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LETTER AND U S NAVY RESPONSE TO U S EPA COMMENTS TO TECHNICAL MEMORANDUM FOR PERFLUORINATED COMPOUNDS IN SURFACE WATER AND SEDIMENT NAS SOUTH WEYMOUTH MA
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C-NAVY-02-12-4964W

February 1, 2012

Project Number G02073

Mr. Brian Helland, RPM
BRAC PMO, Northeast
4911 South Broad Street
Philadelphia, Pennsylvania 19112

Reference: CLEAN Contract No. N62470-08-D-1001
Contract Task Order (CTO) No. WE11

Subject: Responses to Comments, Technical Memorandum, Perfluorinated Compounds in Surface Water and Sediment
Former Naval Air Station South Weymouth, Weymouth, Massachusetts

Dear Mr. Helland:

Enclosed are responses to comments (RTCs) received on the Technical Memorandum, Perfluorinated Compounds in Surface Water and Sediment, Former Naval Air Station South Weymouth, Weymouth, Massachusetts. As discussed at the January 18, 2012 BRAC Cleanup Team Meeting and stated in the meeting notes as well as the enclosed RTCs, the Technical Memorandum will not be revised and issued as a final document since the information will be included in the Decision Document being prepared by the Navy. The surface water and sediment portions of the Decision Document will reflect the information noted in the RTCs as appropriate.

On behalf of the Navy, the RTCs on the Technical Memorandum, Perfluorinated Compounds in Surface Water and Sediment are being provided to the recipients listed below. If you have any questions regarding the RTCs, please contact me at (978) 474-8403.

Very truly yours,

Phoebe A. Call

Phoebe A. Call
Project Manager

PAC/lh

Enclosures

c: D. Barney, Navy (w/encl. – 1)
C. Keating, EPA (w/encl. – 3)
D. Chaffin, MADEP (w/encl. – 1)
P. Steinberg, Mabbett & Associates, Inc. (w/encl. - 1)
P. Sortin, Abington (w/encl. – 1)
M. Brennan, Weymouth (w/encl. – 1)
M. Parsons, Rockland (w/encl. – 1)
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Public Library, Abington (w/encl. – 1)
Public Library, Rockland (w/encl. – 1)
Public Library, Hingham (w/encl. – 1)
Chief Executive Officer, South Shore Tri-town Development Corp. (w/encl. – 1)
J. Traut, Tetra Tech (w/encl. – 1 paper)
J. Trepanowski, Tetra Tech (w/encl. – w/o encl.)
G. Glenn, Tetra Tech (w/o encl.)
File G02073-3.2 (w/o encl.); G02073-8.0 (w/encl. – original)

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NAVY RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) COMMENTS (DATED OCTOBER 11, 2011)
TECHNICAL MEMORANDUM, PFCS IN SURFACE WATER AND SEDIMENT
FORMER NAVAL AIR STATION (NAS) SOUTH WEYMOUTH, MASSACHUSETTS

The Navy's responses to the EPA comments on the Technical Memorandum, Perfluorinated Compounds in Surface Water and Sediment (dated August 2011) are presented below. The EPA comments are presented first (in italics) followed by Navy's responses.

General Comments

Comment 1. *EPA Region I concurs that PFOS and PFOA occur in surface water and sediment at concentrations lower than ingestion-based risk-based concentrations for child trespassers, as well as adult trespassers and maintenance workers. EPA concurs with the site-specific screening levels on the condition that Navy provides in Appendix A, and EPA concurs with, all equations and parameter values (e.g. dermal permeability coefficient) that were used to calculate risk-based concentrations for sediment and surface water. It is noted that the screening levels do not include the potential contribution of dermal risk due to surface water. Please include this pathway in the appropriate receptor screening levels, or demonstrate in the text that the potential dermal risk due to surface water is negligible relative to ingestion.*

Response: The Technical Memorandum will not be revised and issued as a final document since the information will be included in the Decision Document being prepared by the Navy. The Navy provided the supporting assumptions and calculations completed by the Navy Marine Corps Public Health Center (NMCPHC) to EPA and MassDEP via email on September 29, 2011. This information is included as Attachment 1 to these RTCs and will be included in an appendix in the Decision Document. Please also see the Response to MassDEP Comment 1.

Due to the lack of chemical-specific values (e.g., permeability coefficients [Kp]) to predict transport across the skin, the Navy's calculations did not quantify the dermal absorption from contact with PFOA/PFOS in water. Given the uncertainty associated with these values, trying to quantify dermal exposure would not be useful in making risk management decisions for a site given the significant uncertainties associated with the calculation. However, given the order of magnitude difference between the surface water screening levels and the site concentrations, the Navy does not believe that not including dermal exposure to water will impact the risk management decisions that need to be made for this site.

Comment 2. *The surface water and sediment locations investigated are within areas designated for open space and/or recreational use; consequently, risk evaluations should be conducted to assess exposures associated with recreational users. It is acknowledged that the concentrations of perfluorinated compounds detected in surface water and sediment are orders of magnitude lower than the screening level concentrations calculated by Navy; nevertheless, Navy should confirm that there is no excess risk for recreational users.*

Response: Screening levels for surface water and sediment have been calculated by the NMCPHC for child and adult recreational users and maintenance workers, in addition to the child trespasser scenario. The data set will be compared to these calculated screening values to address the planned future uses of the areas covered by the perfluorinated compounds investigation.

Comment 3*. EPA notes that the provisional health advisory of 0.4 parts per billion for PFOA is not based on long-term exposure; consequently, making comparisons to the provisional health advisory based on long-term exposures may underestimate the true risk.*

Response: Comment noted. Although the provisional health advisory is based on short-term exposure, EPA's January 8, 2009 Provisional Health Advisory states that the "*value should be protective of all population subgroup and lifestages*." Additionally, since the only toxicity data for PFOA and PFOS are based on subchronic exposure, the provisional health advisory levels are consistent with the exposure

duration of the toxicity values. As such, although there is some uncertainty with the use of these values the Navy believes that this uncertainty does not significantly impact the decisions being made on this site. The Decision Document will use the surface water screening levels calculated by the NMCPHC to evaluate the surface water results; the EPA provisional health advisory will be used to screen the groundwater results.

Comment 4. *Please conduct and add to this document an evaluation of the potential ecological risks of the measured concentrations of PFOS and PFOA in surface water and sediment. Qi et al (2011) recently derived predicted toxicity thresholds (predicted no-effect concentrations, or PNECs) for PFOS that ranged from 0.61 to 6.66 ug/L using published aquatic toxicity data for PFOS and several EPA and European approaches to derive aquatic toxicity thresholds. EPA Region 1 also conducted a limited literature review for chronic and/or sublethal effects of PFOS and PFOA on aquatic organisms. Based on the results of this review, the lowest toxic concentrations were 10 ug/L PFOS, which lowered post-exposure survival of zebrafish, and 10 ug/L PFOA, which lowered successful metamorphosis of damselfly larvae. The results of this literature review are summarized in the attached table of toxicity values, for which references are provided below**. Since the maximum measured concentration of PFOS in surface water (1 ug/L) is within an order of magnitude of the PNECs derived by Qi et al (2011) and the lowest observed effect concentration in zebrafish, it is possible that toxic effects may be occurring in French Stream in the area downstream from the firefighting training area.*

Response: An ecological risk assessment (ERA) was performed as part of the FFTA Phase II RI. Toxicity tests, which measure effects of all chemical present in the media, were performed on the sediment as part of the ERA. The midge, amphipod, and amphibian toxicity testing programs resulted in no lethal or sub-lethal toxicity to the three species. The ERA states: "In summary, the results of the FFTA ERA indicate that with the possible exception of ephemeral exposures to surface water in the palustrine wetland to the east of the FFTA, potential exposure to chemical stressors in the wetland environmental at the FFTA is not likely to result in significant potential risk to wetlands vertebrates and invertebrate wildlife receptors." This demonstrates that chemicals present in surface water and sediment from operations at FFTA, including the use of AFFF in training exercises at FFTA, do not pose a significant risk to wildlife receptors. Key sections of the ERA are included as Attachment 2 to these RTCs and can also be included in an appendix of the Decision Document.

Comment 5. *Since a literature analysis suggests that aquatic toxic effects are possible, and in conformance with CERCLA, it is necessary to determine the extent of contamination by PFOS and PFOA in sediment and surface water and to conduct a screening level ecological risk assessment (SCLERA). The SCLERA should include an evaluation of the screening level risk of PFOS and PFOA through the aquatic and terrestrial food web, using the results of soil investigations that are ongoing.*

Response: Please see the Response to Comment 4.

Comment 6. *When Navy updates the calculations for the screening level concentrations for exposures identified in these comments, please provide those supporting calculations to the regulators for review and concurrence.*

Response: The Navy provided the assumptions and equations used in calculating the screening levels for various exposure scenarios to EPA and MassDEP via email on September 29, 2011. This information is attached to these RTCs and will be included in an appendix to the Decision Document.

Page-Specific Comments

Comment 7. Page 4, Section 4.0 *– The last sentence states that the results of the surface water and sediment sampling support the Navy's Finding of Suitability for Transfer. This conclusion may be a bit premature, pending demonstration that there is no excess risk for the recreational user exposure, which is related to the intended use of the property. The Navy must also demonstrate that land use controls are not required to prevent unrestricted use of the property.*

Response: Comment noted.

Comment 8. Figure 2 *- Comparison of upstream and downstream concentrations of perfluorinated compounds indicates a clear impact to the environment from the use of perfluorinated compounds at the fire fighting training area. This finding suggests that a more comprehensive investigation at and downstream of the fire fighting training area is warranted to determine if the single downstream sample location is representative of conditions at and downstream of the fire fighting training area.*

Response: The sampling design documented in the SAP Addendum was biased toward selection of locations where the highest concentrations were expected. Due to the fact that the concentrations are orders of magnitude lower than the screening values and that it was demonstrated during the ERA that there was no significant ecological impact to French Stream, the Navy believes that a more comprehensive investigation downstream of the FFTA is not warranted. In addition, the East Branch of French Stream does not flow into waters used as a source of drinking water.

Comment 9. Appendix C: *Several internal standard detected areas were significantly below the acceptable range and also matrix spike recoveries were below the quality control requirements. Navy concluded that these quality control problems did not impact the project accuracy goals; however, that conclusion is questionable. Clearly the concentrations of perfluorinated compounds have been under-reported based on the recoveries obtained; the magnitude of the under-reporting has not been quantitated.*

Response: In all cases where quality control limits were not met, the affected results were estimated (J, UJ). The project accuracy goals are not impacted in these cases since the affected sample results are more than an order of magnitude below their associated project action limits. The internal standards areas were >20% of the associated daily continuing calibration area.

Some of the samples initially had very poor internal standards; therefore, the lab reanalyzed those samples and the results of the re-analyses were reported. Samples AFFF-SD-SD03-0004 and AFFF-SD-DUP01-050211 were re-extracted. The results of the re-extractions were significantly different from the initial sample results. On June 13, 2011 the laboratory explained that these differences were due to matrix interferences (See note in DV memo). In general, it is common to have matrix interferences with sediments.

**References

Ankley, G. T. , D. W. Kuehl, M. D. Kahl, K. M. Jensen, B. C. Butterworth, and J. W. Nichols. 2004. Partial life-cycle and bioconcentration modeling of perfluorooctanesulfonate in the Northern Leopard Frog (*Rana pipiens*). Environ. Toxicol. Chem. 23(11): 2745-2755.

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Bots, J. , L. De Bruyn, T. Snijkers, B. Van den Branden, H. Van Gossum. 2010. Exposure to perfluorooctane sulfonic acid (PFOS)*sic* adversely affects the life-cycle of the damselfly *Enallagma cyathigerum*. Environ. Pollution 158: 901-905.

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Hagenaars, A., L. Vergauwen, W. De Coen, D. Knapen. 2011. Structure-activity relationship assessment of four perfluorinated chemicals using a prolonged zebrafish early life stage test. Chemosphere 82: 764-772.

Hagenaars, A. , D. Knapen, I. J. Meyer, K. van der Ven, P. Hoff, W. De Coen. 2008. Toxicity evaluation of perfluorooctane sulfonate (PFOS) in the liver of common carp (*Cyprinus carpio*). Aquatic Toxicol. 88:155-163.

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Huang, H., C. Huang, L. Wang, X. Ye, C. Bai, M. T. Simonich, R. L. Tanguay, Q. Dong. 2010. Toxicity, uptake kinetics and behavior assessment in zebrafish embryos following exposure to perfluorooctanesulphonicacid (PFOS). Aquatic Toxicol. 98: 139-147.

Kyunghee, Ji, Y. Kim, S. Oh, B. Ahn, H. Jo, and K. Choi. 2008. Toxicity of perfluorooctane sulfonic acid and perfluorooctanoic acid on freshwater macroinvertebrates (*Daphnia magna* and *Moina macrocopa*) and fish (*Oryzias latipes*). Environ. Toxicol. Chem. 27(10): 2159-2168.

Latala, A. , M. Nedzi, P. Stepnowski. 2009. Acute toxicity assessment of perfluorinated carboxylic acids towards the Baltic microalgae. Environ. Toxicol. Pharmacol. 28: 167-171.

Effects of PFOS and PFOA on aquatic organisms

Chemical	Species	Common Name	Duration	EC50 (mg/l)	Effect	NOEC (mg/l)	LOEC (mg/l)	Reference
PFOS	*Daphnia magna*	waterflea	48-h	37.36	survival	12.5	25	Kyunghee et al 2008
PFOS	*Daphnia magna*	waterflea	21-d		survival	1.25	2.5	Kyunghee et al 2008
PFOS	*Moina macrocopa*	waterflea	48-h	17.95	survival	6.25	12.5	Kyunghee et al 2008
PFOS	*Moina macrocopa*	waterflea	7-d		survival	12.5	25	Kyunghee et al 2008
PFOS	*Oryzias latipes*	Rice fish	14-d		GSI, no. eggs, hatchability	0	0.01	Kyunghee et al 2008
PFOS	*Rana pipiens*	Leopard frog	n.s.		time to metamorphosis	1	3	Ankley et al 2004
PFOS	*Xiphophorus helleri*	Swordtail fish	6-wk		GSI	0.5	0.1	Jian and Fang, 2010
PFOS	*Daphnia magna*	waterflea	21-d		survival	25	50	Sanderson et al 2004
PFOS	*Daphnia pulicaria*	waterflea	21-d		survival	6	13	Sanderson et al 2004
PFOS	*Daphnia magna*	waterflea	21-d	9.1	repro	1	5	Li, 2010
PFOS	*Danio rerio*	Zebrafish	70-d		growth during recovery	0	0.01	Du, et al 2009
PFOS	*Danio rerio*	Zebrafish	70-d		F1 survival	0.01	0.05	Du, et al 2009
PFOS	*Pimephales promelas*	Fathead minnow	24-d	0.23	fecundity	0.3	1	Ankley et al 2005
PFOS	*Dugesia japonica*	freshwater planarian	96-h	23	survival	10		Li, 2008a
PFOS	*Physa acuta*	freshwater snail	96-h	178	survival	100		Li, 2008a
PFOS	*Neocaridina denticulate*	green neon shrimp	96-h	20	survival	5		Li, 2008a
PFOS	*Daphnia magna*	waterflea	48-h	63	survival	20		Li, 2008a
PFOS	*Scenedesmus obliquus*	freshwater green alga	ns		growth inhibition	40		Liu, et al 2009
PFOS	*Danio rerio*	Zebrafish	ns		embryo development	0.5	1	Shi et al 2008
PFOS	*Danio rerio*	Zebrafish	96-h	22.2	adult survival			Sharpe et al 2010
PFOS	*Oncorhynchus mykiss*	Rainbow Trout	96-h	2.5	paar survival			Sharpe et al 2010
PFOS	*Danio rerio*	Zebrafish	2 wk		fecundity	0	0.5	Sharpe et al 2010
PFOS	*Dugesia japonica*	freshwater planarian	96-h	17	survival	12	18	Li, 2008b
PFOS	*Cyprinus carpio*	Common Carp	14-d		relative condition factor	0	0.1	Hagenaars et al 2008
PFOS	*Danio rerio*	Zebrafish	120 hr	1.08	developmental effects		0.1	Hagenaars et al 2011

Effects of PFOS and PFOA on aquatic organisms

Chemical	Species	Common Name	Duration	EC50 (mg/l)	Effect	NOEC (mg/l)	LOEC (mg/l)	Reference
PFOA	*Enallagma cyathigerum*	damselfly larva	4 mo.		behavior	0.01	0.1	van Gossum et al 2009
PFOA	*Enallagma cyathigerum*	damselfly larva	ns		metamorphosis	0	0.01	Bots et al 2010
PFOA	*Daphnia magna*	waterflea	48-h	476.52	survival	250	500	Kyunghee et al 2008
PFOA	*Daphnia magna*	waterflea	21-d		survival	6.25	12.5	Kyunghee et al 2008
PFOA	*Moina macrocopa*	waterflea	48-h	199.51	survival	62.5	125	Kyunghee et al 2008
PFOA	*Moina macrocopa*	waterflea	7-d		survival	3.125	6.25	Kyunghee et al 2008
PFOA	*Oryzias latipes*	Rice fish	21-d		F1 survival	0	0.1	Kyunghee et al 2008
PFOA	*Daphnia magna*	waterflea	21-d	>100	repro	10	32	Li, 2010
PFOA	*Dugesia japonica*	freshwater planarian	96-h	337	survival	150		Li, 2008a
PFOA	*Physa acuta*	freshwater snail	96-h	672	survival	250		Li, 2008a
PFOA	*Neocaridina denticulate*	green neon shrimp	96-h	454	survival	250		Li, 2008a
PFOA	*Daphnia magna*	waterflea	48-h	181	survival	125		Li, 2008a
PFOA	*Dugesia japonica*	freshwater planarian	96-h	458	survival	400	450	Li, 2008b
PFOA	*Chlorella vulgaris*	green alga	72-h	977	growth inhibition			Latala et al 2009
PFOA	*Skeletonema marinoi*	diatom	72-h	368	growth inhibition			Latala et al 2009
PFOA	*Geitlerinema amphibium*	bluegreen alga	72-h	248	growth inhibition			Latala et al 2009
PFOA	*Danio rerio*	Zebrafish	ns	1.12	developmental effects	0.005	0.05	Huang et al 2010
PFOA	*Danio rerio*	Zebrafish	120-hr	113	developmental effects	50	75	Hagenaars et al 2011

F1 = first generation offspring
GSI= gonadal somatic index
ns = not specified
EC50 = median effect concentration
NOEC = No Observed Effect Concentration
LOEC = Lowest Observed Effect Concentration
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

NAVY RESPONSES TO MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (MASSDEP) COMMENTS (DATED AUGUST 24, 2011)
TECHNICAL MEMORANDUM, PFCS IN SURFACE WATER AND SEDIMENT
FORMER NAVAL AIR STATION (NAS) SOUTH WEYMOUTH, MASSACHUSETTS

The Navy's responses to the MassDEP comments on the Technical Memorandum, Perfluorinated Compounds in Surface Water and Sediment (dated August 2011) are presented below. The MassDEP's comments are presented first (in italics) followed by Navy's responses.

Comment 1: Section 1.0*: The statement indicating that screening levels were selected based on the "most likely potential exposure and future land use" is incorrect. The Reuse Plan specifies open space use in the locations where the surface water and sediment samples were collected. Accordingly, open space use scenarios such as passive and active recreation, rather than trespassing scenarios, should be used to evaluate future risk*

Response: Screening levels for surface water and sediment have been calculated by the Navy Marine Corps Public Health Center (NMCPHC) for child and adult recreational users and maintenance workers, in addition to trespasser scenarios. The Navy provided the assumptions and equations used in calculating the screening levels for various exposure scenarios to EPA and MassDEP via email on September 29, 2011. This information is included as Attachment 1 to these RTCs. The data set will be compared to these calculated screening values to address the planned future uses of the areas covered by the perfluorinated compounds investigation.

Comment 2: Section 4.0*: The contents of this memorandum are insufficient to determine whether or not all necessary remedial action has been taken to address the chemicals reported in the samples and, consequently, insufficient to support a Finding of Suitability to Transfer (FOST) for property impacted by the chemicals:*

- *The surface water and sediment results were not screened against risk-based values that represent the expected future of the areas where the samples were collected (refer to Comment 1).*

Response: Comment noted. Please see the Response to Comment 1.

- *The surface water and sediment results were not screened against risk-based values that represent an unrestricted use scenario to determine if any action is necessary to prevent unrestricted use in the future (e.g., land use controls and five-year reviews).*

Response: Comment noted. Please see the Response to Comment 1.

- *The results from other impacted media (soil and groundwater) were not evaluated along with the results from the surface water and sediment samples to determine whether or not remedial action is necessary. Though removal or treatment of surface water and sediment might not be necessary, the potential risk contributions from these media could be significant to a decision about remedial action for other impacted media (e.g., due to cumulative risk), and if remedial action is necessary, results from samples of other media could affect decisions about remedial objectives (e.g., cleanup for Reuse Plan or cleanup for unrestricted use) and remedial alternatives (e.g., land use controls vs. removal or treatment).*

Response: The surface water and sediment results will be evaluated with the soil and groundwater results in one report. The Technical Memorandum will not be revised and issued as a final document since the information will be included in the Decision Document being prepared by the Navy.

Comment 3: Appendix C:

- *The screening levels were not derived from assumptions that are representative of the expected future use of the areas sampled (refer to Comment 1) or unrestricted use (refer to Comment 2).*

Response: Comment noted. Please see the Response to Comment 1.

- *The accuracy of the screening levels presented here could not be confirmed because essential supporting assumptions (e.g., toxicity values and calculations) were not presented.*

Response: The Navy provided the assumptions and equations used in calculating the screening levels for various exposure scenarios to EPA and MassDEP via email on September 29, 2011. This information is included as Attachment 1 to these RTCs and will be included in an appendix to the Decision Document.

ATTACHMENTS

Call, Phoebe

From: Barney, David A CIV OASN (EI&E), BRAC PMO NE <david.a.barney@navy.mil>
Sent: Thursday, September 29, 2011 7:54 AM
To: Keating.Carol@epamail.epa.gov; Helland, Brian J CIV NAVFAC MIDLANT, EV
Cc: Call, Phoebe; Chaffin, David (DEP)
Subject: RE: NASOWEY-PFCs in surface water and sediment
Attachments: 2011.09.22 PFOA_PFOS calcseq.xlsx

Hi Carol,

Not sure if this had been previously sent to you but I am sending here as a follow up.

r/

David Barney
BRAC Environmental Coordinator
NAS South Weymouth, NCBC Davisville
617-753-4656

-----Original Message-----
From: Keating.Carol@epamail.epa.gov [mailto:Keating.Carol@epamail.epa.gov]
Sent: Thursday, September 15, 2011 16:56
To: Helland, Brian J CIV NAVFAC MIDLANT, EV
Cc: Barney, David A CIV OASN (EI&E), BRAC PMO NE; Call, Phoebe; Chaffin, David (DEP)
Subject: Fw: NASOWEY-PFCs in surface water and sediment

Please see request below from Rick Sugatt.

Thanks,

Carol A. Keating
Remedial Project Manager
Federal Facilities Superfund Program
----- Forwarded by Carol Keating/R1/USEPA/US on 09/15/2011 04:51 PM

From: Rick Sugatt/R1/USEPA/US
To: Carol Keating/R1/USEPA/US@EPA
Date: 09/15/2011 04:22 PM
Subject:NASOWEY-PFCs in surface water and sediment

Please ask Navy to provide documentation (equations and electronic readable/writable spreadsheets) for calculation of screening levels in Appendix A of August 2011 "Technical Memorandum Perfluorinated Compounds

in Surface Water and Sediment", specifically showing how cumulative risks for combined pathways are accounted for. Thanks.

Richard H. Sugatt
U.S.EPA New England
5 Post Office Square, Suite 100
OSRR07-2
Boston, MA 02109-3912
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	Chemical-Specific Parameters			Risk-Based Screening Level		
	Reference Dose (mg/kg-day)	GIABS (unitless)	ABS (unitless)	Soil (mg/kg)	Sediment (mg/kg)	Surface Water (µg/L)
PFOA	2.00E-04	1	0.1	612	4,737	21,292
PFOS	8.00E-05	1	0.1	245	1,895	8,517

Exposure Parameters	Value	Units	Abbreviation in Formula Below
Body weight	70	kg	BW
Exposure duration	24	years	ED
Exposure frequency			EF
- Sediment	12	days/year	
- Soil	39	days/year	
- Water	12	days/year	
Ingestion rate			IR
- Sediment	50	mg/day	
- Soil	100	mg/day	
- Water	0.01	L/hr	
Exposed skin surface area	5,700	cm2	SA
Soil-to-skin adherence factor			AF
- Sediment	0.07	mg/cm2	
- Soil	0.2	mg/cm2	
Exposure time - water	2	hour/day	ET
Target hazard quotient	1	unitless	THQ
Conversion factor 1	0.000001	kg/mg	CF
Conversion factor 2	1000	ug/mg	CF

Soil/Sediment Equations:

$$SL_{ingestion} = \left(\frac{THQ \times AT_{nc} \times BW}{EF \times ED \times IR \times CF \left(\frac{1}{RfD_{oral}} \right)} \right)$$

$$SL_{dermal} = \left(\frac{THQ \times AT_{nc} \times BW}{EF \times ED \times SA \times AF \times ABS \times CF \left(\frac{1}{(RfD_{oral} \times GIABS)} \right)} \right)$$

$$SL = \frac{1}{\left(\frac{1}{SL_{ingestion}} \right) + \left(\frac{1}{SL_{dermal}} \right)}$$

Surface Water Equations:

$$SL_{ingestion} = \left(\frac{THQ \times AT_{nc} \times BW \times CF}{EF \times ED \times ET \times IR \times \left(\frac{1}{RfD_{o}} \right)} \right)$$

$$SL = \frac{1}{\left(\frac{1}{SL_{ingestion}} \right)}$$

Phase II Remedial Investigation
Fire Fighting Training Area

Naval Air Station South Weymouth

Weymouth, Massachusetts

Northern Division

Naval Facilities Engineering Command

Contract Number N62472-90-D-1298

Contract Task Order 0310

April 2001

- The evaluation of background data in the food web model indicates that the models are overly conservative and that the majority of the elevated HQs are attributable to background concentrations of COPCs.
- The CBR analysis for cadmium measured in small mammal tissue suggests that tissue concentrations are likely below levels known to cause renal failure.

In summary, the results of the FFTA ERA indicate that potential exposure to chemical stressors in surface soil at the FFTA is not likely to result in significant ecological risk to terrestrial or wetland wildlife receptors.

7.5.4 Wetland and Aquatic Organisms

In general, the results of this ERA suggest no significant ecological risks to wetland and aquatic receptors. This finding is based largely on the results of the site-specific hydric soil toxicity testing program, where no lethal or sub-lethal toxicity was observed for any of the three species evaluated. However, there is some uncertainty with this finding due to slightly elevated concentrations of dissolved phase inorganic constituents in the water column in the palustrine wetland to the east of the FFTA. Specifically, these conclusions are based on the following ERA findings:

- The amphipod, midge, and amphibian toxicity testing programs resulted in no lethal or sub-lethal toxicity to these species.

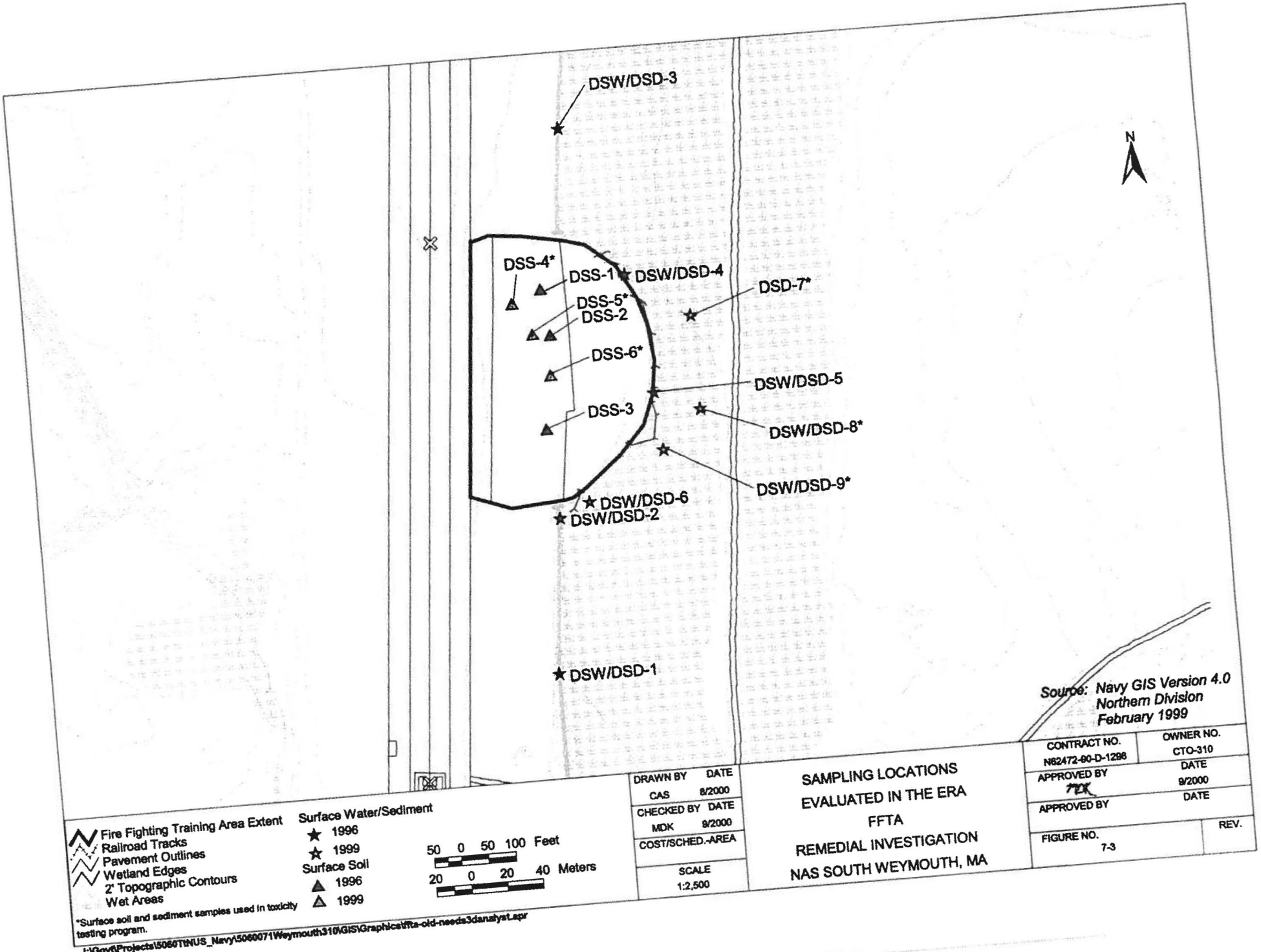
- Although EPCs exceeded chronic sediment/hydric soil benchmarks for some organics, particularly tPAHs, no acute benchmarks were exceeded. However, considerable uncertainty is associated with the use of these benchmarks, particularly in light of the lack of toxicity in the toxicity testing program.

- SEM exceeded AVS concentrations at all three sampling locations meaning that metal toxicity could potentially occur. (e.g., SEM:AVS > 1). However, the absolute difference between SEM and AVS concentrations were small (usually less than 0.26 µmols/g), so the amount of metal not bound to sulfides may not be significant, and the bulk sediment concentrations of the metals evaluated in this program were generally low and consistent with background.

- Concentrations of five dissolved phase inorganic constituents (aluminum, barium, lead, manganese, and vanadium), as well as two organic constituents (bis 2-ethylhexylphthalate and carbon disulfide) exceeded water quality screening values. While the two organic constituents are likely laboratory contaminants, it is unclear why the inorganic concentrations in the site's palustrine wetlands exceed water quality screening values. Although the dissolved phase

palustrine wetland water column concentrations of these inorganic compounds exceed benchmarks, it is possible that these inorganic compounds are not bioavailable. The presence of water in this wetland system is ephemeral, and it is possible that the metals are colloidal bound to dissolved organic carbon (DOC), and DOC-metal complexes are generally not bioavailable.

In summary, the results of the FFTA ERA indicate that with the possible exception of ephemeral exposures to surface water in the palustrine wetland to the east of the FFTA, potential exposure to chemical stressors in the wetland environments at the FFTA is not likely to result in significant potential risk to wetlands vertebrate and invertebrate wildlife receptors.


DSW/DSD-3
N
DSS-4*
DSS-1
DSW/DSD-4
DSD-7*
DSS-5*
DSS-2
DSS-6*
DSW/DSD-5
DSS-3
DSW/DSD-8*
DSW/DSD-9*
DSW/DSD-6
DSW/DSD-2
DSW/DSD-1
Source: Navy GIS Version 4.0
Northern Division
February 1999
Fire Fighting Training Area Extent
Railroad Tracks
Pavement Outlines
Wetland Edges
2' Topographic Contours
Wet Areas
Surface Water/Sediment
1996
1999
Surface Soil
1996
1999
50 0 50 100 Feet
20 0 20 40 Meters
*Surface soil and sediment samples used in toxicity testing program.
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DRAWN BY CAS DATE 8/2000
CHECKED BY MDK DATE 9/2000
COST/SCHED.-AREA
SCALE 1:2,500
SAMPLING LOCATIONS
EVALUATED IN THE ERA
FFTA
REMEDIAL INVESTIGATION
NAS SOUTH WEYMOUTH, MA
CONTRACT NO. N62472-90-D-1298
OWNER NO. CTO-310
APPROVED BY
DATE 9/2000
APPROVED BY
DATE
FIGURE NO. 7-3
REV.

TABLE 7-19
SEDIMENT - MIDGE SURVIVAL AND GROWTH TOXICITY RESULTS
FFTA
REMEDIAL INVESTIGATION
NAS SOUTH WEYMOUTH, MA

Sampling Location	Midge Test Survival Data								
	% Survival								
	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Ref G	Ref H	Treatment
ABC	100	90	100	100	90	100	100	100	98
DSD-07	80	80	100	100	80	90	100	90	90
DSD-08	90	80	100	90	100	100	100	90	94
DSD-09	100	80	90	100	80	100	70	80	88
HSD-17	70	40	90	90	90	100	90	100	84
HSD-18	80	100	100	100	100	90	80	100	94
HSD-20	100	70	90	100	90	80	90	100	90
Sampling Location	Midge Test Growth Data								
	Replicate Weight (mg/animal)								
	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Ref G	Ref H	Treatment
ABC	2.6	3.2	2.8	2.2	3	2	3.5	2.4	2.7
DSD-07	2	3.4	5	2.4	2	2.6	6.8	3.7	3.5
DSD-08	4.3	2	4.2	4.2	1.6	2.7	1.3	1.2	2.7
DSD-09	3.1	4.3	2	3	2	1.7	1.8	2.8	2.6
HSD-17	1.4	1.8	1.4	1.8	0.7	1.1	0.9	0.7	1.2
HSD-18	3.3	3.8	5.5	3.5	1.4	1.8	4.5	2.6	3.3
HSD-20	2.2	1.9	2.3	2.4	1.9	2.6	2.1	1.5	2.1

Sampling Location	Statistical Results on Midge Survival and Growth							
	Survival				Growth			
	ABC	HSD-17	HSD-18	HSD-20	ABC	HSD-17	HSD-18	HSD-20
DSD-07	NS	NS	NS	NS	NS	NS	NS	NS
DSD-08	NS	NS	NS	NS	NS	NS	NS	NS
DSD-09	NS	NS	NS	NS	NS	NS	NS	NS

Notes:
Refer to Appendix GEN-A for a comprehensive list of acronyms used in this table.
Samples tested from July 17 to July 27, 1999.
DSD* - Fire Fighting Training Area Sediment Sampling Location
ABC - ABC Toxicity Laborotory Control
HSD-17, HSD-18 & HSD-20 - Basewide background sampling location.
NS - Not statistically significant (a = 0.05)

TABLE 7-20
SEDIMENT - AMPHIPOD SURVIVAL AND GROWTH TOXICITY RESULTS
FFTA
REMEDIAL INVESTIGATION
NAS SOUTH WEYMOUTH, MA

Sampling Location	Amphipod Test Survival Data								
	% Survival								
	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Ref G	Ref H	Treatment
ABC	80	90	100	100	100	100	100	100	96
DSD-07	100	100	100	100	100	90	100	80	96
DSD-08	100	100	100	100	100	100	100	100	100
DSD-09	100	100	100	100	90	90	100	100	98
HSD-17	100	100	90	90	100	100	100	80	95
HSD-18	100	90	100	100	100	100	100	100	99
HSD-20	100	100	95	100	100	100	100	100	99
Sampling Location	Amphipod Test Growth Data								
	Replicate Weight (mg/animal)								
	Rep A	Rep B	Rep C	Rep D	Rep E	Rep F	Ref G	Ref H	Treatment
ABC	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.3	0.3
DSD-07	0.3	0.2	0.3	0.1	0.2	0.3	0.3	0.3	0.3
DSD-08	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
DSD-09	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.3	0.3
HSD-17	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3
HSD-18	0.3	0.3	0.1	0.3	0.5	0.2	0.3	0.3	0.3
HSD-20	0.2	0.2	0.2	0.3	0.3	0.2	0.4	0.2	0.3

Sampling Location	Statistical Results on Amphipod Survival and Growth							
	Survival				Growth			
	ABC	HSD-17	HSD-18	HSD-20	ABC	HSD-17	HSD-18	HSD-20
DSD-07	NS	NS	NS	NS	NS	NS	NS	NS
DSD-08	NS	NS	NS	NS	NS	NS	NS	NS
DSD-09	NS	NS	NS	NS	NS	NS	NS	NS

Notes:
Refer to Appendix GEN-A for a comprehensive list of acronyms used in this table.
Samples tested from July 17 to July 27, 1999.
DSD* - Fire Fighting Training Area Sediment Sampling Location
ABC - ABC Toxicity Laborotory Control
HSD-17, HSD-18 & HSD-20 - Basewide background sampling location.
NS - Not statistically significant (a = 0.05)

TABLE 7-21
SEDIMENT - FROG SURVIVAL TOXICITY RESULTS
FFTA
REMEDIAL INVESTIGATION
NAS SOUTH WEYMOUTH, MA

Sampling Location	Frog Test Survival Data				
	% Survival				
	Rep A	Rep B	Rep C	Rep D	Treatment
ABC	100	100	100	100	100
DSD-07	100	100	100	70	93
DSD-09	100	90	100	90	95
HSD-18	100	100	100	100	100
HSD-19	100	90	100	100	98
Sampling Location	Frog tadpole weight data				
	Average weight (mg/animal)				
	Rep A	Rep B	Rep C	Rep D	Treatment
ABC	107.3	99.2	84.5	112	100.8
DSD-07	138.2	117.2	125.3	98.6	119.8
DSD-09	134.2	115.4	126.9	116.8	123.3
HSD-18	139.1	83.5	100.1	93.6	104.1
HSD-19	111.8	109.2	103.4	98.7	105.8

Sampling Location	Statistical Results on Frog Survival and Growth					
	Survival			Growth		
	ABC	HSD-18	HSD-19	ABC	HSD-18	HSD-19
DSD-07	NS	NS	NS	NS	NS	NS
DSD-09	NS	NS	NS	NS	NS	NS

Notes:
Refer to Appendix GEN-A for a comprehensive list of acronyms used in this table.
Samples tested from July 7 to July 14, 1999.
DSD* - Fire Fighting Training Area Sediment Sampling Location
ABC - ABC Toxicity Laborotory Control
HSD-17, HSD-18 & HSD-20 - Basewide background sampling location.
NS - Not statistically significant (a = 0.05)