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MEMORANDUM CH2MHILL

Proposed Methods for Preparing the Human Health Risk Assessment for SWMU 15, Abondoned Tank Farm, at Naval Air Station, Oceana

TO: Betty Ann Quinn/EPA

COPIES: Jack Robinson/CH2M HILL

FROM: Roni Warren/CH2M HILL
Ushma Shah/CH2M HILL

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This memorandum presents the methods that will be used to prepare the human health risk assessment for SWMU 15, 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 to determine the residual contaminant concentrations in biopile soil. Subsurface and surface soil samples (collected December 1998), groundwater samples (monitoring well and piezometer groundwater samples collected July/August 1999), and surface water and sediment samples (collected July/August 1999 from the Pond) 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. 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 site served as the primary source of aircraft fuel for the North station area when it was active. Surface soil (collected from around the excavation perimeter) and subsurface soil (collected at the base of the biopile) samples were collected at the site. 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 surface soil through ingestion, dermal contact, and inhalation. It is also 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, 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 pond located in the middle of the site. It is assumed that adult and adolescent trespasser/visitors may access the pond and be exposed to the surface water and sediment.

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 15, Abandoned Tank Farm, at Naval Station Oceana. This unit is located in the former North Station area, approximately 800 feet northwest of Runway 23R and 1,000 feet northeast of the area used to store recreation vehicles near the old CPO officers' club. The abandoned tank farm served as the primary source of aircraft fuel for the North Station area when it was active from the mid-1950s to the mid-1970s. The tank farm consisted of six tanks: a 414,000-gallon tank used to store JP-3, two 50,000-gallon concrete tanks used for aviation gas, and three adjacent 12,000- to 18,000-gallon tanks believed to be used for automotive fuel, kerosene, or lube oil (RGH, 1984).

According to a report by R. E. Wright Associates, the tanks were emptied of fuel and filled with water after they were abandoned (R. E. Wright Associates, 1983). Tank G-5 was later used to store waste oil. The tanks and their associated piping were dismantled and removed in the mid-1980s. With the exception of some mounded earth near the former location of tank G-9, no signs of the locations of the tanks or their associated piping were observed during the RFI. Their locations were inferred from historical maps of the North Station area.

Investigation History

The first environmental investigation at the tank farm was conducted in 1982. Free-phase product was discovered in test pits and well borings. The 1984 IAS identified the tank farm as a potential hazard. The 1988 RFA identified the tank farm as SWMU 15 and documented recommendations for additional investigation.

SWMU 15 was investigated during two phases of the RFI. Phase I was completed in 1993 and Phase II was completed in 1995. The purpose of the RFIs were to characterize the extent of soil and groundwater contamination. Results of the RFIs are documented in the *RCRA Facility Investigation Final Report – Phase I, Naval Air Station Oceana, Virginia Beach, Virginia,* December 1993 and the *RCRA Facility Investigation Report – Phase II, Naval Air Station Oceana, Virginia Beach, Virginia,* February 1985.

A CMS was initiated 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. The purpose of the CMS was to define the extent of the groundwater contaminant plume, characterize surface soil contamination, and obtain treatability data on contaminated soil and groundwater.

Results of the investigations indicated that surface soils were found to contain elevated TPH and PAH concentrations and subsurface soils were found to contain elevated concentrations of BTEX, TPH, and PAH compounds. Groundwater was found to contain elevated concentrations of BTEX, TPH, and PAH compounds and free-phase product. Vinyl chloride and isomers of 1,2-dichloroethylene were also detected at low concentrations in a few locations.

In the CMS, the evaluation of remedial alternatives resulted in the recommendation to excavate approximately 20,000 cy of contaminated soil to be processed in an on-site biopile

with nutrient insemination and aeration. This will be followed by confirmatory sampling of biopile and excavation perimeter. The CMS recommended monitored natural attenuation (MNA) of groundwater.

In 1996 contaminated soil was excavated and placed in a biopile for biological treatment. In September 1998 a final work plan was submitted to the EPA that defines sampling tasks and field investigation procedures that will be performed during confirmation soil sampling for soil remediation at SWMU 15. The principal goals of the confirmation sampling were to: (1) determine the contaminant concentrations in the remaining soil around the perimeter of the excavation area, (2) determine the residual contaminant concentrations in the soil within the biopile area, and (3) support a human health risk assessment of the biopile soil.

Current Status

Current status pertains to the results of biopile soil and excavation perimeter sampling and planning for Long-Term Monitoring. Results of the biopile soil and excavation perimeter sampling are documented in the *Draft Final Technical Memorandum for the Soil Sampling at SWMU 15, Oceana Naval Air Station, Virginia Beach, Virginia,* April 1999.

Biopile Soil And Excavation Perimeter Sampling

Soil sampling of the excavation perimeter and the SWMU 15 biopiles was conducted in October of 1998. Excavation-perimeter soil samples and biopile soil samples were analyzed for the volatiles benzene, ethylbenzene, toluene, and xylenes (BTEX), low-concentration PAHs, and TPH. Analyses of biopile soils were used to support a human health risk assessment and the TPH analyses for the biopile soil were used for comparison to VADEQ solid waste regulations.

The analytical data from the excavation perimeter subsurface soil sampling ndicate that three PAH compounds exceed EPA Region III RBCs for residential soil and one compound exceeds industrial RBCs. The exceedances are detected in three of ten perimeter samples. These results were not included in the SWMU 15 human health risk assessment of biopile soil and will be included in a subsequent site-wide multi-media human health risk assessment.

The analytical data from the biopile soil samples indicate that the EPA Region III RBC for two PAH compounds for industrial and/or residential soil(s) was exceeded in soils from the biopiles at SWMU-15. Five of twenty eight samples from the large biopile and three of seven samples from small biopile had exceedances. Most of the exceedances were from soil at the base of the piles (depths of approximately eight feet below the top of the piles).

The TPH values (sum of DRO and GRO) were compared to the Virginia Department of Environmental Quality (VDEQ) solid waste regulatory limit for TPH. The total TPH values (sum of DRO and GRO) exceeded the VDEQ solid waste regulatory criteria of 50 parts per million (ppm) in eight soil samples collected from the large biopile and one soil sample collected from the small biopile. Most of the exceedances of the clean fill regulatory limit occur at the base of the biopiles at a sample depth of 8 feet.

Biopile soil samples were analyzed for BTEX compounds and the values were summed as total BTEX. Only one sample in the large biopile exceeded the VDEQ solid waste regulatory

criteria of 10 ppm. The human health risk assessment of the biopile soil found that all of the noncarcinogenic and carcinogenic risks for the individual pathways evaluated in the assessment to be below or within the USEPA's target levels for residential exposure scenario. Additionally, all of the cumulative risks associated with potential exposure to the biopile soil were below or with in the USEPA's target levels.

The Navy has removed the upper six feet of biopile soil and distributed it as clean fill. The soil at the base of the biopiles is being re-treated to reduce the TPH to a level below the 50 PPM solid waste threshold. Re-treatment has been accomplished the soil has been re-sampled to confirm that the TPH cleanup goal of 50 mg/Kg has been achieved. Analytical results have not been received. If the solid waste threshold had been achieved the soil will be used as clean fill per VADEQ solid waste regulations. The Navy recommends that the pond be left in place to aid in the natural remediation of groundwater.

In late July 1999 the Navy installed and sampled four new monitoring wells, collected groundwater samples from three existing monitoring wells, collected four surface soil samples from around the excavation perimeter, and collected five surface water samples and sixteen sediment samples from the pond. These data, combined with previous subsurface soil sampling data, will be used to support risk assessment. Analytical results from the recent sampling have not been received.

Attachment B

Interim Deliverable Table 1

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 15 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	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.
Current/Future	Surface Water	Surface Water	Pond	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 the Pond	Fisher	Adult	Ingestion	On-site	None	Fishing does not occur in the pond because there are no fish in the pond.
	Sediment	Sediment	Pond	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, 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.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 15 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, 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	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.
				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	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.
				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 4.17

VALUES USED FOR DAILY INTAKE CALCULATIONS

SWMU 15 at NAS Oceana

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Soil
Exposure Point: Direct Contact
Receptor Population: Trespasser/Visitor
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	see Table ----		see Table ----	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1991	50	EPA, 1993	CS x IR-S x EF x ED x CF3 x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	52	(1)	26	(1)	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	CF3	Conversion Factor 3	kg/mg	0.000001	--	0.000001	--	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	EPA, 1989	3,285	EPA, 1989	
Dermal Absorption	CS	Chemical Concentration in Soil	mg/kg	see Table ----		see Table ----	--	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	5,300	EPA, 1992	2,000	EPA, 1992	CS x SA x SSAF x DABS x CF3 x EF x
	SSAF	Soil to Skin Adherence Factor	mg/cm^2-day	0.2	EPA, 1997	0.2	EPA, 1992	ED x 1/BW x 1/AT
	DABS	Dermal Absorption Factor Solids	--	chem specific	EPA, 1995	chem specific	EPA, 1995	
	CF3	Conversion Factor 3	kg/mg	0.000001	--	0.000001	--	
	EF	Exposure Frequency	days/year	52	(1)	26	(1)	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	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.

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, 1995: Assessing Dermal Exposure from Soil. EPA Region III. EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa; SSAF based on maximum adherence factor for gardeners.

DABS: Based on Region III Technical Guidance "Assessing Dermal Exposure from Soil, December 1995", for constituents not listed used volatile organics value of 20%, semi-volatile organics value of 10%, and Inorganics value of 1%.