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MEMORANDUM

CH2M HILL

Proposed Methods for Preparing the Human Health Risk Assessment for SWMU 1,West Woods Oil Disposal Pit, 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 1, 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 -Table 1 summarizes 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 1998 for dioxins and furans only), subsurface soil samples (collected in December 1998), surface soil samples (collected in 1993),, groundwater samples (monitoring well and piezometer groundwater samples collected December 1998), and surface water and sediment samples (collected August 1999 from the drainage ditch west of the former West Woods Oil Pit will be evaluated in the risk assessment. Groundwater, surface water and sediment data has been valiadated and will be evaluated in the risk assessment. Surface and subsurface soil data are not validated but they will be evaluated in 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. Ten times the tap water RBC will be used to select the COPCs for surface water. Ten times the residential soil RBC will be used to select the COPCs for sediment.

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 groundwater, soil, surface water, and sediment, 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. Future 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 originally an open pit in which an estimated 110,000 gallons of waste oil, and other waste products were disposed off. Subsurface soil samples were collected during Phase I RFI and CMS investigation. Additionally, 6 subsurface soil samples were collected and analyzed for dioxins/furans during Phase III investigation. There were 2 subsurface soil samples collected during the Phase I RFI. It is conservatively assumed that subsurface soil is the same as the surface soil for the current/future site worker and trespasser/visitor scenario. Since the site is not fenced and it is located at the perimeter of the Base, it is assumed that site workers and trespasser/visitors can be exposed to soil through ingestion, dermal contact, and inhalation. It is also assumed that in the future if any kind of excavation activities occur at the site, the subsurface soil could become surface soil and site workers, trespasser/visitors 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 excavation activities.

M) Surface Water and Sediment

1. Surface water and sediment data were collected from the drainage ditch west of the former West Woods Oil Pit. It is assumed that adult and adolescent trespasser/visitors may access the drainage ditch and be exposed to the surface water and sediment.

Toxicity Assessment

A) Toxicity values for use in the risk assessment will be obtained from the 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 1, West Woods Oil Disposal Pit, at Naval Station Oceana. The West Woods Oil Disposal Pit is located in the northwest part of NAS Oceana, approximately 1,000 feet west of abandoned Runway 9 and the fire fighting training area. According to the IAS, the unit was originally an open pit in which an estimated 110,000 gallons of waste oil, fuels (such as JP-5, JP-3, and AVGAS), PD 680, various chlorinated and aromatic hydrocarbons (trichlorotrifluoromethane, benzene, toluene, and naphtha), aircraft-maintenance chemicals, paints, paint thinners and strippers, and agitine were disposed of from the mid-1950s to the late 1960s (RGH, 1984). Drilling at this unit also has shown that metal, concrete, and other debris were disposed of in the pit or were included in the fill material. On the basis of a 1958 aerial photograph of the unit, the pit appears to have been approximately 50 to 100 feet in diameter.

In the late 1960s, the pit flooded and its contents are believed to have washed into the main drainage ditch, 100 feet west of the oil disposal pit. As a result, waste disposal ceased and the pit was filled with soil (RGH, 1984). The NAS boundary is approximately 1,000 to 2,000 feet west or northwest of the oil pit.

Investigation History

SWMU 1 has been investigated on five occasions. The Initial Assessment Study (IAS), conducted in 1984, identified the site and inventoried the types of waste liquids disposed of in the pit. In 1986 CH2M HILL conducted a Phase I Verification Study, which was followed by the Interim RFI in 1991. These two investigations showed that the groundwater is contaminated locally with compounds associated with petroleum Hydrocarbons (TPH). Sediment samples taken from the drainage ditch west of the former West Woods Oil Pit contained petroleum constituents.

In 1993 CH2M HILL conducted a Phase I RFI investigation to determine the vertical and lateral extent of groundwater contamination and the hydraulic characteristics and flow regime of the shallow aquifer. This investigation also characterized the type and extent of soil contamination in the vicinity of the pit to confirm earlier data on the contamination of the surface water and sediment and to determine if sediment and surface water contamination extended as far as the culvert 1000 feet downstream of the area adjacent to the pit. During the RFI high concentrations of free petroleum products were detected in several borings including those north of the pit. Results are documented in the *RCRA Facility Investigation Final Report – Phase I, Naval Air Station Oceana, Virginia Beach, Virginia,* December 1993.

Consequently, in 1994-1995, CH2M HILL performed a CMS field investigation to determine the extent of soil contamination in order that a remedy might be designed, should there be a risk posed by the contamination at the site. Results are documented in the *Final Corrective Measures Study for SWMUs 1, 2B, and 2C, Naval Air Station Oceana, Virginia Beach, Virginia,* November 1995.

Trenching was performed at the site to determine the thickness of free product in the subsurface. The trenching confirmed the presence of free product contamination in soil on top of the water table. Product thickness was determined to be approximately 0.04 feet, much less than the thickness that accumulated in some wells and piezometers. An extraction well and monitoring system were installed at SWMU 1 to test the viability of extracting free product from the top of the water table. The objective of the system was to create a cone of depression in the water-table at the extraction well to enhance the flow and collection of free product. Two pilot tests were completed, however, no free product was recovered during either test due to the tightness of the silts that contained the product.

Groundwater sampling completed during the CMS indicated that groundwater is essentially not contaminated with dissolved-phase VOCs or PAHs. The groundwater was sampled for PAHs and VOCs as part of the RFI. No PAHs were detected. Two of six wells contained BTEX at 67ppb (1-MW4) and 16 ppb (1-MW5). Well 1-MW4 also contained 2ppb of 1,1-DCA. From data collected during the RFI and CMS at SWMU 1, only one BTEX constituent was detected in groundwater at concentrations that exceed the MCLs. This was benzene detected at 6 ug/L in 1993. The MCL is 5 ug/L. Benzene exceeded the MCL in well 1-MW4. This well contains free product. Other wells that contained free product did not have BTEX constituents that exceeded the MCL.

In the CMS, the evaluation of remedial alternatives resulted in the recommendation of the following remedial action: pulsed-pump extraction of free product.

In 1997 CH2M HILL conducted a Phase III RFI of SWMU 1. As part of this investigation, The Navy installed two solar-powered skimmers each equipped with a recovery pump that can extract product from two wells simultaneously, and began recovering the free phase petroleum product found in 1-MW4, 1-MW5, 1-PZ3, and 1-PZ5. The skimmers contain product recovery pumps attached to a hydrophobic screen that is centered across the water table in a well. A timer on the pumps is set to automatically initiate the pumping cycle for approximately 2 minutes per hour. The accumulation tanks are periodically emptied by the Navy. Also, confirmatory subsurface soil samples were collected at locations where low levels of dioxins were detected during Phase I. Phase III FRI Results are documented in the *Draft Final RCRA Facility Investigation Report – Phase III, Naval Air Station Oceana, Virginia Beach, Virginia*, July 1998.

In December 1998 groundwater was sampled from site monitoring wells and piezometers in support of risk assessment and long-term monitoring. Analytical results indicate that the shallow groundwater at SWMU 01 contains low concentrations of benzene and one PAH, specifically benzo(a)pyrene at concentrations that exceed MCLs and EPA Region III RBCs for tap water. The waste-oil product floating on the water table was sampled and a fingerprint analysis indicated that it is degraded kerosene. Results of the groundwater sampling are documented in the *Draft-Final Technical Memorandum for the Groundwater Sampling at SWMU 1, Naval Air Station Oceana, Virginia Beach, Virginia,* April 1999.

Current Status

A draft-final long-term monitoring work plan was submitted to the EPA in November 1997 that defines sampling tasks and field investigation procedures that will be performed during confirmatory long-term monitoring of groundwater at SWMU 1. Comments were received from the EPA in March 1998 and responses to comments were submitted to the EPA in May 1998. Free-product removal using the solar powered free-product skimmers will continue until no additional free product is recoverable from existing wells at the SWMU.

Based upon results of the 1998 groundwater sampling the Navy is also conducting additional sediment and surface water sampling at SWMU 1 to reassess potential impacts of benzene in groundwater on surface water. This sampling is being conducted to support risk assessment.

Attachment B

Interim Deliverable Table 1

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 1 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.
Current/Future	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	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact soil.
						Ingestion	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact soil.
					Adolescents	Dermal Absorption	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact soil.
						Ingestion	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact soil.
		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	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may inhale vapors and dust from soil.
					Adolescents	Inhalation	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may inhale vapors and dust from soil.
	Surface Water	Surface Water	Drainage ditch along west side of site	Trespasser/Visitor	Adult	Dermal Absorption	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact surface water.
						Ingestion	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact surface water.
					Adolescents	Dermal Absorption	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact surface water.
						Ingestion	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact surface water.
		Animal Tissue	Fish from drainage ditch along west side of site	Fisher	Adult	Ingestion	On-site	None	Fishing does not occur in the drainage ditch.
	Sediment	Sediment	Drainage ditch along west side of site	Trespasser/Visitor	Adult	Dermal Absorption	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact sediment.
						Ingestion	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact sediment.
					Adolescents	Dermal Absorption	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact sediment.
						Ingestion	On-site	Quant	Site is not fenced and the site is located at the perimeter of the Base. General public can access the site and may contact sediment.
Future	Groundwater	Groundwater	Columbia Aquifer - Tap Water	Resident	Adult	Dermal Absorption	On-site	Quant	Although unlikely, shallow groundwater could be used as a potable water supply in the future.
						Ingestion	On-site	Quant	Although unlikely, shallow groundwater could be used as a potable water supply in the future.
					Child	Dermal Absorption	On-site	Quant	Although unlikely, shallow groundwater could be used as a potable water supply in the future.
						Ingestion	On-site	Quant	Although unlikely, shallow 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.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 1 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	Groundwater	Air	Columbia Aquifer -Water Vapors at Showerhead	Resident	Adult	Inhalation	On-site	Quant	Although unlikely, shallow groundwater could be used as a potable water supply in the future.
					Child	Inhalation	On-site	None	Children are assumed to bathe, not to shower.
			Columbia Aquifer - Volatilization from Water in Excavation Pit	Construction Worker	Adult	Inhalation	On-site	Quant	Construction worker may inhale vapors from shallow groundwater during construction activities.
	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	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.

*Only subsurface soil data.

Attachment C

Interim Deliverable Table 4

TABLE 4.8

VALUES USED FOR DAILY INTAKE CALCULATIONS

SWMU 1 at NAS Oceana

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Drainage ditch along west side of site
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CSW	Chemical Concentration in Surface Water	µg/l	see Table ----	--	see Table ----	--	Chronic Daily Intake (CDI) (mg/kg-day) = CSW x IR-SW x ET x EF x ED x CF1 x 1/BW x 1/AT
	IR-SW	Ingestion Rate of Surface Water	l/hour	0.08	EPA, 1989	0.08	(2)	
	ET	Exposure Time	hr/day	2.6	EPA, 1989	2.6	(2)	
	EF	Exposure Frequency	days/year	52	(1)	26	(1)	
	ED	Exposure Duration	years	9	(3)	9	EPA, 1993	
	CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
	BW	Body Weight	kg	51	EPA, 1997,(3)	51	EPA, 1997,(3)	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,285	EPA, 1989	3,285	EPA, 1989	
Dermal Absorption	CSW	Chemical Concentration in Surface Water	µg/l	see Table ----	--	see Table ----	--	CDI (mg/kg-day) = CSW x SA x PC x CF1 x ET x EF x ED x CF2 x 1/BW x 1/AT
	SA	Skin Surface Area Available for Contact	cm^2	4,800	EPA, 1997	4,800	EPA, 1997	
	PC	Permeability Constant	cm/hr	chem specific	EPA, 1992	chem specific	EPA, 1992	
	CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
	ET	Exposure Time	hr/day	2.6	EPA, 1989	2.6	(2)	
	EF	Exposure Frequency	days/year	52	(1)	26	(1)	
	ED	Exposure Duration	years	9	(3)	9	EPA, 1993	
	CF2	Conversion Factor 2	l/cm^3	0.001	--	0.001	--	
	BW	Body Weight	kg	51	EPA, 1997,(3)	51	EPA, 1997,(3)	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,285	EPA, 1989	3,285	EPA, 1989	

(1) Professional Judgement assuming 1 day per week for 52 weeks per year for the RME and 1/2 the RME value for the CT.

(2) Not available, used RME value.

(3) Body weight is average value for the 9 year old and 18 year old male body weight.

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.