-AH-14	TW16-AH-15	TW16-AH-16	TW16-AH-17	TW16-AH-18
SEDIMENT SAMPLE CO-LOCATED	SD16-AH-20	SD16-AH-21	SD16-AH-21	SD16-AH-21	SD16-AH-22	SD16-AH-23	SD16-AH-24	SD16-AH-25
VOLATILES (UG/L)								
ACETONE	3 J	2 U	2.5 J	4 J	2 U	3 J	2 J	3 J
CARBON DISULFIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 J	0.3 J	0.3 J
CIS-1,2-DICHLOROETHENE	0.3 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
TOTAL CHLORINATED VOCS	0.3	0 U	0 U	0 U	0 U	0 U	0 U	0 U
FIELD SCREENING (UNITLESS)								
COLOR-TEC[1]	ND	ND	NA	NA	ND	ND	ND	ND

1 Presents direct tube reading, tube-type, and purge volume, respectively. Direct tube reading needs to be correlated against laboratory results in order to estimate field screening concentration.

Abbreviations:
NA - Not analyzed
NC - No Criterion
ND - Not detected
J - Estimated value
U - Nondetected result

2004 Sediments

TABLE 5

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN 2004 SEDIMENT SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND
PAGE 1 OF 4

Investigation	07	07	07	07	07	07	07	07
Location	AH-03	AH-06	AH-06	AH-08	AH-11	AH-11	AH-17	AH-23
Sample Number	AH-03-NSD-032304	AH-06-NSD-032304	AH-06-NSD-032304-D	AH-08-NSD-032204	AH-11-NSD-032204	AH-11-NSD-032204-D	AH-17-NSD-032304	AH-23-NSD-032404
Sample Code	NORMAL	ORIG	DUP	NORMAL	ORIG	DUP	NORMAL	NORMAL
Sample Date	3/23/2004	3/23/2004	3/23/2004	3/22/2004	3/22/2004	3/22/2004	3/23/2004	3/24/2004
Volatile Organic Compounds (ug/kg)								
1,1-Dichloroethene	7 U	12 U	10 U	17 R	11 UJ	12 U	15 U	10 U
2-Butanone	**7 J**	**10 J**	**14 J**	33 R	21 U	23 U	**20 J**	21 U
Acetone	**220**	**390 J**	**83 J**	210 R	110 U	150 U	**200**	210 U
Carbon Disulfide	11 U	12 U	11 U	24 R	11 U	12 U	24 U	10 U
cis-1,2-Dichloroethene	7 U	12 U	10 U	17 R	11 UJ	12 U	15 U	10 U
Total 1,2-Dichloroethene	7 U	12 U	10 U	17 U	11 U	12 U	15 U	10 U
Total Chlorinated VOCs	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
trans-1,2-Dichloroethene	7 U	12 U	10 U	17 R	11 UJ	12 U	15 U	10 U
Trichloroethene	7 U	12 U	10 U	17 R	11 UJ	12 U	15 U	10 U

TABLE 5

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN 2004 SEDIMENT SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND
PAGE 2 OF 4

Investigation	**07**	**07**	**07**	**07**	**07**	**07**	**07**	**07**
Location	**AH-26**	**AH-28**	**AH-29**	**AH-32**	**AH-33**	**AH-33**	**AH-35**	**AH-40**
Sample Number	**AH-26-NSD-032704**	**AH-28-NSD-032504**	**AH-29-NSD-032604**	**AH-32-NSD-032604**	**AH-33-NSD-032604**	**AH-33-NSD-032604-D**	**AH-35-NSD-032604**	**AH-40-NSD-032704**
Sample Code	**NORMAL**	**NORMAL**	**NORMAL**	**NORMAL**	**ORIG**	**DUP**	**NORMAL**	**NORMAL**
Sample Date	**3/27/2004**	**3/25/2004**	**3/26/2004**	**3/26/2004**	**3/26/2004**	**3/26/2004**	**3/26/2004**	**3/27/2004**
Volatile Organic Compounds (ug/kg)								
1,1-Dichloroethene	8 U	5 U	13 U	11 U	10 U	10 U	12 U	5 U
2-Butanone	17 U	10 U	27 U	**17 J**	**17 J**	**23**	**20 J**	**8**
Acetone	67 UJ	84 UJ	93 UJ	130 U	120 U	85 U	91 U	45 U
Carbon Disulfide	9 U	5 U	13 U	11 U	10 U	10 U	12 U	10 U
cis-1,2-Dichloroethene	8 U	5 U	13 U	**5 J**	**6 J**	10 U	12 U	5 U
Total 1,2-Dichloroethene	8 U	5 U	13 U	**5**	**6**	10 U	12 U	5 U
Total Chlorinated VOCs	0 U	0 U	0 U	**5**	**6**	0 U	0 U	0 U
trans-1,2-Dichloroethene	8 U	5 U	13 U	11 U	10 U	10 U	12 U	5 U
Trichloroethene	8 U	5 U	13 U	11 U	10 U	10 U	12 U	5 U

TABLE 5

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN 2004 SEDIMENT SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND
PAGE 3 OF 4

Investigation	07	07	07	07	07	07	07	05
Location	AH-42	AH-45	AH-47	AH-49	AH-51	CORE1-BOT	CORE1-TOP	OPSED16-01
Sample Number	AH-42-NSD-032704	AH-45-NSD-032604	AH-47-NSD-032604	AH-49-NSD-032504	AH-51-NSD-032704	CORE1-BOTNSD-032704	CORE1-TOPNSD-032704	OPSED16-01-NSD-03220
Sample Code	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
Sample Date	3/27/2004	3/26/2004	3/26/2004	3/25/2004	3/27/2004	3/27/2004	3/27/2004	3/22/2001
Volatile Organic Compounds (ug/kg)								
1,1-Dichloroethene	5 U	12 U	**0.9 J**	5 U	11 U	5 U	5 U	6 UJ
2-Butanone	**8 J**	**15 J**	**8 J**	10 U	**16 J**	**5 J**	**5 J**	13 UJ
Acetone	52 UJ	190 U	72 UJ	79 U	210 UJ	65 UJ	20 U	**89 J**
Carbon Disulfide	5 U	12 U	5 U	5 U	11 U	5 U	5 U	6 UJ
cis-1,2-Dichloroethene	5 U	12 U	**880**	5 U	11 U	5 U	5 U	6 UJ
Total 1,2-Dichloroethene	5 U	12 U	**883**	5 U	11 U	5 U	5 U	6 U
Total Chlorinated VOCs	0 U	0 U	**885**	0 U	0 U	0 U	0 U	0 U
trans-1,2-Dichloroethene	5 U	12 U	**3 J**	5 U	11 U	5 U	5 U	6 UJ
Trichloroethene	5 U	12 U	**2 J**	5 U	11 U	5 U	5 U	6 UJ

TABLE 5

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN 2004 SEDIMENT SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND
PAGE 4 OF 4

Investigation	**05**	**05**	**05**
Location	**SED16-01**	**SED16-01**	**SED16-02**
Sample Number	**SED16-01-NSD-032101**	**SED16-01-NSD-032101-D**	**SED16-02-NSD-032601**
Sample Code	**ORIG**	**DUP**	**NORMAL**
Sample Date	**3/21/2001**	**3/21/2001**	**3/26/2001**
Volatile Organic Compounds (ug/kg)			
1,1-Dichloroethene	12 U	5 U	20 U
2-Butanone	24 UJ	10 UJ	41 UJ
Acetone	**84 J**	**30 J**	**120 J**
Carbon Disulfide	**5 J**	**50 J**	**12**
cis-1,2-Dichloroethene	12 U	5 U	20 U
Total 1,2-Dichloroethene	12 U	5 U	20 U
Total Chlorinated VOCs	0 U	0 U	0 U
trans-1,2-Dichloroethene	12 U	5 U	20 U
Trichloroethene	12 U	5 U	20 U

2007 Sediments

TABLE 6

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN 2007SHALLOW SEDIMENT SAMPLES
PHASE III RI FOR IR PROGRAM SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND

Investigation	**10**	**10**	**10**	**10**
Location	**SD16-AH-01**	**SD16-AH-03**	**SD16-AH-03**	**SP16-AH-01**
Sample Number	**SD16-AH-01-SD-0506**	**SD16-AH-03-SD-0304**	**SD16-AH-03-SD-0809**	**AH-1-SHEEN-121907**
Sample code	**NORMAL**	**NORMAL**	**NORMAL**	**NORMAL**
Sample Date	**8/6/2007**	**8/6/2007**	**8/6/2007**	**12/19/2007**
Depth Range (feet)	**5 - 6**	**3 - 4**	**8 - 9**	**0 - 0.5**
Matrix	**SD**	**SD**	**SD**	**SD**
Area	**ALLEN HARBOR**	**ALLEN HARBOR**	**ALLEN HARBOR**	**ALLEN HARBOR**
Volatile Organic Compounds (ug/kg)				
1,2,4-Trichlorobenzene	0.52 U	0.49 U	0.56 U	**2.1 J**
2-Hexanone	0.38 UJ	0.35 UJ	0.4 UJ	**3.1 J**
Acetone	1.3 U	1.2 U	1.3 U	**95 J**
cis-1,2-Dichloroethene	**20**	0.32 U	0.37 U	6.9 U
Methyl Acetate	1.7 U	1.6 U	1.8 U	**12 J**
Methyl Tert-Butyl Ether	0.32 U	0.29 U	0.34 U	**1.7 J**
Methylene Chloride	0.6 U	**1.1 J**	0.64 U	6.9 U
Total Chlorinated VOCs	**26.5**	**8.5**	**11**	
Trichloroethene	**6.5**	**7.4**	**11**	6.9 U

Notes:
Bolding indicates that the chemical was detected in the sample.

Qualifiers:
J - Estimated value.
U - Non-detected result.
UJ - Non-detected result is estimated.
UR - Non-detected result is rejected.

Sample Code Description:
NORMAL - One sample was collected at this location.
ORIG - First of two samples collected at this location.
DUP - Second of two samples collected at this location.

2010 Sediments

TABLE 7

SEDIMENT FROM ALLEN HARBOR POSITIVE RESULTS
SITE 16 FEASIBILITY STUDY
FORMER NCBC DAVISVILLE FACILITY
NORTH KINGSTOWN, RHODE ISLAND
PAGE 1 OF 2

LOCATION	SOUTHWEST POINT	SOUTHWEST POINT	MIDDLE LINE - WESTERN POINT	MIDDLE LINE - EASTERN POINT	MIDDLE LINE - EASTERN POINT	MIDDLE LINE - EASTERN POINT	MIDDLE LINE - EASTERN POINT
SAMPLE ID	SD16-AH-20-0000	SD16-AH-20-0102	SD16-AH-21-0000	SD16-AH-22-0000	SD16-AH-22-0001	SD16-AH-22-0001-AVG	SD16-AH-22-0001-D
SAMPLE DATE	20100621	20100621	20100621	20100622	20100622	20100622	20100622
PROBLEM CODE	3	3	3	3	3	3	3
SAMPLE CODE	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP
MATRIX	SD	SD	SD	SD	SD	SD	SD
TOP DEPTH (FT)	0	1	0	0	0.25	0.25	0.25
BOTTOM DEPTH (FT)	0.25	2	0.25	0.25	1	1	1
TEMPORARY WELL CO-LOCATED	TW16-AH-13	TW16-AH-13	TW16-AH-14	TW16-AH-15	TW16-AH-15	TW16-AH-15	TW16-AH-15
SURFACE WATER SAMPLE CO-	SW16-AH-08	SW16-AH-08	SW16-AH-09	SW16-AH-10	SW16-AH-10	SW16-AH-10	SW16-AH-10
MISCELLANEOUS PARAMETERS (%)							
TOTAL SOLIDS	**50**	**68**	**64**	**38**	**48**	**48.5**	**49**
VOLATILES (UG/KG)							
2-BUTANONE	**50**	NA	**14 J**	18 U	16 U	**15 J**	**15 J**
ACETONE	**180**	NA	**66**	**59 J**	**54 J**	**57 J**	**60 J**
CARBON DISULFIDE	**6 J**	NA	**7**	**14 J**	**14**	**18**	**22**
METHYL TERT-BUTYL ETHER	2 U	NA	**2 J**	3 U	3 U	3 U	3 U
TOTAL CHLORINATED VOCS	0 U	NA	**1**	0 U	0 U	0 U	0 U
TRICHLOROETHENE	0.9 U	NA	**1 J**	2 U	2 U	1.5 U	1 U
FIELD SCREENING							
JAR HEADSPACE (PPM)	0.0	1.4	0.0	0.0	0.0	NA	NA
COLOR-TEC (UNITLESS)[1]	ND	ND	ND	ND	ND	NA	NA

Notes:
Bolded values indicate positive results.

Footnotes:
1 Presents direct tube reading, tube-typ
against laboratory results in order to es

Calculations:
Total chlorinated VOCs - sum of 1,1,1-
cis-1,2-DCE, cis-1,3-dichloropropene

Qualifers:
J - Estimated value
U - Nondetected result
UJ - Estimated, nondetected result
UR - Rejected, nondetected result

Abbreviations:
DCA - Dichloroethane
DCE - Dichloroethene
NA - Not applicable; analysis not perfo
NC - No criteria available
PCE - Tetrachloroethene
TCA - Trichloroethane
TCE - Tetrachloroethene
VOC - Volatile organic compound

TABLE 7

SEDIMENT FROM ALLEN HARBOR POSITIVE RESULTS
SITE 16 FEASIBILITY STUDY
FORMER NCBC DAVISVILLE FACILITY
NORTH KINGSTOWN, RHODE ISLAND

LOCATION	NORTHERN LINE - WESTERN POINT	NORTHERN LINE - CENTER POINT	NORTHERN LINE - EASTERN POINT	NORTHERN LINE - EASTERN POINT
SAMPLE ID	SD16-AH-23-0000	SD16-AH-24-0000	SD16-AH-25-0000	SD16-AH-25-0001
SAMPLE DATE	20100621	20100621	20100622	20100622
PROBLEM CODE	3	3	3	3
SAMPLE CODE	NORMAL	NORMAL	NORMAL	NORMAL
MATRIX	SD	SD	SD	SD
TOP DEPTH (FT)	0	0	0	0.25
BOTTOM DEPTH (FT)	0.25	0.25	0.25	1
TEMPORARY WELL CO-LOCATED	TW16-AH-16	TW16-AH-17	TW16-AH-18	TW16-AH-18
SURFACE WATER SAMPLE CO-	SW16-AH-11	SW16-AH-12	SW16-AH-13	SW16-AH-13
MISCELLANEOUS PARAMETERS (%)				
TOTAL SOLIDS	25	46	45	53
VOLATILES (UG/KG)				
2-BUTANONE	47 J	17 U	15 U	7 U
ACETONE	190 J	80	48 J	22 J
CARBON DISULFIDE	40 J	21	16	11
METHYL TERT-BUTYL ETHER	5 UR	3 U	3 U	1 U
TOTAL CHLORINATED VOCS	0 U	0 U	0 U	0 U
TRICHLOROETHENE	2 UR	2 U	2 U	0.7 U
FIELD SCREENING				
JAR HEADSPACE (PPM)	0.0	0.0	0.0	0.0
COLOR-TEC (UNITLESS)[1]	ND	ND	ND	ND

ɔe, and purge volume, respectively. Direct tube reading needs to be correlated
ɪtimate field screening concentration.

TCA, 1,1,2,2-PCE, 1,1,2-TCA, 1,1,-DCA, 1,1-DCE, 1,2-DCA, 1,2-dichloropropane, carbon tetrachloride, chloroethane, chloromethane,
ı, methylene chloride, PCE, total 1,2-DCE, trans 1,2-DCE, trans-1,3-dichloropropene, TCE, and vinyl chloride

Sample Code:
NORMAL - One sample was collected at this location.
ORIG - First of two samples collected at this location.
DUP - Second of two samples collected at this location.
AVG - Average of two samples collected at this location.

ɪmed

ATTACHMENT B

SUPPORT DOCUMENTATION FOR SCREENING LEVELS

SUPPORT DOCUMENTATION FOR HUMAN HEALTH SCREENING LEVELS

Table B-1
Surface Water Screening Levels for Recreational Users
NCBC Davisville Site 16
(Calculations Provided on Attached Spreadsheets)

CAS No.	Parameter	Human Health (ug/L)
Volatile Organic Compounds		
79-00-5	1,1,2-Trichloroethane	79.1
75-34-3	1,1-Dichloroethane	681
75-35-4	1,1-Dichloroethene	27,600
120-82-1	1,2,4-Trichlorobenzene	13.1
107-06-2	1,2-Dichloroethane	59.7
106-46-7	1,4-Dichlorobenzene	126
78-93-3	2-Butanone	1,210,000
591-78-6	2-Hexanone	6,060
108-10-1	4-Methyl-2-Pentanone	102,000
67-64-1	Acetone	2,040,000
71-43-2	Benzene	38.5
75-27-4	Bromodichloromethane	79.2
75-15-0	Carbon Disulfide	58,000
108-90-7	Chlorobenzene	5,240
124-48-1	Chlorodibromomethane	63.2
75-00-3	Chloroethane	NA
67-66-3	Chloroform	120
74-87-3	Chloromethane	NA
156-59-2	cis-1,2-Dichloroethene	1,160
110-82-7	Cyclohexane	NA
100-41-4	Ethylbenzene	65.1
98-82-8	Isopropylbenzene	9,530
79-20-9	Methyl Acetate	2,100,000
108-87-2	Methyl Cyclohexane	NA
1634-04-4	Methyl Tert-Butyl Ether	4,570
75-09-2	Methylene Chloride	7,390
100-42-5	Styrene	42,200
127-18-4	Tetrachloroethene	1,140
108-88-3	Toluene	20,100
540-59-0	Total 1,2-Dichloroethene	5,210
1330-20-7	Total Xylenes	32,600
156-60-5	trans-1,2-Dichloroethene	11,600
79-01-6	Trichloroethene (Adult Only)	72
79-01-6	Trichloroethene (Lifelong)	35
79-01-6	Trichloroethene (Child 2-6 & Adult)	47
79-01-6	Trichloroethene (Noncarcinogenic)	260
75-01-4	Vinyl Chloride (Lifelong) (1)	0.142
75-01-4	Vinyl Chloride (Adult Only) (1)	6.4
75-01-4	Vinyl Chloride (Child 2-6 & Adult) (1)	0.142

1) The lifelong screening level is an order of magnitude less than the current Safe Drinking Wate Act maximum contaminant level.

Site-specific
Recreator Equation Inputs for Surface Water

Adult and Small Child Receptor
EPA RSL Calculator

Variable	Value
TR (target cancer risk) unitless	0.000001
THQ (target hazard quotient) unitless	1
EF_{recwc} (child exposure frequency) day/year	52
EF_{recwa} (adult exposure frequency) day/year	52
EF_{0-2} (mutagenic exposure frequency) day/year	52
EF_{2-6} (mutagenic exposure frequency) day/year	52
EF_{6-16} (mutagenic exposure frequency) day/year	52
EF_{16-30} (mutagenic exposure frequency) day/year	52
ED_{recwc} (exposure duration - child) year	6
ED_{recwa} (exposure duration - adult) year	24
ED_{0-2} (mutagenic exposure duration) year	2
ED_{2-6} (mutagenic exposure duration) year	4
ED_{6-16} (mutagenic exposure duration) year	10
ED_{16-30} (mutagenic exposure duration) year	14
LT (lifetime - recreator) year	70
EV_{recwa} (adult) events/day	1
EV_{recwc} (child) events/day	1
EV_{0-2} (mutagenic) events/day	1
EV_{2-6} (mutagenic) events/day	1
EV_{6-16} (mutagenic) events/day	1
EV_{16-30} (mutagenic) events/day	1
ET_{recwa} (adult exposure time) hour/event	4
ET_{recwc} (child exposure time) hour/event	4
$ET_{recw0-2}$ (mutagenic exposure time) hour/event	4
$ET_{recw2-6}$ (mutagenic exposure time) hour/event	4
$ET_{recw6-16}$ (mutagenic exposure time) hour/event	4
$ET_{recw16-30}$ (mutagenic exposure time) hour/event	4
$ET_{recw-adj}$ (age-adjusted exposure time) hour/event	4
$ET_{recw-madj}$ (mutagenic age-adjusted exposure time) hour/event	4
BW_{recwa} (body weight - adult) kg	70
BW_{recwc} (body weight - child) kg	15
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	70
BW_{16-30} (mutagenic body weight) kg	70
RW_{recwa} (water intake rate - adult) L/hr	0.01
RW_{recwc} (water intake rate - child) L/hr	0.01
RW_{0-2} (mutagenic water intake rate) L/hr	0.01
RW_{2-6} (mutagenic water intake rate) L/hr	0.01
RW_{6-16} (mutagenic water intake rate) L/hr	0.01
RW_{16-30} (mutagenic water intake rate) L/hr	0.01
SA_{recwa} (skin surface area - adult) cm^2	5700
SA_{recwc} (skin surface area - child) cm^2	2800
SA_{0-2} (mutagenic skin surface area) cm^2	2800
SA_{2-6} (mutagenic skin surface area) cm^2	2800
SA_{6-16} (mutagenic skin surface area) cm^2	5700
SA_{16-30} (mutagenic skin surface area) cm^2	5700
$_{sc}$ (apparent thickness of stratum corneum) cm	0.001
$FW_{rec-adj}$ (age-adjusted water intake rate) L/kg	1.545
$FWM_{rec-adj}$ (mutagenic age-adjusted water intake rate) L/kg	5.745
$DFW_{rec-adj}$ (age-adjusted dermal factor) cm^2-event/kg	159862.857
$DFWM_{rec-adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	496921.905

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ite-specific
ecreator Risk-Based Screening Levels (RSL) for Surface Water Adult and Small Child Receptor
s=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
a** (Where nc SL < 10 x ca SL),
ax=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat

Chemical	CAS Number	Chemical Type	Ingestion SF (mg/kg-day)$^{-1}$	SFO Ref	Chronic RfD (mg/kg-day)	RfD Ref	RAGSe GIABS (unitless)	KP	MW	pi	logds	dsclc	dsc	c	littleb	B	tstar	tau_event	FA	In EPD?	DAeventc	DAeventnc	DAeventna	Ingestion SL TR=1.0E-6 (ug/L)	Dermal SL TR=1.0E-6 (µg/L)	Carcinogenic SL TR=1.0E-6 (ug/L)	Ingestion SL (Child) HQ=1 (ug/L)	Dermal SL (Child) HQ=1 (µg/L)	Noncarcinogenic SL (Child) HQ=1 (ug/L)	Ingestion SL (Adult) HQ=1 (ug/L)	Dermal SL (Adult) HQ=1 (µg/L)	Noncarcinogenic SL (Adult) HQ=1 (ug/L)	Screening Level (ug/L)
cetone	67-64-1	Organics	-		9.00E-01	I	1	5.12E-04	58.08	3.141593	-3.125248	7.50E-04	7.49E-07	3.34E-01	3.04E-01	1.50E-03	5.34E-01	2.22E-01	1	Yes	-	33.84272	77.580972	-	-	-	2.37E+06	1.49E+07	2.04E+06	1.11E+07	3.41E+07	8.35E+06	
enzene	71-43-2	Organics	5.50E-02	I	4.00E-03	I	1	1.49E-02	78.11	3.141593	-3.237416	5.79E-04	5.79E-07	3.68E-01	3.35E-01	5.06E-02	6.91E-01	2.88E-01	1	Yes	0.002906	0.1504121	0.3448043	3.01E+02	4.42E+01	3.85E+01	1.05E+04	2.29E+03	1.88E+03	4.91E+04	5.24E+03	4.74E+03	3.85E+01 ca**
romodichloromethane	75-27-4	Organics	6.20E-02	I	2.00E-02	I	1	4.02E-03	163.8	3.141593	-3.717448	1.92E-04	1.92E-07	3.47E-01	3.15E-01	1.98E-02	2.09E+00	8.70E-01	1	Yes	0.002578	0.7520604	1.7240216	2.67E+02	1.13E+02	7.92E+01	5.26E+04	3.28E+04	2.02E+04	2.46E+05	7.53E+04	5.76E+04	7.92E+01 ca**
arbon Disulfide	75-15-0	Organics	-		1.00E-01	I	1	1.14E-02	76.13	3.141593	-3.226328	5.94E-04	5.94E-07	3.59E-01	3.27E-01	3.83E-02	6.74E-01	2.81E-01	1	Yes	-	3.7603022	8.620108	-	-	-	2.63E+05	7.44E+04	5.80E+04	1.23E+06	1.70E+05	1.50E+05	
hlorobenzene	108-90-7	Organics	-		2.00E-02	I	1	2.82E-02	112.6	3.141593	-3.430336	3.71E-04	3.71E-07	4.14E-01	3.78E-01	1.15E-01	1.08E+00	4.49E-01	1	Yes	-	0.7520604	1.7240216	-	-	-	5.26E+04	5.81E+03	5.24E+03	2.46E+05	1.33E+04	1.26E+04	
hlorodibromomethane	73506-94-2	Organics	-		-		1	-	-	3.141593	-	-	-	-	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-	-	-	-
hloroform	67-66-3	Organics	3.10E-02	C	1.00E-02	I	1	6.83E-03	119.4	3.141593	-3.468528	3.40E-04	3.40E-07	3.53E-01	3.21E-01	2.87E-02	1.18E+00	4.90E-01	1	Yes	0.005156	0.3760302	0.8620108	5.33E+02	1.54E+02	1.20E+02	2.63E+04	1.12E+04	7.88E+03	1.23E+05	2.58E+04	2.13E+04	1.20E+02 ca**
hloromethane	74-87-3	Organics	-		-		1	3.28E-03	50.49	3.141593	-3.082744	8.27E-04	8.27E-07	3.39E-01	3.09E-01	8.96E-03	4.84E-01	2.02E-01	1	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
umene	98-82-8	Organics	-		1.00E-01	I	1	8.97E-02	120.2	3.141593	-3.47312	3.36E-04	3.36E-07	6.20E-01	5.69E-01	3.78E-01	1.19E+00	4.95E-01	1	Yes	-	3.7603022	8.620108	-	-	-	2.63E+05	9.89E+03	9.53E+03	1.23E+06	2.27E+04	2.23E+04	
yclohexane	110-83-8	Organics	-		5.00E-03	P	1	4.31E-02	82.15	3.141593	-3.26004	5.50E-04	5.49E-07	4.40E-01	4.02E-01	1.50E-01	7.28E-01	3.03E-01	1	Yes	-	0.1880151	0.4310054	-	-	-	1.32E+04	1.05E+03	9.68E+02	6.14E+04	2.40E+03	2.31E+03	
ibromochloromethane	124-48-1	Organics	8.40E-02	I	2.00E-02	I	1	2.89E-03	208.3	3.141593	-3.966368	1.08E-04	1.08E-07	3.44E-01	3.13E-01	1.60E-02	3.70E+00	1.54E+00	1	Yes	0.001903	0.7520604	1.7240216	1.97E+02	9.31E+01	6.32E+01	5.26E+04	3.68E+04	2.17E+04	2.46E+05	8.44E+04	6.28E+04	6.32E+01 ca**
ichlorobenzene, 1,4-	106-46-7	Organics	5.40E-03	C	7.00E-02	A	1	4.53E-02	147	3.141593	-3.6232	2.38E-04	2.38E-07	4.86E-01	4.48E-01	2.11E-01	1.68E+00	7.00E-01	1	Yes	0.029597	2.6322115	6.0340756	3.06E+03	1.31E+02	1.26E+02	1.84E+05	1.16E+04	1.10E+04	8.60E+05	2.67E+04	2.59E+04	1.26E+02 ca**
ichloroethane, 1,1-	75-34-3	Organics	5.70E-03	C	2.00E-01	P	1	6.75E-03	98.96	3.141593	-3.354176	4.42E-04	4.42E-07	3.51E-01	3.19E-01	2.58E-02	9.04E-01	3.77E-01	1	Yes	0.028039	7.5206044	17.240216	2.90E+03	8.89E+02	6.81E+02	5.26E+05	2.38E+05	1.64E+05	2.46E+06	5.47E+05	4.47E+05	6.81E+02 ca**
ichloroethane, 1,2-	107-06-2	Organics	9.10E-02	I	6.00E-03	X	1	4.20E-03	98.96	3.141593	-3.354176	4.42E-04	4.42E-07	3.44E-01	3.13E-01	1.61E-02	9.04E-01	3.77E-01	1	Yes	0.001756	0.2256181	0.5172065	1.82E+02	8.89E+01	5.97E+01	1.58E+04	1.14E+04	6.63E+03	7.37E+04	2.62E+04	1.93E+04	5.97E+01 ca**
ichloroethylene, 1,1-	75-35-4	Organics	-		5.00E-02	I	1	1.17E-02	96.94	3.141593	-3.342864	4.54E-04	4.54E-07	3.63E-01	3.31E-01	4.43E-02	8.81E-01	3.67E-01	1	Yes	-	1.8801511	4.310054	-	-	-	1.32E+05	3.50E+04	2.76E+04	6.14E+05	8.01E+04	7.09E+04	
ichloroethylene, 1,2- (Mixed Isomers)	540-59-0	Organics	-		9.00E-03	H	1	1.10E-02	96.94	3.141593	-3.342864	4.54E-04	4.54E-07	3.62E-01	3.29E-01	4.17E-02	8.81E-01	3.67E-01	1	Yes	-	0.3384272	0.7758097	-	-	-	2.37E+04	6.68E+03	5.21E+03	1.11E+05	1.53E+04	1.35E+04	
ichloroethylene, 1,2-cis-	156-59-2	Organics	-		2.00E-03	I	1	1.10E-02	96.94	3.141593	-3.342864	4.54E-04	4.54E-07	3.62E-01	3.29E-01	4.17E-02	8.81E-01	3.67E-01	1	Yes	-	0.075206	0.1724022	-	-	-	5.26E+03	1.48E+03	1.16E+03	2.46E+04	3.40E+03	2.99E+03	
ichloroethylene, 1,2-trans-	156-60-5	Organics	-		2.00E-02	I	1	1.10E-02	96.94	3.141593	-3.342864	4.54E-04	4.54E-07	3.62E-01	3.29E-01	4.17E-02	8.81E-01	3.67E-01	1	Yes	-	0.7520604	1.7240216	-	-	-	5.26E+04	1.48E+04	1.16E+04	2.46E+05	3.40E+04	2.99E+04	
thyl Chloride	75-00-3	Organics	-		-		1	6.07E-03	64.52	3.141593	-3.161312	6.90E-04	6.90E-07	3.46E-01	3.15E-01	1.88E-02	5.80E-01	2.42E-01	1	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-
thylbenzene	100-41-4	Organics	1.10E-02	C	1.00E-01	I	1	4.93E-02	106.2	3.141593	-3.394552	4.03E-04	4.03E-07	4.74E-01	4.35E-01	1.95E-01	9.92E-01	4.13E-01	1	Yes	0.01453	3.7603022	8.620108	1.50E+03	6.81E+01	6.51E+01	2.63E+05	1.76E+04	1.65E+04	1.23E+06	4.04E+04	3.91E+04	6.51E+01 ca**
lexanone, 2-	591-78-6	Organics	-		5.00E-03	I	1	3.55E-03	100.2	3.141593	-3.360896	4.36E-04	4.36E-07	3.43E-01	3.12E-01	1.37E-02	9.18E-01	3.83E-01	1	Yes	-	0.1880151	0.4310054	-	-	-	1.32E+04	1.12E+04	6.06E+03	6.14E+04	2.57E+04	1.81E+04	
ethyl Acetate	79-20-9	Organics	-		1.00E+00	X	1	7.92E-04	74.08	3.141593	-3.214848	6.10E-04	6.10E-07	3.35E-01	3.05E-01	2.62E-03	6.56E-01	2.73E-01	1	Yes	-	37.603022	86.20108	-	-	-	2.63E+06	1.05E+07	2.10E+06	1.23E+07	2.40E+07	8.12E+06	
ethyl Ethyl Ketone (2-Butanone)	78-93-3	Organics	-		6.00E-01	I	1	9.62E-04	72.11	3.141593	-3.203816	6.25E-04	6.25E-07	3.35E-01	3.05E-01	3.14E-03	6.40E-01	2.66E-01	1	Yes	-	22.561813	51.720648	-	-	-	1.58E+06	5.19E+06	1.21E+06	7.37E+06	1.19E+07	4.55E+06	
ethyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	Organics	-		8.00E-02	H	1	3.19E-03	100.2	3.141593	-3.360896	4.36E-04	4.36E-07	3.42E-01	3.11E-01	1.23E-02	9.18E-01	3.83E-01	1	Yes	-	3.0082418	6.8960864	-	-	-	2.11E+05	2.00E+05	1.02E+05	9.83E+05	4.57E+05	3.12E+05	
ethyl tert-Butyl Ether (MTBE)	1634-04-4	Organics	1.80E-03	C	-		1	2.11E-03	88.15	3.141593	-3.29364	5.09E-04	5.09E-07	3.38E-01	3.08E-01	7.62E-03	7.87E-01	3.28E-01	1	Yes	0.088791	-	-	9.19E+03	9.09E+03	4.57E+03	-	-	-	-	-	-	- 4.57E+03 ca**
ethylcyclohexane	108-87-2	Organics	-		-		1	1.10E-01	98.19	3.141593	-3.349864	4.47E-04	4.47E-07	6.54E-01	6.28E-01	4.19E-01	8.95E-01	3.73E-01	1	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-
ethylene Chloride	75-09-2	Organics	2.00E-03	I	6.00E-03	I	1	3.54E-03	84.93	3.141593	-3.275608	5.30E-04	5.30E-07	3.42E-01	3.11E-01	1.25E-02	7.55E-01	3.14E-01	1	Yes	0.025708	0.2256181	0.5172065	2.22E+03	1.58E+03	9.25E+02	1.58E+04	1.39E+04	7.39E+03	7.37E+04	3.19E+04	2.22E+04	9.25E+02 ca**
yrene	100-42-5	Organics	-		2.00E-01	I	1	3.72E-02	104.2	3.141593	-3.38324	4.14E-04	4.14E-07	4.37E-01	3.99E-01	1.46E-01	9.67E-01	4.03E-01	1	Yes	-	7.5206044	17.240216	-	-	-	5.26E+05	4.58E+04	4.22E+04	2.46E+06	1.05E+05	1.01E+05	
etrachloroethylene	127-18-4	Organics	2.10E-03	I	6.00E-03	I	1	3.34E-02	165.8	3.141593	-3.728648	1.87E-04	1.87E-07	4.51E-01	4.13E-01	1.65E-01	2.14E+00	8.92E-01	1	Yes	0.076107	0.2256181	0.5172065	7.87E+03	4.14E+02	3.93E+02	1.58E+04	1.23E+03	1.14E+03	7.37E+04	2.81E+03	2.71E+03	3.93E+02 ca**
oluene	108-88-3	Organics	-		8.00E-02	I	1	3.11E-02	92.14	3.141593	-3.315984	4.83E-04	4.83E-07	4.14E-01	3.77E-01	1.15E-01	8.28E-01	3.45E-01	1	Yes	-	3.0082418	6.8960864	-	-	-	2.11E+05	2.22E+04	2.01E+04	9.83E+05	5.09E+04	4.84E+04	
richlorobenzene, 1,2,4-	120-82-1	Organics	2.90E-02	P	1.00E-02	I	1	7.05E-02	181.5	3.141593	-3.81612	1.53E-04	1.53E-07	6.09E-01	5.77E-01	3.65E-01	2.62E+00	1.09E+00	1	Yes	0.005511	0.3760302	0.8620108	5.70E+02	1.34E+01	1.31E+01	2.63E+04	9.11E+02	8.81E+02	1.23E+05	2.09E+03	2.05E+03	1.31E+01 ca**
richloroethane, 1,1,2-	79-00-5	Organics	5.70E-02	I	4.00E-03	I	1	5.04E-03	133.4	3.141593	-3.547096	2.84E-04	2.84E-07	3.48E-01	3.17E-01	2.24E-02	1.41E+00	5.87E-01	1	Yes	0.002804	0.1504121	0.3448043	2.90E+02	1.09E+02	7.91E+01	1.05E+04	5.84E+03	3.75E+03	4.91E+04	1.34E+04	1.05E+04	7.91E+01 ca**
inyl Chloride	75-01-4	Organics	7.20E-01	I	3.00E-03	I	1	6.38E-03	62.5	3.141593	-3.15	7.08E-04	7.08E-07	3.51E-01	3.19E-01	2.55E-02	5.65E-01	2.35E-01	1	Yes	7.20E-06	0.1128091	0.2586032	5.09E-01	1.96E-01	1.42E-01	7.90E+03	3.07E+03	2.21E+03	3.69E+04	7.04E+03	5.91E+03	1.42E-01 ca**
ylenes	1330-20-7	Organics	-		2.00E-01	I	1	5.00E-02	106.2	3.141593	-3.394552	4.03E-04	4.03E-07	4.76E-01	4.38E-01	1.98E-01	9.92E-01	4.13E-01	1	Yes	-	7.5206044	17.240216	-	-	-	5.26E+05	3.48E+04	3.26E+04	2.46E+06	7.97E+04	7.72E+04	

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CALCULATION OF RISK-BASED PRELIMINARY CLEANUP LEVELS **Trichloroethene**

SITE NAME: FORMER NCBC DAVISVILLE, NORTH KINGSTOWN, RHODE ISLAND
EXPOSURE POINT: SITE 16
EXPOSURE SCENARIO: *ADULT RECREATIONAL USERS*
MEDIA: SURFACE WATER
DATE: FEBRUARY 6, 2013

THIS SPREADSHEET CALCULATES RISK-BASED CLEANUP GOALS FOR EXPOSURES TO SURFACE WATER
THE INCIDENTAL INGESTION AND DERMAL CONTACT ROUTES OF EXPOSURE ARE CONSIDERED.

RELEVANT EQUATIONS:

$$PRG_{child} = \frac{TCR}{[IntakeFac_{oral(0\text{-}2)} \times CSF_{oral} + IntakeFac_{derm(0\text{-}2)} \times DA_{event} \times CSF_{derm}] \times ADAF_{(0\text{-}2)} + [IntakeFac_{oral(2\text{-}6)} \times CSF_{oral} + IntakeFac_{derm(2\text{-}6)} \times DAevent \times CSF_{derm}] \times ADAF_{(2\text{-}6)}}$$

$$PRG_{adult} = \frac{TCR}{[IntakeFac_{oral(6\text{-}16)} \times CSF_{oral} + IntakeFac_{derm(6\text{-}16)} \times DAevent \times CSF_{derm}] \times ADAF_{(6\text{-}16)} + [IntakeFac_{oral(16\text{-}30)} \times CSF_{oral} + IntakeFac_{derm(16\text{-}30)} \times DAevent \times CSF_{derm}] \times ADAF_{(16\text{-}30)}}$$

$$PRG_{Lifetime} = \frac{TCR}{Intake_{child(0\text{-}2)} \times CSF \times ADAF_{(0\text{-}2)} + Intake_{child(2\text{-}6)} \times CSF \times ADAF_{(2\text{-}6)} + Intake_{adult(6\text{-}16)} \times CSF \times ADAF_{(6\text{-}16)} + Intake_{adult(16\text{-}30)} \times CSF \times ADAF_{(16\text{-}30)}}$$

$$IntakeFac_{oral} = \frac{CR \times ET \times EF \times ED}{BW \times AT}$$

$$IntakeFac_{derm} = \frac{DA_{Event} \times EV \times ED \times EF \times SA}{BW \times AT}$$

WHERE:

Parameter	Child Ages 0 - 2	Child Ages 2 - 6	Adult Ages 6 - 16	Adult Ages 16 - 30	Definition
TCR = :	1E-06				Target Cancer Risk
CR = :	0	0	0.01	0.01	Contact Rate (L/hour)
CF = :	1.0E-03	1.0E-03	1.0E-03	1.0E-03	Conversion Factor (L/m3)
ET = :	4	4	4	4	Exposure time (hours/day)
SA = :	0	0	5700	5700	Skin surface available for contact (cm^2)
DA_{event} = :	Chemical Specific				Chemical specific absorbed dose per event (mg/cm2-event)
EV = :	1	1	1	1	Event frequency (events/day)
EF = :	52	52	52	52	Exposure Frequency (days/year)
ED = :	2	4	10	14	Exposure Duration (years)
BW = :	15	15	70	70	Body Weight (kg)
ATc = :	25,550	25,550	25,550	25,550	Averaging time for carcinogenic exposures (days)
$IntakeFac_{oral}$ = :	0.00E+00	0.00E+00	1.16E-05	1.63E-05	Intake factor - Ingestion (kg/kg-day)
$IntakeFac_{derm}$ = :	0.00E+00	0.00E+00	1.66E+00	2.32E+00	Intake factor - Dermal (kg/kg-day)

CHEMICAL	Organic or Inorganic	Estimated Kp (cm/hr)	FA	tau-event (hr)	B	t* (hr)	DA_{event} - Child (L/cm^2 - event)	DA_{event} - Adult (L/cm^2 - event)
Trichloroethene (Mutagenic)	Organic	1.16E-02	1	5.72E-01	5.11E-02	1.37E+00	5.83E-05	5.83E-05
Trichloroethene (Nonmutagenic)	Organic	1.16E-02	1	5.72E-01	5.11E-02	1.37E+00	5.83E-05	5.83E-05

CHEMICAL	Cancer Slope Factor		Age Dependent Adjustment Factor			
	Oral $(mg/kg/day)^{-1}$	Dermal $(mg/kg/day)^{-1}$	Ages 0 - 2	Ages 2 - 6	Ages 6 - 16	Ages >16
Trichloroethene (Mutagenic)	9.3E-03	9.3E-03	10	3	3	1
Trichloroethene (Nonmutagenic)	3.7E-02	3.7E-02	1	1	1	1

CHEMICAL	Surface Water Concentration (ug/L)		
	Child	Adult	Lifelong
Trichloroethene (Mutagenic)	NA	2.3E+02	2.3E+02
Trichloroethene (Nonmutagenic)	NA	1.0E+02	1.0E+02
Trichloroethene	NA	7.2E+01	7.2E+01

CALCULATION OF RISK-BASED PRELIMINARY CLEANUP LEVELS **Trichloroethene**

SITE NAME: FORMER NCBC DAVISVILLE, NORTH KINGSTOWN, RHODE ISLAND
EXPOSURE POINT: SITE 16
EXPOSURE SCENARIO: *LIFELONG (CHILD AGES 2-6 AND ADULT) RECREATIONAL USERS*
MEDIA: SURFACE WATER
DATE: FEBRUARY 6, 2013

THIS SPREADSHEET CALCULATES RISK-BASED CLEANUP GOALS FOR EXPOSURES TO SURFACE WATER
THE INCIDENTAL INGESTION AND DERMAL CONTACT ROUTES OF EXPOSURE ARE CONSIDERED.

RELEVANT EQUATIONS:

$$PRG_{child} = \frac{TCR}{[IntakeFac_{oral(0\text{-}2)} \times CSF_{oral} + IntakeFac_{derm(0\text{-}2)} \times DA_{event} \times CSF_{derm}] \times ADAF_{(0\text{-}2)} + [IntakeFac_{oral(2\text{-}6)} \times CSF_{oral} + IntakeFac_{derm(2\text{-}6)} \times DAevent \times CSF_{derm}] \times ADAF_{(2\text{-}6)}}$$

$$PRG_{adult} = \frac{TCR}{[IntakeFac_{oral(6\text{-}16)} \times CSF_{oral} + IntakeFac_{derm(6\text{-}16)} \times DAevent \times CSF_{derm}] \times ADAF_{(6\text{-}16)} + [IntakeFac_{oral(16\text{-}30)} \times CSF_{oral} + IntakeFac_{derm(16\text{-}30)} \times DAevent \times CSF_{derm}] \times ADAF_{(16\text{-}30)}}$$

$$PRG_{Lifetime} = \frac{TCR}{Intake_{child(0\text{-}2)} \times CSF \times ADAF_{(0\text{-}2)} + Intake_{child(2\text{-}6)} \times CSF \times ADAF_{(2\text{-}6)} + Intake_{adult(6\text{-}16)} \times CSF \times ADAF_{(6\text{-}16)} + Intake_{adult(16\text{-}30)} \times CSF \times ADAF_{(16\text{-}30)}}$$

$$IntakeFac_{oral} = \frac{CR \times ET \times EF \times ED}{BW \times AT}$$

$$IntakeFac_{derm} = \frac{DA_{Event} \times EV \times ED \times EF \times SA}{BW \times AT}$$

WHERE:

Parameter	Child Ages 0 - 2	Child Ages 2 - 6	Adult Ages 6 - 16	Adult Ages 16 - 30	Definition
TCR = :	1E-06				Target Cancer Risk
CR = :	0	0.01	0.01	0.01	Contact Rate (L/hour)
CF = :	1.0E-03	1.0E-03	1.0E-03	1.0E-03	Conversion Factor (L/m3)
ET = :	4	4	4	4	Exposure time (hours/day)
SA = :	0	2800	5700	5700	Skin surface available for contact (cm^2)
DA_{event} = :	Chemical Specific				Chemical specific absorbed dose per event (mg/cm2-event)
EV = :	1	1	1	1	Event frequency (events/day)
EF = :	52	52	52	52	Exposure Frequency (days/year)
ED = :	2	4	10	14	Exposure Duration (years)
BW = :	15	15	70	70	Body Weight (kg)
ATc = :	25,550	25,550	25,550	25,550	Averaging time for carcinogenic exposures (days)
$IntakeFac_{oral}$ = :	0.00E+00	2.17E-05	1.16E-05	1.63E-05	Intake factor - Ingestion (kg/kg-day)
$IntakeFac_{derm}$ = :	0.00E+00	1.52E+00	1.66E+00	2.32E+00	Intake factor - Dermal (kg/kg-day)

CHEMICAL	Organic or Inorganic	Estimated Kp (cm/hr)	FA	tau-event (hr)	B	t* (hr)	DA_{event} - Child (L/cm^2 - event)	DA_{event} - Adult (L/cm^2 - event)
Trichloroethene (Mutagenic)	Organic	1.16E-02	1	5.72E-01	5.11E-02	1.37E+00	5.83E-05	5.83E-05
Trichloroethene (Nonmutagenic)	Organic	1.16E-02	1	5.72E-01	5.11E-02	1.37E+00	5.83E-05	5.83E-05

CHEMICAL	Cancer Slope Factor		Age Dependent Adjustment Factor			
	Oral $(mg/kg/day)^{-1}$	Dermal $(mg/kg/day)^{-1}$	Ages 0 - 2	Ages 2 - 6	Ages 6 - 16	Ages >16
Trichloroethene (Mutagenic)	9.3E-03	9.3E-03	10	3	3	1
Trichloroethene (Nonmutagenic)	3.7E-02	3.7E-02	1	1	1	1

CHEMICAL	Surface Water Concentration (ug/L)		
	Child	Adult	Lifelong
Trichloroethene (Mutagenic)	3.3E+02	2.3E+02	1.3E+02
Trichloroethene (Nonmutagenic)	2.5E+02	1.0E+02	7.4E+01

Trichloroethene	1.4E+02	7.2E+01	4.7E+01

CALCULATION OF RISK-BASED PRELIMINARY CLEANUP LEVELS **Trichloroethene**

SITE NAME: FORMER NCBC DAVISVILLE, NORTH KINGSTOWN, RHODE ISLAND
EXPOSURE POINT: SITE 16
EXPOSURE SCENARIO: *LIFELONG (CHILD AND ADULT) RECREATIONAL USERS*
MEDIA: SURFACE WATER
DATE: FEBRUARY 6, 2013

THIS SPREADSHEET CALCULATES RISK-BASED CLEANUP GOALS FOR EXPOSURES TO SURFACE WATER
THE INCIDENTAL INGESTION AND DERMAL CONTACT ROUTES OF EXPOSURE ARE CONSIDERED.

RELEVANT EQUATIONS:

$$PRG_{child} = \frac{TCR}{[IntakeFac_{oral(0\text{-}2)} \times CSF_{oral} + IntakeFac_{derm(0\text{-}2)} \times DA_{event} \times CSF_{derm}] \times ADAF_{(0\text{-}2)} + [IntakeFac_{oral(2\text{-}6)} \times CSF_{oral} + IntakeFac_{derm(2\text{-}6)} \times DAevent \times CSF_{derm}] \times ADAF_{(2\text{-}6)}}$$

$$PRG_{adult} = \frac{TCR}{[IntakeFac_{oral(6\text{-}16)} \times CSF_{oral} + IntakeFac_{derm(6\text{-}16)} \times DAevent \times CSF_{derm}] \times ADAF_{(6\text{-}16)} + [IntakeFac_{oral(16\text{-}30)} \times CSF_{oral} + IntakeFac_{derm(16\text{-}30)} \times DAevent \times CSF_{derm}] \times ADAF_{(16\text{-}30)}}$$

$$PRG_{Lifetime} = \frac{TCR}{Intake_{child(0\text{-}2)} \times CSF \times ADAF_{(0\text{-}2)} + Intake_{child(2\text{-}6)} \times CSF \times ADAF_{(2\text{-}6)} + Intake_{adult(6\text{-}16)} \times CSF \times ADAF_{(6\text{-}16)} + Intake_{adult(16\text{-}30)} \times CSF \times ADAF_{(16\text{-}30)}}$$

$$IntakeFac_{oral} = \frac{CR \times ET \times EF \times ED}{BW \times AT}$$

$$IntakeFac_{derm} = \frac{DA_{Event} \times EV \times ED \times EF \times SA}{BW \times AT}$$

WHERE:

Parameter	Child Ages 0 - 2	Child Ages 2 - 6	Adult Ages 6 - 16	Adult Ages 16 - 30	Definition
TCR = :	1E-06				Target Cancer Risk
CR = :	0.01	0.01	0.01	0.01	Contact Rate (L/hour)
CF = :	1.0E-03	1.0E-03	1.0E-03	1.0E-03	Conversion Factor (L/m3)
ET = :	4	4	4	4	Exposure time (hours/day)
SA = :	2800	2800	5700	5700	Skin surface available for contact (cm^2)
DA_{event} = :	Chemical Specific				Chemical specific absorbed dose per event (mg/cm2-event)
EV = :	1	1	1	1	Event frequency (events/day)
EF = :	52	52	52	52	Exposure Frequency (days/year)
ED = :	2	4	10	14	Exposure Duration (years)
BW = :	15	15	70	70	Body Weight (kg)
ATc = :	25,550	25,550	25,550	25,550	Averaging time for carcinogenic exposures (days)
$IntakeFac_{oral}$ = :	1.09E-05	2.17E-05	1.16E-05	1.63E-05	Intake factor - Ingestion (kg/kg-day)
$IntakeFac_{derm}$ = :	7.60E-01	1.52E+00	1.66E+00	2.32E+00	Intake factor - Dermal (kg/kg-day)

CHEMICAL	Organic or Inorganic	Estimated Kp (cm/hr)	FA	tau-event (hr)	B	t* (hr)	DA_{event} - Child (L/cm^2 - event)	DA_{event} - Adult (L/cm^2 - event)
Trichloroethene (Mutagenic)	Organic	1.16E-02	1	5.72E-01	5.11E-02	1.37E+00	5.83E-05	5.83E-05
Trichloroethene (Nonmutagenic)	Organic	1.16E-02	1	5.72E-01	5.11E-02	1.37E+00	5.83E-05	5.83E-05

CHEMICAL	Cancer Slope Factor		Age Dependent Adjustment Factor			
	Oral $(mg/kg/day)^{-1}$	Dermal $(mg/kg/day)^{-1}$	Ages 0 - 2	Ages 2 - 6	Ages 6 - 16	Ages >16
Trichloroethene (Mutagenic)	9.3E-03	9.3E-03	10	3	3	1
Trichloroethene (Nonmutagenic)	3.7E-02	3.7E-02	1	1	1	1

CHEMICAL	Surface Water Concentration (ug/L)		
	Child	Adult	Lifelong
Trichloroethene (Mutagenic)	1.2E+02	2.3E+02	7.9E+01
Trichloroethene (Nonmutagenic)	1.6E+02	1.0E+02	6.4E+01
Trichloroethene	7.0E+01	7.2E+01	3.5E+01

RISK ASSESSMENT SPREADSHEET - CLEANUP LEVELS **Vinyl Chloride**

SITE NAME: FORMER NCBC DAVISVILLE, NORTH KINGSTOWN, RHODE ISLAND
LOCATION: SITE 16
EXPOSURE SCENARIO: *ADULT RECREATIONAL USERS*
MEDIA: SURFACE WATER
DATE: FEBRUARY 6, 2013

THIS SPREADSHEET CALCULATES CLEANUP LEVELS FOR EXPOSURES TO SURFACE WATER VIA INCIDENTAL INGESTION AND DERMAL CONTACT

RELEVANT EQUATIONS:

$$PRG_{GW} = \frac{TCR}{Intake_{ing} \cdot CSF_{oral} + Intake_{derm} \cdot CSF_{derm}}$$

$$PRG_{GW} = \frac{THI}{\left(\frac{Intake_{ing}}{RfD_{oral}}\right) + \left(\frac{Intake_{derm}}{RfD_{derm}}\right)}$$

$$Intake_{ing} = \frac{CR \times ET \times EF \times ED}{BW \times AT}$$

$$Intake_{derm} = \frac{DA_{Event} \times EV \times ED \times EF \times SA}{BW \times AT}$$

For Inorganics DAevent = Kp x CF x tevent

For Organics

$$\text{If } tevent \le t^*, \text{ then : } DAevent = 2 \times Kp \times FA \times CF \times \sqrt{\frac{6 \times tau \times tevent}{\pi}}$$

$$\text{If } tevent > t^*, \text{ then : } DAevent = Kp \times FA \times CF \times \left[\frac{tevent}{1+B} + 2 \times tau \times \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Where:

TCR = :	1.0E-06	Target Cancer Risk
THI = :	1	Target Hazard Index
CR = :	0.01	Contact Rate (L/hour)
ET = :	4	Exposure time (hours/day)
SA = :	5,700	Skin surface available for contact (cm^2)
DAevent = :		Chemical specific absorbed dose per event (mg/cm^2-event)
EV = :	1	Event frequency (events/days)
EF = :	52	Exposure frequency (days/year)
ED = :	30	Exposure duration (years)
BW = :	70	Body weight (kg)
ATc = :	25,550	Averaging time for carcinogenic exposures (days)
ATn = :	10,950	Averaging time for noncarcinogenic exposures (days)
CF = :	0.001	Conversion Factor (L/m^3)
Kp =:		Chemical specific permeability coefficient (cm/hr)
Cw = :		Concentration of chemical in water (mg/L)
tevent = :	4	duration of event (hr/event)
tau = :		Chemical specific lag time (hr)
t* = :		Chemical specific time it takes to reach steady state (hr)
B = :		Chemical specific dimensionless constant
FA = :		Fraction absorbed (dimensionless)

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH GROUNDWATER (PAGE TWO)

SITE NAME: FORMER NCBC DAVISVILLE, NORTH KINGSTOWN, RHODE ISLAND
LOCATION: SITE 16
EXPOSURE SCENARIO: ADULT RECREATIONAL USERS
MEDIA: SURFACE WATER
DATE: FEBRUARY 6, 2013

CHEMICAL	Organic or Inorganic	Estimated Kp (cm/hr)	FA	tau-event (hr)	B	t* (hr)	DAevent (L/cm^2 - event)
Vinyl Chloride	Organic	8.38E-03	1	2.35E-01	2.55E-02	5.65E-01	3.67E-05

CHEMICAL	Cancer Slope Factor		Reference Dose	
	Oral $(mg/kg/day)^{-1}$	Dermal $(mg/kg/day)^{-1}$	Oral (mg/kg/day)	Dermal (mg/kg/day)
Vinyl Chloride	7.20E-01	7.20E-01	3.00E-03	3.00E-03

CHEMICAL	Carcinogenic Intakes		Noncarcinogenic Intakes	
	Ingestion (L/kg/day)	Dermal (L/kg/day)	Ingestion (L/kg/day)	Dermal (L/kg/day)
Vinyl Chloride	3.49E-05	1.83E-04	8.14E-05	4.26E-04

CHEMICAL	Groundwater Concentration		Risk-Based[1] Cleanup Level (ug/L)
	Carcinogenic (ug/L)	Noncarcinogenic (ug/L)	
Vinyl Chloride	6.4	5912	6.4

Site-specific
Recreator Equation Inputs for Surface Water

Vinyl Chloride - Adult and 2-6 year old child

Variable	Value
TR (target cancer risk) unitless	0.000001
THQ (target hazard quotient) unitless	1
EF_{recwc} (child exposure frequency) day/year	52
EF_{recwa} (adult exposure frequency) day/year	52
EF_{0-2} (mutagenic exposure frequency) day/year	0
EF_{2-6} (mutagenic exposure frequency) day/year	52
EF_{6-16} (mutagenic exposure frequency) day/year	52
EF_{16-30} (mutagenic exposure frequency) day/year	52
ED_{recwc} (exposure duration - child) year	4
ED_{recwa} (exposure duration - adult) year	24
ED_{0-2} (mutagenic exposure duration) year	0
ED_{2-6} (mutagenic exposure duration) year	4
ED_{6-16} (mutagenic exposure duration) year	10
ED_{16-30} (mutagenic exposure duration) year	14
LT (lifetime - recreator) year	70
EV_{recwa} (adult) events/day	1
EV_{recwc} (child) events/day	1
EV_{0-2} (mutagenic) events/day	1
EV_{2-6} (mutagenic) events/day	1
EV_{6-16} (mutagenic) events/day	1
EV_{16-30} (mutagenic) events/day	1
ET_{recwa} (adult exposure time) hour/event	4
ET_{recwc} (child exposure time) hour/event	4
$ET_{recw0-2}$ (mutagenic exposure time) hour/event	4
$ET_{recw2-6}$ (mutagenic exposure time) hour/event	4
$ET_{recw6-16}$ (mutagenic exposure time) hour/event	4
$ET_{recw16-30}$ (mutagenic exposure time) hour/event	4
$ET_{recw-adj}$ (age-adjusted exposure time) hour/event	4
$ET_{recw-madj}$ (mutagenic age-adjusted exposure time) hour/event	4
BW_{recwa} (body weight - adult) kg	70
BW_{recwc} (body weight - child) kg	15
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	70
BW_{16-30} (mutagenic body weight) kg	70
IRW_{recwa} (water intake rate - adult) L/hr	0.01
IRW_{recwc} (water intake rate - child) L/hr	0.01
IRW_{0-2} (mutagenic water intake rate) L/hr	0
IRW_{2-6} (mutagenic water intake rate) L/hr	0.01
IRW_{6-16} (mutagenic water intake rate) L/hr	0.01
IRW_{16-30} (mutagenic water intake rate) L/hr	0.01
SA_{recwa} (skin surface area - adult) cm^2	5700
SA_{recwc} (skin surface area - child) cm^2	2800
SA_{0-2} (mutagenic skin surface area) cm^2	2800
SA_{2-6} (mutagenic skin surface area) cm^2	2800
SA_{6-16} (mutagenic skin surface area) cm^2	5700
SA_{16-30} (mutagenic skin surface area) cm^2	5700
l_{sc} (apparent thickness of stratum corneum) cm	0.001
$IFW_{rec-adj}$ (age-adjusted water intake rate) L/kg	1.268
$IFWM_{rec-adj}$ (mutagenic age-adjusted water intake rate) L/kg	2.971
$DFW_{rec-adj}$ (age-adjusted dermal factor) cm^2-event/kg	140449.524
$DFWM_{rec-adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	302788.571

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ite-specific
ecreator Risk-Based Screening Levels (RSL) for Surface Water
a=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
a** (Where nc SL < 10 x ca SL),
ax=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat

Vinyl Chloride only - Adult and 2-6 year child

Chemical	CAS Number	Chemical Type	Ingestion SF (mg/kg-day)$^{-1}$	SFO Ref	Chronic RfD (mg/kg-day)	RfD Ref	RAGSe GIABS (unitless)	KP	MW	pl	logds	dsclc	dsc	c	lttleb	B	tstar	tau_event	FA	In EPD?	DAeventc	DAeventnc	DAeventna
inyl Chloride	75-01-4	Organics	7.20E-01	I	3.00E-03	I	1	0.00838	62.5	3.1415927	-3.15	0.0007079	7.0795E-7	0.3505315	0.3189446	0.0254807	0.565015	0.2354229	1	Yes	7.2276E-6	0.1128091	0.2586032

Chemical	Ingestion SL TR=1.0E-6 (ug/L)	Dermal SL TR=1.0E-6 (µg/L)	Carcinogenic SL TR=1.0E-6 (ug/L)	Ingestion SL (Child) HQ=1 (ug/L)	Dermal SL (Child) HQ=1 (µg/L)	Noncarcinogenic SL (Child) HQ=1 (ug/L)	Ingestion SL (Adult) HQ=1 (ug/L)	Dermal SL (Adult) HQ=1 (µg/L)	Noncarcinogenic SL (Adult) HQ=1 (ug/L)	Screening Level (ug/L)
inyl Chloride	5.11E-01	1.97E-01	1.42E-01	7.90E+03	3.07E+03	2.21E+03	3.69E+04	7.04E+03	5.91E+03	1.42E-01 ca**

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SUPPORT DOCUMENTATION FOR ECOLOGICAL SCREENING LEVELS

May 2010

RECOMMENDED MARINE SURFACE WATER ECOLOGICAL SCREENING VALUES (ESVs) FORMER NCBC DAVISVILLE SITES 07, 09, AND 16

Prepared for:
Naval Facilities Engineering Command
Mid-Atlantic Division

Tetra Tech NUS

Recommended Marine Surface Water Ecological Screening Values (ESVs)
NCBC Davisville

The purpose of this memorandum is to present the results of a literature search that was performed to determine/evaluate if USEPA Region 3 BTAG marine salt water ESVs (2006) are appropriate screening criteria, or if recent research has resulted in more appropriate screening criteria. The goal is to reach agreement on an appropriate set of marine water screening criteria for use at NCBC Davisville.

Based on the results of the literature review and a comparison of the basis/derivation of each ESV, the Navy recommends use of USEPA Region 3 BTAG ESVs. The following narrative provides the rationale for this recommendation.

In 2006, USEPA Region 3 BTAG updated their marine (salt water) ESVs (USEPA, 2006) that were derived/compiled from numerous sources (Table 1). The Region 3 ESVs are also known as marine screening benchmarks. These are designed to be protective of sensitive species, and in choosing values for use as marine ESVs, preference was given to toxicity data based on chronic exposure, non-lethal endpoint studies (USEPA, 2006). Of the nine Region 3 ESVs in Table 1, four were USEPA Region 4 ESVs (USEPA, 2001), three were from the State of Texas (TNRCC, 2001), one was Canadian (CCME, 2003) and one was from the state of Michigan (2002).

Nine VOCs have been detected in groundwater in close proximity to marine surface water at NCBC Davisville Sites 7, 9, and 16 (Table 1). Other VOCs have been detected in groundwater at these sites, but the nine VOCs in Table 1 represent the primary VOCs in groundwater at these sites.

Table 1 shows potential (alternate) ESVs for these nine VOCs and notes regarding the literature source from which the alternate ESVs were obtained. Several alternate ESVs in Table 1 are marine chronic surface water ESVs derived by Buchman (2008) for the National Oceanic and Atmospheric Administration (NOAA). The NOAA values are intended to be used as preliminary screening values for environmental concentrations of contaminants and were taken from numerous federal and state, and international regulatory agencies (Buchman, 2008). Table 1 also summarizes a search of USEPA's ECOTOX (formerly known as AQUIRE) database. ECOTOX is a source for locating single chemical toxicity data for aquatic life, terrestrial plants, and wildlife; the ECOTOX database includes more than 400,000 test records covering 5,900 aquatic and terrestrial species and 8,400 chemicals, and is available at http:/www.epa.gov/ecotox. The objective of summarizing the ECOTOX data in Table 1 was to compare the Region 3 ESVs to the ECOTOX data. The ECOTOX data are summarized in Attachment A. ECOTOX did not have saltwater toxicity data for vinyl chloride or 1,2-DCE.

Ideally, an ESV is based on chronic exposure, non-lethal endpoint studies in which a toxicity threshold (such as a no-observed-effect concentration [NOEC] or a lowest-observed-effect concentration [LOEC]) was derived. Often, however, NOEC and LOEC data are not generated or are absent, chronic data are lacking, and lethality rather than non-lethal endpoints are the test-endpoints. In such cases, USEPA regions and state agencies apply various safety factors to derive an ESV. For example, some toxicity tests are designed to determine the concentration that is lethal to 50 percent of the test organisms; this value is known as the LC_{50}, and a safety factor of 100 is often used to estimate a chronic toxicity threshold from an LC_{50} value. Table 1 explains where safety factors were used by various agencies to derive ESVs for the chemicals in the table.

The EPA Region 3 ESVs for the nine VOCs in Table 1 tended to be at the low end of the range of LC_{50} and E_{50} values, when such values are divided by 100, as is typically done when using LC_{50} values and EC_{50}.values to derive ESVs. The Region 3 ESVs in Table 1 are reasonably conservative and are within the range of values presented in the literature search. For this reason, the Navy proposes that the Region 3 ESVs are appropriate for use as screening values at NCBC Davisville.

Table 1. Marine Water Ecological Screening Values, Sources, and Derivation

Chemical	USEPA Region 3 BTAG Screening Benchmark[a]		Other Ecological Screening Benchmark		Source & Notes
	Value (µg/L)	Reference[b]	Value (µg/L)	Reference	
Benzene CAS # 71432	110	CCME, 2003	-	-	1100 µg/L benzene reduced the survival of larval Dungeness crabs *(Cancer magister)* in 40 day exposures (Caldwell et al., 1976). CCME (2003) divided the 40-day marine LOEL (1100 µg/L) by a safety factor of 10 to derive the 110 µg/L guideline.
	-	-	700	USEPA, 1980a)	The Water Quality Criteria document for benzene (USEPA, 1980a) reported that female Pacific herring (*Clupea harengus pallasi*) exposed to 700 µg/L benzene for 48 hours prior to spawning resulted in reduced survival of embryos and larvae upon continued exposure to 700 µg/L. The USEPA (1980a) document pointed out, however, that the adult herring were captured in San Francisco Bay, so accumulated contaminants from the bay might have impacted the toxicity test results. Acute LC_{50} and EC_{50} values in a variety of saltwater species (shrimp, copepods, oysters, crabs, and fish) ranged from 5,100 µg/L to 924,000 µg/L (USEPA, 1980a).
					From ECOTOX database[c]: Range of EC_{50} and LC_{50} values divided by 100 = 10 µg/L to 9,244 µg/L
1,1-Dichloroethene (1,1-Dichloroethylene) CAS # 75354	2240	EPA Region 4[d]	-	-	The EPA Region 4 value was obtained from the Water Quality Criteria document for dichloroethylenes (USEPA, 1980b); the value is based on the lowest 96-hour LC_{50} value for three saltwater species tested under static conditions: 224,000 µg/L for the mysid shrimp (*Mysidopsis bahia*), 249,000 µg/L for the sheepshead minnow (*Cyprinodon variegatus*), and 250,000 µg/L for the tidewater silversides (*Menidia beryllina*). No flow-through data were available to USEPA (1980b) and the only chronic data reported by USEPA (1980b) was an embryo-larval test using the fathead minnow (*Pimephales promelas*) in which no adverse effects were observed at the highest concentration tested (2,800 µg/L). EPA Region 4 divided the lowest acute value (224,000 µg/L) by a safety factor of 10 to derive a chronic value from the reported acute value, and divided by 10 a second time "to protect for a more sensitive species" because there was insufficient information available to derive a criterion.
					From ECOTOX database[c]: Range of LC_{50} values divided by 100 = 2500 µg/L Single available NOEC value = 80,000 µg/L

Table 1. Marine Water Ecological Screening Values, Sources, and Derivation (Continued)					
Chemical	**USEPA Region 3 BTAG Screening Benchmark[a]**		**Other Ecological Screening Benchmark**		**Source & Notes**
	Value (µg/L)	**Reference[b]**	**Value (µg/L)**	**Reference**	
1,2-Dichloroethene (mixed *cis* & *trans*) isomers CAS # 540590	680	TNRCC, 2001	-	-	The TNRCC website cited by Region 3 BTAG is no longer current, and the agency formerly known as Texas Natural Resource Conservation Commission (TNRCC) is now known as the Texas Council on Environmental Quality (TCEQ). According to TCEQ's Water Quality Standards Group, the value is derived from a toxicity test using brine shrimp (*Artemia salina*) in which the 24-hour LC_{50} was 6800 µg/L; TCEQ multiplied the LC_{50} by 0.1 in accordance with their policy for deriving chronic criteria for non-persistent chemicals.
Cis-1,2-Dichloroethene	-	-	-	-	No toxicity data were located for this isomer of 1,2-dichloroethene.
Trans-1,2-Dichloroethene	-	-	-	-	No toxicity data were located for this isomer of 1,2-dichloroethene.
1,2-Dichloroethane CAS # 107062	1130	EPA Region 4[d]	-	-	The EPA Region 4 value was obtained from the Water Quality Criteria document for chlorinated ethanes (USEPA, 1980c), which stated that the 96-hour LC_{50} value for 1,2-Dichloroethane in a static test using mysid shrimp (a saltwater species) was 113,000 µg/L. No data for other saltwater species were available for this chemical in the document, and no flow-through test data were available (USEPA, 1980c). EPA Region 4 divided the LC_{50} value by a safety factor of 10 to derive a chronic value from the reported acute value, and by 10 a second time "to protect for a more sensitive species" because there was insufficient information available to derive a criterion.
			11,300	Buchman, 2008	The National Oceanic and Atmospheric Administration (NOAA) chronic screening value (11,300 µg/L) for this chemical in marine surface water (Buchman, 2008) was derived using the same data as EPA Region 4 (see above), but NOAA applied a safety factor of 10 (for acute-to-chronic derivation) without the additional safety factor of 10.
					From ECOTOX database[c]: Range of LC_{50} and EC_{50} values divided by 100 = 364 µg/L to 9,000 µg/L Single available NOEC value =130,000 µg/L

Table 1. Marine Water Ecological Screening Values, Sources, and Derivation (Continued)					
Chemical	USEPA Region 3 BTAG Screening Benchmark[a]		Other Ecological Screening Benchmark		Source & Notes
	Value (µg/L)	Reference[b]	Value (µg/L)	Reference	
Tetrachloroethane (1,1,2,2-Tetrachloroethane) CAS # 79345	90.2	EPA Region 4[d]	-	-	The EPA Region 4 value was obtained from the Water Quality Criteria document for chlorinated ethanes (USEPA, 1980c), which reported tetrachloroethane 96-hour static test LC_{50} values for two saltwater species: 9,020 µg/L for mysid shrimp and 12,300 µg/L for sheepshead minnows. No flow-through test data were available (USEPA, 1980c). EPA Region 4 divided the lowest LC_{50} value (9,020 µg/L by a safety factor of 10 to derive a chronic value from the reported acute value, and by 10 a second time "to protect for a more sensitive species" because there was insufficient information available to derive a criterion.
	-	-	902	Buchman, 2008	The NOAA chronic screening value (902 µg/L) for this chemical in marine surface water (Buchman, 2008) was derived using the same data as EPA Region 4 (see above), but NOAA applied a safety factor of 10 (for acute-to-chronic derivation) without the additional safety factor of 10.
					From ECOTOX database[c]: Range of LC_{50} values divided by 100 = 120 µg/L to 190 µg/L Single available NOEC value = 8,800 µg/L
1,1,2-Trichloroethane CAS # 79005	550	TNRCC, 2001	275	TCEQ, 2006-	See notes for 1,2-dichloroethene mixed isomers (above) regarding TNRCC citation and current agency name. The current TCEQ ecological benchmark for this compound in marine surface water is 275 µg/L (TCEQ, 2006). According to TCEQ's Water Quality Standards Group, the value is derived from a toxicity test using plaice (*Pleuronectes platessa*) in which the LC_{50} was 5,500 µg/L. TCEQ multiplied the LC_{50} by 0.05 in accordance with their policy for deriving chronic criteria for persistent chemicals that do not bioaccumulate. TCEQ defines a persistent chemical as one with a half life of $\geq$ 4 days in water or sediment. The previous TNRCC/TCEQ benchmark of 550 µg/L was derived from the same LC_{50} value but was multiplied by 0.1 rather than 0.05.
	-	-	1,900	Buchman, 2008	The NOAA chronic screening value (1,900 µg/L) for this chemical in marine surface water (Buchman, 2008) is the ANZECC (2000) "trigger value" for marine water. ANZECC (2000) did not provide data regarding specific toxicity test conditions and species used to derive the value for this chemical, but stated that it was a "moderate reliability" value that was derived from acute toxicity data by applying acute-to-chronic conversion factors, and is intended to protect 95% of aquatic species.
					From ECOTOX database[c]: Range of LC50 values divided by 100 = 1,600 µg/L to 5,000 µg/L

Table 1. Marine Water Ecological Screening Values, Sources, and Derivation (Continued)					
Chemical	USEPA Region 3 BTAG Screening Benchmark[a]		Other Ecological Screening Benchmark		Source & Notes
	Value (µg/L)	Reference[b]	Value (µg/L)	Reference	
Tetrachloroethene (Tetrachloroethylene, 1,1,2,2-Tetrachloroethene, Perchloroethylene) CAS # 127184	45	EPA Region 4[d]	-	-	The EPA Region 4 value was obtained from the Water Quality Criteria document for tetrachloroethylene (USEPA, 1980d), which stated that the chronic LOEL for mysid shrimp (a saltwater species) was 450 µg/L. The length of the study was not provided by USEPA (1980d), but the document stated that it was a "life cycle or partial life cycle" test. The USEPA (1980d) document did not state whether the study was static or flow-through. EPA Region 4 divided the 450 µg/L value by a safety factor of 10 "to protect for a more sensitive species" because there was insufficient information available to derive a criterion.
	-	-	450	Buchman, 2008	The NOAA chronic screening value (450 µg/L) for this chemical in marine surface water (Buchman, 2008) was derived using the same data as EPA Region 4 (see above), but without the safety factor of 10.
					From ECOTOX database[c]: Range of LC_{50} values divided by 100 = 2 µg/L to 520 µg/L Single available NOEC value : 29,000 µg/L
Trichloroethene (TCE, Trichloroethylene, 1,1,2-Trichloroethylene) CAS # 79016	1940	TNRCC, 2001	970	TCEQ, 2006-	See notes for 1,2-dichloroethene (above) regarding TNRCC citation and current agency name. The current TCEQ ecological benchmark for this compound in marine surface water is 970 µg/L (TCEQ, 2006). According to TCEQ's Water Quality Standards Group, the value is based on the geometric mean of several LC_{50} values in toxicity tests using mysid shrimp (*Mysidopsis bahia*). The geometric mean (19,400 µg/L) was multiplied by 0.05 in accordance with their policy for deriving chronic criteria for persistent chemicals that do not bioaccumulate. TCEQ defines a persistent chemical as one with a half life of $\geq$ 4 days in water or sediment. The previous TNRCC/TCEQ benchmark of 1940 µg/L was derived from the same data and geometric mean value, but was multiplied by 0.1 rather than 0.05.
	-	-	200	Buchman, 2008	The Water Quality Criteria document for Trichloroethylene (USEPA, 1980e) had no chronic toxicity data for marine species. Acute toxicity data for two saltwater species were reported in the USEPA (1980e) document; grass shrimp (*Palaemonetes pugio*) were adversely impacted after several minutes of exposure at 2,000 µg/L, and sheepshead minnows were adversely impacted at 20,000 µg/L. The NOAA chronic screening value (200 µg/L) for trichloroethene in marine surface water was derived using the USEPA (1980e) lowest acute value (the 2,000 µg/L) divided by a safety factor of 10 (Buchman, 2008).
					From ECOTOX database[c]: Range of EC50 and LC50 values divided by 100 = 140 µg/L to 1500 µg/L

Table 1. Marine Water Ecological Screening Values, Sources, and Derivation (Continued)					
Chemical	Chemical		Chemical		Chemical
	Value (µg/L)	Reference[b]	Value (µg/L)	Reference	
Vinyl chloride CAS # 75014	930	MDEQ, 2002	-	-	USEPA Region 3 BTAG has no marine surface water benchmark for this compound, so it uses the freshwater value (930 µg/L) as a surrogate. The MDEQ (2002) value is a Final Chronic Value, which is defined by MDEQ as the level "that does not allow injurious or debilitating effects in an aquatic organism resulting from repeated long-term exposure to a substance relative to the organism's lifespan". Specific data regarding the test species, endpoints, etc used to derive the value were not available on the MDEQ website. No saltwater aquatic toxicity data were available for this chemical in the ECOTOX database.

Footnotes:

a USEPA (U.S. Environmental Protection Agency). 2006. EPA Region III BTAG Marine Screening Benchmarks, 7/2006. Mid-Atlantic Risk Assessment, Screening Values. Available at http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/marine/screenbench.htm

b Reference cited by Region 3 BTAG (USEPA 2006); see "Source and Notes" column for further explanation.

c USEPA. 2007. ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. Available at http:/www.epa.gov/ecotox. Data retrievals for this table were performed using Advanced Database Query function; saltwater test conditions; taxonomic groups were animals (amphibians, crustaceans, fish, mollusks, worms, and other invertebrates) and plants (algae, moss, and fungi).

d USEPA Region 4 ecological screening value for marine surface water (USEPA, 2001).

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TNRCC (Texas Natural Resource Conservation Commission), Toxicology and Risk Assessment Section. December 2001. Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, http://www.tceq.state.tx.us/comm_exec/forms_pubs/pubs/rg/rg-263_189521.pdf, cited in USEPA (2006).

USEPA (United States Environmental Protection Agency). 1980a. Ambient Water Quality Criteria for Benzene. EPA 440/5-80-018, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, DC. October.

USEPA. 1980b. Ambient Water Quality Criteria for Dichloroethylenes. EPA 440/5-80-041, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, DC. October.

USEPA. 1980c. Ambient Water Quality Criteria for Chloronated Ethanes. EPA 440/5-80-029, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, DC. October.

USEPA. 1980d. Ambient Water Quality Criteria for Tetrachloroethylene. EPA 440/5-80-073, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, DC. October.

USEPA. 1980e. Ambient Water Quality Criteria for Trichloroethylene. EPA 440/5-80-077, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, DC. October.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.htm. Note: The Region 3 BTAG Marine Screening Benchmark table (USEPA, 2006) provides a date of February 11, 2002 for the Region 4 website. However, the actual Region 4 website provides a date of November 30, 2001.

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USEPA. 2007. ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. Available at http:/www.epa.gov/ecotox.

ATTACHMENT A

SUMMARY OF ECOTOX RESULTS

Benzene										
Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	Calculated EC50 or LC50 (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Dunaliella tertiolecta	Green algae	Algae, Moss, Fungi	EC50	0.04 (1 hour)	S	12,500,000	NR	NR	Water Res. 17(12):1757-1762	1983
Dunaliella tertiolecta	Green algae	Algae, Moss, Fungi	EC50	1	S	27,000,000	NR	NR	Water Res. 17(12):1757-1762	1983
Artemia salina	Brine shrimp	Crustaceans	LC50*	1	S	66,000	NR	NR	J.Water Pollut.Control Fed. 46(1):63-77	1974
Artemia salina	Brine shrimp	Crustaceans	LC50*	2	S	21,000	NR	NR	J.Water Pollut.Control Fed. 46(1):63-77	1974
Cancer magister	Dungeness or edible crab	Crustaceans	LC50	2	S	347,000	NR	NR	In: D.A.Wolfe (Ed.) Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms, Pergamon Press, NY :210-220	1977
Cancer magister	Dungeness or edible crab	Crustaceans	LC50	4	S	108,000	NR	NR	In: D.A.Wolfe (Ed.) Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms, Pergamon Press, NY :210-220	1977
Crangon franciscorum	Bay shrimp	Crustaceans	LC50	1	S	22,000	20000	24000	Calif.Fish Game 63(4):204-209	1977
Crangon franciscorum	Bay shrimp	Crustaceans	LC50	4	S	20,000	19000	22000	Calif.Fish Game 63(4):204-209	1977
Nitocra spinipes	Harpacticoid copepod	Crustaceans	LC50	1	S	111,500	61000	156600	Ph.D.Thesis, Lehigh University, Bethlehem, PA :108 p.	1975
Nitocra spinipes	Harpacticoid copepod	Crustaceans	LC50	1	S	82,000	73000	91000	Ph.D.Thesis, Lehigh University, Bethlehem, PA :108 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	1	S	33,500	31000	36000	Ph.D.Thesis, Lehigh University, Bethlehem, PA :108 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	1	S	38,000	36600	40200	Ph.D.Thesis, Lehigh University, Bethlehem, PA :108 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	1	S	40,200	33500	48200	Ph.D.Thesis, Lehigh University, Bethlehem, PA :108 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	1	S	40,800	38600	43500	Ph.D.Thesis, Lehigh University, Bethlehem, PA :108 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	1	S	43,500	36300	52500	Ph.D.Thesis, Texas A&M University, College Station, TX :133 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	1	S	74,400	66800	81800	Ph.D.Thesis, Lehigh University, Bethlehem, PA :108 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	1	S	90,800	61100	113500	Ph.D.Thesis, Lehigh University, Bethlehem, PA :108 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	1	S	43,500	NR	NR	Estuar.Coast.Mar.Sci. 6(4):365-373	1978
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	2	S	35,000	28000	43800	Ph.D.Thesis, Texas A&M University, College Station, TX :133 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	2	S	35,000	NR	NR	Estuar.Coast.Mar.Sci. 6(4):365-373	1978
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	4	S	27,000	19900	43800	Ph.D.Thesis, Texas A&M University, College Station, TX :133 p.	1975
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	4	S	27,000	NR	NR	Estuar.Coast.Mar.Sci. 6(4):365-373	1978
Scylla serrata	Crab	Crustaceans	LC50	1	S	10,360	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	1	S	12,840	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	1	S	6,380	NR	NR	Environ.Ecol. 6(2):335-339	1988
Scylla serrata	Crab	Crustaceans	LC50	1	S	8,120	NR	NR	Environ.Ecol. 6(2):335-339	1988
Scylla serrata	Crab	Crustaceans	LC50	1	S	8,120	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	2	S	11,380	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	2	S	5,020	NR	NR	Environ.Ecol. 6(2):335-339	1988
Scylla serrata	Crab	Crustaceans	LC50	2	S	6,590	NR	NR	Environ.Ecol. 6(2):335-339	1988
Scylla serrata	Crab	Crustaceans	LC50	2	S	6,590	NR	NR	Environ.Ecol. 6(1):220-221	1988

Benzene										
Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	Calculated EC50 or LC50 (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Scylla serrata	Crab	Crustaceans	LC50	2	S	9,150	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	3	S	10,160	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	3	S	3,740	NR	NR	Environ.Ecol. 6(2):335-339	1988
Scylla serrata	Crab	Crustaceans	LC50	3	S	5,260	NR	NR	Environ.Ecol. 6(2):335-339	1988
Scylla serrata	Crab	Crustaceans	LC50	3	S	5,260	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	3	S	8,340	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	4	S	4,180	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	4	S	6,920	NR	NR	Environ.Ecol. 6(1):220-221	1988
Scylla serrata	Crab	Crustaceans	LC50	4	S	8,730	NR	NR	Environ.Ecol. 6(1):220-221	1988
Homarus americanus	American lobster	Crustaceans	NR-LETH	NR	S	111,800	NR	NR	In: S.W.Nielsen, G.Migaki, and D.G.Scarpelli (Eds.), Symp.Animals Monitors Environ.Pollut.1977, Storrs, CT 12:383-384	1979
Homarus americanus	American lobster	Crustaceans	NR-LETH	NR	S	111,800	NR	NR	In: S.W.Nielsen, G.Migaki, and D.G.Scarpelli (Eds.), Symp.Animals Monitors Environ.Pollut.1977, Storrs, CT 12:383-384	1979
Oncorhynchus kisutch	Coho salmon,silver salmon	Fish	LC100	1	S	100,000	NR	NR	Copeia 2:326-331	1975
Clupea pallasii	Pacific herring	Fish	LC50	2	R	NR	20000	25000	In: F.J.Vernberg and W.B.Vernberg (Eds.), Pollution and Physiology of Mar.Organisms, Acad.Press, NY :253-284	1974
Clupea pallasii	Pacific herring	Fish	LC50	4	R	NR	40000	45000	In: F.J.Vernberg and W.B.Vernberg (Eds.), Pollution and Physiology of Mar.Organisms, Acad.Press, NY :253-284	1974
Engraulis mordax	Northern anchovy	Fish	LC50	2	R	NR	20000	25000	In: F.J.Vernberg and W.B.Vernberg (Eds.), Pollution and Physiology of Mar.Organisms, Acad.Press, NY :253-284	1974
Morone saxatilis	Striped bass	Fish	LC50	1	S	6,900	NR	NR	Calif.Fish Game 63(4):204-209	1977
Morone saxatilis	Striped bass	Fish	LC50	3	F	10,900	NR	NR	J.Fish.Res.Board Can. 32(10):1864-1866	1975
Morone saxatilis	Striped bass	Fish	LC50	4	F	10,900	NR	NR	J.Fish.Res.Board Can. 32(10):1864-1866	1975
Morone saxatilis	Striped bass	Fish	LC50	4	S	5,800	NR	NR	Calif.Fish Game 63(4):204-209	1977
Mugil curema	White mullet	Fish	LC50	2	R	22,000	NR	NR	Bull.Environ.Contam.Toxicol. 44(2):428-434	1990
Oncorhynchus gorbuscha	Pink salmon	Fish	LC50	4	S	8,470	7890	9090	Trans.Am.Fish.Soc. 108(4):408-414	1979
Oncorhynchus nerka	Sockeye salmon	Fish	LC50	4	S	5,550	2890	8210	Trans.Am.Fish.Soc. 108(4):408-414	1979
Salvelinus malma	Dolly varden	Fish	LC50	4	S	6,300	4600	8000	Trans.Am.Fish.Soc. 108(4):408-414	1979
Terapon jarbua	Tigerfish	Fish	LC50	1	S	96,000	NR	NR	Proc.Symp.Coastal Aquacult. 3:828-832	1984
Terapon jarbua	Tigerfish	Fish	LC50	2	S	94,000	NR	NR	Proc.Symp.Coastal Aquacult. 3:828-832	1984
Terapon jarbua	Tigerfish	Fish	LC50	3	S	88,000	NR	NR	Proc.Symp.Coastal Aquacult. 3:828-832	1984
Terapon jarbua	Tigerfish	Fish	LC50	4	S	84,000	NR	NR	Proc.Symp.Coastal Aquacult. 3:828-832	1984
Morone saxatilis	Striped bass	Fish	LOEC	28	F	NR	1500	5400	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	LOEC	14	F	NR	1500	5400	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976

Benzene										
Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	Calculated EC50 or LC50 (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Morone saxatilis	Striped bass	Fish	LOEC	21	F	NR	3600	8100	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	LOEC	28	F	NR	3600	8100	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	LOEC	7	F	NR	3600	8100	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	LOEC	28	F	NR	3600	8100	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	NOEC	21	F	NR	1500	5400	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	NOEC	28	F	NR	1500	5400	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	NOEC	7	F	NR	1500	5400	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	NOEC	28	F	NR	3600	8100	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Morone saxatilis	Striped bass	Fish	NOEC	28	F	NR	1500	5400	U.S.Natl.Mar.Fish Serv.Fish.Bull. 74(3):694-698	1976
Brachionus plicatilis	Rotifer	Invertebrates	LC50	1	S	1,000	NR	NR	Bull.Environ.Contam.Toxicol. 49(2):266-271	1992
Pocillopora damicornis	Ciliate protozoa	Invertebrates	NR-ZERO	10	S	100,000	NR	NR	Pac.Sci. 45(3):290-298	1991
Crassostrea gigas	Pacific oyster	Molluscs	EC50*	2	S	924,400	NR	NR	Ph.D.Thesis, Univ.of Washington, Seattle, WA :189 p.	1974
Crassostrea gigas	Pacific oyster	Molluscs	LC50*	2	S	377000*	NR	NR	Ph.D.Thesis, Univ.of Washington, Seattle, WA :189 p.	1974
Katelysia opima	Marine bivalve	Molluscs	LC50	1	S	225,000	NR	NR	Proc.Symp.Coastal Aquacult. 3:828-832	1984
Katelysia opima	Marine bivalve	Molluscs	LC50	2	S	205,000	NR	NR	Proc.Symp.Coastal Aquacult. 3:828-832	1984
Katelysia opima	Marine bivalve	Molluscs	LC50	3	S	195,000	NR	NR	Proc.Symp.Coastal Aquacult. 3:828-832	1984
Katelysia opima	Marine bivalve	Molluscs	LC50	4	S	190,000	NR	NR	Proc.Symp.Coastal Aquacult. 3:828-832	1984

Exposure Type: S = static, F = flow through, R = Renewal

Range of EC50 and LC50 values = 1,000 ug/L to 924,400 ug/L (excluding green algae LC50 values of 12,500,00 and 27,000,000 ug/L)
Range of EC50 and LC50 values divided by 100 = 10 ug/L to 9,244 ug/L

1,1-Dichloroethene										
Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	LC50 or NOEC (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	1	Static	250,000	200,000	340,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	2	Static	250,000	200,000	340,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	3	Static	250,000	200,000	340,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	4	Static	250,000	200,000	340,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Menidia beryllina	Inland silverside	Fish	LC50	4	Static	250,000	NR	NR	J.Hazard.Mater. 1(4):303-318 (OECDG Data File)	1977
Cyprinodon variegatus	Sheepshead minnow	Fish	NOEC	4	Static	80,000	NR	NR	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981

Range of LC50 values = 250,000 ug/L
Range of LC50 values divided by 100 = 2500 ug/L
Single NOEC value = 80,000 ug/L

1,2-Dichloroethane										
Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	LC50, EC50, or NOEC (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Artemia salina	Brine shrimp	Crustaceans	EC50	1	Static	36,400	30,600	43,000	Environ.Pollut.Ser.A 38:273-281	1985
Artemia salina	Brine shrimp	Crustaceans	EC50	1	Static	79,700	69,700	90,600	Environ.Pollut.Ser.A 38:273-281	1985
Artemia salina	Brine shrimp	Crustaceans	EC50	1	Static	93,640	77,000	113,600	Aquat.Toxicol. 5(3):245-254	1984
Artemia salina	Brine shrimp	Crustaceans	LC50	1	Static	320,000	NR	NR	J.Water Pollut.Control Fed. 46(1):63-77	1974
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	1	Static	NR	130,000	230,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	2	Static	NR	130,000	230,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	3	Static	NR	130,000	230,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	4	Static	NR	130,000	230,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Pleuronectiformes	Sole order	Fish	LC50	4	Flow through	115,000	NR	NR	Proc.R.Soc.Lond,B Biol.Sci. 189:305-332	1975
Cyprinodon variegatus	Sheepshead minnow	Fish	NOEC	4	Static	130,000	NR	NR	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Ophryotrocha labronica	Polychaete	Worms	LC50	4	Renewal	400,000	NR	NR	Water Res. 9(7):607-612	1975
Ophryotrocha labronica	Polychaete	Worms	LC50	4	Static	900,000	NR	NR	Water Res. 9(7):607-612	1975

Range of LC50 and EC50 values = 36,400 ug/L to 900,000 ug/L
Range of LC50 and EC50 values divided by 100 = 364 ug/L to 9,000 ug/L
Single NOEC value = 130,000 ug/L

1,1,2,2-Tetrachloroethane

Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	LC50 or NOEC (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	1	Static	19,000	14,000	20,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	2	Static	16,000	12,000	20,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	3	Static	13,000	5,100	33,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	4	Static	12,000	4,700	32,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	NOEC	4	Static	8,800	NR	NR	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981

Range of LC50 values = 12,000 ug/L to 19,000 ug/L
Range of LC50 values divided by 100 = 120 ug/L to 190 ug/L
Single NOEC value = 8,800 ug/L

Tetrachloroethene

Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	LC50, EC50, or NOEC (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Skeletonema costatum	Diatom	Algae, Moss, Fungi	EC50	1	Static	200	NR	NR	Chemosphere 33(5):865-877	1996
Skeletonema costatum	Diatom	Algae, Moss, Fungi	EC50	2	Static	200	NR	NR	Chemosphere 33(5):865-877	1996
Skeletonema costatum	Diatom	Algae, Moss, Fungi	EC50	3	Static	200	NR	NR	Chemosphere 33(5):865-877	1996
Acartia tonsa	Calanoid copepod	Crustaceans	LC50	4	Static	13,200	11,300	15,400	Rep.No.4398, Final Report, EPA Contract No.68-01-6201, NUS Corp., Houston, TX :196 p.	1983
Crangon septemspinosa	Bay shrimp, Sand shrimp	Crustaceans	LC50	4	Static	17,400	15,300	19,800	Rep.No.4398, Final Report, EPA Contract No.68-01-6201, NUS Corp., Houston, TX :196 p.	1983
Gammarus annulatus	Scud	Crustaceans	LC50	4	Static	9,100	5,900	14,100	Rep.No.4398, Final Report, EPA Contract No.68-01-6201, NUS Corp., Houston, TX :196 p.	1983
Palaemonetes pugio	Daggerblade grass shrimp	Crustaceans	LC50	4	Static	1,300	1,100	1,500	Rep.No.4398, Final Report, EPA Contract No.68-01-6201, NUS Corp., Houston, TX :196 p.	1983
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	1	Static	52,000	NR	NR	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	2	Static	52,000	NR	NR	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	4	Static	NR	29,000	52,000	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	4	Static	9,800	8,800	11,000	Rep.No.4398, Final Report, EPA Contract No.68-01-6201, NUS Corp., Houston, TX :196 p.	1983
Menidia beryllina	Inland silverside	Fish	LC50	4	Static	28,100	27,300	28,900	Rep.No.4398, Final Report, EPA Contract No.68-01-6201, NUS Corp., Houston, TX :196 p.	1983
Pleuronectiformes	Sole order	Fish	LC50	4	Flow through	5,000	NR	NR	Proc.R.Soc.Lond.B Biol.Sci. 189:305-332	1975
Cyprinodon variegatus	Sheepshead minnow	Fish	NOEC	4	Static	29,000	NR	NR	Bull.Environ.Contam.Toxicol. 27(5):596-604 (OECDG Data File)	1981
Neanthes arenaceodentata	Polychaete worm	Worms	LC50	4	Static	1,300	1,100	1,500	Rep.No.4398, Final Report, EPA Contract No.68-01-6201, NUS Corp., Houston, TX :196 p.	1983

Range of LC50 and EC50 values = 200 ug/L to 52,000 ug/L
Range of LC50 and EC50 values divided by 100 = 2 ug/L to 520 ug/L
Single NOEC value = 29,000 ug/L

1,1,2-Trichloroethane										
Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	LC50 (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Ophryotrocha labronica	Polychaete	Worms	LC50	4	Renewal	160,000	NR	NR	Water Res. 9(7):607-612	1975
Ophryotrocha labronica	Polychaete	Worms	LC50	4	Renewal	225,000	NR	NR	Water Res. 9(7):607-612	1975
Ophryotrocha labronica	Polychaete	Worms	LC50	4	Static	400,000	NR	NR	Water Res. 9(7):607-612	1975
Ophryotrocha labronica	Polychaete	Worms	LC50	4	Static	500,000	NR	NR	Water Res. 9(7):607-612	1975

Range of LC50 values = 160,000 ug/L to 500,000 ug/L
Range of LC50 values divided by 100 = 1,600 ug/L to 5,000 ug/L

Trichloroethene										
Species Scientific Name	Species Common Name	Species Group	Endpoint	Exposure Duration (Days)	Exposure Type	Calculated EC50 or LC50 (ug/L)	Min Conc. tested (ug/L)	Max Conc. Tested (ug/L)	Source	Publication Year
Skeletonema costatum	Diatom	Algae, Moss, Fungi	EC50	4	Static	150,000	139,000	162,000	Bull.Environ.Contam.Toxicol. 37(6):830-836	1986
Skeletonema costatum	Diatom	Algae, Moss, Fungi	EC50	4	Static	95,000	79,000	143,000	Bull.Environ.Contam.Toxicol. 37(6):830-836	1986
Americamysis bahia	Opossum shrimp	Crustaceans	LC50	4	Static	14,000	12,000	26,000	Bull.Environ.Contam.Toxicol. 37(6):830-836	1986
Americamysis bahia	Opossum shrimp	Crustaceans	LC50	4	Static	27,000	19,000	36,000	Bull.Environ.Contam.Toxicol. 37(6):830-836	1986
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	4	Static	52,000	43,000	64,000	Bull.Environ.Contam.Toxicol. 37(6):830-836	1986
Cyprinodon variegatus	Sheepshead minnow	Fish	LC50	4	Static	99,000	83,000	118,000	Bull.Environ.Contam.Toxicol. 37(6):830-836	1986
Pleuronectiformes	Sole order	Fish	LC50	4	Flow through	16,000	NR	NR	Proc.R.Soc.Lond.B Biol.Sci. 189:305-332	1975

Range of EC50 and LC50 values = 14,000 ug/L to 150,000 ug/L
Range of EC50 and LC50 values divided by 100 = 140 ug/L to 1,500 ug/L