Middle River, Maryland

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Prepared for:

Lockheed Martin Corporation

Prepared by:

Tetra Tech, Inc.

Nisha Bansal
Project Manager

Loveriza Sarmiento, Ph.D.
Senior Toxicologist

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Section 1
INTRODUCTION

On behalf of Lockheed Martin Corporation (LMC), Tetra Tech has prepared this Technical

entitled *Supplemental Guidance on Performing Risk Assessments in Remedial Investigation, Feasibility Studies (RI/FS) Conducted by Potential Responsible Parties (PRPs), July 2, 1991.* This Technical Memorandum is being submitted in lieu of a risk assessment work plan.

1.1 GUIDANCE DOCUMENTS

Risk Assessment Guidance for Superfund, Part A, Vol. 1: Human Health Evaluation Manual, USEPA, 1989;

Risk Assessment Guidance for Superfund, Part A, Vol. 1: Human Health Evaluation Manual, Supplemental Guidance Manual, "Standard Default Exposure Factors"

Risk Assessment Guidance for Superfund (RAGS).Vol. I - Human Health Evaluation Manual (USEPA, 1989).

1.2 PURPOSE AND OBJECTIVES OF THE BHRA

could come into contact with the chemicals of potential concern (COPCs) in the soil and groundwater at the Site. Another objective is to propose the cleanup goals for each chemical of concern (COC) in the soil and groundwater in order to reduce or mitigate any unacceptable levels of health risks.

1.3 SCOPE OF THE BASELINE HEALTH RISK ASSESSMENT

The data from soil and groundwater investigations will be collectively used to perform the site-specific human health risk assessment. This includes, (a) the soil data collected during the subsurface investigations conducted from 2000 through 2002, and (b) the groundwater data collected within the

The BHRA will include the following elements:

- Identification of Chemicals of Potential Concern (COPCs),
- Exposure Assessment,
- Toxicity Assessment and

elements, with the ultimate goal of obtaining approval from the MDE on the proposed approach.

1.4 ORGANIZATION OF THE TECHNICAL MEMORANDUM

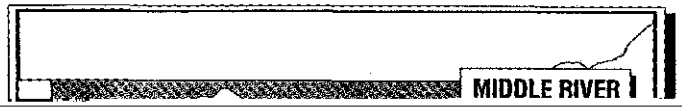
- Section 2.0 presents the background information on the Site. The physical, geological,

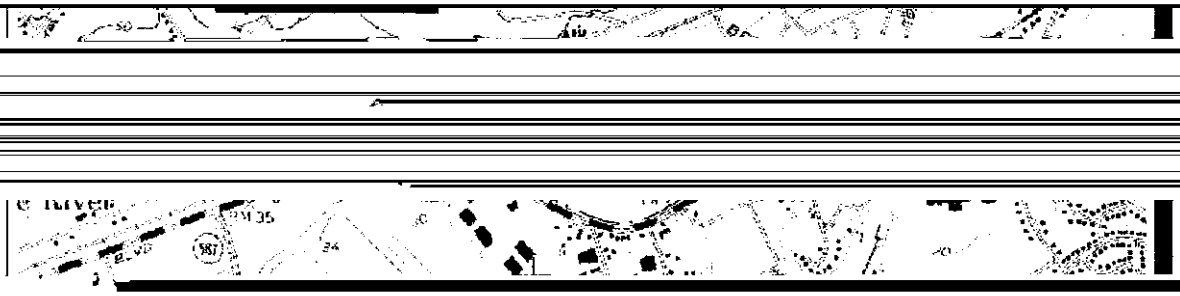
This section also discusses the screening evaluation that will be conducted in order to focus the BHRA on the COPCs that fail the screening evaluation.

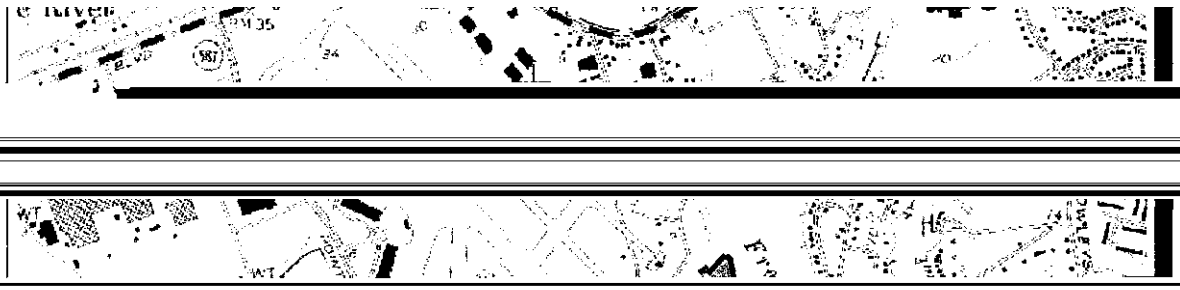
- Section 4.0 presents the conceptual site model (CSM) that provides the framework of the exposure assessment. Section 4 also describes the different factors that will be considered in evaluating how, and to what extent, potential exposures could occur. These

incorporated in estimating the chemical dose to each exposed individual.

FIGURE 2-1
SITE LOCATION MAP







2.4.2 Lockheed Martin Corporation's Investigations

In March 1999, Lockheed Martin collected groundwater monitoring well data to obtain updated chemical data on groundwater quality, groundwater elevation, and flow direction at the Site.

cadmium) were present above the Maximum Contaminant Levels (MCLs)for drinking water..

in groundwater. Each of the four AOCs listed in Section 2.4.1 was investigated through a

and petroleum hydrocarbon areas.

lateral extent of chemical occurrence in the near-surface groundwater at the Site. A limited number of deep wells were installed to evaluate the vertical extent of VOCs and metals in the groundwater. The results of the lateral investigations indicated that the potential source areas are the Taxiway Tango median area, the drum area, and the petroleum hydrocarbon area -- see Section 2.4.1. The primary contaminants were identified to be TCE, vinyl chloride, and cis-1, 2-DCE. The groundwater modeling suggested that VOCs in groundwater appear to be migrating from west to east toward Frog Mortar Creek (Tetra Tech, 2002). The general extent of VOCs in groundwater was delineated to the north and south, but not to the east and west.

investigations were (1) to delineate the eastern and western extent of chemicals in groundwater

intermediate and deep monitoring wells were installed at the site. The lateral and vertical

present at the site contributing to three primary groundwater plumes. Based on the concentration

plumes, in particular with respect to plume migration toward Frog Mortar Creek. The distribution

Section 3

DATA EVALUATION

The data from the previous investigations will be reviewed to ensure that the number and quality of

validation process will be included in the BHRA report.

Since the investigation areas or AOCs are based on the suspected sources of chemical release, the

specific receptors. Therefore, the data set for the BHRA may vary from the data set used for site characterization. The potential human health risks will be evaluated by assuming two exposure

consist of buried drums and debris (MES, 1994). Since it is unlikely that there would be surface

below one foot bgs to a maximum depth of 15 feet bgs.

Any constituent that is detected at least once will be included in the screening risk evaluation. A

the cleanup standard for an industrial site (EPA Region III), then the chemical will be identified as a COPC that will be evaluated further in the risk assessment.

3.2 SCREENING EVALUATION

In the screening evaluation, the highest concentration* of each detected chemical will be compared

average site concentration, is also consistent with the conservative nature of the screening evaluation.

Section 4
EXPOSURE ASSESSMENT

The exposure assessment identifies and describes potentially exposed human receptors, develops

concentration).

4.1 CONCEPTUAL SITE MODEL

Figure 4-1 presents the conceptual site model (CSM) that will be used as the framework for

incomplete pathways are excluded from the BHRA.

4.1.1 Potential Exposure Pathways

An exposure pathway is the mechanism by which a human receptor is exposed to chemicals from a

If any one of the four elements is missing, the exposure pathway is considered incomplete. Only

Current potential exposure pathways are those that exist as a result of the current extent of

existing ponds will not be evaluated in the BHRA. This is not the case for Frog Mortar Creek. Since

4.1.2 Current and Future Receptors

The current and future land use are anticipated to be similar. thus. the current and future receptors are the on-Site workers. Since a potential Site visitor would have more limited exposures than the on-Site worker, the visitor scenario will be evaluated if the potential risk to the

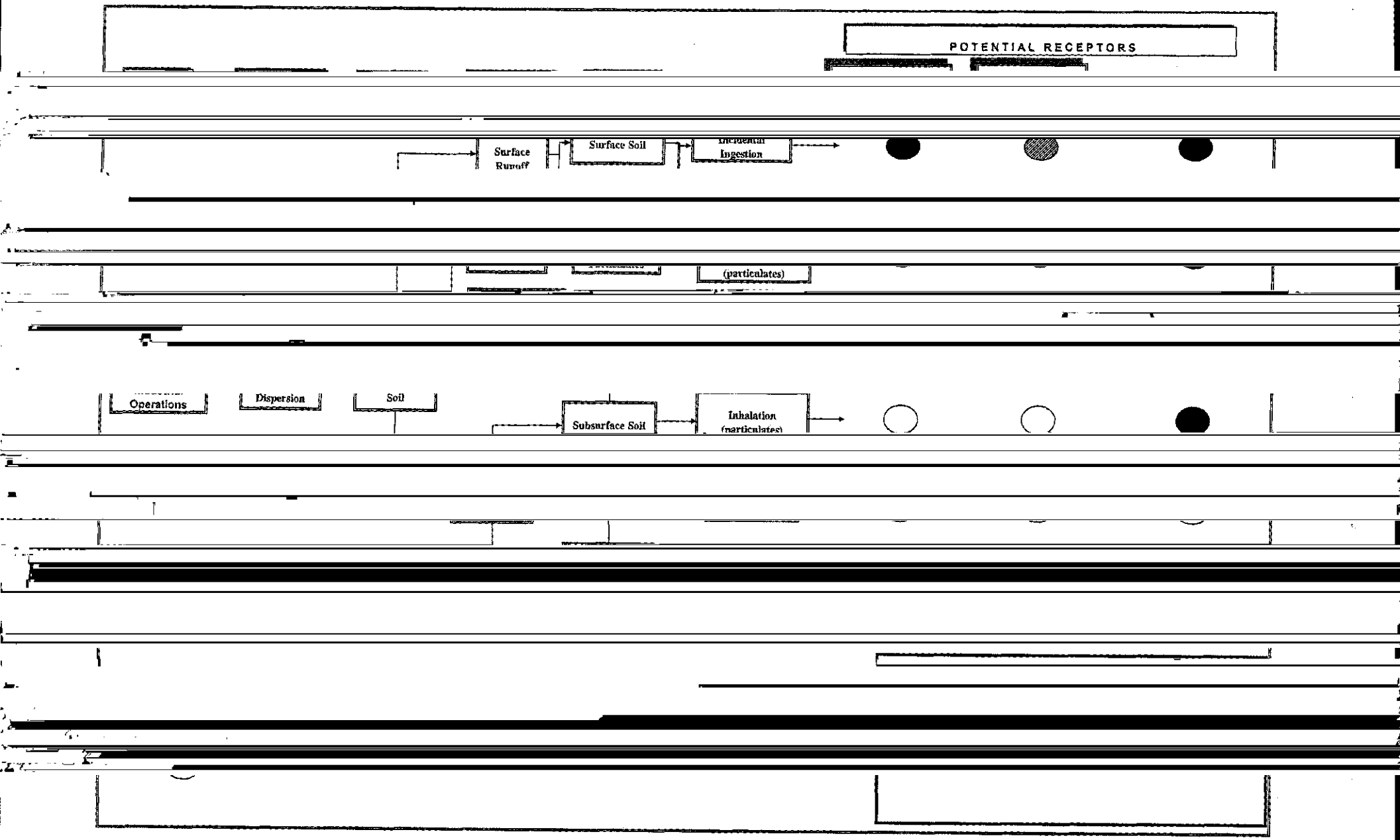

POTENTIAL RECEPTORS
Surface Runoff
Surface Soil
Incidental Ingestion
(particulates)
Operations
Dispersion
Soil
Subsurface Soil
Inhalation
(particulates)

Table 4-1
Summary of Exposure Parameters
Martin State Airport

Ingestion Rate (mg/day)	50	(1)	480
	Specific		
Target Risk	1.00E-06	(1)	1.00E-06
Target Hazard Index	1	(1)	1

Notes:
(1) EPA 1989 Risk Assessment Guidance for Superfund - Volume 1 Human Health Evaluation Manual

4.2.3 Ingestion Algorithm

The equation for calculating [illegible]

$$IngestionDose = \frac{Cs \times IR \times EF \times ED \times CF}{BW \times AT}$$

where:

Ingestion Dose = [illegible]

EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
CF	=	unit conversion factor (10^{-6} kg/mg)

4.2.4 Inhalation Algorithm

The equation for calculating intake through inhalation of dust from Site soil is as follows:

$$Inhalation\ Dose = \frac{EPCa \times InhR \times ET \times EF \times ED}{BW \times AT}$$

where:

Inhalation Dose	=	inhalation dose (mg/kg-day)
InhR	=	inhalation rate (m^3/day or m^3/hr)
EPCa	=	exposure point concentration in air (mg/m^3)
		particulates
	=	concentration in soil x (1/PEF)
	where:	
		PEF = particulate emission factor (m^3/kg),
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)

4.2.5 Dermal Algorithms

The equation for calculating intake through dermal contact with soil is as follows:

$$Dermal\ Dose = \frac{Cs \times SSA \times ABS \times AF \times EF \times ED \times CF}{BW \times AT}$$

where:

Dermal Dose	=	dermal dose (mg/kg-day)
C_s	=	exposure point concentration in soil (mg/kg)
AF	=	soil to skin adherence factor (mg/cm^2),
SSA	=	exposed skin surface area (cm^2/day)
ABS	=	absorption fraction of chemical from soil
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
CF	=	unit conversion (10^{-6} kg/mg)
BW	=	body weight (kg)
AT	=	averaging time (days)

[redacted]

Section 5
TOXICITY ASSESSMENT

[redacted]

report.

Section 6
RISK CHARACTERIZATION

This section describes how the calculated exposure doses will be integrated with the toxicity criteria

The theoretical excess lifetime cancer risk is an estimate of the increased risk of an individual

Excess Cancer Risk = Exposure Dose x Slope Factor

Lifetime daily intakes, using an averaging time of 70 years, effectively prorate the total cumulative dose over a lifetime. This approach is based on the assumption that a high dose of carcinogens received over a short period of time at any age is equivalent to a correspondingly low dose received

The potential for adverse effects on human health other than cancer will be evaluated by comparing

available. Otherwise the reference dose based on chronic exposures will be applied. This

Where: HQ = Hazard Quotient (unitless)

A HQ of slightly greater than 1 is not necessarily an indication that adverse effects will occur. The hazard index is the sum of the HQs for each of the chemicals

than 1.0, it is believed that no threshold health effects will occur. An HI of slightly greater than 1, however, is not necessarily an indication that health effects will occur. Summing HQs across all

[illegible] positive. Since this assumption is known not to be accurate, when a total population hazard index

The estimated cancer and noncancer risks will be presented in the BHRA report. The uncertainties associated with each component of the risk assessment will be discussed.

Section 7
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