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COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

TECHNICAL MEMORANDUM REVISED RISK ASSESSMENT PROCEDURES MARINE CORPS AIR STATION EL TORO, CALIFORNIA

CTO-0079/0140

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TECHNICAL MEMORANDUM

This technical memorandum presents the procedures that will be used in the human-health risk assessment for the Remedial Investigation (RI) for Operable Unit (OU)-3 at Marine Corps Air Station (MCAS) El Toro. This effort is being completed under Contract Task Order (CTO)-0079 for the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Program, contract No. 68711-92-D-4670. This contract is administered by Southwest Division Naval Facilities Engineering Command for the Department of the Navy.

OU-3 encompasses Sites 1, 4, 6 through 16, and 19 through 23. These sites have been subdivided into units based on location, physiographic characteristics, and waste-disposal activities associated with various areas at each site. Site 1, the Explosive Ordinance Disposal (EOD) Range, is currently an active site. Thus, soil and groundwater COPCs will not be identified for this site in the RI report. In addition, the following sites or units, not included in the Phase II RI, will not be discussed in the risk assessment for OU-3:

- Site 4, units 1 and 2,
- Site 7, units 1 and 3,
- Site 13, units 1 and 2,
- Site 14, unit 1,
- Site 15, unit 1,
- Site 19, units 1 and 2,
- Site 20, units 2 and 3, and
- Site 23.

The final Risk Assessment Work Plan for the Phase II RI was issued in August 1995 (BNI 1995). The information presented in this memorandum supplements or modifies the procedures for conducting the human-health risk assessment in that plan as follows:

- provides additional information to the procedures used in the data evaluation section of the human-health risk assessment for selecting chemicals of potential concern (COPCs);
- modifies the receptor analysis and exposure scenarios for the exposure assessment at OU-3 to support the goal of property transfer with unrestricted land use;
- provides additional information to the exposure pathways and exposure assumptions for the exposure assessment at OU-3;
- provides additional information to the approach used in estimating exposure point concentrations; and
- provides additional information to the source of toxicity information.

DATA EVALUATION FOR THE HUMAN-HEALTH RISK ASSESSMENT

The objective of the data evaluation is to develop a list of COPCs suitable for use in the risk assessment. The process will begin by listing all of the target chemicals and tentatively identified compounds detected in samples of soil, groundwater, and any other medium collected within each depth(s) of concern. This list will consist of Phase I and Phase II RI data. Chemical analytical data obtained during the Phase II field investigation from the fixed laboratory will be validated to satisfy Naval Facilities Engineering Service Center Level D quality requirements. If data from the Phase I RI are used and do not meet Level D quality requirements, they will be used "as is" (they will not be revalidated). All concentrations reported as being unusable ("R" qualifier) will not be used in this evaluation.

COPCs in Soil

For soils, selection of COPCs will be based on Phase I and Phase II RI data. Shallow soil data (0 to 10 feet bgs) and surface soil data (0 to 2 feet bgs) will be used in the selection of COPCs in the baseline human health risk assessment for the residential and industrial scenarios, respectively. To aid in the identification and definition of important "source" areas at each of the OU-3 sites, this risk assessment will group several of the site units within a site, as appropriate, into areas of potential concern. This association will be based on the location of the site units relative to each other, the nature and magnitude of the chemical contaminants at contiguous units and the physiographic characteristics of the various units at each site. The resulting areas of potential concern consist of the following:

- Site 6, Drop Tank Drainage Area No. 1:

  units 1 through 3 grouped into an area of potential concern,
- Site 7, Drop Tank Drainage Area No. 2:

  units 2, 4 and 5 addressed individually as areas of potential concern,
- Site 8, DRMO Storage Yard:

  units 1 and 4 grouped into an area of potential concern,

  units 2 and 3 grouped into an area of potential concern,

  unit 5 addressed individually as an area of potential concern,
- Site 9, Crash Crew Pit No. 1:

  units 1 and 2 grouped into an area of potential concern,
- Site 10, Petroleum Disposal Area:

  units 1 through 3 grouped into an area of potential concern,

  unit 4 addressed individually as an area of potential concern,
- Site 11, Transformer Storage Area:

  units 1 through 3 addressed individually as areas of potential concern,

- Site 12, Sludge Drying Beds:

  units 2 and 4 grouped into an area of potential concern,

  units 1 and 3 addressed individually as areas of potential concern,

- Site 15, Suspended fuel Tanks:

  unit 2 addressed individually as an area of potential concern,

- Site 16, Crash Crew Pit No. 2:

  units 1 and 2 grouped into an area of potential concern,

  unit 3 addressed individually as an area of potential concern,

- Site 19, Aircraft Expeditionary Refueling Site:

  units 3 and 4 grouped into an area of potential concern,

- Site 20, Hobby Shop:

  units 1 and 4 addressed individually as areas of potential concern,

- Site 21, Materials Management Shop:

  unit 1 addressed individually as an area of potential concern, and

- Site 22, Tactical Air Fueling Dispensing System:

  units 1 and 2 addressed individually as areas of potential concern.

Data evaluation for the soil medium will be performed for each site by individual area of potential concern (unit or unit group) so that remedial actions, if needed, could be developed for relatively localized remediation targets.

Metal soil concentrations will be compared with background concentrations to identify site-related analytes. When maximum on-site concentrations are not different from background concentrations (upper tolerance limits [UTLs]), the chemical will be eliminated from consideration as COPC. Soil background concentrations (UTLs) will be based on the background statistical results for MCAS El Toro presented in the RI draft reports (BNI 1996a,b,c,d) for the landfill sites (OU-2B and OU-2C), under CTO-0076.

COPCs in Groundwater

Site 16, Crash Crew Pit No. 2, is the only inactive site in OU-3 for which groundwater data was collected as part of the field investigations encompassed in the Phase II RI. Data evaluation will be presented for Site 16 as a whole. Selection of COPCs in groundwater will be based on Phase II RI data and from the recently obtained data from groundwater sampling conducted by the Navy. The Phase I RI data will be assessed for its usability in the risk assessment. Metals will be selected based on a comparison of the maximum concentration at Site 16 to the maximum concentration in monitoring wells upgradient of the site. This comparison will be based on results from the same sampling event. For the metal COPCs, groundwater concentrations used in the risk assessment will be based on unfiltered samples.

EXPOSURE ASSESSMENT FOR THE HUMAN-HEALTH RISK ASSESSMENT

The objective of the exposure assessment is to evaluate the type and magnitude of exposures from COPCs present at a site to a human receptor. An exposure assessment is a multistage process: first, the receptors, or members of the population, or individuals at risk are characterized. Then, the complete exposure pathways and routes by which these receptors are likely to be exposed are identified. The final step is to quantify the chemical concentrations to which the receptors might be exposed (exposure-point concentration) and the chemical intake rates associated with each route of exposure. The following sections describe the exposure scenarios, exposure pathways, hypothetical receptors, the methodology that will be used to quantify exposure for each pathway, and the reasons for their selection.

Receptor Analysis

MCAS El Toro is currently being used as a military air base, and its land use can be technically classified as industrial. The base lies in a semiurban agricultural area in southern California, approximately 8 miles southeast of the city of Santa Ana and 12 miles northeast of the city of Laguna Beach. Land northwest of MCAS El Toro is used for agricultural purposes. The land to the south and northeast is used mainly for commercial, light-industrial, and residential purposes. Reuse plans have not been formulated for the Station following closure. Consequently, to provide risk managers with a margin of safety when making cleanup decisions, exposure conditions used in the estimation of risk will be deliberately chosen to overestimate risk; it will be assumed that sites at OU-3 will be reused for a residential land use scenario.

Exposure of residential receptors is assessed as being greater than for any other potential receptor. Sites that do not pose a risk under residential exposure conditions will, in turn, not pose a risk under other less rigorous land use scenarios (i.e., industrial). For the risk assessment of the soil medium, MCAS El Toro OU-3 sites will be evaluated on an area of potential concern basis (unit or unit group) under residential exposure conditions. Areas that, under residential exposure conditions, result in a soil cancer risk level in excess of 1×10^{-5} or a soil hazard index greater than 1 for the systemic toxicants will also be evaluated under the less restrictive industrial land use scenario. Estimation of risk to an industrial worker provides risk managers with additional information for use in decision making. For the risk assessment of the groundwater medium at Site 16, risk will be evaluated for the entire site under residential exposure conditions.

Based on this information, the potential receptors at OU-3 are identified as:

- children and adult residents exposed to the soil medium at areas of potential concern (unit or unit group),
- industrial workers for areas of potential concern that pose a soil risk under residential exposure conditions, and
- children and adult residents exposed to the groundwater medium at Site 16.

Exposure Pathways

An exposure pathway is the means by which a contaminant moves through the environment from the source to a receptor. Exposure pathways are identified through an analysis of the distribution of the COPCs in the environment and the physical and chemical properties of the COPCs. For a pathway to be complete, all of the following elements must be present: a contaminant source and mechanism for contaminant release, an environmental transport medium, an exposure point, and an exposure route. Exposure pathways are illustrated in Figure 1.

Children and adult residents at the areas of potential concern in the OU-3 sites could be exposed to COPCs in the soil via the following exposure pathways:

- ingestion of impacted soil,
- dermal contact with impacted soil, and
- inhalation of vapors and particulates that have been released from impacted soil.

Office/industrial workers at areas that pose a risk under residential exposure conditions could be exposed to soil COPCs via the following exposure pathways:

- ingestion of impacted soil,
- dermal contact with impacted soil, and
- inhalation of vapors and particulates that have been released from impacted soil.

It should be noted that some of site units are paved. Paved areas will be conservatively treated as being entirely unpaved.

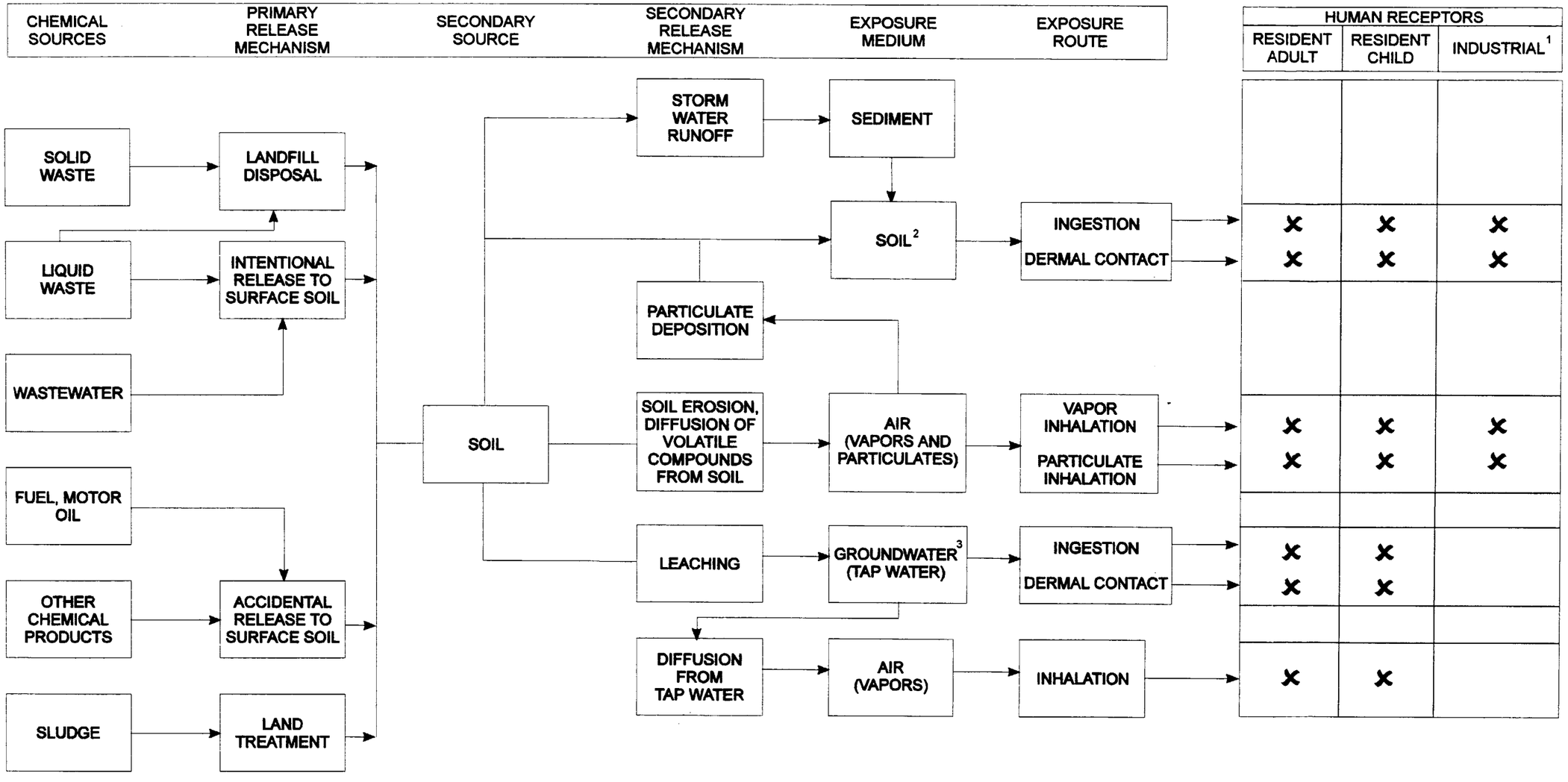
Children and adults living at Site 16 will be assumed to draw water for domestic use from a private well screened in the contaminated aquifer. Exposure at this site to COPCs in the groundwater will be evaluated for the entire site and could occur via the following pathways:

- ingestion of groundwater,
- dermal contact with groundwater, and
- inhalation of volatiles from groundwater during household water use.

Quantification of Exposure

The final step is to quantify exposure for each pathway. Exposure quantification is a two-step process. Step 1 entails estimating exposure-point concentrations, and Step 2 entails estimating dose rates.

The goal of the quantification step, as defined in United States Environmental Protection Agency (U.S. EPA) guidance, is to identify the combination of exposure variables or parameters that results in the most intense level of exposure that may be reasonably expected to occur. Exposure is a function of the individuals at risk and the exposure



LEGEND

1 FOR SITES THAT POSE A RISK UNDER RESIDENTIAL EXPOSURE CONDITIONS

2 EVALUATED BY AREA OF POTENTIAL CONCERN

3 EVALUATED FOR SITE 16 ONLY (BY THE ENTIRE SITE)

Risk Assessment Technical Memorandum OU3

Figure 1

Human Health Exposure Routes and Receptors

MCAS, El Toro, California

CLEAN II Program

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conditions identified through an analysis of land use. Exposure conditions are standard upper-bound estimates set by regulatory agencies (Table 1). The use of upper-bound exposure conditions results in the reasonable maximum exposure (RME). This deliberate attempt to overestimate dose is made in the interest of public protection. This approach is designed so there is high confidence that the actual risk is not underestimated.

An exposure-point concentration is the concentration of a chemical in the contaminated medium (e.g., soil, water, air) at the point of contact with a receptor (e.g., resident). Because of the uncertainty associated with any estimate of exposure concentration, U.S. EPA recommends using the 95-percent upper confidence level (UCL) of the average measured chemical concentration when estimating the RME.

In calculating the 95-percent UCLs, the data will first be tested for normality and lognormality. Sets of data that fail these tests will be analyzed using a nonparametric approach. However, the maximum concentration will be used as the exposure-point concentration instead of the 95-percent UCLs under the following conditions:

- the 95-percent UCL of a chemical exceeds its highest measured concentration; or
- there are fewer than four concentrations above the limits of detection.

Exposure dose rates are the amount of chemical to which a receptor is exposed per unit body weight and time. Dose rates will be estimated by BECRisk software program integrating intake variables, such as ingestion rate, body weight, and exposure duration (Table 1), with the exposure-point concentration. The combination of all intake variable results in a estimate of exposure for each pathway. The BECRisk program has been fully validated and applies the equations published in Parts A and B of the Risk Assessment Guidance for Superfund (U.S. EPA 1989, 1991). It uses a database application both as a database and a tool to calculate the chronic daily intake and risk. Chemical-specific information is stored in the database and is updated as new information becomes available.

TOXICITY ASSESSMENT

This section presents the toxicity assessment for the COPCs identified at each OU-3 site at MCAS El Toro. The objective of the toxicity assessment is to determine the relationship between dose and toxic response for each COPC. The toxicity assessment identifies toxicity criteria (values) for each of the chemicals chosen for inclusion in the risk assessment, and it identifies the kinds of effects each of the chemicals are capable of producing.

Source of Toxicity Criteria

The toxicity values used in the baseline human-health risk assessment of COPCs will be obtained from the September 1995 table of preliminary remediation goals (PRGs) published by U.S. EPA Region IX (U.S. EPA 1995a) and confirmed by a review of the U.S. EPA Integrated Risk Information System (IRIS) database and the U.S. EPA Health Effects Assessment Summary Tables [HEAST] (U.S. EPA 1995b). The IRIS database and HEAST were also searched for toxicity criteria for chemicals not listed in the table of PRGs.

Toxicity values developed by the California Environmental Protection Agency (Cal-EPA) for cadmium, hexavalent chromium, 1,2-dibromo-3-chloropropane, nickel, benzo(a)pyrene, tetrachloroethene, chrysene and benzo(k)fluoranthene will be obtained from the 1994 updated table of cancer potency factors developed by Cal-EPA, Office of Environmental Health Hazard Assessment (Cal-EPA 1994). It is the Department of the Navy policy to use U.S. EPA and Cal-EPA slope factors in estimating the risk presented by those chemicals when present.

Table 1
Values Assigned to Dose Equation Parameters

Equation Parameter	Unit	Resident Child[a]	Resident Adult[b]	Office Worker[c]
Soil Ingestion				
Intake rate, soil	mg/day[d]	200	100	50
Fraction of ingested soil	unitless	1	1	1
Exposure frequency	days/year	350	350	250
Soil Dermal Contact				
Adherence factor	mg/cm^{2} [e]	1	1	1
Exposed skin area[f]	cm^{2} [g]	2,000	5,000	5,000
Dermal absorption factor	unitless		Chemical specific	
Exposure frequency	days/year	350	100	250
Inhalation of Volatiles or Soil Particulates				
Intake rate	m^3/hour[h]	0.42	0.83	0.83
Exposure time	hours/day	24	24	8
Exposure frequency	days/year	350	350	250
Groundwater Dermal Contact				
Exposed skin area[i]	cm^2	7,000	19,000	NA[j]
Permeability constant	cm/hr[k]		Chemical specific	
Exposure time	hours/day	0.25	0.25	NA
Exposure frequency	days/year	350	350	NA
Groundwater Ingestion				
Intake rate	liters/day	1	2	NA
Exposure frequency	days/year	350	350	NA
Inhalation of Groundwater Vapors				
Intake rate, air	m^3/hour	0.42	0.83	NA
Volatilization factor	L/cm^{3} [l]	0.5	0.5	NA
Exposure time	hours/day	24	24	NA
Exposure frequency	days/year	350	350	NA
General Parameters				
Exposure duration (cancer)	years	6	24	25
Exposure duration (noncancer)	years	6	24	25
Body weight	kilograms	15	70	70
Averaging time (cancer)	days	25,550	25,550	25,550
Averaging time (noncancer)	days	$ED^{m} \times 365$	$ED \times 365$	$ED \times 365$

(table continues)

Table 1 (continued)

Notes:

[a] resident child age is 0 to 6 years
[b] adult residential exposure was assumed for a total of 30 years: 6 years as a child and 24 as an adult
[c] for areas of potential concern that pose a risk under residential exposure conditions
[d] mg/day – milligrams per day
[e] mg/cm^2 – milligram per square centimeter
[f] 25 percent of mean total body surface area; values rounded to the nearest 1,000 cm^2; Interim Guidance for Dermal Exposure Assessment (U.S. EPA 1992)
[g] cm^2 – square centimeters
[h] m^3/hour – cubic meters per hour
[i] 100 percent (bath); values rounded to the nearest 1,000 cm^2
[j] NA – not applicable
[k] cm/hr – centimeter per hour
[l] L/cm^3 – liter per cubic centimeter
[m] ED – exposure duration

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