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MEMORANDUM CH2MHILL

Proposed Methods for Preparing the Human Health Risk Assessment for SWMU 24 at Naval Air Station, Oceana

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This memorandum presents the methods that will be used to prepare the human health risk assessment for SWMU 24, at NAS Oceana.

General Information about the Sites

Some general information on the investigation activities at the site that will be evaluated in this risk assessment is provided in Attachment A.

Format

A) The risk assessment will be prepared following the *Risk Assessment Guidance for Superfund: Volume I: Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)* (EPA, January 1998).

B) The Interim Deliverable tables will be submitted to EPA for review. Interim Deliverable Tables 1 and 4 are attached (Attachments B and C) for EPA's review. We are proposing to make 4 separate submittals to the EPA for review. The submittals will combine tables as follows:

1) Tables 1 and 4 - Summarize the Exposure Pathways to be evaluated in the risk assessment. Table 4 defines the exposure parameters to be used in the risk calculations.

2) Tables 2 and 3 - Tables 2 and 3 are similar in that they select the chemicals of potential concern (COPCs) and summarize the concentration statistics for the COPCs.

3) Tables 5 and 6 - Summarize the noncancer and cancer toxicity values for the COPCs to be evaluated in the risk assessment.

4) Tables 7 and 8 - Show the risk calculations for each exposure scenario. Tables 9 and 10 - Summarize the risk calculations for each exposure scenario by receptor. Tables 7, 8, 9 and 10 will be submitted as part of RI.

Data Handling

A) Investigation data was collected during field activities. Subsurface soil samples (collected December 1997 and January 1998) and groundwater samples (monitoring well and piezometer groundwater samples) collected October and November 1998) will be evaluated in the risk assessment. Only validated data will be evaluated in the risk assessment.

B) Estimated values flagged with a J qualifier will be treated as detected concentrations.

C) Data qualified with an R (rejected) will not be included in the risk assessment.

D) Data qualified with a B (blank contamination) will be used in the risk assessment as if it is non-detect and one-half the sample quantitation limit (SQL) or sample detection limit (DL) will be used as the sample concentration.

E) For duplicate samples, the higher of the two concentrations will be used. In calculating the frequency of detection and the 95UCL, the duplicates will be counted as a single sample.

F) One-half the sample quantitation limit (SQL) or sample detection limit (DL) will be used for cases where no detectable contaminant quantities were found in that specific sample, but the contaminant was detected in that medium for that group of samples.

Contaminants of Concern Selection

G) The selection criteria in EPA Region III's *Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening*, January 1993, will be followed to determine which chemicals will be evaluated quantitatively in the risk assessment.

H) Constituents whose maximum detected concentration in a medium is below the Region III Risk-Based Concentration (RBC) (EPA, April 12, 1999) for that medium (based on a target risk of 1×10^{-6} and a target hazard index of 0.1) will not be retained as contaminants of potential concern (COPC). RBCs that are based on noncarcinogenic effects will be divided by 10 to account for exposure to multiple constituents (to base the RBC on a target hazard index of 0.1). RBCs based on carcinogenic effects will be used as presented in the most current RBC table. The RBCs for tap water will be used to screen the contaminants in the groundwater. The residential soil RBCs will be used to select the COPCs for the residential and industrial scenarios.

I) Constituents that are essential human nutrients (magnesium, calcium, potassium, and sodium), are present at low concentrations (only slightly above naturally

occurring levels), and are toxic only at very high doses will not be considered further in the quantitative risk assessment.

Exposure Assessment

J) The 95 percent upper confidence limit of the mean (95UCL) will be used as the exposure point concentration for soils for both the central tendency and reasonable maximum exposure (RME) scenarios. If the 95UCL is greater than the maximum detected concentration, the maximum detected concentration will be used as the exposure point concentration. A W-test will be used to determine if the data are lognormally or normally distributed and the appropriate distribution will be used to calculate the 95UCL. If the results of the W-test are inconclusive, the maximum of the normal and lognormal 95UCL will be used for the comparison to the maximum concentration to determine the exposure point concentration.

K) Groundwater

1. All of the groundwater data will be used to select the groundwater COPCs. Only the most contaminated wells (wells within the groundwater contamination plume) will be used to quantify future groundwater risks associated with the area of concern.

2. The depth to groundwater in the Columbia aquifer is generally between 4 and 5 feet below ground surface (bgs). Although this water will probably never be used as a potable water supply, groundwater in the Columbia aquifer will be evaluated as a potential potable supply. It is assumed that adult residents could be exposed to groundwater through ingestion, and dermal contact and inhalation while showering. Furure child resident could be exposed to groundwater through ingestion, and dermal contact while bathing. Due to the shallow depth to groundwater, construction workers could be exposed to groundwater through dermal contact and inhalation of vapors during excavation activities on the site.

3. Shower Scenario

   a) The Foster and Chrostowski Model will be used to determine exposure by a residential adult to the groundwater while showering.

   b) The exposure concentrations for dermal uptake will be adjusted to reflect loss of the constituents from volatilization.

L) Soil

1. The source of contamination at the site was a surface spill and all stained surface soil was excavated down to few feet. Therefore, there is no contaminated surface soil at the site. Confirmatory sampling was conducted around the excavated area. Subsurface soil samples were also collected beneath the area that was excavated. It is assumed that in the future if any kind of excavation activities take place at the site the subsurface soil could become surface soil and site workers, or future residents, could be exposed to the soil through ingestion, dermal contact, and inhalation. Construction workers could be exposed through ingestion, dermal contact, and inhalation to the soil during construction activities.

Toxicity Assessment

A) Toxicity values for use in the risk assessment will be obtained from Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST) databases. If information is not available from these two sources, toxicity values from the EPA Region III Risk Based Concentration Table will be used. If information is not available from the preceding sources, EPA Region III risk assessors will be consulted.

B) Oral toxicity values will be adjusted from administered to absorbed doses for dermal evaluation using the oral absorption efficiencies provided by the EPA in a fax from Linda Watson, EPA Region III Toxicologist dated June 23, 1997.

Attachment A

General Site Information

This risk assessment will focus on investigation activities for the SWMU 24, at Naval Station Oceana. SWMU 24 is an area near Building 840 which contained a waste-oil bowser. The Naval Construction Battalion (SEABEEs) has been based in Building 840 since 1972. The SEABEEs are involved in construction at Oceana NAS and other local naval installations (RFA, 1988). Waste solvents and oils generated at the equipment maintenance garage in Building 840 were hand carried and poured into the bowser, which was typically located in the southernmost corner of the SEABEE compound (RFA, 1988). The bowser was then transported to the tank farm for disposal (RFA, 1988). During the VSI, heavy staining of the ground was observed in the area surrounding the waste oil bowser at Building 840 (RFA, 1988). Current practice is to dispose of waste oil in drums that are transported to the base hazardous waste lot, where they are transferred to the DRMO and disposed or recycled appropriately. The bowsers are no longer used.

Investigation History

The 1993 RFI field investigation was the first investigation of SWMU 24. However, environmental problems at this SWMU were first recognized during the RFA when oil staining was observed in site surface soil surrounding a used oil bowser. SWMU 24 was investigated during three phases of the RFI. Phase I was completed in 1993, Phase II was completed in 1995, and Phase III was completed in 1997.

In 1993 CH2M HILL conducted a Phase I RFI to delineate the source area and the extent of POL-contaminated soil. Results of the Phase I RFI are documented in the *RCRA Facility Investigation Final Report – Phase I, Naval Air Station Oceana, Virginia Beach, Virginia,* December 1993. Soil sampling results indicated that this SWMU should be characterized for soil removal. Therefore SWMU 24 was included in a POL CMS to delineate the extent of soil contamination. Results of the study are documented in the *Final Corrective Measures Study for Petroleum Contaminated Sites, Oceana Naval Air Station, Virginia Beach, Virginia,* October 1994. During the POL CMS, groundwater contamination was discovered. The SWMU was added to the 1995 Phase II RFI scope of work to address groundwater contamination. Meanwhile the soil contamination was fully characterized and excavated under the 1994 POL CMS.

CH2M HILL conducted the CMS for groundwater in 1995. Results are documented in the *Final Corrective Measures Study for SWMUs 2E, 15, and 24, Oceana Naval Air Station, Virginia Beach, Virginia,* March 1996. Results of the investigations indicated that groundwater as SWMU 24 is contaminated with chlorinated VOCs and BTEX. Chlorinated VOC contaminants are widely distributed across the site and consist of vinyl chloride, 1,2-dichloroethylene, and trichloroethylene.

In late 1996 and early 1997 an in-well aeration pilot study was initiated at SWMU 24. Results are documented in the *Final Report on the Pilot Test of the NoVOCs In-situ Aeration Technology at RCRA SWMU 243, Oceana Naval Air Station, Virginia Beach, Virginia,* April 1997. One treatment well and several monitoring wells were installed.. The monitoring wells were used evaluate the effectiveness and areal and vertical extent of groundwater remediation using the treatment well. Contaminant concentrations in the source area were

dramatically reduced. However, some outlying areas of the contaminant plume were not treated and additional remediation was recommended.

In 1997 CH2M HILL conducted confirmatory subsurface soil sampling at SWMU 25 to confirm that the POL soil removal was effective. Results of the soil sampling are documented in the *Draft Final RCRA Facility Investigation Report – Phase III, Naval Air Station Oceana, Virginia Beach, Virginia,* July 1998.

In July 1998, a final work plan was submitted to the RCRA EPA and VDEQ personnel that defined sampling tasks and field investigation procedures to use during groundwater remediation at SWMU 24 using NoVOCs in-well aeration technology.

In October 1988 subsurface groundwater samples were collected using direct push technology (DPT) and analyzed using a close support laboratory (CSL). The study was conducted in the area of SWMU 24 where NoVOCs groundwater remediation was conducted in 1996. Groundwater samples were also collected from monitoring wells and select piezometers to assess site-wide groundwater quality. The purpose of the standard low-flow groundwater sampling was to support a human health risk assessment. Results of the Geoprobe investigation and the groundwater sampling are documented in the *Draft Final Technical Memorandum for the Groundwater Sampling at SWMU 24, Oceana Naval Air Station, Virginia Beach, Virginia,* April 1999.

A total of one hundred thirteen groundwater samples were collected from forty locations distributed in a grid array. At most locations a shallow (8 foot deep), an intermediate, (14 foot deep), and a deep (20 foot deep) filtered groundwater sample was extracted. The DPT groundwater samples were analyzed in a CSL for modified Method 8010 chlorinated VOCs. Results of the SWMU 24 DPT groundwater study in and around the former NoVOCs groundwater remediation area indicate that the groundwater contains chlorinated VOCs, specifically cis1,2-DCE and TCE, at concentrations that exceed MCLs and RBCs for tap water. The residual groundwater contamination exists hydraulically downgradient of the NoVOCs™ treatment well. The highest contaminant concentrations are detected at a depth of approximately 14 feet below ground surface.

Monitoring well groundwater samples were analyzed for Target Compound List (TCL) low-concentration VOCs, TCL SVOCs, TCL Pesticides and PCBs, low-concentration PAHs, TAL total and dissolved metals and cyanide. These analyses were chosen to support the human health risk assessment of this site. The Navy has found that the groundwater underlying the remainder of SWMU 24 contains low levels of chlorinated VOCs, specifically cis1,2-DCE, TCE, and vinyl chloride, at concentrations that exceed MCLs and RBCs for tap water. Arsenic and iron also exceed the RBC

Attachment B

Interim Deliverable Table 1

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 24 at NAS Oceana

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Groundwater	Groundwater	Columbia Aquifer - Tap Water	Industrial Worker	Adult	Dermal Absorption	On-site	None	Groundwater not currently used on site as a water supply.
						Ingestion	On-site	None	Groundwater not currently used on site as a water supply.
	Surface Soil	Surface Soil	Direct Contact	Industrial Worker	Adult	Dermal Absorption	On-site	None	All stained surface soil was excavated and therefore no current exposure to surface soil.
						Ingestion	On-site	None	All stained surface soil was excavated and therefore no current exposure to surface soil.
				Trespasser/Visitor	Adult	Dermal Absorption	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
						Ingestion	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
					Adolescents	Dermal Absorption	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
						Ingestion	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
		Air	Emissions from exposed soil	Industrial Worker	Adult	Inhalation	On-site	None	All stained surface soil was excavated and therefore no current exposure to surface soil.
				Trespasser/Visitor	Adult	Inhalation	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
					Adolescents	Inhalation	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
Future	Groundwater	Groundwater	Columbia Aquifer - Tap Water	Resident	Adult	Dermal Absorption	On-site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
						Ingestion	On-site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
					Child	Dermal Absorption	On-site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
						Ingestion	On-site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
			Columbia Aquifer - Water in Excavation Pit	Construction Worker	Adult	Dermal Absorption	On-site	Quant	Construction worker may contact shallow groundwater during construction activities.
						Ingestion	On-site	None	Construction worker not expected to incidentally ingest significant amount of groundwater during construction activities.
		Air	Columbia Aquifer -Water Vapors at Showerhead	Resident	Adult	Inhalation	On-site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
					Child	Inhalation	On-site	None	Children are assumed not to shower.
			Columbia Aquifer - Volatilization from Water in Excavation Pit	Construction Worker	Adult	Inhalation	On-site	Quant	Construction worker may inhale vapors from groundwater during construction activities.
	Subsurface Soil	Soil	Direct Contact	Industrial Worker	Adult	Dermal Absorption	On-site	Quant	Site workers could contact soil while conducting maintenance activities.
						Ingestion	On-site	Quant	Site workers could contact soil while conducting maintenance activities.
				Trespasser/Visitor	Adult	Dermal Absorption	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
						Ingestion	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
					Adolescents	Dermal Absorption	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
						Ingestion	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 24 at NAS Oceana

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Subsurface Soil	Soil	Direct Contact	Resident	Adult	Dermal Absorption	On-site	Quant	Residents may contact soil, if the site is used for future residential development.
						Ingestion	On-site	Quant	Residents may contact soil, if the site is used for future residential development.
					Child	Dermal Absorption	On-site	Quant	Residents may contact soil, if the site is used for future residential development.
						Ingestion	On-site	Quant	Residents may contact soil, if the site is used for future residential development.
				Construction Worker	Adult	Dermal Absorption	On-site	Quant	Exposure to soil during construction activities.
						Ingestion	On-site	Quant	Exposure to soil during construction activities.
		Air	Emissions from exposed soil	Industrial Worker	Adult	Inhalation	On-site	Quant	Site workers may inhale vapors and dust from soil.
				Trespasser/Visitor	Adult	Inhalation	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
					Adolescents	Inhalation	On-site	None	Most of the site is entirely fenced and the site is in the middle of the Base. General public cannot access the site.
				Resident	Adult	Inhalation	Off-site	Quant	Residents may inhale vapors and dust from soil, if the site is used for future residential development.
					Child	Inhalation	Off-site	Quant	Residents may inhale vapors and dust from soil, if the site is used for future residential development.
				Construction Worker	Adult	Inhalation	On-site	Quant	Exposure to emissions from soil during construction activities.

Attachment C

Interim Deliverable Table 4

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

SWMU 24 at NAS Oceana

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Columbia Aquifer - Tap Water
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Water	µg/l	see Table ---		see Table ---		Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Water	liters/day	1	EPA, 1997	1	(1)	CW x IR-W x EF x ED x CF1 x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	6	EPA, 1991	6	(1)	
	CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	2,190	EPA, 1989	
Dermal Absorption	CW	Chemical Concentration in Water	µg/l	see Table ---		see Table ---	chem specific	CDI (mg/kg-day) =
	DAevent	Dermally Absorbed Dose per Event	mg/cm^2-event	calculated	EPA, 1992	calculated	EPA, 1992	DAevent x SA x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
	PC	Permeability Constant	cm/hr	chem specific	EPA, 1992	chem specific	EPA, 1992	
	t	Lag Time	hours	chem specific	EPA, 1992	chem specific	EPA, 1992	Inorganics: DAevent (mg/cm2-event) =
	ET	Exposure Time	hr/day	0.33	EPA, 1992	0.33	(1)	PC x CW x ET x CF1 x CF2
	CF2	Conversion Factor 2	l/cm^3	0.001	--	0.001	--	
	SA	Skin Surface Area Available for Contact	cm^2	7,500	EPA, 1992	6,500	EPA, 1992	Organics: DAevent (mg/cm2-event) =
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	2 x PC x CW x (sqrt((6 x t x ET)/3.1415))
	ED	Exposure Duration	years	6	EPA, 1991	6	(1)	x CF1 x CF2
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	2,190	EPA, 1989	

(1) Not available, used RME value.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.