

AN INVESTIGATION INTO RISK-BASED SITE
RESTORATION OF ABANDONED CRUDE
OIL PITS IN OKLAHOMA

By

DUSTIN JAY CRUIKSHANK

Bachelor of Science

University of Nebraska-Lincoln

1994

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
July, 1998

ACKNOWLEDGMENTS

I wish to express my sincere appreciation to my thesis advisor, Dr. Will Focht for his guidance, encouragement, understanding, and most importantly, his friendship. To my committee members, Dr. Hounslow and Dr. Stewart, thank you for all your assistance and suggestions. Dr. Stewart, I wish I would have had the opportunity to take a course taught by you; and Dr. Hounslow, I will now have time to go rock hunting, thank you.

I would like to thank Phil Spurlin and all the employees of BEACON Environmental Assistance Corporation for your assistance, guidance, and patience as I completed this long endeavor. A special thank you goes to Connie Nowell and Greg Cook for spending those long field hours with me during the inception of the Oklahoma Energy Resources Board program. May you both avoid the B.A. Frogs.

I would also like to thank the Oklahoma Energy Resources Board and the Department of Energy for making this research possible.

Finally, my most sincere thank you to my family for your love and affection. Words can never describe my appreciation for all you have given.

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CHAPTER 1

INTRODUCTION

In the oil producing states, a legacy of abandoned and improperly closed crude oil pits has attracted the attention of policy makers and the public. At many localities, wastes produced from exploration and production (E&P) activities were placed into pits near producing wells. In Oklahoma, abandoned pits can be as old as 80 to 85 years and contain various stages of weathered crude oil that may produce long-term, slow releases of contaminants. These releases of contaminants may pose environmental risks.

To reduce the impact of abandoned and orphaned well sites, the Oklahoma Energy Resources Board (OERB) was created by state legislation in 1992. The purpose of the board is to restore (bring back to native conditions) historical E&P sites. Sites targeted for restoration are those that have been abandoned and therefore have no responsible owner and/or operator; these sites are under the jurisdiction of the Oklahoma Corporation Commission (OCC). Funding for the program comes from a one-tenth of one percent voluntary assessment on oil and natural gas producers and royalty owners. By statute, all projects are selected by the OCC. Corporation Commission field inspectors select projects, based on potential harm to the environment, complaints by landowners, status as a public nuisance, and adverse visibility. Once a project is selected, the OCC performs a record check to assess the availability of a responsible party. If it is determined that no responsible owners and/or

operators are available to meet applicable restoration standards, the projects are then forwarded to the OERB for restoration. The first sites nominated to the OERB for restoration were recorded late in 1994 (BEACON, 1998).

Traditionally, total petroleum hydrocarbon (TPH) was used as an indicator of contamination. Given the recent interest in replacing TPH action levels with risk-based levels, the search for site-specific risk standards is intensifying.

This study, funded by a Department of Energy grant (DE-AF22-96BC14932) awarded the Oklahoma Energy Resources Board, explored the possibility of using an initial-screening-level risk-based site restoration approach for abandoned crude oil pits. This study reports only on the risks associated with crude oil pits.

Purpose

The purpose of this research was to investigate the potential for risk-based site restoration of abandoned crude oil pits in Oklahoma. This was accomplished by answering the following questions:

- (1) Based on standard, EPA assessment assumptions, can abandoned crude oil pits be safely left in place without land-use restrictions?
- (2) Based on standard, EPA assessment assumptions, is land application of soil from crude oil pits an acceptable restoration protocol?
- (3) Are TPH concentrations in soil positively correlated with risk estimates? If so, what risk do current TPH soil cleanup levels pose?
- (4) Can the traditional TPH Method 8015 Modified function as a valid indicator of unacceptable risk?

Importance of Study

A study of this nature is important because there are many sites with abandoned crude oil pits. A review of project records of BEACON (the OERB program's environmental consultant) shows that 1,488 sites have been identified for review. Of these sites approximately eight percent (120) contain abandoned crude oil pits. The pits range from 60 feet x 60 feet x 2 feet of impacted material to 90 feet x 60 feet x 2 feet. This corresponds to a range of about 250 to 400 cubic yards of impacted material to be handled per pit. Typically, construction restoration costs range from \$5 to \$8 dollars per cubic yard of material removed. Estimated restoration costs of the 120 pits range from \$160,000 to \$380,000. This estimate does not include consultant assessment fees, drilling and sampling, and costs of analysis.

Despite the fact that nearly 1,500 sites have been identified so far, estimates of the total number of sites range from 10 thousand to 20 thousand. If only two percent of these sites contain crude oil pits, the estimated construction restoration costs could be several million dollars, not including investigation and consulting costs that may total an additional several hundred thousand dollars. This estimate includes neither consultant assessment fees, nor costs of drilling, sampling, and analysis which may approach another several hundred thousand dollars.

Finally, this study is important in determining whether current cleanup standards are adequate, considering unrestricted future land use scenarios. If not, the OERB may incur additional costs in restoration expenses.

CHAPTER 2

LITERATURE REVIEW

Risk-Based Studies on Crude Oil Releases

Research on risk-based decision making for petroleum hydrocarbons has focused principally on refined products, non-weathered products, and marine spills (Hartley and Ohanian, 1990; Calabrese and Kostecki, 1988; Hostettler and Kvenvolden, 1994). Research has also focused on implementation of methods to replace action levels with risk-based standards (MADEP, 1994; TPH CWG, 1996. Vol.6).

Risk-based decision making related to crude oil is limited further by the fact that previous investigations have not evaluated releases of weathered crude oil. A large portion of the research involves the identification of individual constituents and chemical classes in crude oil (Domask, 1984). This research produces a better understanding of the complex chemical makeup, toxicity, and physical and chemical properties of various crude oil types (Heath et al, 1993).

Research has also been conducted on the fate of petroleum hydrocarbons in marine and terrestrial environments. This research has examined transport through water and soil, the mechanisms of their transformation in these environments, and the distribution of released hydrocarbons (Chen, 1992; Eastcott, 1989). Unfortunately, this research is generally limited to a time frame of several days to a few years.

This review of the literature demonstrates there are no risk data on weathered crude oil in pits, particularly in pits that are 80 to 85 years old and pits aging under natural environmental conditions.

Risk Assessment Methodology

To formulate a risk-based restoration policy for abandoned crude oil pits, it is necessary to understand the steps involved in performing a risk assessment.

Risk is defined as the probability of adverse human health effects from exposure to toxic substances or materials released in the environment (Cohrssen and Covello, 1989). Risk assessment is the process of scientific quantification of risk. There are three phases of risk assessment: (1) exposure assessment, (2) toxicity assessment, and (3) risk characterization.

Exposure Assessment

Exposure assessment is the phase of risk assessment in which targeted receptors are identified and the environmental concentration to which these receptors are being exposed are calculated (Focht, 1995). Information to gather in the exposure assessment includes identifying and characterizing sources of releases to the environment (spills, leaks, emissions, discharges, etc.), pathways of migration that can serve as routes of exposure (air, ground and surface water, soil and sediment, and food), and potential receptors (human and ecological). From this information, estimates of receptor delivered, absorbed, or effective dose can be estimated from the generic intake equation:

$$\text{Dose (mg/kg/day)} = \frac{CC \times I \times A \times ED \times EF \times EP}{BW \times AT \times 24 \text{ hours/day}}$$

Dose is calculated as milligrams of chemical per kilogram of receptor body weight per day of exposure. The independent variables are:

CC = chemical concentration (mg/unit)
I = intake assumption (mg/unit)
A = absorption coefficient (unitless)
ED = exposure duration (hours/day)
EF = exposure frequency (days/year)
EP = exposure period (years)
BW = receptor body weight (kg)
AT = averaging time (days)

The default values for the independent variables are described in Chapter 3 - Methodology.

Toxicity Assessment

Toxicity assessment encompasses the toxicological studies that determine the inherent toxicities (potencies) of the chemicals (Focht, 1995). Principally, two types of toxicants are considered: non-threshold and threshold.

Non-threshold toxicants, or carcinogens, have no zero-risk levels. It is assumed that any exposure to a carcinogenic compound creates a risk of cancer. The Environmental Protection Agency (EPA) assumes dose-response relationships for carcinogens to be linear and has adopted a linearized multi-stage model for carcinogen dose-response (Focht, 1995). The slope of the dose-response curve is referred to as the carcinogenic slope factor.

EPA has also established a weight-of-evidence classification system for carcinogenicity (Focht, 1995):

Class A: (Known) Human Carcinogen
Class B: Probable Human Carcinogen
B1: Limited Human Data
B2: Animal Bioassay Data Only

Class C: Possible Human Carcinogen
Class D: Not Classifiable as a Human Carcinogen
Class E: Not a Human Carcinogen

From the weight-of-evidence classification system, carcinogenic toxicants can be researched through EPA's chemical profile database, called the Integrated Risk Information System (IRIS), to identify which chemicals are possible, probable, or known human carcinogens for inclusion into the risk assessment.

Since carcinogens have no threshold dose that produces no response, the level of risk that is considered acceptable has been set at 1×10^{-6} (one person in one million). This level of risk is referred to as *de minimus* risk and is used as the point of departure (POD) in developing cleanup levels for carcinogens. If the risk exceeds 1×10^{-6} the risk is assumed to be unacceptable.

Threshold toxicants, or systemics, have threshold values - a non-zero dose exists that caused no response. This threshold, determined from animal bioassays, is referred to as the "no observed adverse effects level" (NOAEL). The reference levels determined to be protective against systemic effects in humans are called reference doses (RfDs). Reference doses are estimates of the lifetime daily dose that is likely to pose no risk to the human receptors. The RfDs are based on the NOAEL, but are adjusted by uncertainty factors (UF) and modifying factors (MF) (Focht, 1995).

$$\text{RfD} = \frac{\text{NOAEL}}{\text{UF} \times \text{MF}}$$

The UFs generally consist of multiples of 10, with each factor representing a specific area of uncertainty inherent in the extrapolation from the available data (EPA, 1989). The UFs bases are:

- (1) UF of 10 is used to account for variations in human populations
- (2) UF of 10 is used when extrapolating from animals to humans
- (3) UF of 10 is used when a NOAEL is derived from subchronic instead of chronic studies
- (4) UF of 10 is used when a "lowest observed adverse effect level" (LOAEL) is used instead of a NOAEL

The MFs generally range from >0 to 10. Modifying factors reflect a qualitative, professional assessment of additional uncertainties found in the studies, not expressed by the uncertainty factors.

The numerical individual lifetime risk estimate for systemic toxicants is referred to as the hazard quotient (HQ). If the HQ is greater than one, the risk is assumed to be unacceptable.

Risk Characterization

Risk characterization is the phase of risk assessment in which the risk to the receptor is quantified and reported. This phase combines the toxicity information from the toxicity assessment with the dose information from the exposure assessment to produce the estimated response in the receptor (Focht, 1995). The risk characterization is usually completed at the maximum exposed individual (MEI) under a reasonable maximum exposure (RME). For purposes of this study, these will be defined in Chapter 3 - Methodology.

For carcinogens, the risk estimates are calculated by multiplying the slope factor with the dose.

$$\text{Cancer Risk} = \text{Dose (mg/kg/day)} \times \text{Slope Factor (mg/kg/day}^{-1}\text{)}$$

For systemics, the risk estimates are calculated by dividing the dose by the reference dose.

$$\text{Systemic Risk} = \text{HQ} = \text{Dose (mg/kg/day)} / \text{RfD (mg/kg/day)}$$

If the toxicological response (separately for carcinogenic and systemic toxicants) is predicted to be similar across exposure pathways, and is accumulative over the exposure period, then it is assumed that the responses are cumulative and can be summed across the exposures. For carcinogens:

$$\text{Cumulative cancer risk} = \sum(\text{Dose} \times \text{Slope Factor})$$

For systemics the hazard index (HI) is used:

$$\text{Cumulative systemic risk} = \text{HI} = \sum(\text{HQ})$$

Health Implications of Soils Impacted with Petroleum

Crude oil is composed of numerous compounds (Domask, 1984). Studies of the composition of petroleum have identified more than 350 compounds (Chen, 1992). The understanding of the composition, physical and chemical properties, and toxicity of each component is necessary for the assessment of their fate and transport in the environment and their risks to those receptors exposed to them.

Crude oils contain compounds that are known to be environmentally toxic. This is especially true of aromatic compounds, particularly benzene and several polyaromatic hydrocarbons (PAHs) such as benz(a)anthracene, benzo(a)pyrene,

benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and ideno(1,2,3-cd)pyren. Nestler (1974) reported that petroleum mixtures such as crude oil tank bottoms may contain up to 90 percent PAHs. Where sites contain significantly weathered hydrocarbons, PAHs may account for much of the risk (Michelson and Boyce, 1993). Because these compounds are not highly mobile or easily leached into groundwater, they are typically found only in soil (Michelson and Boyce, 1993).

Exposure to petroleum hydrocarbons as a result of soil contamination may occur by the following routes: pulmonary inhalation, dermal absorption, and oral ingestion of compounds (Calabrese and Kostecki, 1988).

Factors that affect the rate of volatilization of compounds are the compound's vapor pressure, Henry's Law Constant, Raoult's Law, and extant environmental conditions. Soil-incorporated chemicals volatilize at a rate that depends not only on the equilibrium distribution between air, water, and soil types as related to vapor pressure, solubility, and adsorption coefficients, but also on the rate of movement through soil (Spencer, 1973). Characteristics of soil, such as organic matter and clay content, moisture, and bulk density also affect the distribution of compounds within the air, water, and soil phases and its potential for loss by diffusion (Karimi, 1983).

Working directly with impacted soil may cause dermal exposure. Because many of the compounds in crude oil are highly lipophilic (they have a high octanol/water coefficient and thus a strong affinity for bioaccumulating in fats), they may have the capacity to be dermally absorbed. This is especially

true for carcinogenic PAHs. Most have high octanol/water coefficients and low solubilities and vapor pressures.

Exposure to compounds through ingestion may take place in several ways. It may occur as a result of direct ingestion of contaminated soil or drinking water, of ingestion of plants that have taken up the toxic compounds and distributed them to edible portions of the plant, and ingestion of exposed animals or contaminated animal products (Calabrese and Kostecki, 1988).

Action Levels

Prior efforts to replace action levels with risk-based standards have included whole product testing (unleaded gasoline, diesel, JP-4, etc.), indicator approach (benzene and carcinogenic PAHs), qualitative toxicity indicators (TPH), individual chemical constituents (American Society for Testing and Materials (ASTM) Risk Based Corrective Action (RBCA) approach), in-situ biotoxicity (daphnia toxicity), and surrogate compounds representing carbon ranges (Massachusetts Department of Environmental Protection and British Columbia Environment). More recently, the TPH Criteria Working Group has developed a methodology that separately assigns composition-weighted toxicity values to 13 boiling point-adjusted fractions.

Debate about the utility of these various approaches hinges on definitions of relative risk, cost and ease of assessment, validity of assessment findings, and reliable concentration data and risk data for weathered petroleum hydrocarbons. This is especially true for weathered crude oil on exploration and production sites on land.

TPH Criteria Working Group Methodology

The TPH Criteria Working Group (TPH CWG) is an *ad hoc* consortium of federal and state regulatory agencies, academic institutions, private consulting firms, and petroleum, power, and transportation industries. The goal of the TPH CWG is to develop scientifically defensible information for establishing soil cleanup levels for TPH that are protective of human health at hydrocarbon contaminated sites (TPH CWG, 1996).

The TPH CWG realized that many sites are contaminated by petroleum hydrocarbons and that several exposure pathways potentially adversely affect human health and the environment adversely. The TPH CWG assumes that compounds of similar nature (aliphatic or aromatic), with similar physical and chemical properties, behave similarly in the environment (TPH CWG, 1996, Vol.3). By grouping hydrocarbons into small numbers of fractions, modeling and estimating risk associated with petroleum releases are simplified.

The TPH CWG identified representative fractions based on simple screening-level partitioning models from the ASTM's (1995) RBCA standard. The model was applied to approximately 250 individual compounds in petroleum to quantify the ability of each compound to leach to groundwater and volatilize from soil. The group specified the delineation of specific fractions based on an order-of-magnitude difference in the partitioning properties. Once the fractions (both aliphatic and aromatic) were defined, physical and chemical properties were assigned to each fraction, based on an empirical relationship of the specific parameters, within each fraction, to boiling points normalized to n-

alkanes (TPH CWG, 1996, Vol.3). From this empirical relationship, a relative carbon number index (RCNI) or equivalent carbon (EC) number boiling point was defined for each individual compound. Figure 1 depicts the relationship of the RCNI to boiling points and the empirical formula used to derive the RCNI. From this, the RCNI (EC) was plotted against the RBCA partitioning equations (leaching, volatilization, vapor pressure, solubility, sorption, etc.) to develop specific physical and chemical properties for each individual fraction that could be used in modeling fractions to receptors. Figures 2 through 4 depict the TPH CWG's estimation of leaching and volatilization, vapor pressure and solubility correlations, and sorption and Henry's Law Constant correlations for aliphatic and aromatic compounds. From the figures, it appears that under different modeling parameters, chemical classes behave differently in the environment; these differences affect exposures.¹

Once the EC fractions were defined from fate and transport characteristics, fraction-specific toxicity values were assigned. Table 1 - Summary of Equivalent Carbon Number Fraction-Specific Ranges - lists these values.

The development of the fraction-specific toxicity values was determined by an indicator/surrogate approach (TPH CWG, 1996, Vol. 6). Indicators are single compounds that are known to be carcinogens and are evaluated

Relative Carbon Number Index Boiling Point Normalized to n-Alkanes

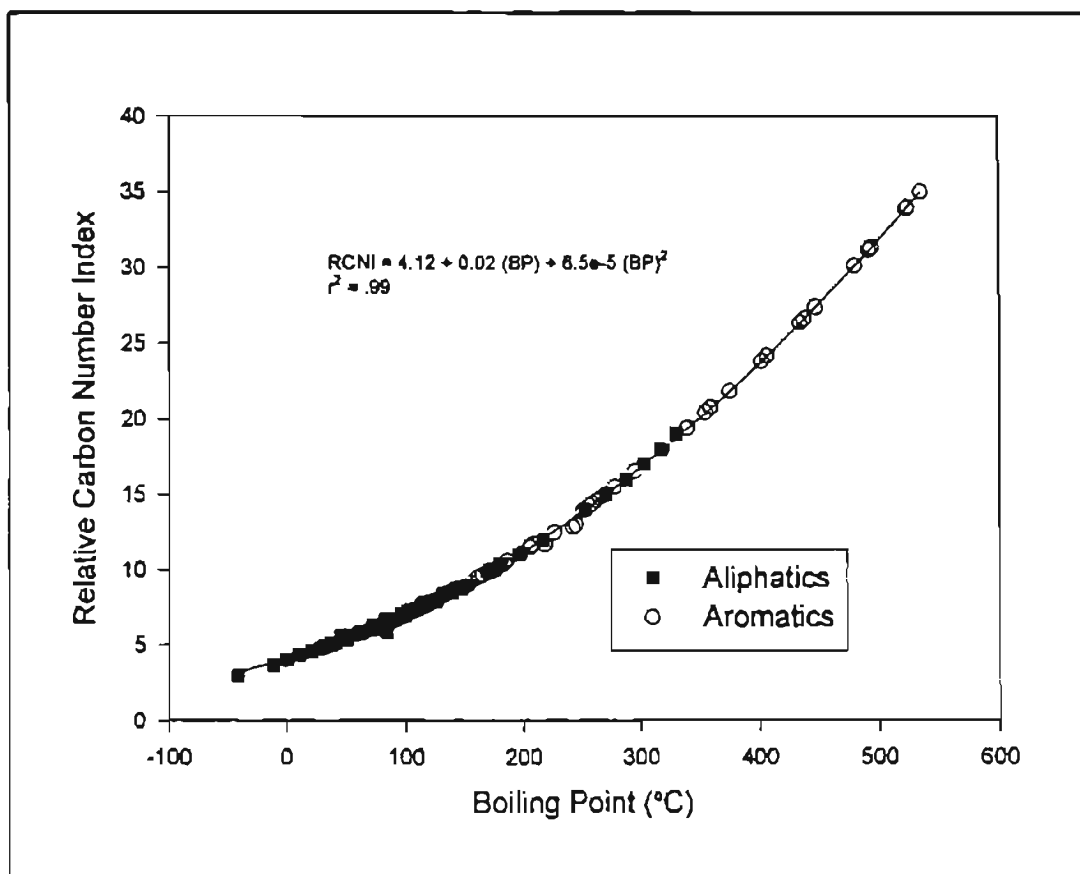
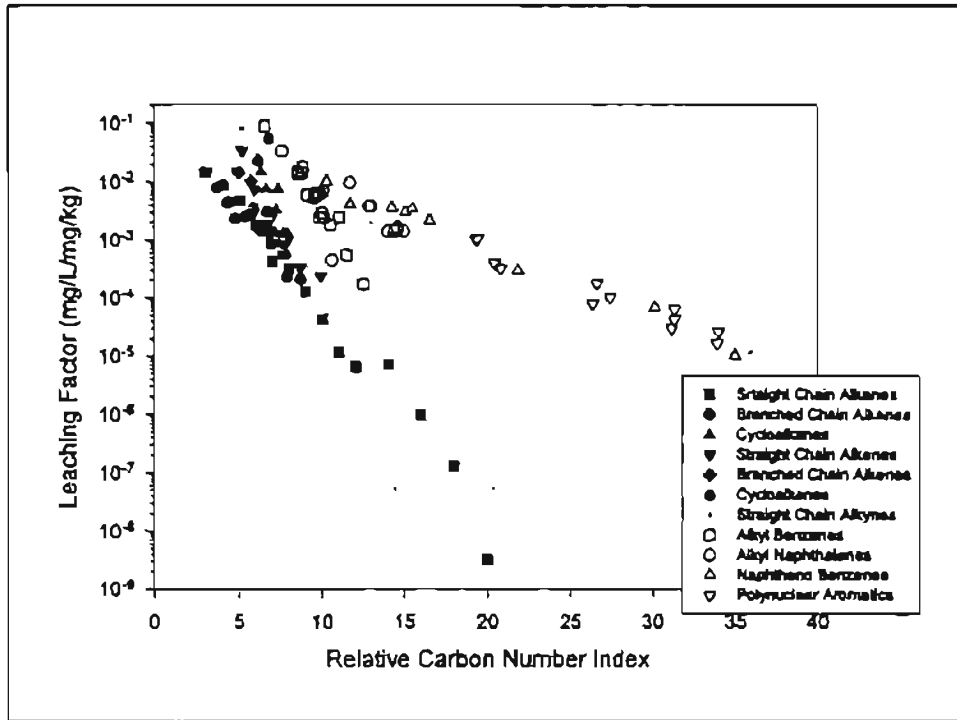


Figure 1 Relative Carbon Number Index Boiling Point Normalized to n-Alkanes.
(From TPH CWG, 1996, Volume 3, Selection of Representative TPH Fractions Based on Fate and Transport Considerations.)

Leaching Factor by Homologous Series



Volatilization Factor by Homologous Series

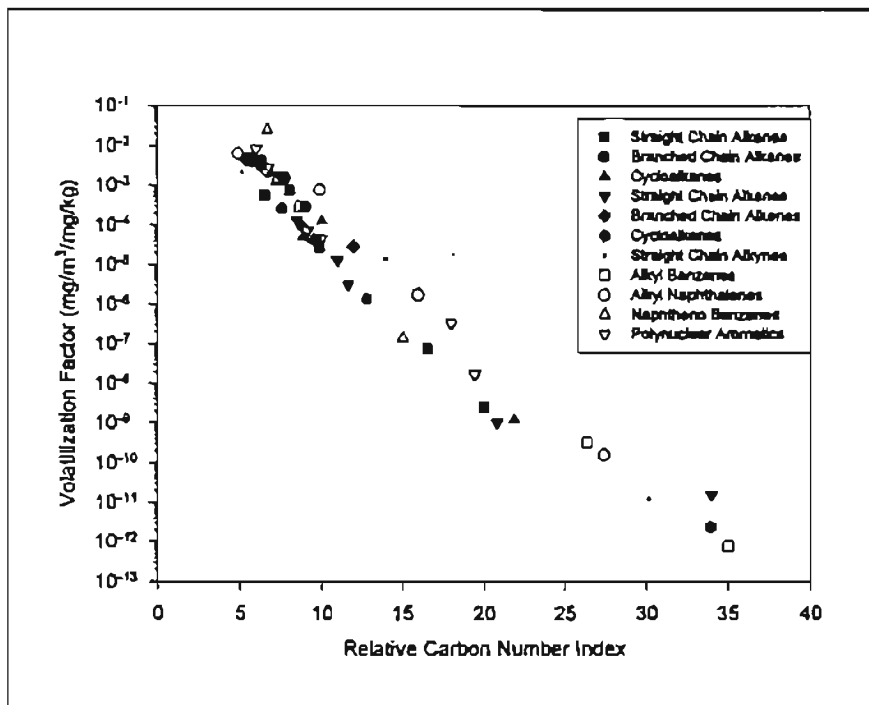
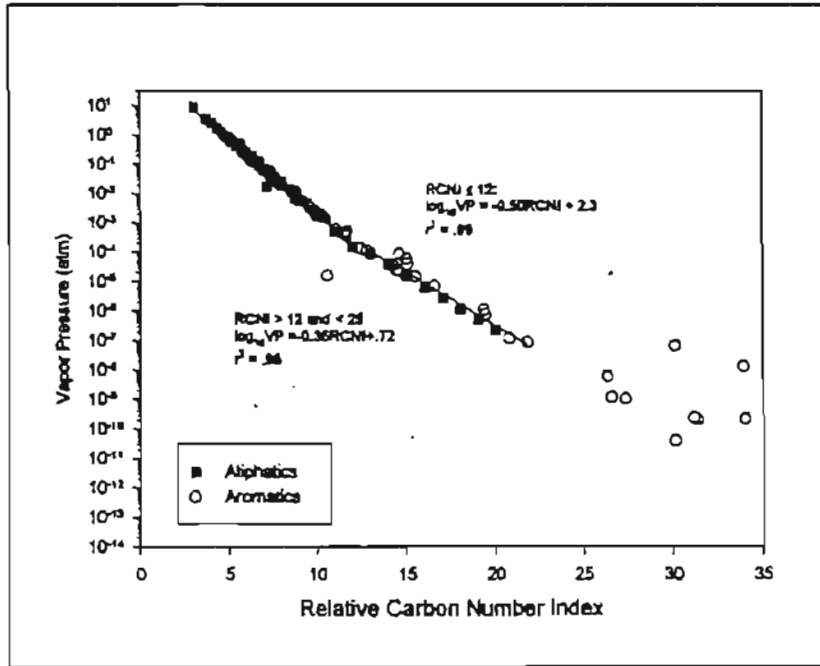


Figure 2 Selection of Representative TPH Fractions Based on Fate and Transport Considerations. (From TPH CWG, 1996, Volume 3).

Vapor Pressure Correlation Relative Carbon Number Index



Solubility Correlation Relative Carbon Number Index

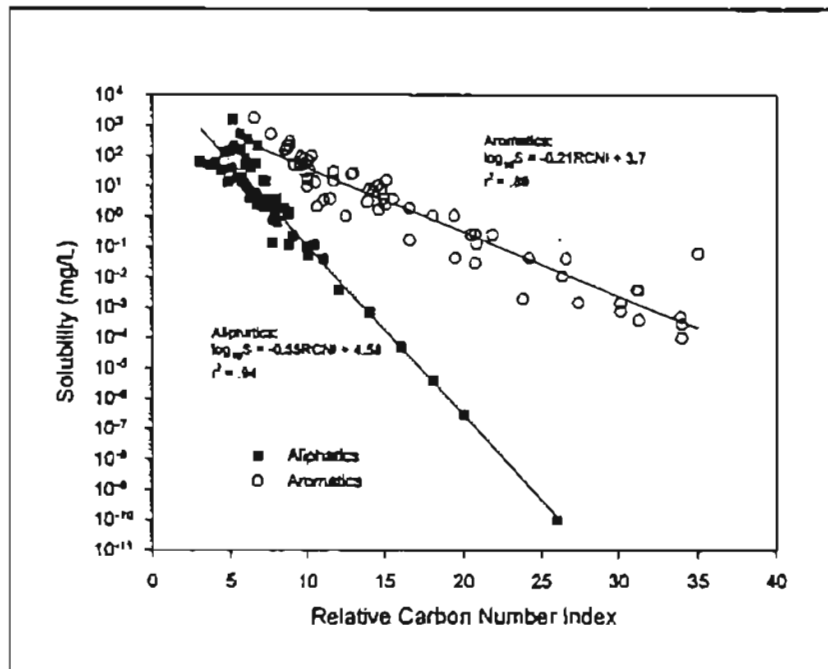
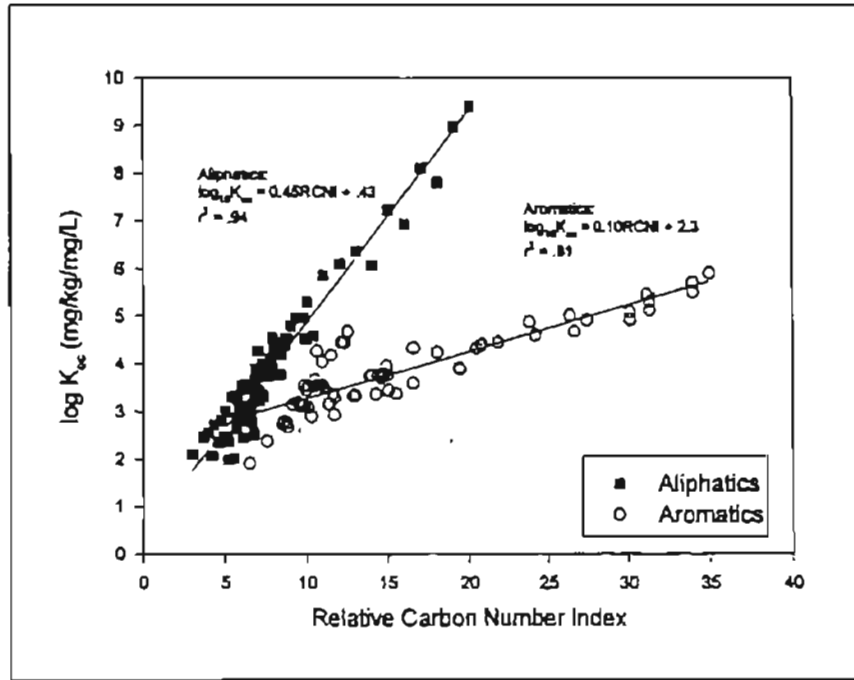


Figure 3 Selection of Representative Fractions Based on Fate and Transport Considerations. (From TPH CWG. 1996. Volume 3).

Sorption Correlation Relative Carbon Number Index



Henry's Law Constant Correlation Relative Carbon Number Index

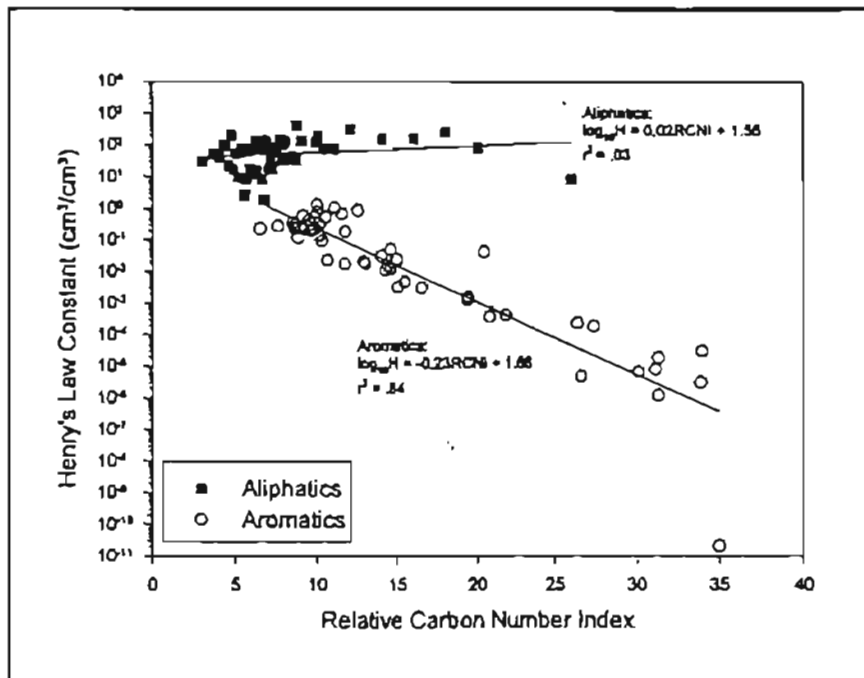


Figure 4 Selection of Representative Fractions Based on Fate and Transport Considerations. (From TPH CWG, 1996, Volume 3).

Table I

Summary of Equivalent Carbon Number
Fraction-Specific Ranges

<u>Equivalent Carbon Number (EC)</u>	<u>Classification</u>
>EC5 - ≤ EC6	Aliphatic
>EC6 - ≤ EC8	Aliphatic
>EC8 - ≤ EC10	Aliphatic
>EC10 - ≤ EC12	Aliphatic
>EC12 - ≤ EC16	Aliphatic
>EC16 - ≤ EC21	Aliphatic
>EC21 - ≤ EC35	Aliphatic
>EC6 - ≤ EC7	Aromatic
>EC7 - ≤ EC8	Aromatic
>EC8 - ≤ EC10	Aromatic
>EC10 - ≤ EC12	Aromatic
>EC12 - ≤ EC16	Aromatic
>EC16 - ≤ EC21	Aromatic
>EC21 - ≤ EC35	Aromatic

Modified from: TPH CWG. 1996. Selection of Representative TPH Fractions
Based on Fate and Transport Considerations. Volume 3: TPHCWG.

individually. Surrogates are compounds (single or mixtures) that are used to represent the toxicity of a group of compounds in fractions. The indicator compounds used to represent fraction toxicity are benzene and the carcinogenic polyaromatic hydrocarbons (PAHs). Surrogates were selected from referenced material and refinery mixtures, where appropriate. All aromatic fractions were determined from surrogates whereas the aliphatic fractions were determined from surrogates and mixtures. Table II - Summary of Equivalent Carbon Number Fraction Specific Ranges and Selected Surrogates - refers to the TPH CWG's EC range for both aromatic and aliphatic fractions and the selected surrogate or mixture applied to that fraction.²

Table II

Summary of Equivalent Carbon Number
Fraction-Specific Ranges and Selected Surrogates

<u>Equivalent Carbon Number (EC)</u>	<u>Classification</u>	<u>Surrogate</u>
>EC5 - ≤ EC6	Aliphatic	*
>EC6 - ≤ EC8	Aliphatic	*
>EC8 - ≤ EC10	Aliphatic	Petroleum Streams and JP-8
>EC10 - ≤ EC12	Aliphatic	Petroleum Streams and JP-8
>EC12 - ≤ EC16	Aliphatic	Petroleum Streams and JP-8
>EC16 - ≤ EC21	Aliphatic	White Mineral Oil
>EC21 - ≤ EC35	Aliphatic	White Mineral Oil
>EC6 - ≤ EC7	Aromatic	
>EC7 - ≤ EC8	Aromatic	Toluene
>EC8 - ≤ EC10	Aromatic	**
>EC10 - ≤ EC12	Aromatic	**
>EC12 - ≤ EC16	Aromatic	**
>EC16 - ≤ EC21	Aromatic	Pyrene
>EC21 - ≤ EC35	Aromatic	Pyrene

* Fraction contains two potential surrogates. If the concentration of n-hexane is <53% then n-heptane is used as the surrogate. If the concentration of n-hexane is >53% then n-hexane is used as the surrogate.

** Fraction contains nine surrogates with reported RfDs. Surrogates include: isopropylbenzene, naphthalene, acenaphthene, biphenyl, fluorene, anthracene, fluoranthene, pyrene, and methylnaphthalene.

Modified from: TPH CWG. 1996. Selection of Representative TPH Fractions Based on Fate and Transport Considerations. Volume 3: TPHCWG.

CHAPTER 3

METHODOLOGY

To explore the possibility of using risk-based restoration of abandoned crude oil pits, the risk from exposure to weathered crude oil-impacted soil was estimated. Standard risk assessment assumptions and methodologies were used in completing the risk estimates. In the interest of producing risk estimates that were conservative, the receptor was placed hypothetically at the edge of the crude oil pit and an unrestricted residential land use scenario was adopted.

Selected crude oil pits were sampled and analyzed by TPH Method 8015M, TPH CWG direct method, and Method 8020 (for benzene only). Since TPH is so variable in composition, the systemic risk assessment involved only the use of the TPH CWG direct method fractions and their respective composite-weighted toxicity values. The carcinogenic risk assessment involved the use of compounds referenced from IRIS and crude oil product surveys. Toxicity values were obtained from IRIS and ATSDR (1995) toxicity equivalency factors (TEFs).

The working hypothesis was that there existed a predictable relationship between TPH analytical methods (Method 8015M and the TPH CWG direct method), and TPH. In addition, the linear relationship between total risk and total soil TPH was used to develop risk curves with respect to soil TPH. The risk curves were used to generate health-based cleanup levels and to compare these levels to current soil TPH action levels for crude oil.

The following is a discussion of the parameters used in selecting the crude oil pits, risk assessment assumptions, and the correlations between analytical methods that were completed.

Crude Oil Pit Selection

Abandoned crude oil pits were researched during the Summer and early Fall 1997 from OERB project records obtained from the OCC. Figure 5 depicts the location of pits selected for this research by county. Pits varying in age from approximately 30 to 80 years were screened by period of operation and physical characteristics. The approximate age of each pit was documented through OCC 1002A well completion records and plugging reports. Specific ages of pits were then recorded from aerial photos, county soil maps, interviews with landowners, and from OCC complaint records.

The period of operation for each pit was limited to an active life of two years or less prior to abandonment, and was estimated through the age-research of each pit. This choice of active life was made to control for the effects of (1) mixing fresh and weathered crude oil on TPH concentrations in the pits, (2) potential changes in crude oil composition through the introduction of nutrients, oxygen, and bacteria, and (3) induced evaporation or dissolution of organic compounds from the pits.

The physical characteristics of each pit used in screening included the geographic location, the geometry of each pit with cross-sections documenting the pit depth and thickness of the crude layer contained within the pit. The physical characteristics also included special considerations or features of each

pit such as proximity to surface water or shallow groundwater, whether the pit was in vegetated land or in a brine-impacted area, the soil type, the current land use, and proximity to residences.

Twenty-one crude oil pits were identified that fit the criteria described above. See Appendix A - Crude Oil Pit Summaries - for a description of the characteristics of each pit.

Crude Oil Pit Sampling

Samples were collected using a stainless steel hand-auger or were collected during restoration activities. A test boring was completed at each pit to determine the depth to soil and thickness of the weathered crude. A minimum of two borings was made in each pit for sample collection. Soil samples were collected from two to four inches below the soil-oil contact zone. This sample collection was selected because it represents the highest chemical concentration for the soil media. Soil samples collected just below the soil-oil contact zone are assumed to have the highest concentration TPH. This assumption is predicated on the overlying crude oil's having acted as a buffer to volatilization and dissolution of the compounds from each matrix.

Samples were composited, placed into four-ounce glass sample jars and sealed with Teflon-coated lids. Each jar was labeled and placed in ice. Laboratory-supplied chain-of-custody forms were completed, and accompanied the sample shipment to the analytical laboratories.

Chemical Analysis of Samples

A duplicate sample was sent to two analytical laboratories for analysis by methods commonly used to report concentrations of total petroleum hydrocarbons (TPH). Samples utilizing the direct method, developed by the TPH CWG, were sent to Lancaster Laboratories in Lancaster, Pennsylvania. A total of 16 crude oil samples and 15 soil samples were analyzed at Lancaster Laboratories.

The direct method was modified for this study. The last EC range of the aliphatics and aromatics ($>EC_{21} - \leq EC_{35}$) was extended to include up to EC_{40} . This range was extended to capture heavier hydrocarbons contained in weathered to highly weathered oils. The last range for this study is consequently reported as $>EC_{21} - \leq EC_{40}$. All references to the TPH CWG's last equivalent carbon range shall be based on this study's new range and all risk calculations shall utilize the working groups reference dose for the last range.

Samples utilizing TPH Method 8015M were sent to Southwell Laboratory in Oklahoma City, Oklahoma. A total of 21 crude oil samples and 20 soil samples was analyzed at Southwell Laboratory. This method was modified to include a total carbon range of C5 - C40. Concentrations of TPH (in mg/kg) were reported for the ranges C5 - C28 (common diesel range) and C5 - C40 (common crude oil range). The two 8015M concentrations were reported to examine their relationship to TPH CWG direct method concentrations of the same sample.

Baseline Risk Assessment: Exposure Assessment

The following is an explanation of the information that was gathered, or calculated, to complete the exposure assessment phase of the risk assessment.

Exposure Setting

In an attempt to develop a risk-based site restoration methodology for the OERB program, a reliance on a conservative definition of the exposure setting is required. With the continual progression of residential uses into areas that were once oil producing lands, a residential exposure setting was used. Table III - Exposure Setting - describes the potentially exposed populations and the land use scenario used in this study.

Table III
Exposure Setting

<u>Population</u>	<u>Land use</u>	<u>Reasoning</u>
Adult and Child Receptors	Residential Setting	Dynamic nature of OERB program with newly identified sites Encroachment of residential areas into oil producing lands and future land use considerations Unrestricted land use near crude oil pits

Exposure Pathways and Routes

The source of potential adverse health effects was determined to be contaminated soil below the crude oil contained within the pits. According to OERB policy it is assumed that the contents of the pits would be removed as

part of the restoration process of the abandoned sites; however, impacted underlying soil could remain.

Exposure routes considered for risk assessment were soil ingestion of soil and dermal contact; other possible routes of exposure were eliminated. Table IV - Summary of Exposure Pathways - outlines all potential exposure paths and the reasoning for their inclusion or exclusion from risk assessment.

Exposure Concentrations

The chemical concentrations for completing systemic risk assessment calculations were determined by the TPH CWG method. Concentration of hydrocarbons in soil (mg/kg) are reported for each aliphatic and aromatic fraction and for total TPH for each sample.

The chemical concentrations for compounds other than benzene were determined from crude oil product survey reports. A search of EPA's Integrated Risk Information System (IRIS) for Class A, B1, and B2 compounds that appear in crude oil were used to complete carcinogenic risk calculations. The crude oil product surveys were researched to determine the relative weight percentage composition of each of the carcinogenic compounds. The relative weight percentages for the compounds were multiplied by the total reported TPH concentration from the CWG's direct method for each individual pit.

Table IV

Summary of Exposure Pathways

<u>Exposed Population</u>	<u>Exposure Pathway</u>	<u>Pathway Selected</u>	<u>Reasoning</u>
Residents	Ingestion - soil	Yes	Potential for significant exposure due to contents of pit having been removed.
Residents	Ingestion - Groundwater	No	No groundwater data. Variation of geology across the state. Shallow groundwater not potable.
Residents	Ingestion - Surface water	No	Pits contain water only after rain events.
Residents	Inhalation - Vapor Phase and Particulate	No	Relatively quick volatility of compounds. No air monitoring data.
Residents	Direct Contact - Soil	Yes	Potential for significant exposure due to contents of pit being removed.
Residents	Direct Contact - Surface Water	No	Pits contain water only after rain events.
Residents	Food Intakes	No	No data.

Table V - Summary of Carcinogenic Compounds Selected from IRIS - outlines the compounds used in the carcinogenic risk calculations and their EPA classification, equivalent carbon number, and weight percentage.

<u>Compound¹</u>	<u>EPA Classification¹</u>	<u>EC Number²</u>	<u>Weight Percent³</u>
Benzene	A	6.5	NA
Benz(a)anthracene	B2	26.37	0.00067
Benzo(a)pyrene	B2	31.34	0.00084
Benzo(b)fluoranthene	B2	30.14	0.0024
Benzo(g,h,i)perylene	B2	34.01	0.00004
Benzo(k)fluoranthene	B2	30.14	0.000195
Chrysene	B2	27.41	0.00039
Dibenz(a,h)anthracene	B2	33.92	0.00067
Ideno(1,2,3-cd)pyrene	B2	35.01	0.0012

1 From IRIS On-Line at EPA
2 From TPH CWG, (1996) Volume 3: Selection of Representative TPH Fractions
3 From API (1993) and BP (1996)

Concentrations for benzene were taken from records of soil samples analyzed by EPA Method 8020.

Chemical Intake

The estimates of receptor intake are outlined in Table VI - Residential Exposure: Ingestion of Chemicals in Soil - and Table VII - Residential Exposure: Dermal Contact with Chemicals in Soil. All exposure and intake assumptions are

standard EPA intake assumptions for residential settings, for adult and child populations (EPA, 1989).

Exposure Assumptions

For adult exposure, these assumptions were 70 year life span, exposure frequency to impacted soil of 365 days per year, exposure duration equal to 24 hours per day, exposure period equal to the life span, and averaging time equal to the exposure period (25,550 days). For child exposure, the assumptions were based on a five year exposure period, exposure frequency of 365 days per year, exposure duration equal to 24 hours per day, and averaging time equal to the exposure period (1,825 days). Under the residential exposure scenario; however, the lifespan, exposure frequency, and averaging time reduce to a factor of one, and consequently, cancel in the chemical intake equations. This leaves the concentration of the compounds or fractions in soil, ingestion rate, receptor body weight, skin surface area, adherence factors, and absorption factors as the only variables used in estimating the chemical intakes.

Intake Assumptions

The concentrations of compounds or fractions in soil were taken from or developed as described in the Exposure Concentrations section. An ingestion rate of 0.0001 kg/day and 0.0002 kg/day was utilized for adult and child receptors, respectively, and was based on the 90th-percentile default value (EPA, 1989). The receptor body weights were 60 kg for adults and 16 kg for children. The adult body weight was taken as an average of adult male (70 kg) and adult female (50 kg) body weights (based on the 90th-percentile default).

The child body weight was based on the 50th-percentile default as recommended by EPA (1989). The adult skin surface area was estimated from the 50th-percentile body part-specific surface area for arms, hands, and leg exposure for males (8620 cm²). Utilization of arm, hand, and leg exposure, for males, was assumed to be conservative estimate for year-round exposure estimates for both male and female adult receptors. The child skin surface area was estimated from the 50th-percentile body part-specific surface area for arms, hands, and leg exposure for 6 year-old male receptors (3910 cm²). Utilization of arm, hand, and leg exposure for males are conservative estimates for year-round exposure estimates for both male and female child receptors. Adherence factors (AFs) for clay (2.77E-06 kg/cm²), potting soil (1.45E-06 kg/cm²), and sand (1.03E-06 kg/cm²) were used to compute a weighted composite AF (EPA, 1989). From soil texture analyses at the test sites, it was determined that 70 percent of the soils were clay, 15 percent silt, and 15 percent sand. These percentages were used in estimating the composite adherence factor by multiplying the reported clay adherence factor by 0.7, the potting soil and sand adherence factors by 0.15, respectively, and by summing the results. An adherence factor of 2.31E-06 kg/cm² was estimated. The absorption factors were all conservatively assumed to be 1.

Table VI

Residential Exposure¹:
Ingestion of Chemicals in Soil

$$\text{Dose (mg/kg/day)} = \frac{\text{CS} \times \text{IR} \times \text{A} \times \text{ED} \times \text{EF} \times \text{EP}}{\text{BW} \times \text{AT} \times 24 \text{ hrs/day}}$$

CS = Compound/Fraction Concentration in Soil (mg/kg)

IR = Ingestion Rate (kg soil/day)

Adult = 0.0001

Child = 0.0002

ED = Exposure Duration (hours/day)

Adult = 24

Child = 24

EF = Exposure Frequency (days/year)

Adult = 365

Child = 365

EP = Exposure Period (years)

Adult = 70

Child = 5

BW = Body Weight (kg)

Adult = 60

Child = 16

AT = Averaging Time = Exposure Period = EP (days)

Adult = ED x 365 = 25550

Child = ED x 365 = 1825

¹ Intake assumptions from EPA (1989).

Table VII

Residential Exposure¹ :
Dermal Contact with Chemicals in Soil

$$\text{Absorbed Dose (mg/kg/day)} = \frac{\text{CS} \times \text{SA} \times \text{AF} \times \text{A} \times \text{ED} \times \text{EF} \times \text{EP}}{\text{BW} \times \text{AT} \times 24 \text{ hrs/day}}$$

CS = Compound/Fraction Concentration in Soil (mg/Kg)

SA = Skin Surface Area (cm²/day)

Adult = 8620

Child = 3910

AF = Adherence Factor (kg/cm²)

Adult = 2.31 E-06

Child = 2.31 E-06

A = Absorption Factor (unitless)

Adult = 1

Child = 1

ED = Exposure Duration (hours/day)

Adult = 24

Child = 24

EF = Exposure Frequency (days/year)

Adult = 365

Child = 365

EP = Exposure Period (years)

Adult = 70

Child = 5

BW = Body Weight (kg)

Adult = 60

Child = 16

AT = Averaging Time (days)

Adult = ED x 365 = 25550

Child = ED x 365 = 1825

¹Intake assumptions from EPA (1989).

Identification of Exposure Assessment Uncertainties

The information below is a list of the various sources of uncertainty that accompany exposure assessment assumptions.

- (1) Interindividual sensitivities and variabilities to intake assumptions (e.g., age, weight, gender, occupation, existing health, activity patterns, genetic makeup)
- (2) Exposure and intake assumptions and measurements (e.g. exposure frequency and duration, routes of exposure, intake, adherence factors)
- (3) Residential land use scenarios
- (4) Selection of compounds to estimate risks
- (5) Release mechanisms and magnitudes of compounds to receptors
- (6) Identification of the maximum exposed individuals (MEIs)

Baseline Risk Assessment: Toxicity Assessment

The following is an explanation of the information that was gathered, or calculated, to complete the toxicity assessment phase of the risk assessment.

Carcinogenic Effects

The slope factors used in the carcinogenic risk calculations were taken from IRIS. For the carcinogenic PAHs listed in Table V, toxicity equivalency factors (TEFs) were used to derive the oral and dermal slope factors. Since reported toxicity values are based on administered doses, an adjustment for absorption efficiency was used to derive the dermal slope factors. An administered to absorbed dose slope factor was estimated by using an EPA assumption of 20% absorption efficiency for the compounds (EPA, 1989). Table

VIII - Summary of Carcinogenic Slope Factors lists the carcinogenic compounds with the oral slope factors and derived dermal slope factors.

Table VIII

Summary of Carcinogenic Slope Factors¹

<u>Compound</u>	<u>EPA</u> ¹	<u>TEF</u> ²	<u>Slope Factor Oral</u> ³	<u>Slope Factor Dermal</u> ⁴	<u>EC Number</u> ⁵
Benzene	A	NA	2.9E-02	5.8E-03	6.5
Benz(a)anthracene	B2	0.1	7.3E-01	1.46E-01	26.37
Benzo(a)pyrene	B2	1.0	7.3E+00	1.46E+00	31.34
Benzo(b)fluoranthene	B2	0.1	7.3E-01	1.46E-01	30.14
Benzo(g,h,i)perylene	B2	0.01	7.3E-02	1.40E-02	34.01
Benzo(k)fluoranthene	B2	0.1	7.3E-01	1.46E-01	30.14
Chrysene	B2	0.01	7.3E-02	1.40E-02	27.41
Dibenz(a,h)anthracene	B2	5	3.65E+01	7.3E+00	33.92
Ideno(1,2,3-cd)pyrene	B2	0.1	7.3E-01	1.46E-01	35.01

1 From IRIS On-Line at EPA Website

2 Toxicity Equivalency Factor from ATSDR 1995 Relative to Benzo(a)pyrene

3 From TPH CWG (1996) Volume 6: TPHCWG Methodology

4 Derived from ATSDR (1995) TEFs and Adjusted to Absorbed Utilizing EPA (1989) and 20% Absorption Efficiency

5 From TPH CWG (1996) Volume 3: Selection of Representative TPH Fractions

Systemic Effects

The reference doses used in the systemic risk calculations were taken from the TPH CWG risk assessment methodology (TPH CWG, 1996, Vol.6). As explained above, an administered to absorbed reference dose was estimated by using an assumed 20% absorption efficiency for the compounds (EPA, 1989).

Table IX - Summary of Fraction Specific RfDs - lists the TPH CWG fractions with oral reference doses and derived dermal reference doses.

<u>EC Range</u>	<u>Aliphatic¹ Oral RfD</u>	<u>Aliphatic² Dermal RfD</u>	<u>Aromatic¹ Oral RfD</u>	<u>Aromatic² Dermal RfD</u>
>EC5 - ≤ EC6	5.0	25.0		
>EC6 - ≤ EC8	5.0	25.0		
>EC6 - ≤ EC7			0.20	1.0
>EC7 - ≤ EC8			0.20	1.0
>EC8 - ≤ EC10	0.1	0.5	0.04	0.2
>EC10 - ≤ EC12	0.1	0.5	0.04	0.2
>EC12 - ≤ EC16	0.1	0.5	0.04	0.2
>EC16 - ≤ EC21	2.0	10.0	0.03	0.15
>EC21 - ≤ EC40	2.0	10.0	0.03	0.15

1 From TPHCWG (1996) Volume 6: TPHCWG Methodology.
2 From TPHCWG and Adjusted to Absorbed Utilizing EPA (1989) and 20% Absorption Efficiency.

Identification of Toxicity Assessment Uncertainties

Listed below the various sources of uncertainty associated with the toxicity assessment.

- (1) Interindividual sensitivities and variabilities
- (2) Dose-response information
 - a. using observed effects produced at high doses to predict effects at low doses
 - b. using short term exposure studies to predict effects of long term exposure
 - c. extrapolations from studies based on animal to predictions about humans
 - d. adjustment of administered dose to absorbed dose
- (3) Difficulty proving causation of compounds in receptors
- (4) Toxicological model uncertainties (e.g. linearity between dose and response, existence of a "no observed adverse effects level")

Baseline Risk Assessment: Risk Characterization

The following is an explanation of the information that was gathered or calculated to complete the risk characterization phase of the risk assessment.

Carcinogenic Risk

Carcinogenic risk was calculated by using the estimated exposure concentrations of each compound identified in Table V. The concentrations were incorporated into the standard intake equations (Tables VI and VII), to derive a dose for ingestion of soil and for dermal contact. For carcinogens,

chemical-specific risk is calculated as the product of the dose and the slope factor.

$$\text{Risk} = \text{Dose (mg/kg/day)} \times \text{Slope Factor (mg/kg/day)}^{-1}$$

Total risk was calculated by summing the chemical specific risk for each pathway and summing across all intake pathways.

$$\text{Risk}_{\text{Total}} = \sum \text{Risk}_{\text{Individual Compounds Across Pathway}}$$

Systemic Risk

Systemic risk was calculated by using the exposure concentration of each reported TPH CWG fraction. The fraction concentrations were incorporated into standard intake equations (Tables 6 and 7) to derive a dose for both ingestion of soil and for dermal contact. For systemics, fraction specific hazard quotients (HQs) were calculated by dividing the dose by the fraction specific reference dose (RfD).

$$\text{Hazard Quotient (HQ)} = \text{Dose (mg/kg/day)} / \text{RfD (mg/kg/day)}$$

Total cumulative risk (Hazard Index (HI)) was calculated by summing the fraction specific HQs for each fraction across each pathway, and summing across all intake pathways.

$$\text{Hazard Index (HI)} = \sum \text{HQ}_{\text{Across Pathways}}$$

See Appendix B - Risk Characterization Calculations - for a description of the crude oil pit-specific risk assessment calculations for carcinogenic and systemic compounds/fractions for each individual pathway and MEI receptor.

Identification of Risk Characterization Uncertainties

Listed below are sources of uncertainty associated with the risk characterization phase of the risk assessment. Since risk characterization takes information from the exposure assessment and toxicity assessment, the uncertainties with these phases also affects the risk characterization phase.

- (1) no incorporation of biodegradation and effects on lifetime excess risk levels
- (2) cumulative risk and mixture interactions

Statistical Analysis of Data

Data were analyzed statistically using SPSS Release 7.5.2 for Windows licensed to Oklahoma State University.

Correlations between soil TPH concentrations and carcinogenic and systemic risk for both adult and child receptors were conducted to develop soil risk curves and risk-based cleanup levels as related to total TPH.

Correlations were made between the two analytical methods (TPH CWG direct method and TPH Method 8015M). Comparisons were made with respect to the TPH CWG total TPH and TPH Method 8015M total TPH for the ranges C5 - C28 and C5 - C40. The data were correlated to test the working hypothesis of a relationship between the two methods, in an attempt to validate the TPH Method 8015M as an indicator of unacceptable risk.

CHAPTER 4

RESULTS

The purpose of this study was to examine the potential for risk-based restoration of abandoned crude oil pits. This investigation was accomplished by answering the following questions, first presented in chapter one:

- (1) Based on standard, EPA assessment assumptions, can abandoned crude oil pits be safely left in place without land use restrictions?
- (2) Based on standard, EPA assessment assumptions, is land application of crude oil pit soil an acceptable restoration protocol?
- (3) Are TPH concentrations in soil positively correlated with risk estimates. If so, what risk do current TPH soil cleanup levels pose?
- (4) Can the traditional TPH Method 8015 Modified function as a valid indicator of unacceptable risk?

The following are the results to the questions enumerated above. Note that the results of the first two questions are discussed in Chapter 5 - Conclusions.

Risk Calculations

Carcinogenic risk calculations for ingestion of soil by adult receptors show unacceptable risk in four of the 15 samples (risk exceeds *de minimus* levels (1E-06)). Calculations of cancer risk owing to ingestion range from 5E-09 to 5E-06. Carcinogenic risk calculations for dermal contact with soil by adult receptors were greater than *de minimus* in 14 of the 15 samples. Calculations of cancer

risk owing to dermal exposure range from 2E-07 to 2E-04. Cumulative risk for both pathways was greater than *de minimus* in 14 of the 15 samples.

Cumulative cancer risk calculations range from 3E-07 to 3E-04.

Systemic risk calculations for ingestion of soil by adult receptors show acceptable risk in all samples (hazard index (HI) is less than one). The ingestion systemic hazard indices range from 3.04E-03 to 2.49E-01. Systemic risk calculations for dermal contact with soil by adult receptors show a HI >1 in 13 of the 15 samples. The dermal systemic hazard indices range from 1.21E-01 to 9.91E+00. Cumulative systemic risk across the two pathways show hazard indices >1 in 13 of the 15 samples. The cumulative systemic hazard indices range from 1.24E-01 to 1.02E+01. See Table X - Summary of Carcinogenic and Systemic Risk (Adult) - for a summary of the calculated risks for carcinogens and systemically toxic compounds in weathered crude.

Carcinogenic child risk calculations for ingestion of soil, dermal contact, and for cumulative carcinogenic risk across pathways are above *de minimus* in 14 of the 15 samples. Cancer risk estimates range from 4E-08 to 4E-05 for soil ingestion, 3E-07 to 3E-04 for dermal contact, and 4E-07 to 4E-04 for total cumulative risk.

Systemic risk calculations for ingestion of soil by child receptors, show a HI <1 in 14 of the 15 samples. The ingestion systemic hazard indices range from 2.28E-02 to 1.87E+00. Systemic risk calculations for dermal contact with soil show a HI >1 in 13 of the 15 samples. The dermal systemic hazard indices range from 2.06E-01 to 1.69E+01.

Table X

Summary of Carcinogenic and Systemic Risk (Adult)

<u>Pit Name</u>	<u>Carcinogenic Risk¹ (POD 10⁻⁶)</u>			<u>Systemic Risk² (HI=1.0)</u>		
	<u>Ingestion</u>	<u>Dermal</u>	<u>Total</u>	<u>Ingestion</u>	<u>Dermal</u>	<u>Total</u>
Barrick	8E-07	3E-05*	4E-05*	5.00E-02	1.99E+00*	2.04E+00*
Caughlin	2E-06*	6E-05*	7E-05*	7.15E-02	2.85E+00*	2.92E+00*
Choquette	2E-06*	9E-05*	1E-04*	1.27E-01	5.04E+00*	5.17E+00*
Dewitt	5E-06*	2E-04*	3E-04*	2.49E-01	9.91E+00*	1.02E+01*
Hyde	1E-06*	4E-05*	5E-05*	5.57E-02	2.22E+00*	2.28E+00*
Lair	5E-07	2E-05*	3E-05*	3.23E-02	1.29E+00*	1.32E+00*
Landrum-North	5E-09	2E-07	3E-07	3.04E-03	1.21E-01	1.24E-01
Landrum-South	1E-06*	5E-05*	6E-05*	6.15E-02	2.45E+00*	2.51E+00*
Mandrell-North	2E-06*	7E-05*	8E-05*	9.25E-02	3.69E+00*	3.78E+00*
Mandrell-South	3E-07	1E-05*	2E-05*	1.44E-02	5.72E-01	5.86E-01
Martin	8E-07	3E-05*	4E-05*	4.99E-02	1.99E+00*	2.04E+00*
Pollard-East	1E-06*	5E-05*	6E-05*	6.56E-02	2.61E+00*	2.68E+00*
Pollard-West	1E-06*	4E-05*	5E-05*	5.82E-02	2.32E+00*	2.38E+00*
Walters-East	4E-07	2E-05*	3E-05*	2.64E-02	1.05E+00*	1.08E+00*
Walters-West	1E-06*	5E-05*	6E-05*	9.43E-02	3.75E+00*	3.84E+00*

1 Carcinogenic Risk = Dose x Slope Factor

2 Systemic Risk = Dose / RFD

* Indicates Unacceptable Risk

Cumulative systemic risk across the pathways show hazard indices >1 in 14 of the 15 samples. These hazard indices range from 2.29E-01 to 1.88E+01. See Table XI - Summary of Carcinogenic and Systemic Risk (Child) for an outline of the calculated risks for carcinogens and systemically toxic compounds.

Table XI

Summary of Carcinogenic and Systemic Risk (Child)

Pit Name	Carcinogenic Risk ¹ (POD 10 ⁻⁸)			Systemic Risk ² (HI>1.0)		
	Ingestion	Dermal	Total	Ingestion	Dermal	Total
Barrick	6E-06*	6E-05*	7E-05*	3.75E-01	3.39E+00*	3.77E+00*
Caughlin	1E-05*	1E-04*	2E-04*	5.36E-01	4.84E+00*	5.38E+00*
Choquette	2E-05*	2E-04*	3E-04*	9.49E-01	8.57E+00*	9.52E+00*
Dewitt	4E-05*	3E-04*	4E-04*	1.87E+00	1.69E+01*	1.88E+01*
Hyde	8E-06*	8E-05*	9E-05*	4.18E-01	3.77E+00*	4.19E+00*
Lair	4E-06*	3E-05*	4E-05*	2.43E-01	2.19E+00*	2.43E+00*
Landrum-North	4E-08	3E-07	4E-07	2.28E-02	2.06E-01	2.29E-01
Landrum-South	1E-05*	9E-05*	1E-04*	4.62E-01	4.17E+00*	4.63E+00*
Mandrell-North	1E-05*	1E-04*	2E-04*	6.94E-01	6.27E+00*	6.96E+00*
Mandrell-South	2E-06*	2E-05*	3E-05*	1.08E-01	9.73E-01	1.08E+00*
Martin	6E-06*	5E-05*	6E-05*	3.74E-01	3.38E+00*	3.75E+00*
Pollard-East	9E-06*	8E-05*	9E-05*	4.92E-01	4.44E+00*	4.93E+00*
Pollard-West	8E-06*	7E-05*	8E-05*	4.36E-01	3.94E+00*	4.38E+00*
Walters-East	3E-06*	3E-05*	4E-05*	1.98E-01	1.79E+00*	1.99E+00*
Walters-West	9E-06*	8E-05*	9E-05*	7.07E-01	6.38E+00*	7.09E+00*

1 Carcinogenic Risk = Dose x Slope Factor

2 Systemic Risk = Dose / RfD

* Indicates Unacceptable Risk

Soil TPH Concentration and Levels of Risk

Risk curves and risk-based cleanup levels were developed by correlating total cumulative risk (both carcinogenic and systemic for adult and child receptors) with total soil TPH. Figures 6 through 9 depict these relationships. Soil TPH concentrations of 772 mg/kg and 76 mg/kg, at the 50th-percentile confidence limit, correlates to acceptable carcinogenic risk levels (at 10^{-6}) for adult and child receptors, respectively. Soil TPH concentrations of 867 mg/kg and 321 mg/kg, at the 50th-percentile confidence limit, correlates to acceptable systemic risk levels for adult and child receptors, respectively. Further discussion on the implications of the risk curves are discussed in Chapter 5 - Conclusions.

Comparison of TPH Methods

There is no correlation (at .05 level of significance) between TPH methods. The correlations were examined between the TPH CWG total TPH and TPH Method 8015M for the ranges C5 - C28 and C5 - C40. Figure 10 depicts the correlation between the direct method and TPH Method 8015 Modified (C5 - C40 range). Figure 11 depicts the correlation between the direct method and TPH Method 8015 Modified (C5 - C28 range).

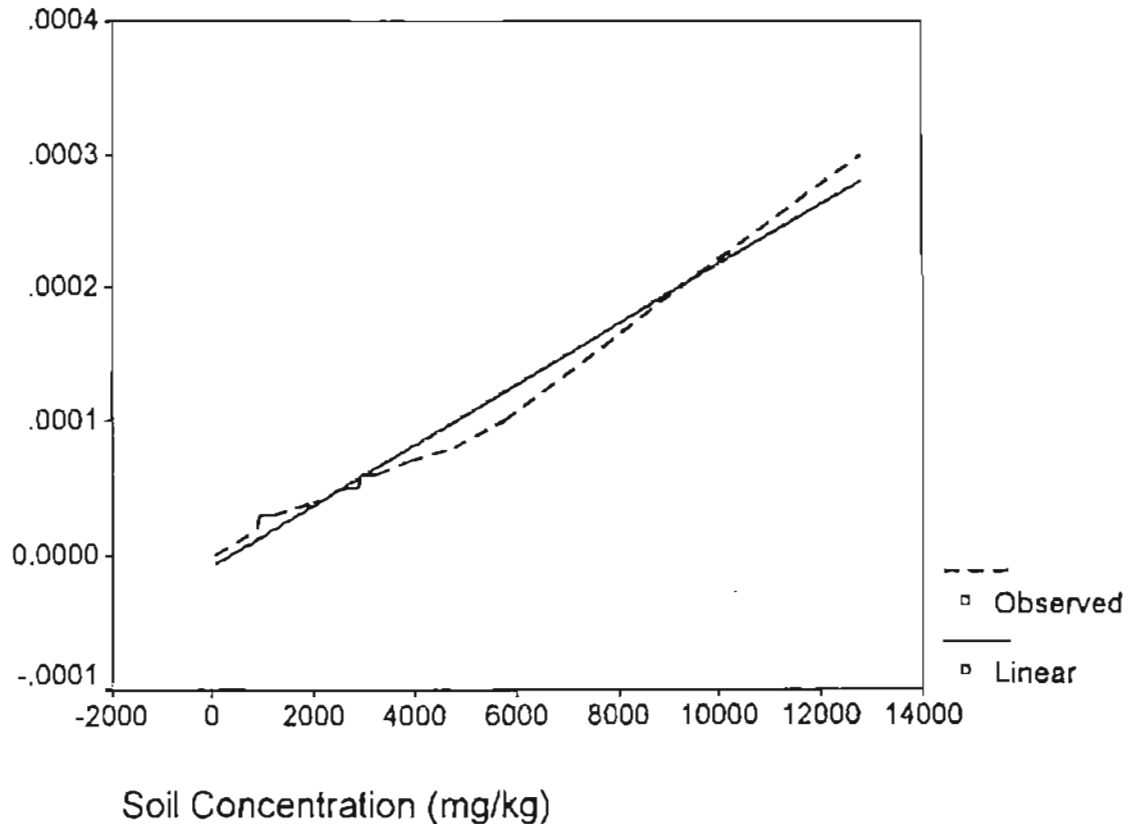
Carcinogenic Risk and Soil TPH Concentration (Adult)

Correlations

		Carcinogenic Risk	SOIL TPH CWG
Pearson Correlation	Carcinogenic Risk	1.000	.986**
	SOIL TPH CWG	.986**	1.000
Sig. (2-tailed)	Carcinogenic Risk	.	.000
	SOIL TPH CWG	.000	.
N	Carcinogenic Risk	15	15
	SOIL TPH CWG	15	15

** . Correlation is significant at the 0.01 level (2-tailed).

Carcinogenic Risk



Carcinogenic Risk = $2.2E-08 \times (\text{Soil TPH Concentration mg/kg}) - 7E-06$
 For Risk = $10E-06$ (acceptable risk)
 $\text{TPH} = ((10E-06 + 7E-06)/2.2E-08) = 772 \text{ mg/kg} \pm 1,389 \text{ mg/kg}$
 (at 95th-percentile confidence limit)

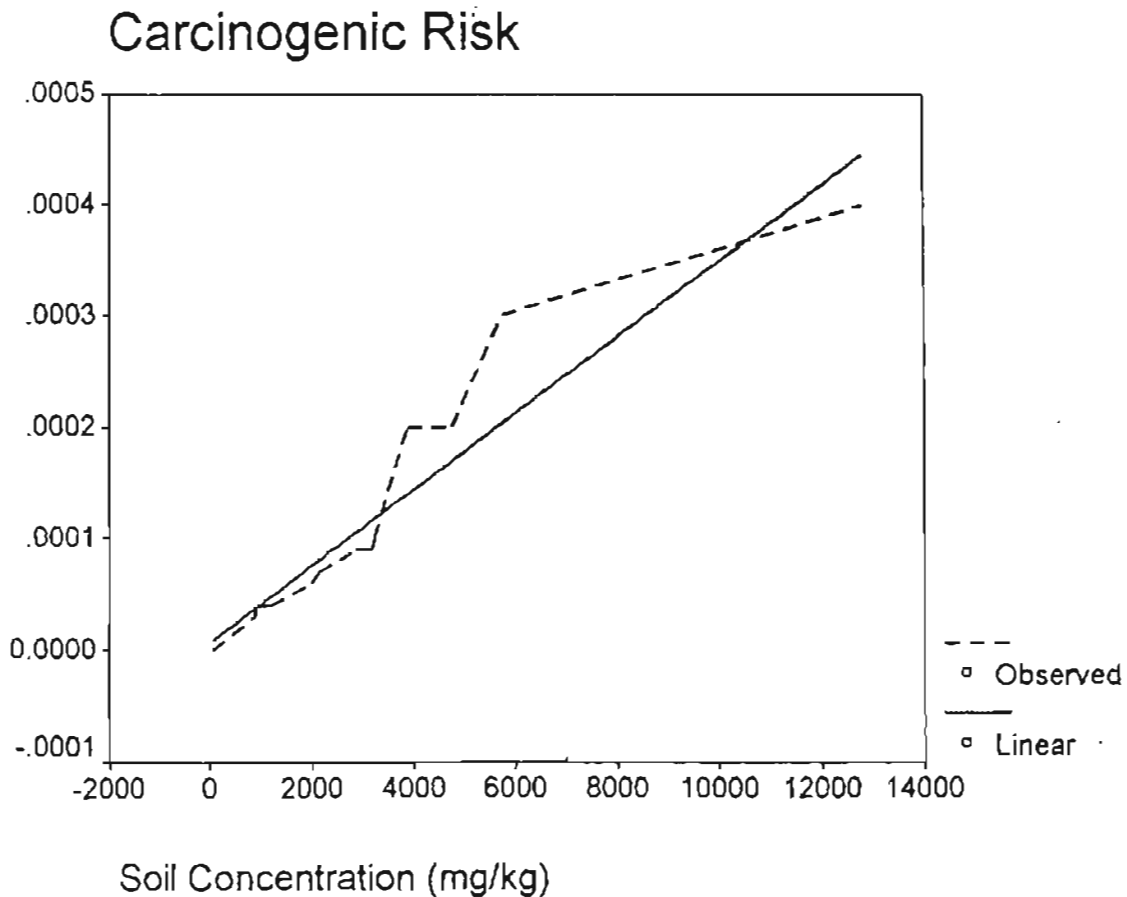
Figure 6 Comparison of Carcinogenic Risk and Total Petroleum Hydrocarbon Soil Concentrations for an Adult Receptor

Carcinogenic Risk and Soil TPH Concentration (Child)

Correlations

		SOIL TPH CWG	Carcinogenic Risk
Pearson Correlation	SOIL TPH CWG	1.000	.945**
	Carcinogenic Risk	.945**	1.000
Sig. (2-tailed)	SOIL TPH CWG	.	.000
	Carcinogenic Risk	.000	.
N	SOIL TPH CWG	15	15
	Carcinogenic Risk	15	15

** Correlation is significant at the 0.01 level (2-tailed).



$$\text{Carcinogenic Risk} = 3.4\text{E-}08 \times (\text{Soil TPH Concentration mg/kg}) + 7.4\text{E-}06$$

For Risk = $10\text{E-}06$ (acceptable risk)

$$\text{TPH} = ((10\text{E-}06 - 7.4\text{E-}06)/3.4\text{E-}08) = 76 \text{ mg/kg} \pm 1,389 \text{ mg/kg}$$

(at 95th-percentile confidence limit)

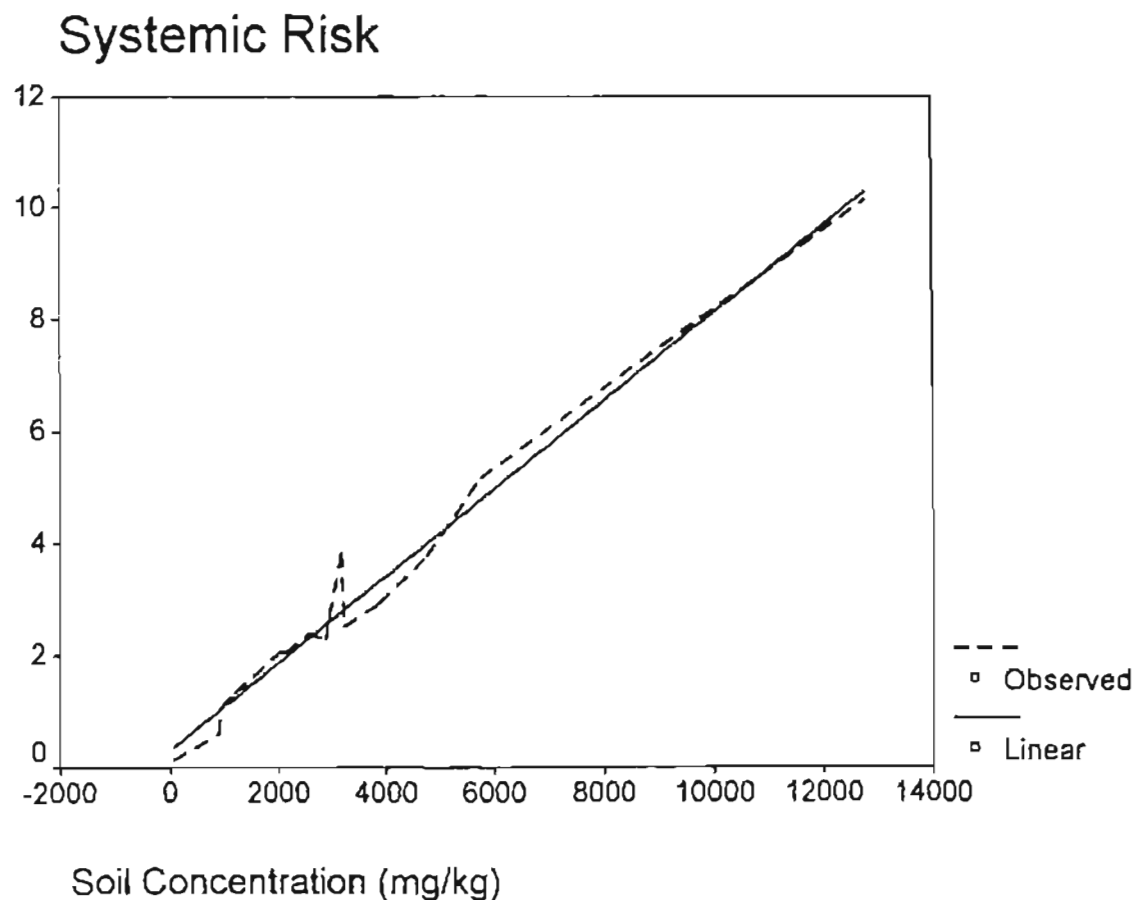
Figure 7 Comparison of Carcinogenic Risk and Total Petroleum Hydrocarbon Soil Concentrations for a Child Receptor

Systemic Risk and Soil TPH Concentration (Adult)

Correlations

		SOIL TPH CWG	Systemic Risk
Pearson Correlation	SOIL TPH CWG	1.000	.988**
	Systemic Risk	.988**	1.000
Sig. (2-tailed)	SOIL TPH CWG	.	.000
	Systemic Risk	.000	.
N	SOIL TPH CWG	15	15
	Systemic Risk	15	15

** . Correlation is significant at the 0.01 level (2-tailed).



Systemic Risk = $0.0008 \times (\text{Soil TPH Concentration mg/kg}) + 0.3059$
 For Risk = 1 (acceptable risk)
 $\text{TPH} = ((1.0 - 0.3059)/0.0008) = 867 \text{ mg/kg} \pm 1,389 \text{ mg/kg}$
 (at 95th-percentile confidence limit)

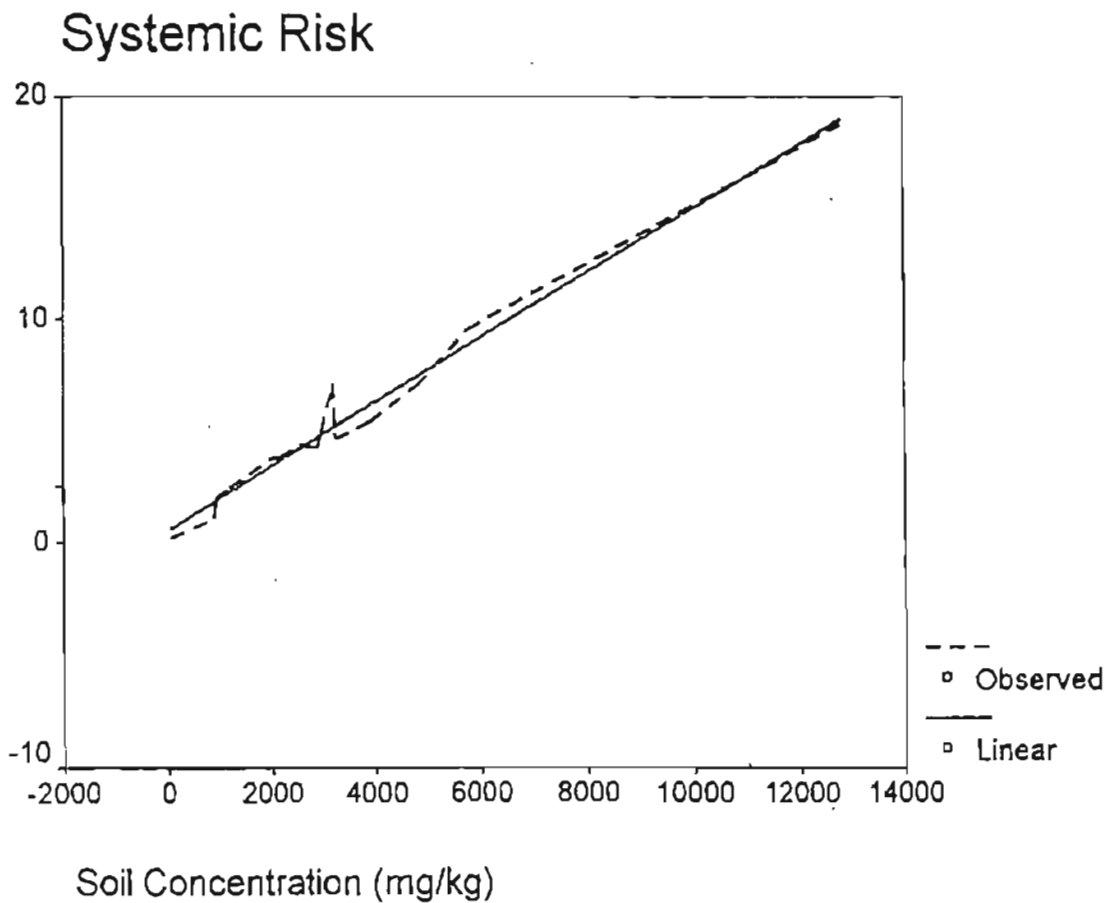
Figure 8 Comparison of Systemic Risk and Total Petroleum Hydrocarbon Soil Concentrations for an Adult Receptor

Systemic Risk and Soil TPH Concentration (Child)

Correlations

		SOIL TPH CWG	Systemic Risk
Pearson Correlation	SOIL TPH CWG	1.000	.988**
	Systemic Risk	.988**	1.000
Sig. (2-tailed)	SOIL TPH CWG	.	.000
	Systemic Risk	.000	.
N	SOIL TPH CWG	15	15
	Systemic Risk	15	15

** . Correlation is significant at the 0.01 level (2-tailed).



$$\text{Systemic Risk} = 0.0014 \times (\text{Soil TPH Concentration mg/kg}) + 0.5497$$

For Risk = 1 (acceptable risk)
 $\text{TPH} = ((1.0 - 0.5497)/0.0014) = 321 \text{ mg/kg} \pm 1,389 \text{ mg/kg}$
 (at 95th-percentile confidence limit)

Figure 9 Comparison of Systemic Risk and Total Petroleum Hydrocarbon Soil Concentrations for a Child Receptor

Correlation of TPH Methods

Descriptive Statistics

	Mean	Std. Deviation	N
TPH CWG	3272.20	3039.82	15
TPH 8015 Mod.	3125.93	3573.44	15

Correlations

		TPH CWG	TPH 8015 Mod.
Pearson Correlation	TPH CWG	1.000	.165
	TPH 8015 Mod.	.165	1.000
Sig. (2-tailed)	TPH CWG	.	.557
	TPH 8015 Mod.	.557	.
N	TPH CWG	15	15
	TPH 8015 Mod.	15	15

Comparison of TPH Method Results

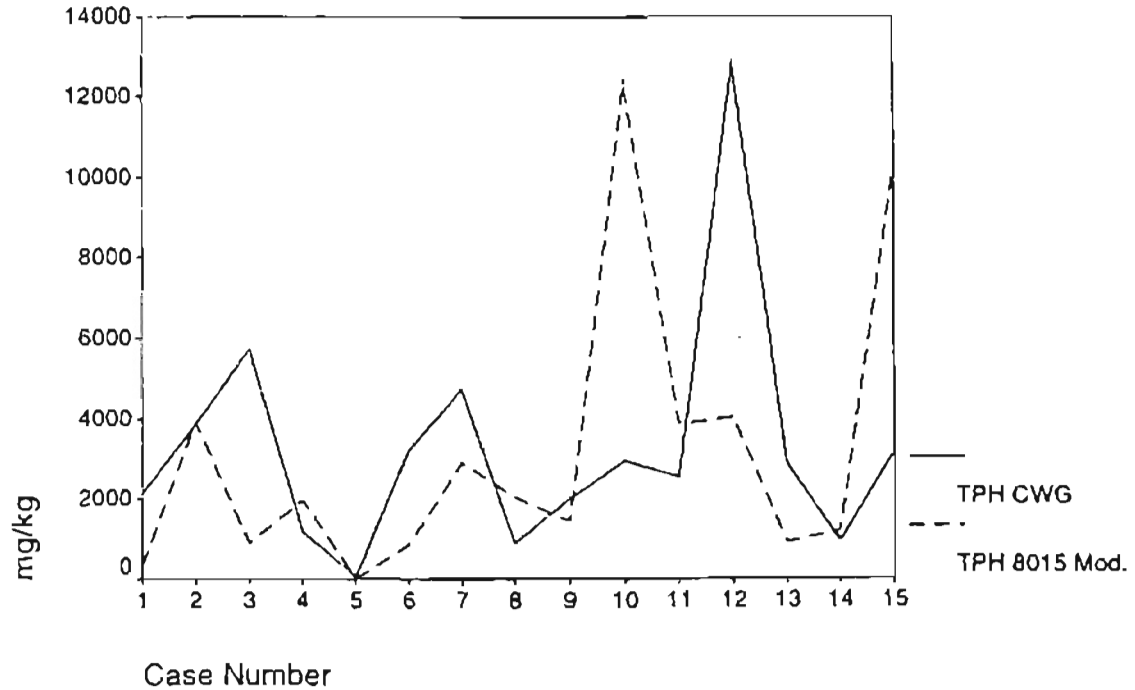


Figure 10 Correlation of TPH Methods

Correlation of TPH Methods - 2

Correlations

		SOIL TPH CWG	TPH 8015M (C5-C28)
Pearson	SOIL TPH CWG	1.000	.164
Correlation	TPH 8015M (C5-C28)	.164	1.000
Sig. (2-tailed)	SOIL TPH CWG	.	.559
	TPH 8015M (C5-C28)	.559	.
N	SOIL TPH CWG	15	15
	TPH 8015M (C5-C28)	15	15

Comparison of TPH Method Results

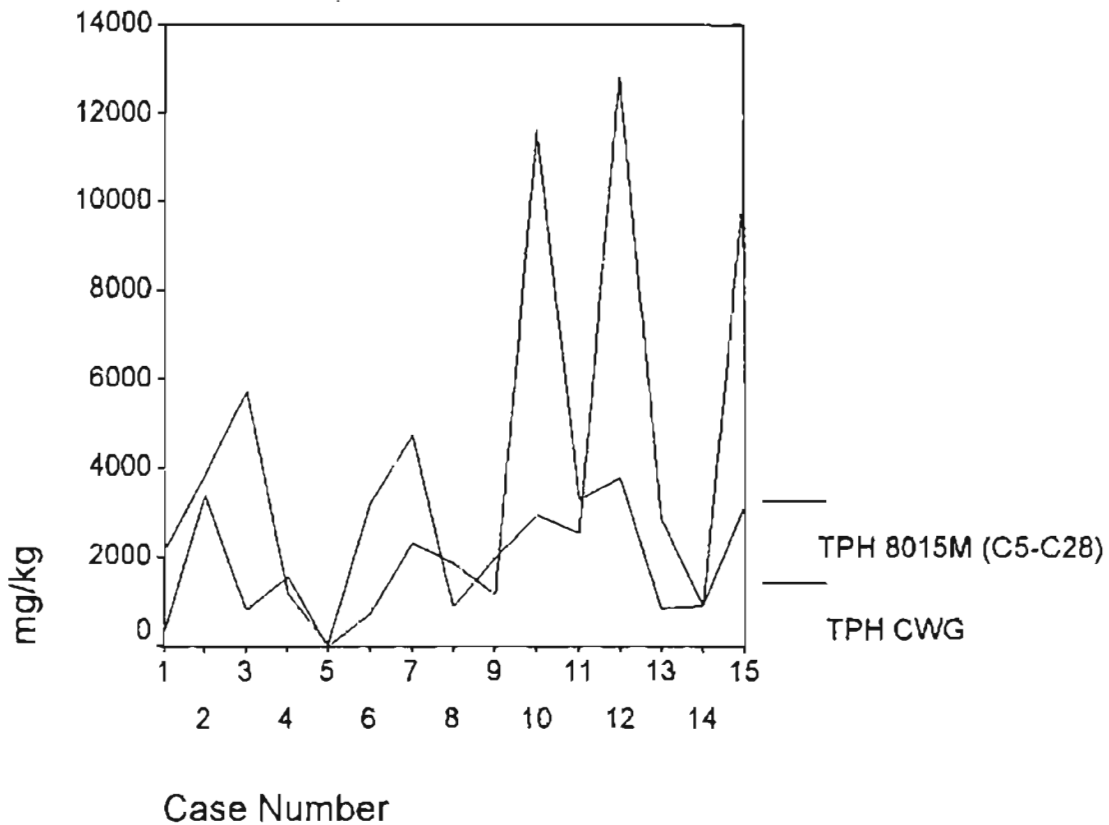


Figure 11 Correlation of TPH Methods - 2

CHAPTER 5

CONCLUSIONS

From the results of this study, important conclusions can be drawn on the questions posed about risk-based site restoration of crude oil pits. First, under the risk assumptions used to calculate total risk, abandoned crude oil pits pose unacceptable risk and cannot be closed in-place. The dermal contact pathway is the major cause of unacceptable risks.

Using an average calculated adult cancer risk level of $1E-04$ found in this study, the risk levels are approximately 100 times greater than EPA's $1E-06$ *de minimus* levels that are used as points of departure in risk management decision making. Using a residential setting based on lifetime exposures, a human receptor could expect to develop cancer from only 250 days of continuous exposure to impacted pit soil, (based on a residential exposure averaging time of 25,550 days for carcinogens (70 years x 365 days/year)). Table XII - Comparison of Cancer Risk Levels to Exposure Duration (days) - describes a breakdown of the cancer risk levels and expected site exposure duration (in days) to developing cancer.

Table XII
Comparison of Cancer Risk Levels to Exposure Duration (days)

<u>Cancer Risk</u>	<u>Exposure Duration (days)</u>
1E-04	25,000
1E-05	2,500
1E-06	250
1E-07	25

The second conclusion drawn from this research is that land application of impacted soil is not an acceptable restoration protocol unless administrative controls are enforced to restrict access to the sites. With risk levels that are approximately 100 times greater than *de minimus*, land applied contaminated soil would have to be diluted at a 100:1 ratio of non-impacted soil to impacted soil to lower the risk estimates to *de minimus* risk. By bringing impacted soil to the surface, the likelihood of exposure to chemicals and magnitude of risk is increased. This study suggests not to excavate the impacted soil, but to establish restricted land use conditions as the acceptable protocol.

The third conclusion drawn from this study compares the relationship between soil TPH and risk levels. Though Oklahoma currently has not promulgated TPH cleanup levels for crude oil, at least 30 states have set specific cleanup levels or guidelines based on the TPH measurement (Oliver and Kostecki, 1992). The most commonly used soil cleanup standard for TPH is 100 mg/kg, although the standards and guidelines range from background concentrations to 10,000 mg/kg TPH in soil (Michelson and Boyce, 1993).

These promulgated cleanup levels; however, are not based on the TPH CWG direct method, but are determined from different analytical methods for measuring TPH concentrations and are based on different carbon ranges. Only if the states adopt the TPH CWG's method can a comparison of risk-based cleanup levels calculated from this research be compared to those of other states.

Under the assumptions outlined in this research, risk-based mean soil TPH concentrations are 772 mg/kg and 76 mg/kg, \pm 1389 mg/kg at the 95th-percentile confidence limit, correlates to acceptable carcinogenic risk levels (at 10^{-6}) for adult and child receptors, respectively. Mean soil TPH concentrations are 867 mg/kg and 321 mg/kg, \pm 1389 mg/kg at the 95th-percentile confidence limit, correlates to acceptable systemic risk levels for adult and child receptors, respectively. These risk-based cleanup levels are based on protection (at *de minimus* levels) of adult human receptors via soil ingestion and dermal contact pathways.

Finally, the data suggest that there is no correlation between the TPH CWG's direct method and TPH Method 8015 Modified (either C5-C28 or C5-C40 ranges). This implies that the simple, relatively inexpensive, TPH Method 8015M is not a valid indicator of unacceptable risk. This can potentially be explained by the variation of distributed TPH in soil; Method 8015M does not selectively remove all hydrocarbons (i.e., the method may be influenced by "background organic noise") and the relatively few number of observations used to calculate correlations.

CHAPTER 6

IMPLICATIONS AND FUTURE RESEARCH

Implications of this research include:

- (1) Under a residential exposure setting, abandoned crude oil pits cannot be closed in place without administrative land use restrictions;
- (2) Land application of crude oil waste requires administrative land use restrictions;
- (3) TPH Method 8015 Modified cannot be used as a risk indicator;
- (4) A soil TPH concentration of 50 mg/kg should be employed as a risk-based cleanup level for crude oil-impacted soil to protect human receptors against ingestion of and dermal contact with impacted soil.

An important variable not considered in this research is the rate of biodegradation for the petroleum fractions and for carcinogenic compounds. Because biodegradation is a function of site specific characteristics and the specific chemical, rates can vary by orders of magnitude from site to site. It was determined for this study to assume a biodegradation rate of zero in this initial screening level study of risk-based decision making for abandoned pits.

Research to define better the use of risk-based site closures of abandoned crude oil pits should include:

- (1) Collection of composite soil samples in areas where crude oil waste has been land applied, followed by analysis of the samples for carcinogenic PAHs outlined herein and for the TPH CWG direct

method. A risk assessment utilizing the same intake assumptions from this research should be performed using these analytic data.

- (2) Examination of the potential for generating in-situ hydrocarbon degradation curves. Variables such as age, depth of sample, and soil type are predicted to be significant estimators of hydrocarbon degradation in crude oil pits.
- (3) Examination of the potential for generating ex-situ degradation rate curves from the expanded data set outlined in suggestion one above. The same variables outlined in suggestion two for determining the significance of the variables should be used in calculating risks.
- (4) Examination of the relationship between TPH concentration of crude oil contained in the pits and TPH concentration in soil should be examined. Variables such as TPH oil concentration, age, depth of sample, and soil type are predicted to be significant estimators of soil TPH.
- (5) Expansion of this data set by finding additional crude oil pits that satisfy the screening criteria should be analyzed to increase the number of observations such that the validity of the statistical analysis is increased.
- (6) Expansion of a potential groundwater exposure pathway should be considered. Simple fate and transport equations using soil concentrations to model the movement of chemical compounds and/or

fractions to hypothetical groundwater wells near the crude oil pits should be used.

(7) Applying different land use assumptions to generate risk estimates for scenarios other than residential exposure should be considered if land use restrictions are planned as institutional risk management strategies.

(8) Applying uncertainty analysis models to the intake variables to produce confidence limits and probability distributions to increase the validity of risk estimates.

In conclusion, the reader is cautioned to keep in mind that these results are preliminary. Due to the small sample size, it is impossible to state with confidence that current remediation schemes present unacceptable risk. Rather, this study suggests that further study, including more extensive sampling, investigation of groundwater, and rates of biodegradation, to name a few, should be conducted to add to the risk database. The findings of these additional studies can then be properly used to formulate policy regarding crude oil pit remediation.

Endnotes

¹ It should be noted that the TPH CWG methodology does not incorporate biodegradation rates into the risk assessment frameworks. It is not within the current scope of the TPH CWG's tasks to develop fraction-specific degradation rates, but it is an area they have acknowledged requires research (TPH CWG, 1996, Vol. 3).

² It should be noted the TPH CWG was not the first group to utilize fractions to evaluate risk from TPH. They acknowledge the Massachusetts Department of Environmental Protection as the first group to apply a fractional approach (MADEP, 1994). Also, British Columbia Environment later modified the MADEP approach to include fate and transport of fractions specific to ecological receptors (BCE, 1995).

³ Ecological exposure settings were considered for this study but were beyond the scope of this research.

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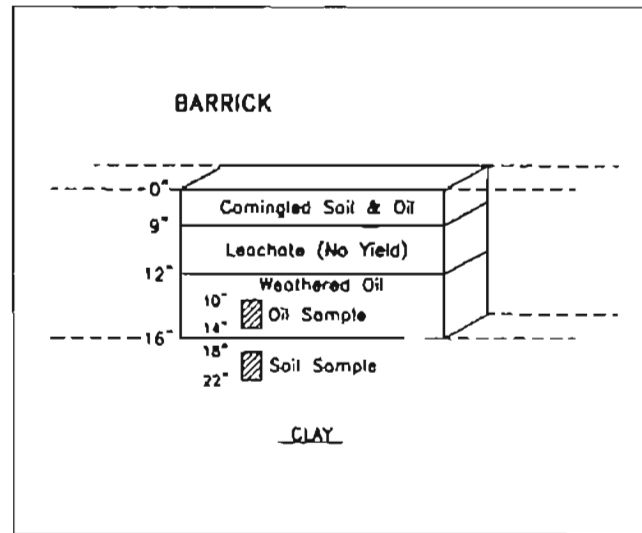
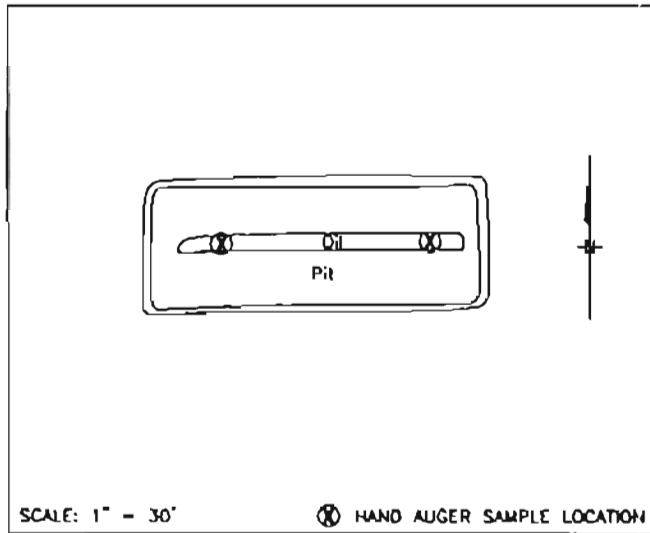
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APPENDIXES

APPENDIX A--CRUDE OIL PIT SUMMARIES

BARRICK PIT SUMMARY

USPLS: C N/2 NW/4 SEC. 29-T1S-R8W	County: STEPHENS	GPS: N34° 28' 51.1" W98° 03' 54.1"
Age: 77	Depth to Soil: 16"	Soil Type: CLAY
Open/Closed Pit: CLOSED	Thickness of Crude: 16"	Thickness of Covering: NA
Thickness of Water Body: 3" (NO YIELD)		Sampling Method: HAND AUGER



Pit Narratives: The Barrick pit appears to have been trenched and backfilled prior to closing. At the time of sampling crude oil had migrated to the surface through the trench. There was a thin veneer of leachate within the profile of the pit trench that did not yield enough fluid for sample collection. The crude oil that was sampled was a black, slightly weathered, heavy crude. There was not an appreciable commingling of soil in the oil sample from the trenching and backfilling of the pit during closure. The pit is located in pasture and only the crude seep is non-vegetated.

CALVIN PIT SUMMARY

USPLS: C SW/4 NE/4 SEC. 21-T16N-R8E

County: CREEK

GPS: N35° 51' 9.7"
W96° 27' 54.5"

Age: 72

Depth to Soil: 28"

Soil Type: NO SAMPLE TAKEN

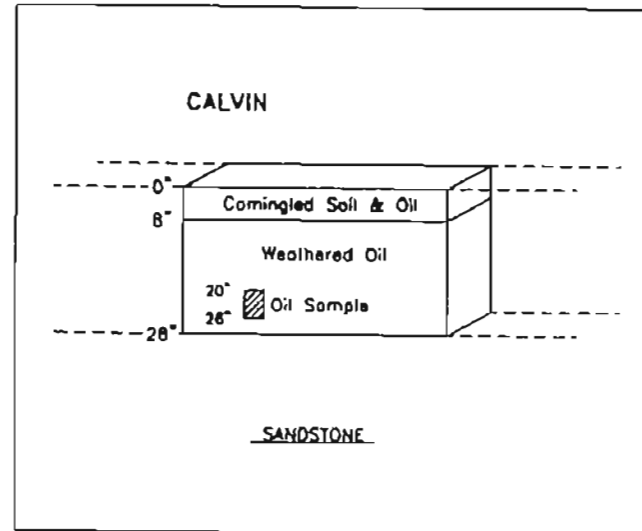
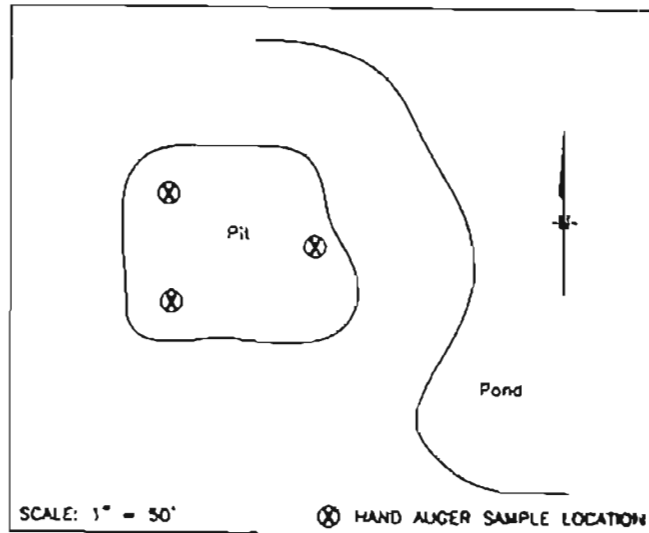
Open/Closed Pit: CLOSED

Thickness of Crude: 28"

Thickness of Covering: NA

Thickness of Water Body: NA

Sampling Method: HAND AUGER



Pit Narratives: The Calvin pit is a closed pit located adjacent to a farm pond in wooded pasture. The pit is located in an area of very shallow sandstone bedrock. No underlying soil sample was collected as a result. The crude oil has migrated to the surface in only localized areas through the soil cap.

CAUGHLIN PIT SUMMARY

USPLS: NW/4 SEC. 34-T25N-R1W

County: KAY

GPS: N36° 36' 15"
W97° 117' 50"

Age: 36

Depth to Soil: 22"

Soil Type: Silty Clay

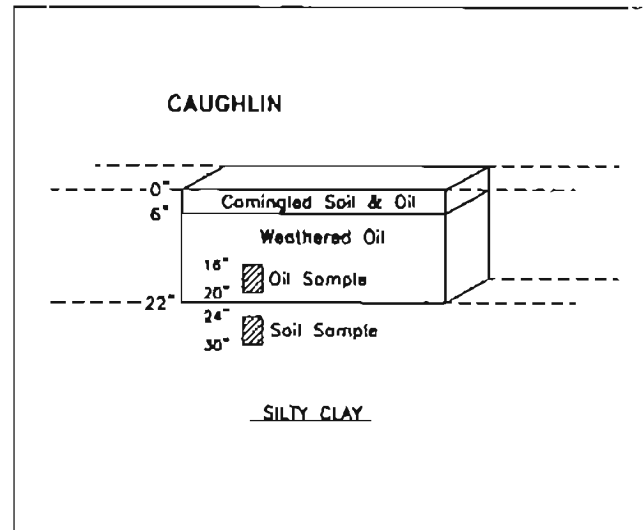
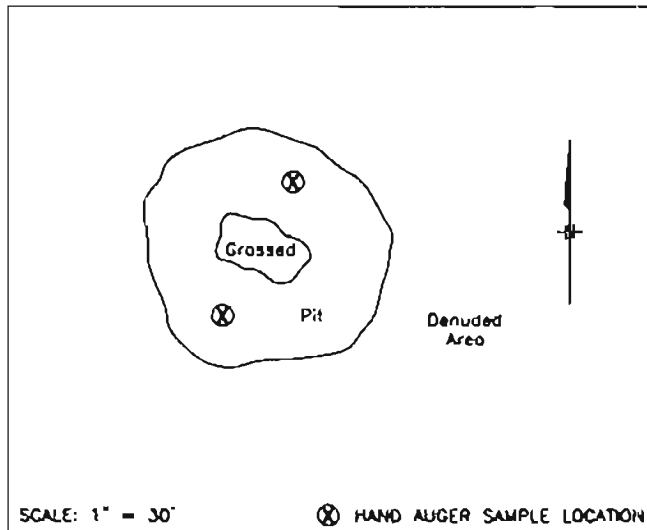
Open/Closed Pit: CLOSED

Thickness of Crude: 22"

Thickness of Covering: 6"

Thickness of Water Body: NA

Sampling Method: HAND AUGER



Pit Narratives: The Caughlin pit is a closed pit located within a very large denuded area in pasture. It is an open pit that does have a grassed center. The oil samples, at depth, were heavily laden with oil, but with a "light" hydrocarbon odor.

CHOQUETTE PIT SUMMARY

USPLS: SE/4 SW/4 NW/4 SEC. 9-T18N-R11E

County: CREEK

GPS: N35° 03' 19.5"
W96° 09' 08.1"

Age: 82

Depth to Soil: 40"

Soil Type: CLAY LOAM

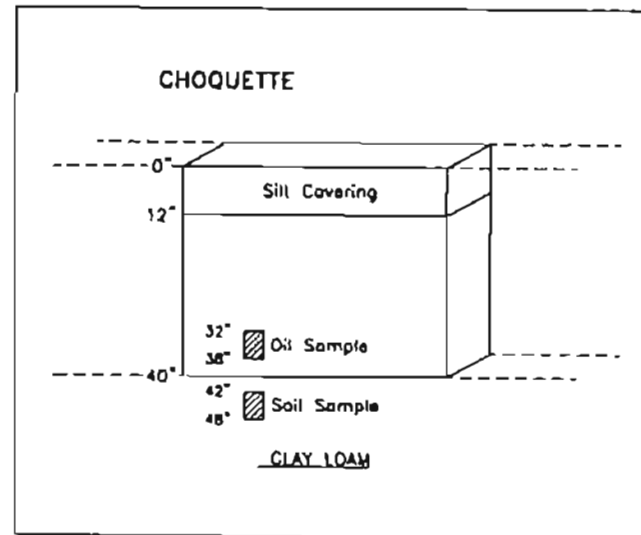
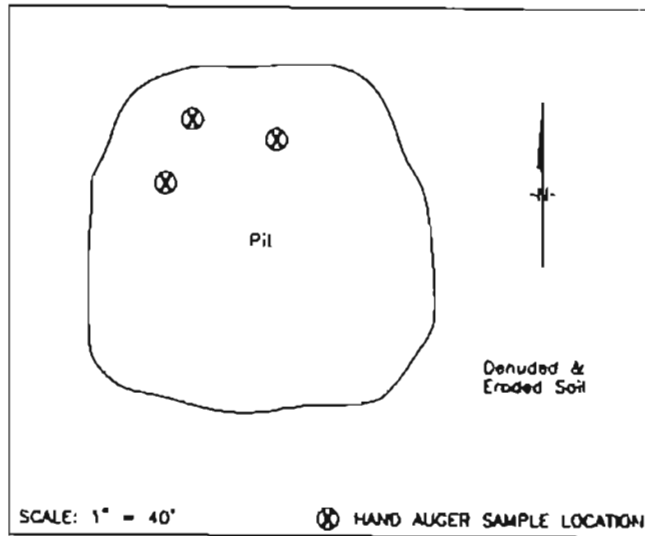
Open/Closed Pit: CLOSED

Thickness of Crude: 28"

Thickness of Covering: 12" (SILT)

Thickness of Water Body: NA

Sampling Method: HAND AUGER



Pit Narrative: The Choquette pit is located within a denuded area from historical brine spills. The outline of the pit is at a higher elevation than the existing terrain; as the weathered oil has held the soil in this area and has been resistant to erosion. Only sparsely vegetated scrub grasses grow in this area and the surrounding area is used as pasture. The oil samples did contain some commingling of soil and were weathered, heavy black crude oil samples.

D. BURNS PIT SUMMARY

USPLS: NE/4 SW/4 NE/4 SEC. 31-T1N-R8W

County: STEPHENS

GPS: N34° 31' 05.1"
W98° 04' 36.4"

Age: 69

Depth to Soil: 9"

Soil Type: CLAY LOAM

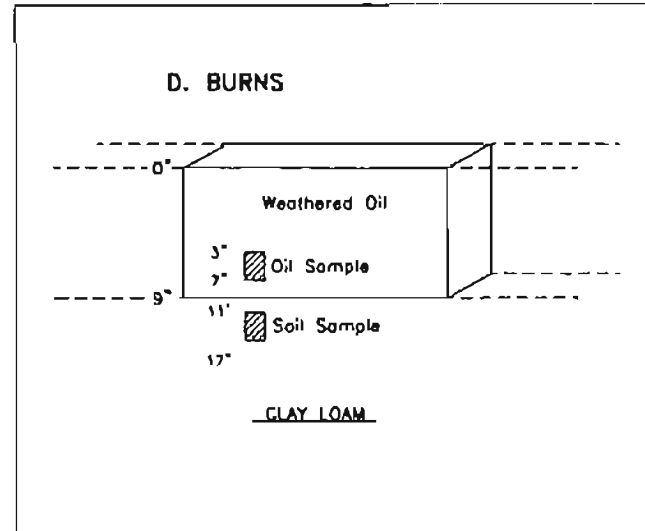
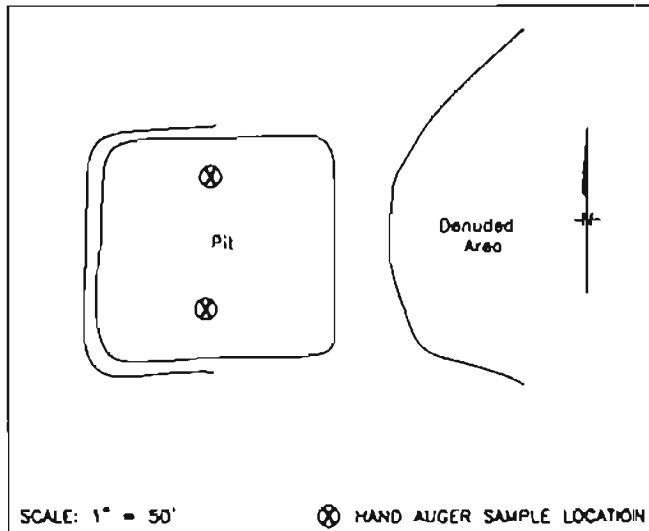
Open/Closed Pit: OPEN

Thickness of Crude: 9"

Thickness of Covering: NA

Thickness of Water Body: NA

Sampling Method: HAND AUGER



Pit Narratives: The D. Burns pit is located adjacent to a denuded area. There is grass established between the pit and the denuded area. The quarter section is used as pasture. The pit is a shallow pit; consequently, the oil samples were very weathered.

DEWITT PIT SUMMARY

USPLS: C SW/4 SE/4 SEC. 4-T13N-R8E

County: OKFUSKEE

GPS: N35° 37' 36.2"
W96° 27' 57.6"

Age: 74

Depth to Soil: 9"

Soil Type: FINE SAND/LOAMY FINE SAND

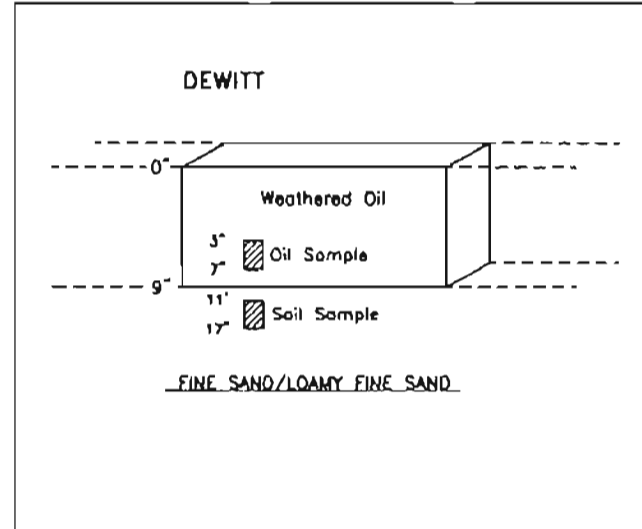
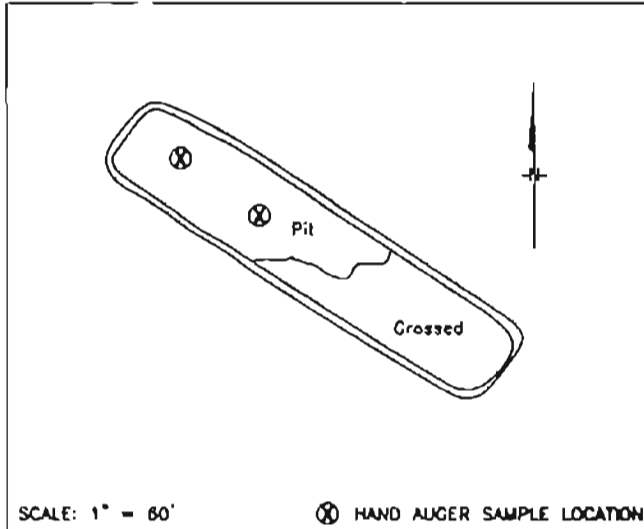
Open/Closed Pit: OPEN

Thickness of Crude: 9"

Thickness of Covering: NA

Thickness of Water Body: NA

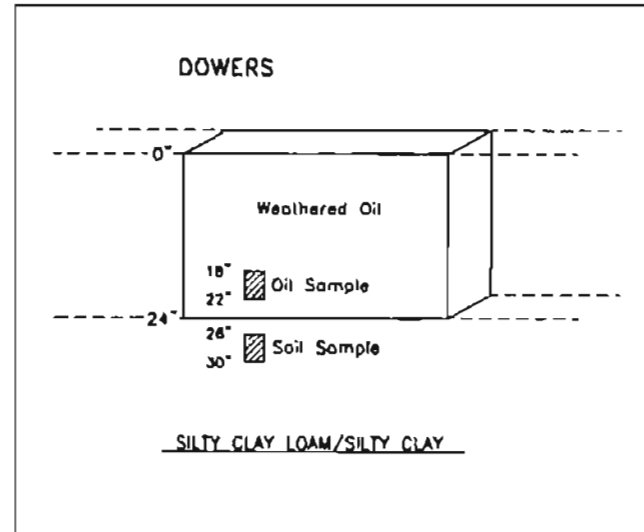
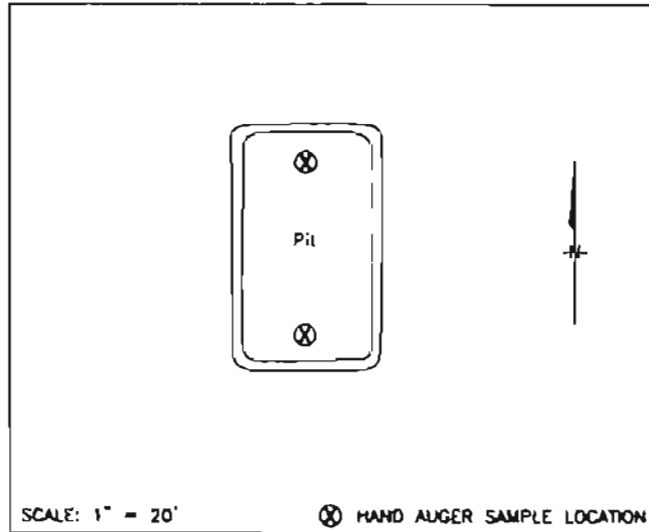
Sampling Method: HAND AUGER



Pit Narratives: The DeWitt pit is located within a clearing of a heavily wooded area. There is thick bermuda grass in the area and only the west side of the pit is non-vegetated. This region has shallow sandstone bedrock and this particular area is very sandy. This is a shallow open pit; consequently, the oil that was sampled was very weathered.

DOWERS PIT SUMMARY

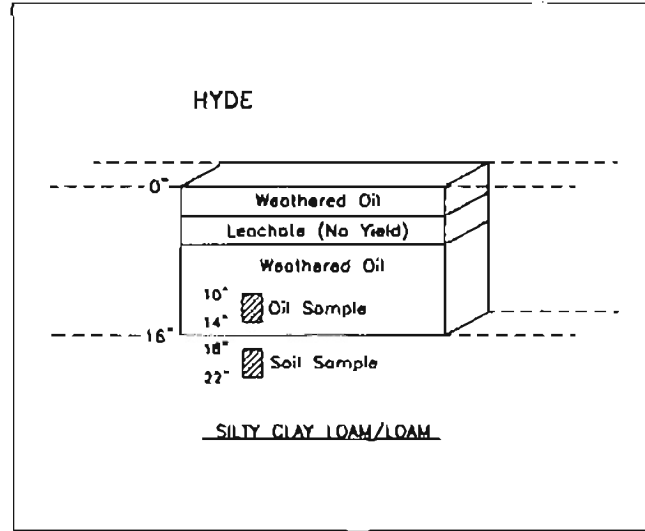
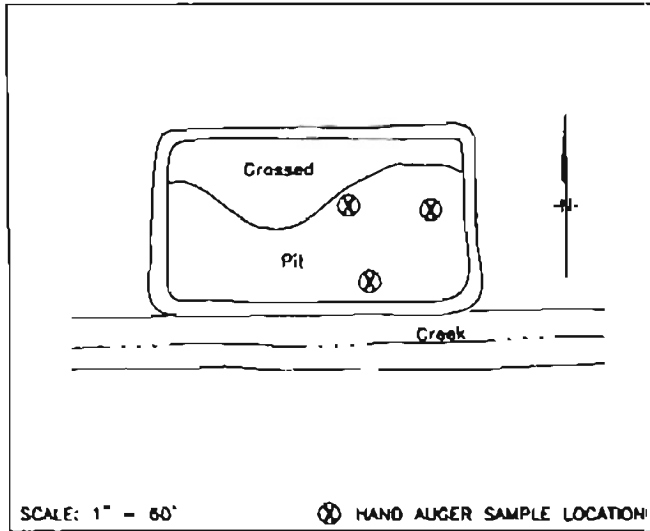
USPLS: NW/4 NE/4 SW/4 Section 2-T15N-R11E	County: OKMULGEE	GPS: N35° 48' 19.6" W96° 6' 56.6"
Age: 58	Depth to Soil: 24"	Soil Type: Olive Clay
Open/Closed Pit: CLOSED	Thickness of Crude: 24"	Thickness of Covering: NA
Thickness of Water Body: NA	Sampling Method: HAND AUGER	



Pit Narratives: The Dowers pit is a closed pit located in pasture. The crude oil has migrated to the surface and has re-defined the outline of the former pit. The surrounding areas are vegetated with thick bermuda grass. The crude oil samples were a very black, slightly weathered oil.

HYDE PIT SUMMARY

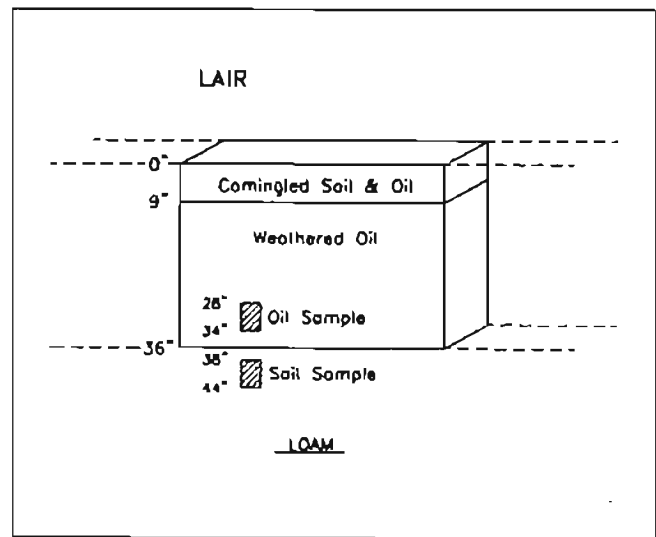
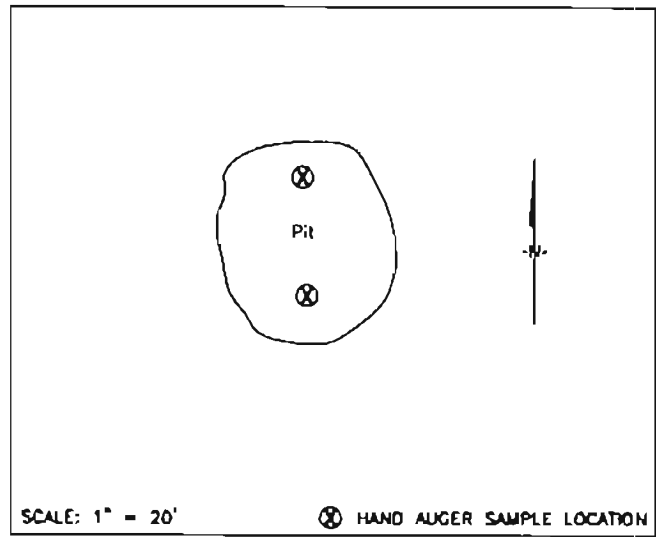
USPLS: C S/2 NW/4 NW/4 SEC. 12-T14N-R6E	County: LINCOLN	GPS: N35° 42' 26.9" W96° 37' 28.6"
Age: 54	Depth to Soil: 16"	Soil Type: SILTY CLAY LOAM/LOAM
Open/Closed Pit: OPEN	Thickness of Crude: 16"	Thickness of Covering: NA
Thickness of Water Body: 2" (NO YIELD)		Sampling Method: HAND AUGER



Pit Narratives: The Hyde pit is located adjacent to an intermittent stream. The south berm of the pit serves as the bank of the creek. The pit is also located in an area that is deeply incised by erosion from brine spills from historical practices. The pit is predominantly surrounded by eroded channels and denuded soils. Only sparse vegetation exists outside the denuded areas in this pastured quarter section. Within the soil profile was a thin veneer of leachate that did not yield enough for sampling. The oil that was sampled was a black, weathered, heavy crude oil.

LAIR PIT SUMMARY

USPLS: NE/4 SE/4 NW/4 SEC. 3-T27N-R15E	County: NOWATA	GPS: N36° 51' 15.9" W95° 41' 37.5"
Age: 72	Depth to Soil: 36"	Soil Type: CLAY
Open/Closed Pit: CLOSED	Thickness of Crude: 36"	Thickness of Covering: 8" SILT
Thickness of Water Body: NA		Sampling Method: HAND AUGER



Pit Narratives: The Lair pit is a closed pit located in pasture approximately 100 feet from an intermittent stream. The surrounding area is in brome grass prairie. The pit contains a soil cap that crude oil has migrated through to the surface. The crude oil was a black, weathered oil.

LANDRUM-NORTH PIT SUMMARY

USPLS: C W/2 NE/4 NW/4 SEC. 5-T10N-R8E

County: SEMINOLE

GPS: N35° 22' 29.5"
W96° 29' 20.6"

Age: 73

Depth to Soil: 32"

Soil Type: CLAY

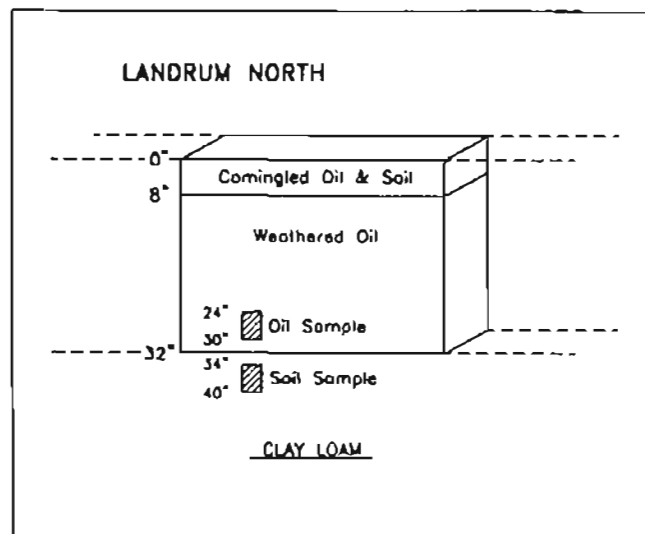
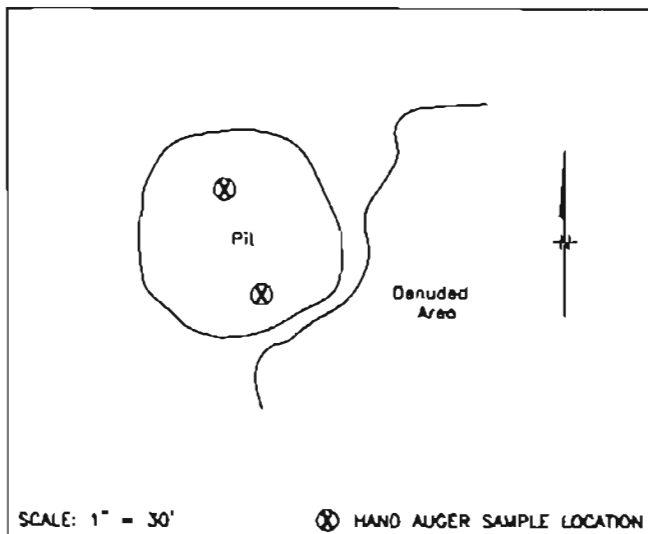
Open/Closed Pit: CLOSED

Thickness of Crude: 24"

Thickness of Covering: 8" SILT

Thickness of Water Body: NA

Sampling Method: HAND AUGER



Pit Narratives: The Landrum-North pit is a closed pit located adjacent to and within a small denuded area. Crude oil has migrated to the surface through the soil cap. The surrounding area (outside the pit and denuded area) is bermuda grass pasture. Directly on the down-gradient edge of the pit and denuded area are two large trees that are no longer living.

LANDRUM SOUTH PIT SUMMARY

USPLS: SW/4 SW/4 NE/4 SEC. 5-T10N-R8E

County: SEMINOLE

GPS: N35° 22' 18"
W96° 29' 4.7"

Age: 73

Depth to Soil: 16"

Soil Type: LOAM

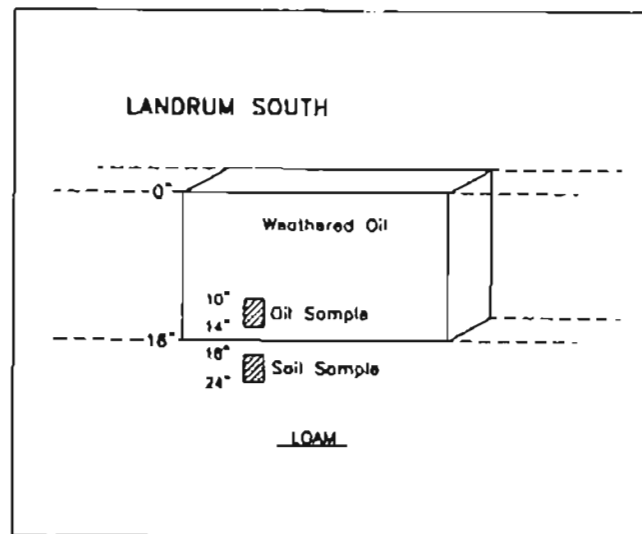
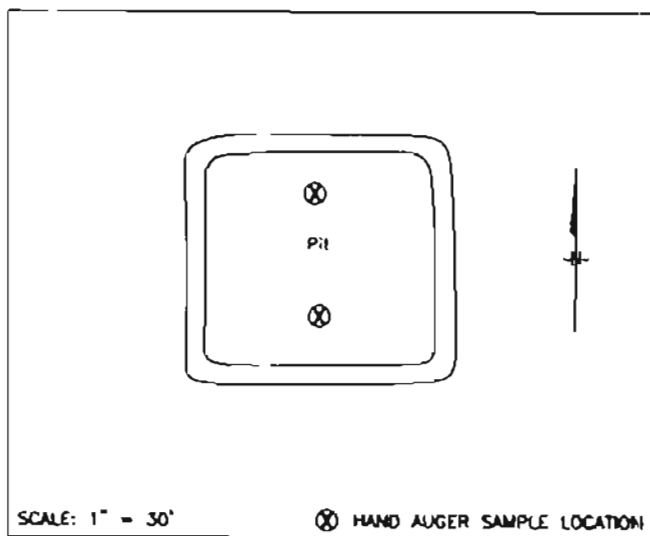
Open/Closed Pit: CLOSED

Thickness of Crude: 16"

Thickness of Covering: NA

Thickness of Water Body: NA

Sampling Method: HAND AUGER

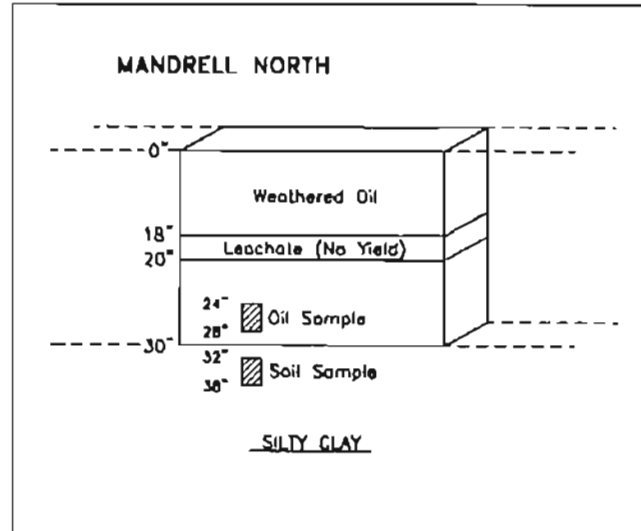
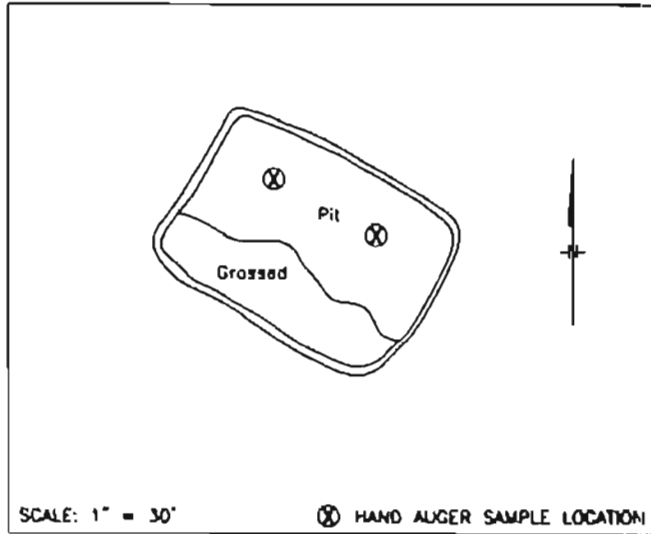


Pit Narrative: The Landrum-South pit is a closed pit located in pasture. Crude oil has migrated to the surface where it is now exposed. The area is surrounded by exposed sandstone rock and bermuda grass prairie.

MANDRELL NORTH PIT SUMMARY

USPLS: NE/4 NW/4 NW/4 SEC. 30-T15N-R11E County: OKMULGEE GPS: N35° 45' 15.7"
W96° 11' 22.7"

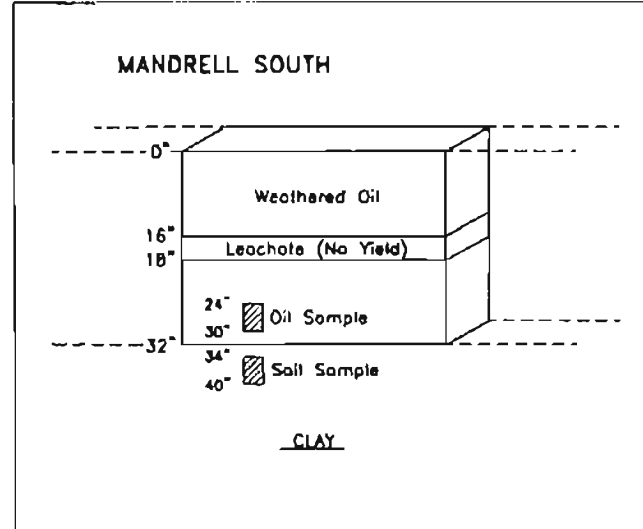
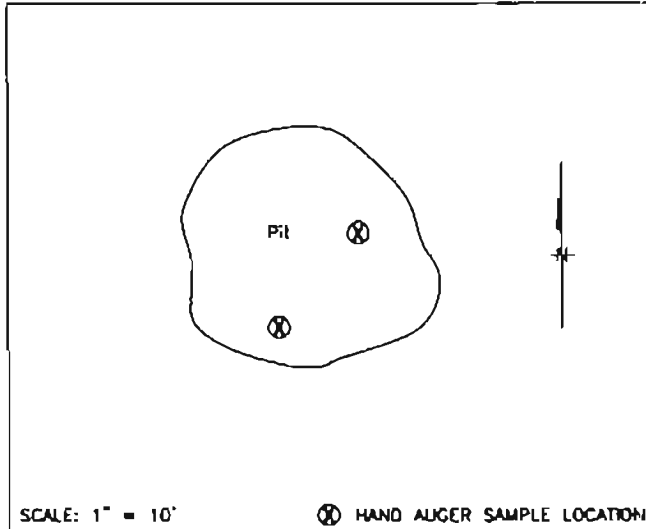
Age: 78 Depth to Soil: 30" Soil Type: SILTY CLAY
Open/Closed Pit: CLOSED Thickness of Crude: 30" Thickness of Covering: NA
Thickness of Water Body: 2" (NO YIELD) Sampling Method: HAND AUGER



Pit Narratives: The Mandrell North pit is a closed pit located in pasture. Crude oil has migrated to the surface through the backfilled soil on the downgradient side of the pit. There was a thin veneer of leachate that did not yield enough fluid for sampling. The oil that was sampled was a very black, sticky, slightly weathered oil.

MANDRELL SOUTH PIT SUMMARY

USPLS: SE/4 NW/4 NW/4 SEC. 30-T15N-R11E	County: OKMULGEE	GPS: N35° 45' 06.2" W96° 11' 23.3"
Age: 79	Depth to Soil: 32"	Soil Type: CLAY
Open/Closed Pit: OPEN	Thickness of Crude: 32"	Thickness of Covering: NA
Thickness of Water Body: 2" (NO YIELD)		Sampling Method: HAND AUGER



Pit Narratives: The Mandrell South pit is an open pit located in pasture. The pit contained wood debris that had been thrown into the pit. This is a very small but relatively deep pit that contained a thin veneer of leachate that did not yield enough fluid for sampling. The sampled oil was a very black, sticky, slightly weathered oil.

MARTIN PIT SUMMARY

USPLS: NE/4 SE/4 SW/4 SEC. 34-T20N-R4E

County: PAYNE

GPS: N36° 09' 44.3"

W96° 51' 51.3"

Age: 46

Depth to Soil: 18"

Soil Type: SILTY CLAY/SILTY CLAY LOAM

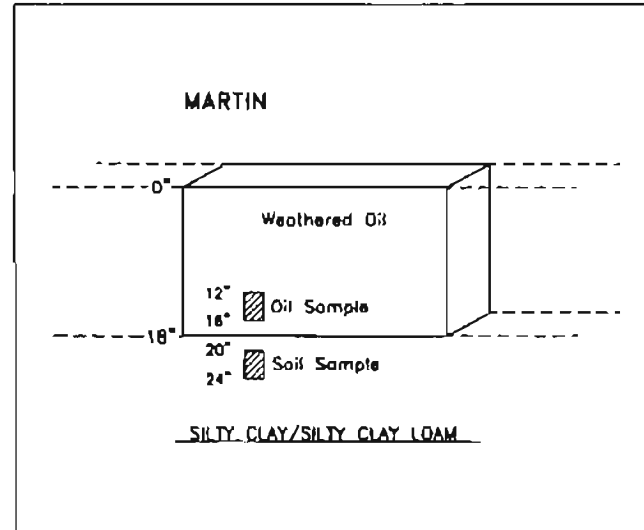
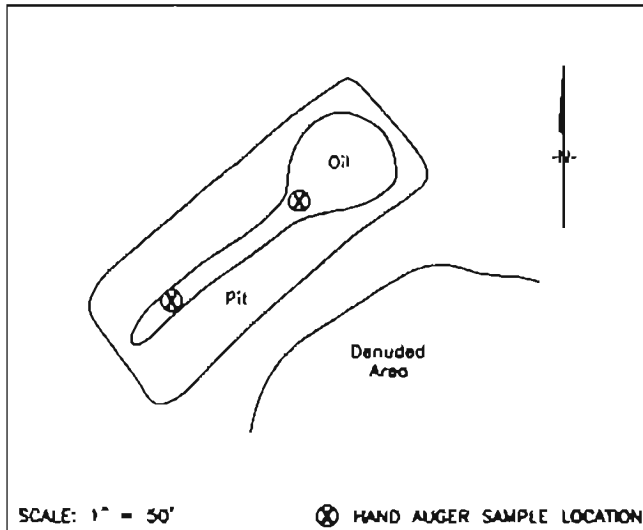
Open/Closed Pit: CLOSED

Thickness of Crude: 18"

Thickness of Covering: NA

Thickness of Water Body: NA

Sampling Method: HAND AUGER



Pit Narratives: The Martin pit is a trenched and partially backfilled pit. Oil has migrated to the surface through the trench. The pit also appears to have been closed with produced waters that vertically leached through the pit to a relatively impermeable clay layer and then migrated topographically downgradient of the pit. The surrounding area is used as pasture and vegetation is established within and outside the pit except for crude oil seeps and brine leaching areas. The oil samples were heavy, black crude oil samples that did contain some commingled soil.

MATTHEWS PIT SUMMARY

USPLS: C SE/4 SW/4 SEC. 26-T9N-R6E

County: SEMINOLE

GPS: NA

Age: 72

Depth to Soil: 48"

Soil Type: SILTY CLAY

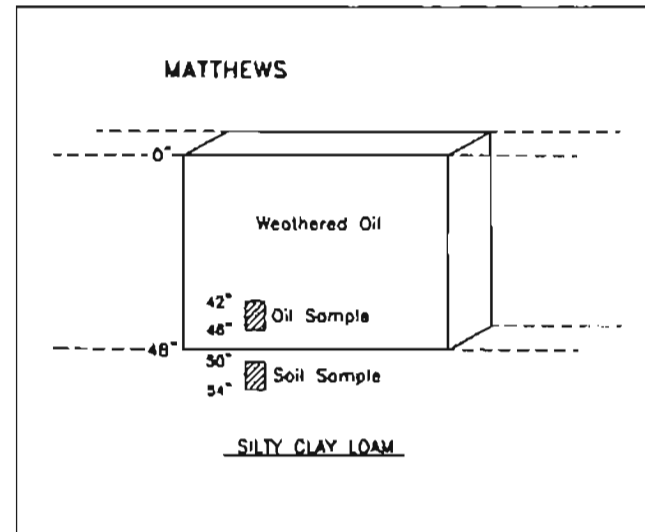
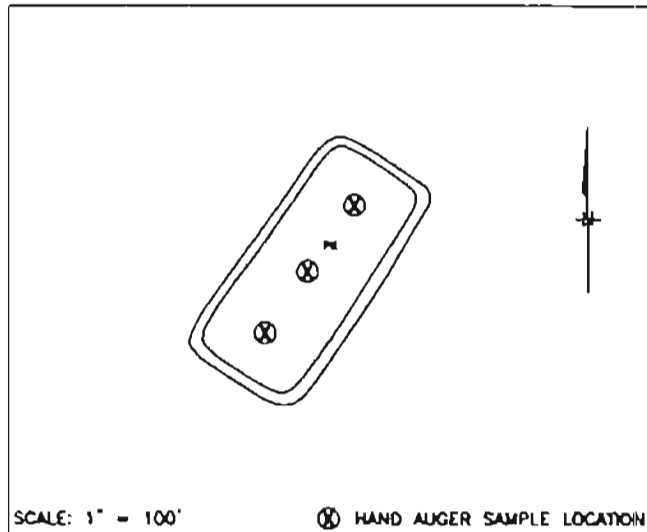
Open/Closed Pit: OPEN

Thickness of Crude: 48"

Thickness of Covering: NA

Thickness of Water Body: NA

Sampling Method: HAND AUGER



Pit Narrative: The Matthews pit is a large open pit that is located on the edge of the town of Seminole. The area surrounding the pit is in pastured bermuda grass. This pit is also a relatively deep pit with thickness of weathered oil up to 4'.

MOUNCE PIT SUMMARY

USPLS: SW/4 SW/4 NE/4 SEC. 8-T15N-R8E

County: LINCOLN

GPS: N35° 47' 38.3"
W96° 29' 3.7"

Age: 74

Depth to Soil: 36"

Soil Type: VERY FINE SANDY LOAM

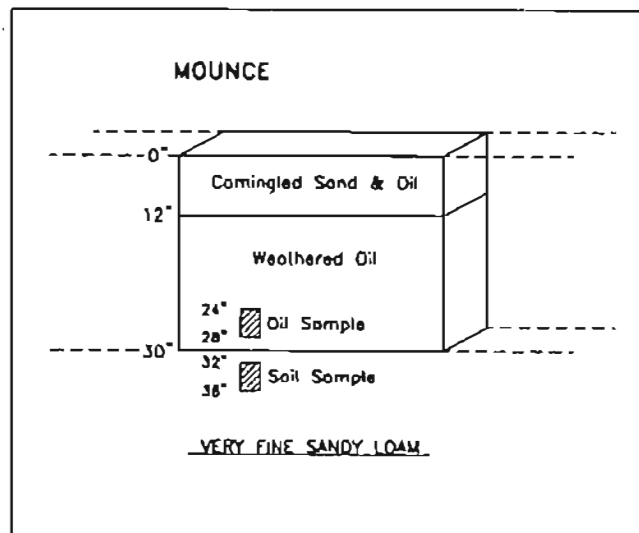
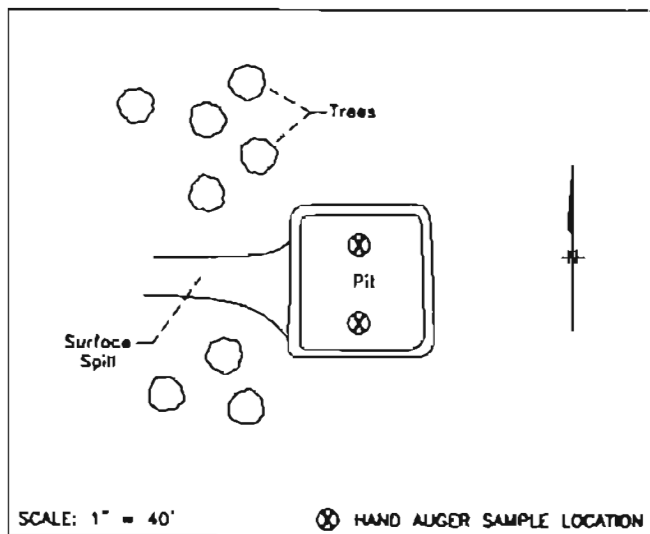
Open/Closed Pit: CLOSED

Thickness of Crude: 24"

Thickness of Covering: 12"

Thickness of Water Body: NA

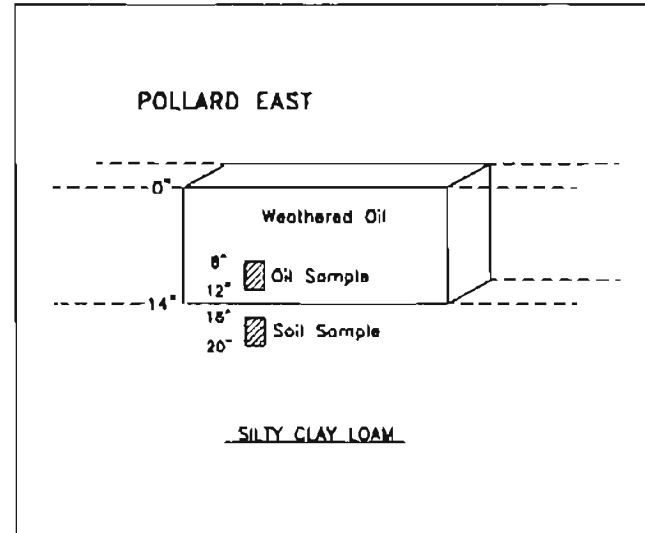
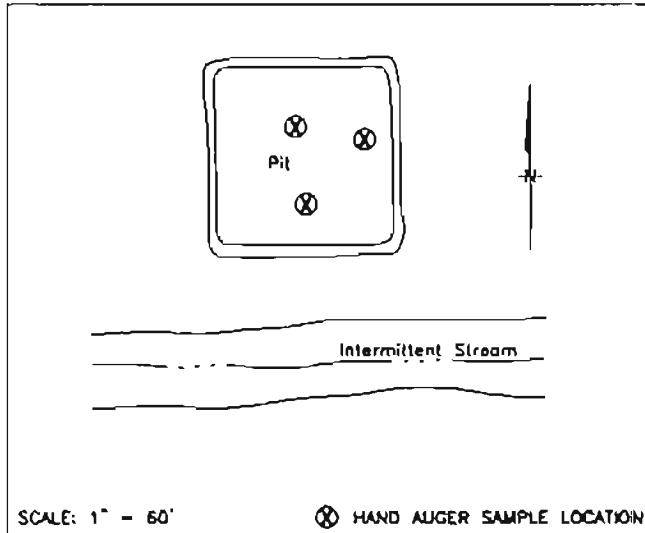
Sampling Method: HAND AUGER



Pit Narratives: The Mounce pit is a closed pit located in a heavily wooded area. Crude oil has migrated to the surface where it is now exposed. Crude oil has flowed outside the containment berms on at least two occasions in the past. The crude oil is a black, slightly weathered oil.

POLLARD EAST PIT SUMMARY

USPLS: SW/4 NE/4 NW/4 SEC. 31-T19N-R4W	County: LOGAN	GPS: N36° 04' 57.9" W97° 40' 13.0"
Age: 48	Depth to Soil: 14"	Soil Type: SILTY CLAY LOAM
Open/Closed Pit: CLOSED	Thickness of Crude: 14"	Thickness of Covering: NA
Thickness of Water Body: NA		Sampling Method: HAND AUGER



Pit Narratives: The Pollard East pit is located in an area used for pasture and is located near an intermittent stream. The pit appears to have been backfilled; however, most of the oil has migrated to the surface and has been weathered to create an asphaltic covering. There is no established vegetation over any part of the pit within the berms. Outside the berms thick bermuda grass is established. The oil and soil samples were heavily laden with oil, probably due to the asphaltic covering and clay sub soil.

POLLARD-WEST PIT SUMMARY

USPLS: SW/4 NE/4 NW/4 SEC. 31-T19N-R4W

County: LOGAN

GPS: N36° 4' 59.5"
W97° 40' 14.8"

Age: 69

Depth to Soil: 16"

Soil Type: CLAY

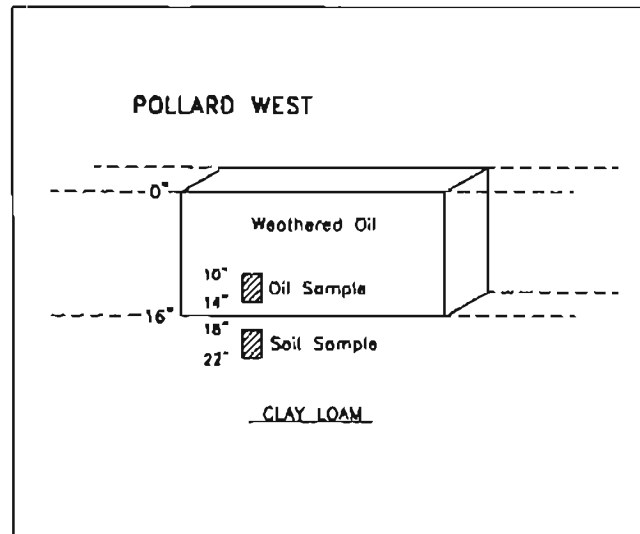
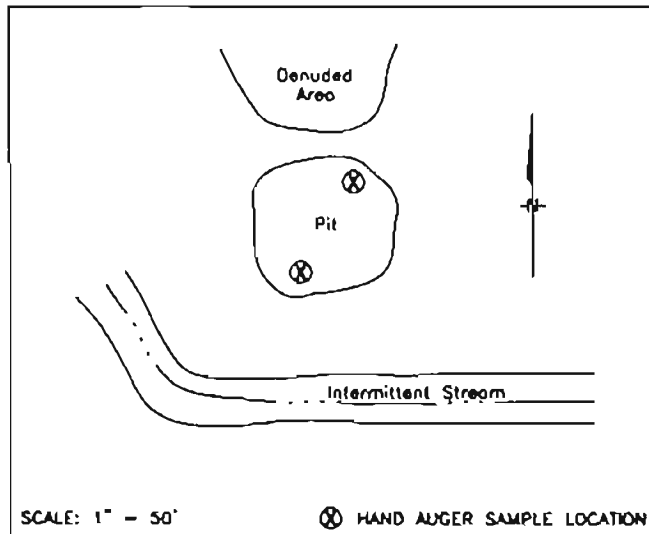
Open/Closed Pit: OPEN

Thickness of Crude: 16"

Thickness of Covering: NA

Thickness of Water Body: NA

Sampling Method: HAND AUGER



Pit Narratives: The Pollard-West pit is an open pit that is located near a denuded area and also located within 50' of an intermittent stream. The pit appears to be the source of the denuded area. The surrounding area is bermuda grass prairie. The crude oil was a very sticky, black, weathered oil.

WALTERS-EAST PIT SUMMARY

USPLS: NE/4 NE/4 SEC. 16-T1N-R3W

County: GARVIN

GPS: NA

Age: 76

Depth to Soil: 36"

Soil Type: LOAM

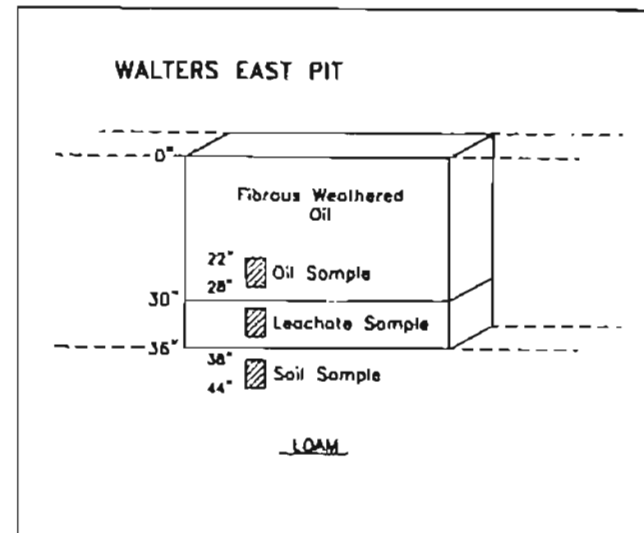
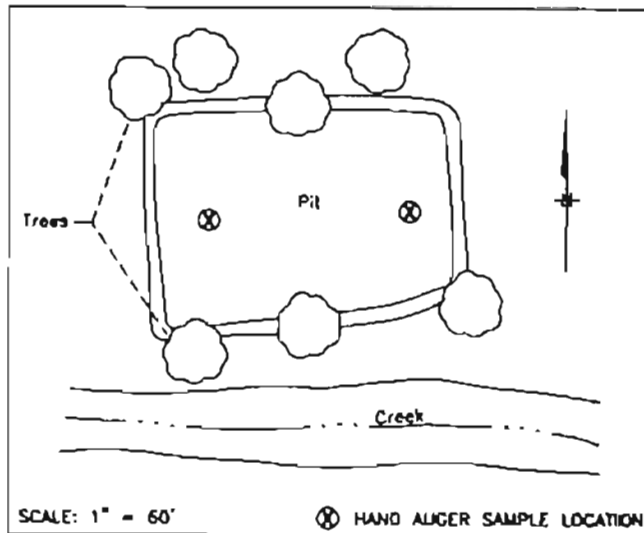
Open/Closed Pit: OPEN

Thickness of Crude: 36"

Thickness of Covering: NA

Thickness of Water Body: 6"

Sampling Method: HAND AUGER



Pit Narratives: The Walters-East pit is an open pit located adjacent to Highway 76 and a county road. The pit's south berm was built along the edge of a stream. The pit is a deep pit that contains a layer of leachate below the crude layer. The crude oil is a very black, leathery, fibrous, weathered oil. There is bermuda grass and trees located on the berms and outside the pit.

WALTERS-WEST PIT SUMMARY

USPLS: NE/4 NE/4 NE/4 SEC. 16-T1N-R3W

County: GARVIN

GPS: NA

Age: 76

Depth to Soil: 48"

Soil Type: LOAM

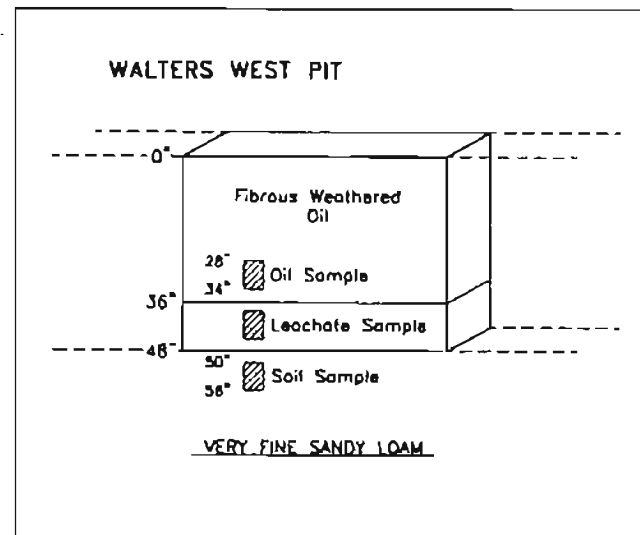
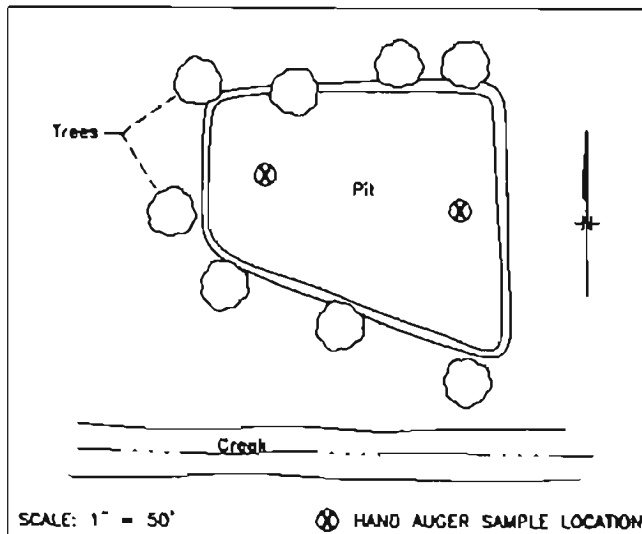
Open/Closed Pit: OPEN

Thickness of Crude: 48"

Thickness of Covering: NA

Thickness of Water Body: 12"

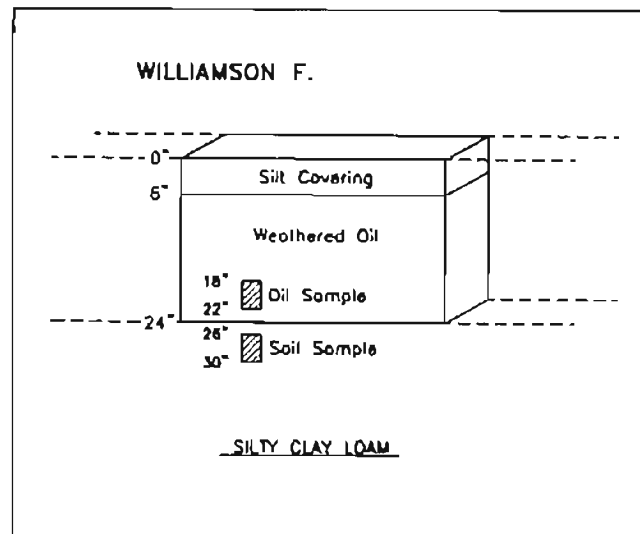
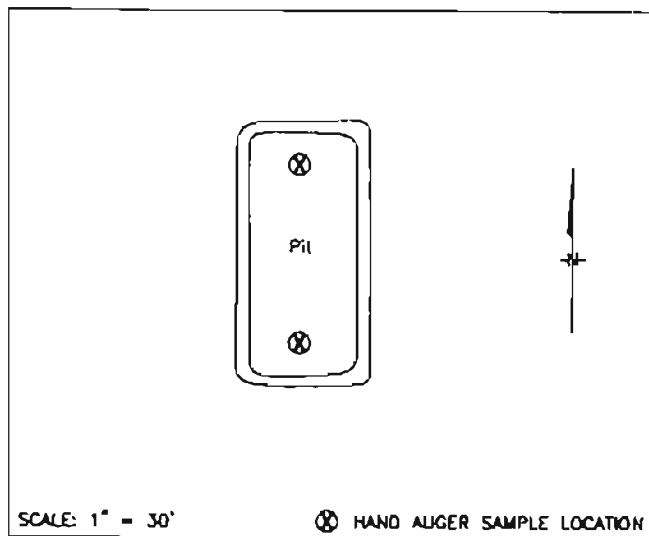
Sampling Method: HAND AUGER



Pit Narratives: The Walters-West pit is an open pit located adjacent to Highway 76 and a county road. The pit's south berm was built along the edge of a stream. The pit is a deep pit that contains a layer of leachate below the crude layer. The crude oil is a very black, leathery, fibrous, weathered oil. There is bermuda grass and trees located on the berms and outside the pit.

WILLIAMSON F. PIT SUMMARY

USPLS: C SW/4 SW/4 SW/4 SEC. 29-T7N-R8E	County: HUGHES	GPS: N35° 2' 36.8" W96° 29' 40.5"
Age: 64	Depth to Soil: 24"	Soil Type: SANDY CLAY
Open/Closed Pit: CLOSED	Thickness of Crude: 18"	Thickness of Covering: 6"
Thickness of Water Body: NA	Sampling Method: HAND AUGER	



Pit Narratives: The Williamson F. pit is a closed pit located in a heavily wooded and pastured area. Crude oil has migrated to the surface where it is now exposed.

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS
CARCINOGENIC RISK-INGESTION
ADULT RECEPTORS

Barrick Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.014 mg/kg	2.33E-08 mg/kg/day
Benzo(a)pyrene	0.018 mg/kg	3.00E-08 mg/kg/day
Benzo(b)fluoranthene	0.051 mg/kg	8.50E-08 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.67E-09 mg/kg/day
Benzo(k)fluoranthene	0.004 mg/kg	6.67E-09 mg/kg/day
Dibenz(a,h)anthracene	0.014 mg/kg	2.33E-08 mg/kg/day
Chrysene	0.008 mg/kg	1.33E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.026 mg/kg	4.33E-08 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	2.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08
Benzo(a)pyrene	3.00E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-07
Benzo(b)fluoranthene	8.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	6E-08
Benzo(g,h,i)perylene	1.67E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-10
Benzo(k)fluoranthene	6.67E-09 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-09
Chrysene	2.33E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Dibenz(a,h)anthracene	1.33E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	5E-07
Indeno(1,2,3-cd)pyrene	4.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08

Cumulative Carcinogenic Risk:

8E-07

Caughlin Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.026 mg/kg	4.33E-08 mg/kg/day
Benzo(a)pyrene	0.032 mg/kg	5.33E-08 mg/kg/day
Benzo(b)fluoranthene	0.093 mg/kg	1.55E-07 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	3.33E-09 mg/kg/day
Benzo(k)fluoranthene	0.008 mg/kg	1.33E-08 mg/kg/day
Dibenz(a,h)anthracene	0.026 mg/kg	4.33E-08 mg/kg/day
Chrysene	0.015 mg/kg	2.50E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.046 mg/kg	7.67E-08 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	4.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08
Benzo(a)pyrene	5.33E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	4E-07
Benzo(b)fluoranthene	1.55E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-07
Benzo(g,h,i)perylene	3.33E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-10
Benzo(k)fluoranthene	1.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-08
Chrysene	4.33E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	3E-09
Dibenz(a,h)anthracene	2.50E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	9E-07
Indeno(1,2,3-cd)pyrene	7.67E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	6E-08

Cumulative Carcinogenic Risk:

2E-06

Choquette Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.056 mg/kg	9.33E-08 mg/kg/day
Benz(a)anthracene	0.038 mg/kg	6.33E-08 mg/kg/day
Benzo(a)pyrene	0.048 mg/kg	8.00E-08 mg/kg/day
Benzo(b)fluoranthene	0.138 mg/kg	2.30E-07 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	3.33E-09 mg/kg/day
Benzo(k)fluoranthene	0.011 mg/kg	1.83E-08 mg/kg/day
Dibenz(a,h)anthracene	0.038 mg/kg	6.33E-08 mg/kg/day
Chrysene	0.022 mg/kg	3.67E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.069 mg/kg	1.15E-07 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	9.33E-08 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	3E-09
Benz(a)anthracene	6.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08
Benzo(a)pyrene	8.00E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	6E-07
Benzo(b)fluoranthene	2.30E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(g,h,i)perylene	3.33E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-10
Benzo(k)fluoranthene	1.83E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-08
Chrysene	6.33E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	4E-09
Dibenz(a,h)anthracene	3.67E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	1E-06
Indeno(1,2,3-cd)pyrene	1.15E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	8E-08

Cumulative Carcinogenic Risk:

2E-06

Dewitt Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.086 mg/kg	1.43E-07 mg/kg/day
Benzo(a)pyrene	0.108 mg/kg	1.80E-07 mg/kg/day
Benzo(b)fluoranthene	0.308 mg/kg	5.13E-07 mg/kg/day
Benzo(g,h,i)perylene	0.005 mg/kg	8.33E-09 mg/kg/day
Benzo(k)fluoranthene	0.025 mg/kg	4.17E-08 mg/kg/day
Dibenz(a,h)anthracene	0.086 mg/kg	1.43E-07 mg/kg/day
Chrysene	0.050 mg/kg	8.33E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.154 mg/kg	2.57E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	1.43E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-07
Benzo(a)pyrene	1.80E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	1E-06
Benzo(b)fluoranthene	5.13E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-07
Benzo(g,h,i)perylene	8.33E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	6E-10
Benzo(k)fluoranthene	4.17E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08
Chrysene	1.43E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-08
Dibenz(a,h)anthracene	8.33E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	3E-06
Indeno(1,2,3-cd)pyrene	2.57E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07

Cumulative Carcinogenic Risk:

5E-06

Hyde Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.019 mg/kg	3.17E-08 mg/kg/day
Benzo(a)pyrene	0.024 mg/kg	4.00E-08 mg/kg/day
Benzo(b)fluoranthene	0.069 mg/kg	1.15E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.67E-09 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	1.00E-08 mg/kg/day
Dibenz(a,h)anthracene	0.019 mg/kg	3.17E-08 mg/kg/day
Chrysene	0.011 mg/kg	1.83E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.035 mg/kg	5.83E-08 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	3.17E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08
Benzo(a)pyrene	4.00E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-07
Benzo(b)fluoranthene	1.15E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	8E-08
Benzo(g,h,i)perylene	1.67E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-10
Benzo(k)fluoranthene	1.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-09
Chrysene	3.17E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Dibenz(a,h)anthracene	1.83E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	7E-07
Indeno(1,2,3-cd)pyrene	5.83E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-08

Cumulative Carcinogenic Risk:

1E-06

Lair Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.008 mg/kg	1.33E-08 mg/kg/day
Benzo(a)pyrene	0.010 mg/kg	1.67E-08 mg/kg/day
Benzo(b)fluoranthene	0.028 mg/kg	4.67E-08 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	3.33E-09 mg/kg/day
Dibenz(a,h)anthracene	0.008 mg/kg	1.33E-08 mg/kg/day
Chrysene	0.005 mg/kg	8.33E-09 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.014 mg/kg	2.33E-08 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	1.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-08
Benzo(a)pyrene	1.67E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	1E-07
Benzo(b)fluoranthene	4.67E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	3.33E-09 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-09
Chrysene	1.33E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	9E-10
Dibenz(a,h)anthracene	8.33E-09 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	3E-07
Indeno(1,2,3-cd)pyrene	2.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08

Cumulative Carcinogenic Risk:

5E-07

Landrum-North Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(a)pyrene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(b)fluoranthene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.000 mg/kg	0.00E+00 mg/kg/day
Dibenz(a,h)anthracene	0.000 mg/kg	0.00E+00 mg/kg/day
Chrysene	0.000 mg/kg	0.00E+00 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.000 mg/kg	0.00E+00 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	0.00E+00 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	0E+00
Benzo(a)pyrene	0.00E+00 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	0E+00
Benzo(b)fluoranthene	0.00E+00 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	0E+00
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	0.00E+00 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	0E+00
Chrysene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Dibenz(a,h)anthracene	0.00E+00 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	0E+00
Indeno(1,2,3-cd)pyrene	0.00E+00 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	0E+00

Cumulative Carcinogenic Risk:

5E-09

Landrum-South Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.022 mg/kg	3.67E-08 mg/kg/day
Benzo(a)pyrene	0.027 mg/kg	4.50E-08 mg/kg/day
Benzo(b)fluoranthene	0.077 mg/kg	1.28E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.67E-09 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	1.00E-08 mg/kg/day
Dibenz(a,h)anthracene	0.022 mg/kg	3.67E-08 mg/kg/day
Chrysene	0.013 mg/kg	2.17E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.039 mg/kg	6.50E-08 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	3.67E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08
Benzo(a)pyrene	4.50E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-07
Benzo(b)fluoranthene	1.28E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	9E-08
Benzo(g,h,i)perylene	1.67E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-10
Benzo(k)fluoranthene	1.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-09
Chrysene	3.67E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	3E-09
Dibenz(a,h)anthracene	2.17E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	8E-07
Indeno(1,2,3-cd)pyrene	6.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08

Cumulative Carcinogenic Risk:

1E-06

Mandrell-North Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.032 mg/kg	5.33E-08 mg/kg/day
Benzo(a)pyrene	0.040 mg/kg	6.67E-08 mg/kg/day
Benzo(b)fluoranthene	0.114 mg/kg	1.90E-07 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	3.33E-09 mg/kg/day
Benzo(k)fluoranthene	0.009 mg/kg	1.50E-08 mg/kg/day
Dibenz(a,h)anthracene	0.032 mg/kg	5.33E-08 mg/kg/day
Chrysene	0.018 mg/kg	3.00E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.057 mg/kg	9.50E-08 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	5.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-08
Benzo(a)pyrene	6.67E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	5E-07
Benzo(b)fluoranthene	1.90E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-07
Benzo(g,h,i)perylene	3.33E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-10
Benzo(k)fluoranthene	1.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-08
Chrysene	5.33E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	4E-09
Dibenz(a,h)anthracene	3.00E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	1E-06
Indeno(1,2,3-cd)pyrene	9.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-08

Cumulative Carcinogenic Risk:

2E-06

Mandrell-South Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.006 mg/kg	1.00E-08 mg/kg/day
Benzo(a)pyrene	0.007 mg/kg	1.17E-08 mg/kg/day
Benzo(b)fluoranthene	0.021 mg/kg	3.50E-08 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	3.33E-09 mg/kg/day
Dibenz(a,h)anthracene	0.006 mg/kg	1.00E-08 mg/kg/day
Chrysene	0.003 mg/kg	5.00E-09 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.011 mg/kg	1.83E-08 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	1.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-09
Benzo(a)pyrene	1.17E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	9E-08
Benzo(b)fluoranthene	3.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	3.33E-09 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-09
Chrysene	1.00E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	7E-10
Dibenz(a,h)anthracene	5.00E-09 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	2E-07
Indeno(1,2,3-cd)pyrene	1.83E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-08

Cumulative Carcinogenic Risk:

3E-07

Martin Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.013 mg/kg	2.17E-08 mg/kg/day
Benzo(a)pyrene	0.017 mg/kg	2.83E-08 mg/kg/day
Benzo(b)fluoranthene	0.048 mg/kg	8.00E-08 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.67E-09 mg/kg/day
Benzo(k)fluoranthene	0.004 mg/kg	6.67E-09 mg/kg/day
Dibenz(a,h)anthracene	0.013 mg/kg	2.17E-08 mg/kg/day
Chrysene	0.008 mg/kg	1.33E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.024 mg/kg	4.00E-08 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	2.17E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08
Benzo(a)pyrene	2.83E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-07
Benzo(b)fluoranthene	8.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	6E-08
Benzo(g,h,i)perylene	1.67E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-10
Benzo(k)fluoranthene	6.67E-09 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-09
Chrysene	2.17E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Dibenz(a,h)anthracene	1.33E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	5E-07
Indeno(1,2,3-cd)pyrene	4.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08

Cumulative Carcinogenic Risk:

8E-07

Pollard-East Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.020 mg/kg	3.33E-08 mg/kg/day
Benzo(a)pyrene	0.025 mg/kg	4.17E-08 mg/kg/day
Benzo(b)fluoranthene	0.071 mg/kg	1.18E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.67E-09 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	1.00E-08 mg/kg/day
Dibenz(a,h)anthracene	0.020 mg/kg	3.33E-08 mg/kg/day
Chrysene	0.011 mg/kg	1.83E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.035 mg/kg	5.83E-08 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	3.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08
Benzo(a)pyrene	4.17E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-07
Benzo(b)fluoranthene	1.18E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	9E-08
Benzo(g,h,i)perylene	1.67E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-10
Benzo(k)fluoranthene	1.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-09
Chrysene	3.33E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Dibenz(a,h)anthracene	1.83E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	7E-07
Indeno(1,2,3-cd)pyrene	5.83E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-08

Cumulative Carcinogenic Risk:

1E-06

Pollard-West Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.017 mg/kg	2.83E-08 mg/kg/day
Benzo(a)pyrene	0.021 mg/kg	3.50E-08 mg/kg/day
Benzo(b)fluoranthene	0.061 mg/kg	1.02E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.67E-09 mg/kg/day
Benzo(k)fluoranthene	0.005 mg/kg	8.33E-09 mg/kg/day
Dibenz(a,h)anthracene	0.017 mg/kg	2.83E-08 mg/kg/day
Chrysene	0.010 mg/kg	1.67E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.030 mg/kg	5.00E-08 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	2.83E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08
Benzo(a)pyrene	3.50E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-07
Benzo(b)fluoranthene	1.02E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-08
Benzo(g,h,i)perylene	1.67E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-10
Benzo(k)fluoranthene	8.33E-09 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	6E-09
Chrysene	2.83E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Dibenz(a,h)anthracene	1.67E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	6E-07
Indeno(1,2,3-cd)pyrene	5.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-08

Cumulative Carcinogenic Risk:

1E-06

Walters-East Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.006 mg/kg	1.00E-08 mg/kg/day
Benzo(a)pyrene	0.008 mg/kg	1.33E-08 mg/kg/day
Benzo(b)fluoranthene	0.022 mg/kg	3.67E-08 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	3.33E-09 mg/kg/day
Dibenz(a,h)anthracene	0.006 mg/kg	1.00E-08 mg/kg/day
Chrysene	0.004 mg/kg	6.67E-09 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.011 mg/kg	1.83E-08 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	1.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-09
Benzo(a)pyrene	1.33E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	1E-07
Benzo(b)fluoranthene	3.67E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	3.33E-09 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-09
Chrysene	1.00E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	7E-10
Dibenz(a,h)anthracene	6.67E-09 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	2E-07
Indeno(1,2,3-cd)pyrene	1.83E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-08

Cumulative Carcinogenic Risk:

4E-07

Walters-West Adult Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.67E-07 mg/kg/day
Benz(a)anthracene	0.021 mg/kg	3.50E-08 mg/kg/day
Benzo(a)pyrene	0.027 mg/kg	4.50E-08 mg/kg/day
Benzo(b)fluoranthene	0.076 mg/kg	1.27E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.67E-09 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	1.00E-08 mg/kg/day
Dibenz(a,h)anthracene	0.021 mg/kg	3.50E-08 mg/kg/day
Chrysene	0.012 mg/kg	2.00E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.038 mg/kg	6.33E-08 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.67E-07 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	5E-09
Benz(a)anthracene	3.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-08
Benzo(a)pyrene	4.50E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-07
Benzo(b)fluoranthene	1.27E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	9E-08
Benzo(g,h,i)perylene	1.67E-09 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-10
Benzo(k)fluoranthene	1.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-09
Chrysene	3.50E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Dibenz(a,h)anthracene	2.00E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	7E-07
Indeno(1,2,3-cd)pyrene	6.33E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08

Cumulative Carcinogenic Risk:

1E-06

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS
CARCINOGENIC RISK-INGESTION
CHILD RECEPTORS

Barrick Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.014 mg/kg	1.75E-07 mg/kg/day
Benzo(a)pyrene	0.018 mg/kg	2.25E-07 mg/kg/day
Benzo(b)fluoranthene	0.051 mg/kg	6.38E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.25E-08 mg/kg/day
Benzo(k)fluoranthene	0.004 mg/kg	5.00E-08 mg/kg/day
Dibenz(a,h)anthracene	0.014 mg/kg	1.75E-07 mg/kg/day
Chrysene	0.008 mg/kg	1.00E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.026 mg/kg	3.25E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	1.75E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-07
Benzo(a)pyrene	2.25E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-06
Benzo(b)fluoranthene	6.38E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-07
Benzo(g,h,i)perylene	1.25E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	9E-10
Benzo(k)fluoranthene	5.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-08
Chrysene	1.75E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-08
Dibenz(a,h)anthracene	1.00E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	4E-06
Indeno(1,2,3-cd)pyrene	3.25E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07

Cumulative Carcinogenic Risk:

6E-06

Caughlin Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.026 mg/kg	3.25E-07 mg/kg/day
Benzo(a)pyrene	0.032 mg/kg	4.00E-07 mg/kg/day
Benzo(b)fluoranthene	0.093 mg/kg	1.16E-06 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	2.50E-08 mg/kg/day
Benzo(k)fluoranthene	0.008 mg/kg	1.00E-07 mg/kg/day
Dibenz(a,h)anthracene	0.026 mg/kg	3.25E-07 mg/kg/day
Chrysene	0.015 mg/kg	1.88E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.046 mg/kg	5.75E-07 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	3.25E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(a)pyrene	4.00E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-06
Benzo(b)fluoranthene	1.16E-06 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	8E-07
Benzo(g,h,i)perylene	2.50E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Benzo(k)fluoranthene	1.00E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-08
Chrysene	3.25E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-08
Dibenz(a,h)anthracene	1.88E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	7E-06
Indeno(1,2,3-cd)pyrene	5.75E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-07

Cumulative Carcinogenic Risk:

1E-05

Choquette Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.038 mg/kg	4.75E-07 mg/kg/day
Benzo(a)pyrene	0.048 mg/kg	6.00E-07 mg/kg/day
Benzo(b)fluoranthene	0.138 mg/kg	1.73E-06 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	2.50E-08 mg/kg/day
Benzo(k)fluoranthene	0.001 mg/kg	1.25E-08 mg/kg/day
Dibenz(a,h)anthracene	0.038 mg/kg	4.75E-07 mg/kg/day
Chrysene	0.022 mg/kg	2.75E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.069 mg/kg	8.63E-07 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	4.75E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-07
Benzo(a)pyrene	6.00E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	4E-06
Benzo(b)fluoranthene	1.73E-06 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(g,h,i)perylene	2.50E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Benzo(k)fluoranthene	1.25E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	9E-09
Chrysene	4.75E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	3E-08
Dibenz(a,h)anthracene	2.75E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	1E-05
Indeno(1,2,3-cd)pyrene	8.63E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	6E-07

Cumulative Carcinogenic Risk:

2E-05

Dewitt Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.086 mg/kg	1.08E-06 mg/kg/day
Benzo(a)pyrene	0.108 mg/kg	1.35E-06 mg/kg/day
Benzo(b)fluoranthene	0.308 mg/kg	3.85E-06 mg/kg/day
Benzo(g,h,i)perylene	0.005 mg/kg	6.25E-08 mg/kg/day
Benzo(k)fluoranthene	0.025 mg/kg	3.13E-07 mg/kg/day
Dibenz(a,h)anthracene	0.086 mg/kg	1.08E-06 mg/kg/day
Chrysene	0.050 mg/kg	6.25E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.154 mg/kg	1.93E-06 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	1.08E-06 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	8E-07
Benzo(a)pyrene	1.35E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	1E-05
Benzo(b)fluoranthene	3.85E-06 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-06
Benzo(g,h,i)perylene	6.25E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	4E-09
Benzo(k)fluoranthene	3.13E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Chrysene	1.08E-06 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	8E-08
Dibenz(a,h)anthracene	6.25E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	2E-05
Indeno(1,2,3-cd)pyrene	1.93E-06 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-06

Cumulative Carcinogenic Risk:

4E-05

Hyde Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.019 mg/kg	2.38E-07 mg/kg/day
Benzo(a)pyrene	0.024 mg/kg	3.00E-07 mg/kg/day
Benzo(b)fluoranthene	0.069 mg/kg	8.63E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.25E-08 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	7.50E-08 mg/kg/day
Dibenz(a,h)anthracene	0.019 mg/kg	2.38E-07 mg/kg/day
Chrysene	0.011 mg/kg	1.38E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.035 mg/kg	4.38E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	2.38E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(a)pyrene	3.00E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-06
Benzo(b)fluoranthene	8.63E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	6E-07
Benzo(g,h,i)perylene	1.25E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	9E-10
Benzo(k)fluoranthene	7.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08
Chrysene	2.38E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-08
Dibenz(a,h)anthracene	1.38E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	5E-06
Indeno(1,2,3-cd)pyrene	4.38E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-07

Cumulative Carcinogenic Risk:

8E-06

Lair Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.008 mg/kg	1.00E-07 mg/kg/day
Benzo(a)pyrene	0.010 mg/kg	1.25E-07 mg/kg/day
Benzo(b)fluoranthene	0.028 mg/kg	3.50E-07 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	2.50E-08 mg/kg/day
Dibenz(a,h)anthracene	0.008 mg/kg	1.00E-07 mg/kg/day
Chrysene	0.005 mg/kg	6.25E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.014 mg/kg	1.75E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	1.00E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-08
Benzo(a)pyrene	1.25E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	9E-07
Benzo(b)fluoranthene	3.50E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-07
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	2.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08
Chrysene	1.00E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	7E-09
Dibenz(a,h)anthracene	6.25E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	2E-06
Indeno(1,2,3-cd)pyrene	1.75E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-07

Cumulative Carcinogenic Risk:

4E-06

Landrum-North Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(a)pyrene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(b)fluoranthene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.000 mg/kg	0.00E+00 mg/kg/day
Dibenz(a,h)anthracene	0.000 mg/kg	0.00E+00 mg/kg/day
Chrysene	0.000 mg/kg	0.00E+00 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.000 mg/kg	0.00E+00 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	0.00E+00 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	0E+00
Benzo(a)pyrene	0.00E+00 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	0E+00
Benzo(b)fluoranthene	0.00E+00 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	0E+00
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	0.00E+00 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	0E+00
Chrysene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Dibenz(a,h)anthracene	0.00E+00 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	0E+00
Indeno(1,2,3-cd)pyrene	0.00E+00 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	0E+00

Cumulative Carcinogenic Risk:

4E-08

Landrum-South Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.022 mg/kg	2.75E-07 mg/kg/day
Benzo(a)pyrene	0.027 mg/kg	3.38E-07 mg/kg/day
Benzo(b)fluoranthene	0.077 mg/kg	9.63E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.25E-08 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	7.50E-08 mg/kg/day
Dibenz(a,h)anthracene	0.022 mg/kg	2.75E-07 mg/kg/day
Chrysene	0.013 mg/kg	1.63E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.039 mg/kg	4.88E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	2.75E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(a)pyrene	3.38E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-06
Benzo(b)fluoranthene	9.63E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-07
Benzo(g,h,i)perylene	1.25E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	9E-10
Benzo(k)fluoranthene	7.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08
Chrysene	2.75E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-08
Dibenz(a,h)anthracene	1.63E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	6E-06
Indeno(1,2,3-cd)pyrene	4.88E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-07

Cumulative Carcinogenic Risk:

1E-05

Mandrell-North Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.032 mg/kg	4.00E-07 mg/kg/day
Benzo(a)pyrene	0.040 mg/kg	5.00E-07 mg/kg/day
Benzo(b)fluoranthene	0.114 mg/kg	1.43E-06 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	2.50E-08 mg/kg/day
Benzo(k)fluoranthene	0.009 mg/kg	1.13E-07 mg/kg/day
Dibenz(a,h)anthracene	0.032 mg/kg	4.00E-07 mg/kg/day
Chrysene	0.018 mg/kg	2.25E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.057 mg/kg	7.13E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	4.00E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-07
Benzo(a)pyrene	5.00E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	4E-06
Benzo(b)fluoranthene	1.43E-06 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(g,h,i)perylene	2.50E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-09
Benzo(k)fluoranthene	1.13E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	8E-08
Chrysene	4.00E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	3E-08
Dibenz(a,h)anthracene	2.25E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	8E-06
Indeno(1,2,3-cd)pyrene	7.13E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-07

Cumulative Carcinogenic Risk:

1E-05

Mandrell-South Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.006 mg/kg	7.50E-08 mg/kg/day
Benzo(a)pyrene	0.007 mg/kg	8.75E-08 mg/kg/day
Benzo(b)fluoranthene	0.021 mg/kg	2.63E-07 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	2.50E-08 mg/kg/day
Dibenz(a,h)anthracene	0.006 mg/kg	7.50E-08 mg/kg/day
Chrysene	0.003 mg/kg	3.75E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.011 mg/kg	1.38E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	7.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08
Benzo(a)pyrene	8.75E-08 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	6E-07
Benzo(b)fluoranthene	2.63E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	2.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08
Chrysene	7.50E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	5E-09
Dibenz(a,h)anthracene	3.75E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	1E-06
Indeno(1,2,3-cd)pyrene	1.38E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-07

Cumulative Carcinogenic Risk:

2E-06

Martin Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.013 mg/kg	1.63E-07 mg/kg/day
Benzo(a)pyrene	0.017 mg/kg	2.13E-07 mg/kg/day
Benzo(b)fluoranthene	0.048 mg/kg	6.00E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.25E-08 mg/kg/day
Benzo(k)fluoranthene	0.004 mg/kg	5.00E-08 mg/kg/day
Dibenz(a,h)anthracene	0.013 mg/kg	1.63E-07 mg/kg/day
Chrysene	0.008 mg/kg	1.00E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.024 mg/kg	3.00E-07 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	1.63E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-07
Benzo(a)pyrene	2.13E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-06
Benzo(b)fluoranthene	6.00E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-07
Benzo(g,h,i)perylene	1.25E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	9E-10
Benzo(k)fluoranthene	5.00E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	4E-08
Chrysene	1.63E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-08
Dibenz(a,h)anthracene	1.00E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	4E-06
Indeno(1,2,3-cd)pyrene	3.00E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07

Cumulative Carcinogenic Risk:

6E-06

Pollard-East Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.020 mg/kg	2.50E-07 mg/kg/day
Benzo(a)pyrene	0.025 mg/kg	3.13E-07 mg/kg/day
Benzo(b)fluoranthene	0.071 mg/kg	8.88E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.25E-08 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	7.50E-08 mg/kg/day
Dibenz(a,h)anthracene	0.020 mg/kg	2.50E-07 mg/kg/day
Chrysene	0.011 mg/kg	1.38E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.035 mg/kg	4.38E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	2.50E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(a)pyrene	3.13E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-06
Benzo(b)fluoranthene	8.88E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	6E-07
Benzo(g,h,i)perylene	1.25E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	9E-10
Benzo(k)fluoranthene	7.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08
Chrysene	2.50E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-08
Dibenz(a,h)anthracene	1.38E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	5E-06
Indeno(1,2,3-cd)pyrene	4.38E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-07

Cumulative Carcinogenic Risk:

9E-06

Pollard-West Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.017 mg/kg	2.13E-07 mg/kg/day
Benzo(a)pyrene	0.021 mg/kg	2.63E-07 mg/kg/day
Benzo(b)fluoranthene	0.061 mg/kg	7.63E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.25E-08 mg/kg/day
Benzo(k)fluoranthene	0.005 mg/kg	6.25E-08 mg/kg/day
Dibenz(a,h)anthracene	0.017 mg/kg	2.13E-07 mg/kg/day
Chrysene	0.010 mg/kg	1.25E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.030 mg/kg	3.75E-07 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	2.13E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(a)pyrene	2.63E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-06
Benzo(b)fluoranthene	7.63E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	6E-07
Benzo(g,h,i)perylene	1.25E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	9E-10
Benzo(k)fluoranthene	6.25E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08
Chrysene	2.13E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	1E-08
Dibenz(a,h)anthracene	1.25E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	5E-06
Indeno(1,2,3-cd)pyrene	3.75E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-07

Cumulative Carcinogenic Risk:

8E-06

Walters-East Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.006 mg/kg	7.50E-08 mg/kg/day
Benzo(a)pyrene	0.008 mg/kg	1.00E-07 mg/kg/day
Benzo(b)fluoranthene	0.022 mg/kg	2.75E-07 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	2.50E-08 mg/kg/day
Dibenz(a,h)anthracene	0.006 mg/kg	7.50E-08 mg/kg/day
Chrysene	0.004 mg/kg	5.00E-08 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.011 mg/kg	1.38E-07 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	7.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08
Benzo(a)pyrene	1.00E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	7E-07
Benzo(b)fluoranthene	2.75E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	2.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-08
Chrysene	7.50E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	5E-09
Dibenz(a,h)anthracene	5.00E-08 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	2E-06
Indeno(1,2,3-cd)pyrene	1.38E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	1E-07

Cumulative Carcinogenic Risk:

3E-06

Walters-West Child Risk Calculations - Soil Ingestion (Carc.)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	1.25E-06 mg/kg/day
Benz(a)anthracene	0.021 mg/kg	2.63E-07 mg/kg/day
Benzo(a)pyrene	0.027 mg/kg	3.38E-07 mg/kg/day
Benzo(b)fluoranthene	0.076 mg/kg	9.50E-07 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	1.25E-08 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	7.50E-08 mg/kg/day
Dibenz(a,h)anthracene	0.021 mg/kg	2.63E-07 mg/kg/day
Chrysene	0.012 mg/kg	1.50E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.038 mg/kg	4.75E-07 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Oral SF</u>	<u>Risk</u>
Benzene	1.25E-06 mg/kg/day	2.90E-02 (mg/kg/day) ⁻¹	4E-08
Benz(a)anthracene	2.63E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	2E-07
Benzo(a)pyrene	3.38E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-06
Benzo(b)fluoranthene	9.50E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	7E-07
Benzo(g,h,i)perylene	1.25E-08 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	9E-10
Benzo(k)fluoranthene	7.50E-08 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	5E-08
Chrysene	2.63E-07 mg/kg/day	7.00E-02 (mg/kg/day) ⁻¹	2E-08
Dibenz(a,h)anthracene	1.50E-07 mg/kg/day	3.65E+01 (mg/kg/day) ⁻¹	5E-06
Indeno(1,2,3-cd)pyrene	4.75E-07 mg/kg/day	7.30E-01 (mg/kg/day) ⁻¹	3E-07

Cumulative Carcinogenic Risk:

9E-06

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS
CARCINOGENIC RISK-DERMAL
ADULT RECEPTORS

Barrick Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.014 mg/kg	4.65E-06 mg/kg/day
Benzo(a)pyrene	0.018 mg/kg	5.97E-06 mg/kg/day
Benzo(b)fluoranthene	0.051 mg/kg	1.69E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	3.32E-07 mg/kg/day
Benzo(k)fluoranthene	0.004 mg/kg	1.33E-06 mg/kg/day
Dibenz(a,h)anthracene	0.014 mg/kg	4.65E-06 mg/kg/day
Chrysene	0.008 mg/kg	2.65E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.026 mg/kg	8.63E-06 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	4.65E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	7E-07
Benzo(a)pyrene	5.97E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	9E-06
Benzo(b)fluoranthene	1.69E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(g,h,i)perylene	3.32E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-09
Benzo(k)fluoranthene	1.33E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-07
Chrysene	4.65E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	7E-08
Dibenz(a,h)anthracene	2.65E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-05
Indeno(1,2,3-cd)pyrene	8.63E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

3E-05

Caughlin Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.026 mg/kg	8.63E-06 mg/kg/day
Benzo(a)pyrene	0.032 mg/kg	1.06E-05 mg/kg/day
Benzo(b)fluoranthene	0.093 mg/kg	3.09E-05 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	6.64E-07 mg/kg/day
Benzo(k)fluoranthene	0.008 mg/kg	2.65E-06 mg/kg/day
Dibenz(a,h)anthracene	0.026 mg/kg	8.63E-06 mg/kg/day
Chrysene	0.015 mg/kg	4.98E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.046 mg/kg	1.53E-05 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	8.63E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(a)pyrene	1.06E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	2E-05
Benzo(b)fluoranthene	3.09E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-06
Benzo(g,h,i)perylene	6.64E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	9E-09
Benzo(k)fluoranthene	2.65E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-07
Chrysene	8.63E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	1E-07
Dibenz(a,h)anthracene	4.98E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	4E-05
Indeno(1,2,3-cd)pyrene	1.53E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

6E-05

Choquette Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.038 mg/kg	1.26E-05 mg/kg/day
Benzo(a)pyrene	0.048 mg/kg	1.59E-05 mg/kg/day
Benzo(b)fluoranthene	0.138 mg/kg	4.58E-05 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	6.64E-07 mg/kg/day
Benzo(k)fluoranthene	0.011 mg/kg	3.65E-06 mg/kg/day
Dibenz(a,h)anthracene	0.038 mg/kg	1.26E-05 mg/kg/day
Chrysene	0.022 mg/kg	7.30E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.069 mg/kg	2.29E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	1.26E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(a)pyrene	1.59E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	2E-05
Benzo(b)fluoranthene	4.58E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	7E-06
Benzo(g,h,i)perylene	6.64E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	9E-09
Benzo(k)fluoranthene	3.65E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07
Chrysene	1.26E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-07
Dibenz(a,h)anthracene	7.30E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	5E-05
Indeno(1,2,3-cd)pyrene	2.29E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

9E-05

Dewitt Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.086 mg/kg	2.85E-05 mg/kg/day
Benzo(a)pyrene	0.108 mg/kg	3.58E-05 mg/kg/day
Benzo(b)fluoranthene	0.308 mg/kg	1.02E-04 mg/kg/day
Benzo(g,h,i)perylene	0.005 mg/kg	1.66E-06 mg/kg/day
Benzo(k)fluoranthene	0.025 mg/kg	8.30E-06 mg/kg/day
Dibenz(a,h)anthracene	0.086 mg/kg	2.85E-05 mg/kg/day
Chrysene	0.050 mg/kg	1.66E-05 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.154 mg/kg	5.11E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	2.85E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-06
Benzo(a)pyrene	3.58E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	5E-05
Benzo(b)fluoranthene	1.02E-04 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-05
Benzo(g,h,i)perylene	1.66E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-08
Benzo(k)fluoranthene	8.30E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Chrysene	2.85E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	4E-07
Dibenz(a,h)anthracene	1.66E-05 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	1E-04
Indeno(1,2,3-cd)pyrene	5.11E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	7E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

2E-04

Hyde Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.019 mg/kg	6.31E-06 mg/kg/day
Benzo(a)pyrene	0.024 mg/kg	7.96E-06 mg/kg/day
Benzo(b)fluoranthene	0.069 mg/kg	2.29E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	3.32E-07 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	1.99E-06 mg/kg/day
Dibenz(a,h)anthracene	0.019 mg/kg	6.31E-06 mg/kg/day
Chrysene	0.011 mg/kg	3.65E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.035 mg/kg	1.16E-05 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	6.31E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	9E-07
Benzo(a)pyrene	7.96E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	1E-05
Benzo(b)fluoranthene	2.29E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06
Benzo(g,h,i)perylene	3.32E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-09
Benzo(k)fluoranthene	1.99E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-07
Chrysene	6.31E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	9E-08
Dibenz(a,h)anthracene	3.65E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-05
Indeno(1,2,3-cd)pyrene	1.16E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

4E-05

Lair Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.008 mg/kg	2.65E-06 mg/kg/day
Benzo(a)pyrene	0.010 mg/kg	3.32E-06 mg/kg/day
Benzo(b)fluoranthene	0.028 mg/kg	9.29E-06 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	6.64E-07 mg/kg/day
Dibenz(a,h)anthracene	0.008 mg/kg	2.65E-06 mg/kg/day
Chrysene	0.005 mg/kg	1.66E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.014 mg/kg	4.65E-06 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	2.65E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-07
Benzo(a)pyrene	3.32E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	5E-06
Benzo(b)fluoranthene	9.29E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	6.64E-07 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-07
Chrysene	2.65E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	4E-08
Dibenz(a,h)anthracene	1.66E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	1E-05
Indeno(1,2,3-cd)pyrene	4.65E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	7E-07

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

2E-05

Landrum-North Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(a)pyrene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(b)fluoranthene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.000 mg/kg	0.00E+00 mg/kg/day
Dibenz(a,h)anthracene	0.000 mg/kg	0.00E+00 mg/kg/day
Chrysene	0.000 mg/kg	0.00E+00 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.000 mg/kg	0.00E+00 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	0.00E+00 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	0E+00
Benzo(a)pyrene	0.00E+00 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	0E+00
Benzo(b)fluoranthene	0.00E+00 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	0E+00
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	0.00E+00 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	0E+00
Chrysene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Dibenz(a,h)anthracene	0.00E+00 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	0E+00
Indeno(1,2,3-cd)pyrene	0.00E+00 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	0E+00

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

2E-07

Landrum-South Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.022 mg/kg	7.30E-06 mg/kg/day
Benzo(a)pyrene	0.027 mg/kg	8.96E-06 mg/kg/day
Benzo(b)fluoranthene	0.077 mg/kg	2.56E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	3.32E-07 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	1.99E-06 mg/kg/day
Dibenz(a,h)anthracene	0.022 mg/kg	7.30E-06 mg/kg/day
Chrysene	0.013 mg/kg	4.31E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.039 mg/kg	1.29E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	7.30E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(a)pyrene	8.96E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	1E-05
Benzo(b)fluoranthene	2.56E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-06
Benzo(g,h,i)perylene	3.32E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-09
Benzo(k)fluoranthene	1.99E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-07
Chrysene	7.30E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	1E-07
Dibenz(a,h)anthracene	4.31E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-05
Indeno(1,2,3-cd)pyrene	1.29E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

5E-05

Mandrell-North Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.032 mg/kg	1.06E-05 mg/kg/day
Benzo(a)pyrene	0.040 mg/kg	1.33E-05 mg/kg/day
Benzo(b)fluoranthene	0.114 mg/kg	3.78E-05 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	6.64E-07 mg/kg/day
Benzo(k)fluoranthene	0.009 mg/kg	2.99E-06 mg/kg/day
Dibenz(a,h)anthracene	0.032 mg/kg	1.06E-05 mg/kg/day
Chrysene	0.018 mg/kg	5.97E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.057 mg/kg	1.89E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	1.06E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(a)pyrene	1.33E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	2E-05
Benzo(b)fluoranthene	3.78E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	6E-06
Benzo(g,h,i)perylene	6.64E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	9E-09
Benzo(k)fluoranthene	2.99E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-07
Chrysene	1.06E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	1E-07
Dibenz(a,h)anthracene	5.97E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	4E-05
Indeno(1,2,3-cd)pyrene	1.89E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

7E-05

Mandrell-South Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.006 mg/kg	1.99E-06 mg/kg/day
Benzo(a)pyrene	0.007 mg/kg	2.32E-06 mg/kg/day
Benzo(b)fluoranthene	0.021 mg/kg	6.97E-06 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	6.64E-07 mg/kg/day
Dibenz(a,h)anthracene	0.006 mg/kg	1.99E-06 mg/kg/day
Chrysene	0.003 mg/kg	9.96E-07 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.011 mg/kg	3.65E-06 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	1.99E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-07
Benzo(a)pyrene	2.32E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	3E-06
Benzo(b)fluoranthene	6.97E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	6.64E-07 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-07
Chrysene	1.99E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	3E-08
Dibenz(a,h)anthracene	9.96E-07 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	7E-06
Indeno(1,2,3-cd)pyrene	3.65E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

1E-05

Martin Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.013 mg/kg	4.31E-06 mg/kg/day
Benzo(a)pyrene	0.017 mg/kg	5.64E-06 mg/kg/day
Benzo(b)fluoranthene	0.048 mg/kg	1.59E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	3.32E-07 mg/kg/day
Benzo(k)fluoranthene	0.004 mg/kg	1.33E-06 mg/kg/day
Dibenz(a,h)anthracene	0.013 mg/kg	4.31E-06 mg/kg/day
Chrysene	0.008 mg/kg	2.65E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.024 mg/kg	7.96E-06 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	4.31E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	6E-07
Benzo(a)pyrene	5.64E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	8E-06
Benzo(b)fluoranthene	1.59E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(g,h,i)perylene	3.32E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-09
Benzo(k)fluoranthene	1.33E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-07
Chrysene	4.31E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	6E-08
Dibenz(a,h)anthracene	2.65E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-05
Indeno(1,2,3-cd)pyrene	7.96E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

3E-05

Pollard-East Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.020 mg/kg	6.64E-06 mg/kg/day
Benzo(a)pyrene	0.025 mg/kg	8.30E-06 mg/kg/day
Benzo(b)fluoranthene	0.071 mg/kg	2.36E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	3.32E-07 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	1.99E-06 mg/kg/day
Dibenz(a,h)anthracene	0.020 mg/kg	6.64E-06 mg/kg/day
Chrysene	0.011 mg/kg	3.65E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.035 mg/kg	1.16E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	6.64E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(a)pyrene	8.30E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	1E-05
Benzo(b)fluoranthene	2.36E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06
Benzo(g,h,i)perylene	3.32E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-09
Benzo(k)fluoranthene	1.99E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-07
Chrysene	6.64E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	9E-08
Dibenz(a,h)anthracene	3.65E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-05
Indeno(1,2,3-cd)pyrene	1.16E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

5E-05

Pollard-West Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.017 mg/kg	5.64E-06 mg/kg/day
Benzo(a)pyrene	0.021 mg/kg	6.97E-06 mg/kg/day
Benzo(b)fluoranthene	0.061 mg/kg	2.02E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	3.32E-07 mg/kg/day
Benzo(k)fluoranthene	0.005 mg/kg	1.66E-06 mg/kg/day
Dibenz(a,h)anthracene	0.017 mg/kg	5.64E-06 mg/kg/day
Chrysene	0.010 mg/kg	3.32E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.030 mg/kg	9.96E-06 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	5.64E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	8E-07
Benzo(a)pyrene	6.97E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	1E-05
Benzo(b)fluoranthene	2.02E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06
Benzo(g,h,i)perylene	3.32E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-09
Benzo(k)fluoranthene	1.66E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-07
Chrysene	5.64E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	8E-08
Dibenz(a,h)anthracene	3.32E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-05
Indeno(1,2,3-cd)pyrene	9.96E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

4E-05

Walters-East Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.006 mg/kg	1.99E-06 mg/kg/day
Benzo(a)pyrene	0.008 mg/kg	2.65E-06 mg/kg/day
Benzo(b)fluoranthene	0.022 mg/kg	7.30E-06 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	6.64E-07 mg/kg/day
Dibenz(a,h)anthracene	0.006 mg/kg	1.99E-06 mg/kg/day
Chrysene	0.004 mg/kg	1.33E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.011 mg/kg	3.65E-06 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	1.99E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-07
Benzo(a)pyrene	2.65E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	4E-06
Benzo(b)fluoranthene	7.30E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	6.64E-07 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-07
Chrysene	1.99E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	3E-08
Dibenz(a,h)anthracene	1.33E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	1E-05
Indeno(1,2,3-cd)pyrene	3.65E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

2E-05

Walters-West Adult Risk Calculations - Dermal (Carc.)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	3.32E-05 mg/kg/day
Benz(a)anthracene	0.021 mg/kg	6.97E-06 mg/kg/day
Benzo(a)pyrene	0.027 mg/kg	8.96E-06 mg/kg/day
Benzo(b)fluoranthene	0.076 mg/kg	2.52E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	3.32E-07 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	1.99E-06 mg/kg/day
Dibenz(a,h)anthracene	0.021 mg/kg	6.97E-06 mg/kg/day
Chrysene	0.012 mg/kg	3.98E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.038 mg/kg	1.26E-05 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	3.32E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	2E-07
Benz(a)anthracene	6.97E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(a)pyrene	8.96E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	1E-05
Benzo(b)fluoranthene	2.52E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-06
Benzo(g,h,i)perylene	3.32E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-09
Benzo(k)fluoranthene	1.99E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-07
Chrysene	6.97E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	1E-07
Dibenz(a,h)anthracene	3.98E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-05
Indeno(1,2,3-cd)pyrene	1.26E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

5E-05

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS

CARCINOGENIC RISK-DERMAL

CHILD RECEPTORS

Barrick Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.014 mg/kg	7.90E-06 mg/kg/day
Benzo(a)pyrene	0.018 mg/kg	1.02E-05 mg/kg/day
Benzo(b)fluoranthene	0.051 mg/kg	2.88E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	5.65E-07 mg/kg/day
Benzo(k)fluoranthene	0.004 mg/kg	2.26E-06 mg/kg/day
Dibenz(a,h)anthracene	0.014 mg/kg	7.90E-06 mg/kg/day
Chrysene	0.008 mg/kg	4.52E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.026 mg/kg	1.47E-05 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	7.90E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(a)pyrene	1.02E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	1E-05
Benzo(b)fluoranthene	2.88E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-06
Benzo(g,h,i)perylene	5.65E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	8E-09
Benzo(k)fluoranthene	2.26E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-07
Chrysene	7.90E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	1E-07
Dibenz(a,h)anthracene	4.52E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-05
Indeno(1,2,3-cd)pyrene	1.47E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

6E-05

Caughlin Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.026 mg/kg	1.47E-05 mg/kg/day
Benzo(a)pyrene	0.032 mg/kg	1.81E-05 mg/kg/day
Benzo(b)fluoranthene	0.093 mg/kg	5.25E-05 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	1.13E-06 mg/kg/day
Benzo(k)fluoranthene	0.008 mg/kg	4.52E-06 mg/kg/day
Dibenz(a,h)anthracene	0.026 mg/kg	1.47E-05 mg/kg/day
Chrysene	0.015 mg/kg	8.47E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.046 mg/kg	2.60E-05 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	1.47E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(a)pyrene	1.81E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	3E-05
Benzo(b)fluoranthene	5.25E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	8E-06
Benzo(g,h,i)perylene	1.13E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-08
Benzo(k)fluoranthene	4.52E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	7E-07
Chrysene	1.47E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-07
Dibenz(a,h)anthracene	8.47E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	6E-05
Indeno(1,2,3-cd)pyrene	2.60E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

1E-04

Choquette Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.038 mg/kg	2.15E-05 mg/kg/day
Benzo(a)pyrene	0.048 mg/kg	2.71E-05 mg/kg/day
Benzo(b)fluoranthene	0.138 mg/kg	7.79E-05 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	1.13E-06 mg/kg/day
Benzo(k)fluoranthene	0.011 mg/kg	6.21E-06 mg/kg/day
Dibenz(a,h)anthracene	0.038 mg/kg	2.15E-05 mg/kg/day
Chrysene	0.022 mg/kg	1.24E-05 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.069 mg/kg	3.90E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	2.15E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06
Benzo(a)pyrene	2.71E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	4E-05
Benzo(b)fluoranthene	7.79E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-05
Benzo(g,h,i)perylene	1.13E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-08
Benzo(k)fluoranthene	6.21E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	9E-07
Chrysene	2.15E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	3E-07
Dibenz(a,h)anthracene	1.24E-05 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	9E-05
Indeno(1,2,3-cd)pyrene	3.90E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	6E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

2E-04

Dewitt Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.086 mg/kg	4.85E-05 mg/kg/day
Benzo(a)pyrene	0.108 mg/kg	6.10E-05 mg/kg/day
Benzo(b)fluoranthene	0.308 mg/kg	1.74E-04 mg/kg/day
Benzo(g,h,i)perylene	0.005 mg/kg	2.82E-06 mg/kg/day
Benzo(k)fluoranthene	0.025 mg/kg	1.41E-05 mg/kg/day
Dibenz(a,h)anthracene	0.086 mg/kg	4.85E-05 mg/kg/day
Chrysene	0.050 mg/kg	2.82E-05 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.154 mg/kg	8.69E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	4.85E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	7E-06
Benzo(a)pyrene	6.10E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	9E-05
Benzo(b)fluoranthene	1.74E-04 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-05
Benzo(g,h,i)perylene	2.82E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	4E-08
Benzo(k)fluoranthene	1.41E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Chrysene	4.85E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	7E-07
Dibenz(a,h)anthracene	2.82E-05 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-04
Indeno(1,2,3-cd)pyrene	8.69E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-05

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

3E-04

Hyde Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.019 mg/kg	1.07E-05 mg/kg/day
Benzo(a)pyrene	0.024 mg/kg	1.35E-05 mg/kg/day
Benzo(b)fluoranthene	0.069 mg/kg	3.90E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	5.65E-07 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	3.39E-06 mg/kg/day
Dibenz(a,h)anthracene	0.019 mg/kg	1.07E-05 mg/kg/day
Chrysene	0.011 mg/kg	6.21E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.035 mg/kg	1.98E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	1.07E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(a)pyrene	1.35E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	2E-05
Benzo(b)fluoranthene	3.90E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	6E-06
Benzo(g,h,i)perylene	5.65E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	8E-09
Benzo(k)fluoranthene	3.39E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07
Chrysene	1.07E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-07
Dibenz(a,h)anthracene	6.21E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	5E-05
Indeno(1,2,3-cd)pyrene	1.98E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

8E-05

Lair Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.008 mg/kg	4.52E-06 mg/kg/day
Benzo(a)pyrene	0.010 mg/kg	5.65E-06 mg/kg/day
Benzo(b)fluoranthene	0.028 mg/kg	1.58E-05 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	1.13E-06 mg/kg/day
Dibenz(a,h)anthracene	0.008 mg/kg	4.52E-06 mg/kg/day
Chrysene	0.005 mg/kg	2.82E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.014 mg/kg	7.90E-06 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	4.52E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	7E-07
Benzo(a)pyrene	5.65E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	8E-06
Benzo(b)fluoranthene	1.58E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	1.13E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-07
Chrysene	4.52E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	6E-08
Dibenz(a,h)anthracene	2.82E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-05
Indeno(1,2,3-cd)pyrene	7.90E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

3E-05

Landrum-North Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(a)pyrene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(b)fluoranthene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.000 mg/kg	0.00E+00 mg/kg/day
Dibenz(a,h)anthracene	0.000 mg/kg	0.00E+00 mg/kg/day
Chrysene	0.000 mg/kg	0.00E+00 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.000 mg/kg	0.00E+00 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	0.00E+00 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	0E+00
Benzo(a)pyrene	0.00E+00 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	0E+00
Benzo(b)fluoranthene	0.00E+00 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	0E+00
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	0.00E+00 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	0E+00
Chrysene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Dibenz(a,h)anthracene	0.00E+00 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	0E+00
Indeno(1,2,3-cd)pyrene	0.00E+00 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	0E+00

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

3E-07

Landrum-South Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.022 mg/kg	1.24E-05 mg/kg/day
Benzo(a)pyrene	0.027 mg/kg	1.52E-05 mg/kg/day
Benzo(b)fluoranthene	0.077 mg/kg	4.35E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	5.65E-07 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	3.39E-06 mg/kg/day
Dibenz(a,h)anthracene	0.022 mg/kg	1.24E-05 mg/kg/day
Chrysene	0.013 mg/kg	7.34E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.039 mg/kg	2.20E-05 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	1.24E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(a)pyrene	1.52E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	2E-05
Benzo(b)fluoranthene	4.35E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	6E-06
Benzo(g,h,i)perylene	5.65E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	8E-09
Benzo(k)fluoranthene	3.39E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07
Chrysene	1.24E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-07
Dibenz(a,h)anthracene	7.34E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	5E-05
Indeno(1,2,3-cd)pyrene	2.20E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

9E-05

Mandrell-North Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.032 mg/kg	1.81E-05 mg/kg/day
Benzo(a)pyrene	0.040 mg/kg	2.26E-05 mg/kg/day
Benzo(b)fluoranthene	0.114 mg/kg	6.44E-05 mg/kg/day
Benzo(g,h,i)perylene	0.002 mg/kg	1.13E-06 mg/kg/day
Benzo(k)fluoranthene	0.009 mg/kg	5.08E-06 mg/kg/day
Dibenz(a,h)anthracene	0.032 mg/kg	1.81E-05 mg/kg/day
Chrysene	0.018 mg/kg	1.02E-05 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.057 mg/kg	3.22E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	1.81E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06
Benzo(a)pyrene	2.26E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	3E-05
Benzo(b)fluoranthene	6.44E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	9E-06
Benzo(g,h,i)perylene	1.13E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-08
Benzo(k)fluoranthene	5.08E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	7E-07
Chrysene	1.81E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	3E-07
Dibenz(a,h)anthracene	1.02E-05 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	7E-05
Indeno(1,2,3-cd)pyrene	3.22E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

1E-04

Mandrell-South Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.006 mg/kg	3.39E-06 mg/kg/day
Benzo(a)pyrene	0.007 mg/kg	3.95E-06 mg/kg/day
Benzo(b)fluoranthene	0.021 mg/kg	1.19E-05 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	1.13E-06 mg/kg/day
Dibenz(a,h)anthracene	0.006 mg/kg	3.39E-06 mg/kg/day
Chrysene	0.003 mg/kg	1.69E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.011 mg/kg	6.21E-06 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	3.39E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07
Benzo(a)pyrene	3.95E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	6E-06
Benzo(b)fluoranthene	1.19E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	1.13E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-07
Chrysene	3.39E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-08
Dibenz(a,h)anthracene	1.69E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	1E-05
Indeno(1,2,3-cd)pyrene	6.21E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	9E-07

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

2E-05

Martin Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.013 mg/kg	7.34E-06 mg/kg/day
Benzo(a)pyrene	0.017 mg/kg	9.60E-06 mg/kg/day
Benzo(b)fluoranthene	0.048 mg/kg	2.71E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	5.65E-07 mg/kg/day
Benzo(k)fluoranthene	0.004 mg/kg	2.26E-06 mg/kg/day
Dibenz(a,h)anthracene	0.013 mg/kg	7.34E-06 mg/kg/day
Chrysene	0.008 mg/kg	4.52E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.024 mg/kg	1.35E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	7.34E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(a)pyrene	9.60E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	1E-05
Benzo(b)fluoranthene	2.71E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-06
Benzo(g,h,i)perylene	5.65E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	8E-09
Benzo(k)fluoranthene	2.26E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-07
Chrysene	7.34E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	1E-07
Dibenz(a,h)anthracene	4.52E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	3E-05
Indeno(1,2,3-cd)pyrene	1.35E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

5E-05

Pollard-East Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.020 mg/kg	1.13E-05 mg/kg/day
Benzo(a)pyrene	0.025 mg/kg	1.41E-05 mg/kg/day
Benzo(b)fluoranthene	0.071 mg/kg	4.01E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	5.65E-07 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	3.39E-06 mg/kg/day
Dibenz(a,h)anthracene	0.020 mg/kg	1.13E-05 mg/kg/day
Chrysene	0.011 mg/kg	6.21E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.035 mg/kg	1.98E-05 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	1.13E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(a)pyrene	1.41E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	2E-05
Benzo(b)fluoranthene	4.01E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	6E-06
Benzo(g,h,i)perylene	5.65E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	8E-09
Benzo(k)fluoranthene	3.39E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07
Chrysene	1.13E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-07
Dibenz(a,h)anthracene	6.21E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	5E-05
Indeno(1,2,3-cd)pyrene	1.98E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

8E-05

Pollard-West Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.017 mg/kg	9.60E-06 mg/kg/day
Benzo(a)pyrene	0.021 mg/kg	1.19E-05 mg/kg/day
Benzo(b)fluoranthene	0.061 mg/kg	3.44E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	5.65E-07 mg/kg/day
Benzo(k)fluoranthene	0.005 mg/kg	2.82E-06 mg/kg/day
Dibenz(a,h)anthracene	0.017 mg/kg	9.60E-06 mg/kg/day
Chrysene	0.010 mg/kg	5.65E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.030 mg/kg	1.69E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	9.60E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	1E-06
Benzo(a)pyrene	1.19E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	2E-05
Benzo(b)fluoranthene	3.44E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-06
Benzo(g,h,i)perylene	5.65E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	8E-09
Benzo(k)fluoranthene	2.82E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	4E-07
Chrysene	9.60E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	1E-07
Dibenz(a,h)anthracene	5.65E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	4E-05
Indeno(1,2,3-cd)pyrene	1.69E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

7E-05

Walters-East Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.006 mg/kg	3.39E-06 mg/kg/day
Benzo(a)pyrene	0.008 mg/kg	4.52E-06 mg/kg/day
Benzo(b)fluoranthene	0.022 mg/kg	1.24E-05 mg/kg/day
Benzo(g,h,i)perylene	0.000 mg/kg	0.00E+00 mg/kg/day
Benzo(k)fluoranthene	0.002 mg/kg	1.13E-06 mg/kg/day
Dibenz(a,h)anthracene	0.006 mg/kg	3.39E-06 mg/kg/day
Chrysene	0.004 mg/kg	2.26E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.011 mg/kg	6.21E-06 mg/kg/day

Risk Calculations:

Risk = Dose x Slope Factor

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	3.39E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07
Benzo(a)pyrene	4.52E-06 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	7E-06
Benzo(b)fluoranthene	1.24E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(g,h,i)perylene	0.00E+00 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	0E+00
Benzo(k)fluoranthene	1.13E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-07
Chrysene	3.39E-06 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	5E-08
Dibenz(a,h)anthracene	2.26E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	2E-05
Indeno(1,2,3-cd)pyrene	6.21E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	9E-07

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

3E-05

Walters-West Child Risk Calculations - Dermal (Carc.)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

<u>Compound</u>	<u>Concentration</u>	<u>Dose</u>
Benzene	0.100 mg/kg	5.65E-05 mg/kg/day
Benz(a)anthracene	0.021 mg/kg	1.19E-05 mg/kg/day
Benzo(a)pyrene	0.027 mg/kg	1.52E-05 mg/kg/day
Benzo(b)fluoranthene	0.076 mg/kg	4.29E-05 mg/kg/day
Benzo(g,h,i)perylene	0.001 mg/kg	5.65E-07 mg/kg/day
Benzo(k)fluoranthene	0.006 mg/kg	3.39E-06 mg/kg/day
Dibenz(a,h)anthracene	0.021 mg/kg	1.19E-05 mg/kg/day
Chrysene	0.012 mg/kg	6.77E-06 mg/kg/day
Indeno(1,2,3-cd)pyrene	0.038 mg/kg	2.15E-05 mg/kg/day

Risk Calculations:

$$\text{Risk} = \text{Dose} \times \text{Slope Factor}$$

<u>Compound</u>	<u>Dose</u>	<u>Dermal SF*</u>	<u>Risk</u>
Benzene	5.65E-05 mg/kg/day	5.80E-03 (mg/kg/day) ⁻¹	3E-07
Benz(a)anthracene	1.19E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	2E-06
Benzo(a)pyrene	1.52E-05 mg/kg/day	1.46E+00 (mg/kg/day) ⁻¹	2E-05
Benzo(b)fluoranthene	4.29E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	6E-06
Benzo(g,h,i)perylene	5.65E-07 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	8E-09
Benzo(k)fluoranthene	3.39E-06 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	5E-07
Chrysene	1.19E-05 mg/kg/day	1.40E-02 (mg/kg/day) ⁻¹	2E-07
Dibenz(a,h)anthracene	6.77E-06 mg/kg/day	7.30E+00 (mg/kg/day) ⁻¹	5E-05
Indeno(1,2,3-cd)pyrene	2.15E-05 mg/kg/day	1.46E-01 (mg/kg/day) ⁻¹	3E-06

*From IRIS and adjusted to absorbed

Cumulative Carcinogenic Risk:

8E-05

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS

SYSTEMIC RISK-INGESTION

ADULT RECEPTORS

Barrick Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	26 mg/kg
>EC8-<=EC10	48 mg/kg
>EC10-<=EC12	61 mg/kg
>EC12-<=EC16	182 mg/kg
>EC16-<=EC21	259 mg/kg
>EC21-<=EC40	745 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	11 mg/kg
>EC12-<=EC16	54 mg/kg
>EC16-<=EC21	133 mg/kg
>EC21-<=EC40	612 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	3.33E-06 mg/kg/day	>EC6-<=EC7	3.33E-06 mg/kg/day
>EC6-<=EC8	4.33E-05 mg/kg/day	>EC7-<=EC8	3.33E-06 mg/kg/day
>EC8-<=EC10	8.00E-05 mg/kg/day	>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	1.02E-04 mg/kg/day	>EC10-<=EC12	1.83E-05 mg/kg/day
>EC12-<=EC16	3.03E-04 mg/kg/day	>EC12-<=EC16	9.00E-05 mg/kg/day
>EC16-<=EC21	4.32E-04 mg/kg/day	>EC16-<=EC21	2.22E-04 mg/kg/day
>EC21-<=EC40	1.24E-03 mg/kg/day	>EC21-<=EC40	1.02E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Barrick Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	6.67E-07	>EC6-<=EC7	1.67E-05
>EC6-<=EC8	8.67E-06	>EC7-<=EC8	1.67E-05
>EC8-<=EC10	8.00E-04	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	1.02E-03	>EC10-<=EC12	4.58E-04
>EC12-<=EC16	3.03E-03	>EC12-<=EC16	2.25E-03
>EC16-<=EC21	2.16E-04	>EC16-<=EC21	7.39E-03
>EC21-<=EC40	6.21E-04	>EC21-<=EC40	3.40E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 5.00E-02

Caughlin Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg	>EC6-<=EC7	2 mg/kg
>EC6-<=EC8	24 mg/kg	>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	112 mg/kg	>EC8-<=EC10	20 mg/kg
>EC10-<=EC12	199 mg/kg	>EC10-<=EC12	56 mg/kg
>EC12-<=EC16	494 mg/kg	>EC12-<=EC16	173 mg/kg
>EC16-<=EC21	552 mg/kg	>EC16-<=EC21	221 mg/kg
>EC21-<=EC40	1403 mg/kg	>EC21-<=EC40	608 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	3.33E-06 mg/kg/day	>EC6-<=EC7	3.33E-06 mg/kg/day
>EC6-<=EC8	4.00E-05 mg/kg/day	>EC7-<=EC8	3.33E-06 mg/kg/day
>EC8-<=EC10	1.87E-04 mg/kg/day	>EC8-<=EC10	3.33E-05 mg/kg/day
>EC10-<=EC12	3.32E-04 mg/kg/day	>EC10-<=EC12	9.33E-05 mg/kg/day
>EC12-<=EC16	8.23E-04 mg/kg/day	>EC12-<=EC16	2.88E-04 mg/kg/day
>EC16-<=EC21	9.20E-04 mg/kg/day	>EC16-<=EC21	3.68E-04 mg/kg/day
>EC21-<=EC40	2.34E-03 mg/kg/day	>EC21-<=EC40	1.01E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Caughlin Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	6.67E-07	>EC6-<=EC7	1.67E-05
>EC6-<=EC8	8.00E-06	>EC7-<=EC8	1.67E-05
>EC8-<=EC10	1.87E-03	>EC8-<=EC10	8.33E-04
>EC10-<=EC12	3.32E-03	>EC10-<=EC12	2.33E-03
>EC12-<=EC16	8.23E-03	>EC12-<=EC16	7.21E-03
>EC16-<=EC21	4.60E-04	>EC16-<=EC21	1.23E-02
>EC21-<=EC40	1.17E-03	>EC21-<=EC40	3.38E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 7.15E-02

Choquette Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	51 mg/kg
>EC8-<=EC10	71 mg/kg
>EC10-<=EC12	82 mg/kg
>EC12-<=EC16	308 mg/kg
>EC16-<=EC21	890 mg/kg
>EC21-<=EC40	2202 mg/kg

Fraction

Dose

>EC5-<=EC6	3.33E-06 mg/kg/day
>EC6-<=EC8	8.50E-05 mg/kg/day
>EC8-<=EC10	1.18E-04 mg/kg/day
>EC10-<=EC12	1.37E-04 mg/kg/day
>EC12-<=EC16	5.13E-04 mg/kg/day
>EC16-<=EC21	1.48E-03 mg/kg/day
>EC21-<=EC40	3.67E-03 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	22 mg/kg
>EC12-<=EC16	124 mg/kg
>EC16-<=EC21	450 mg/kg
>EC21-<=EC40	1529 mg/kg

Fraction

Dose

>EC6-<=EC7	3.33E-06 mg/kg/day
>EC7-<=EC8	3.33E-06 mg/kg/day
>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	3.67E-05 mg/kg/day
>EC12-<=EC16	2.07E-04 mg/kg/day
>EC16-<=EC21	7.50E-04 mg/kg/day
>EC21-<=EC40	2.55E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Choquette Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	6.67E-07	>EC6-<=EC7	1.67E-05
>EC6-<=EC8	1.70E-05	>EC7-<=EC8	1.67E-05
>EC8-<=EC10	1.18E-03	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	1.37E-03	>EC10-<=EC12	9.17E-04
>EC12-<=EC16	5.13E-03	>EC12-<=EC16	5.17E-03
>EC16-<=EC21	7.42E-04	>EC16-<=EC21	2.50E-02
>EC21-<=EC40	1.84E-03	>EC21-<=EC40	8.49E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.27E-01

Dewitt Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	93 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	150 mg/kg	>EC8-<=EC10	8 mg/kg
>EC10-<=EC12	256 mg/kg	>EC10-<=EC12	45 mg/kg
>EC12-<=EC16	1089 mg/kg	>EC12-<=EC16	290 mg/kg
>EC16-<=EC21	2025 mg/kg	>EC16-<=EC21	724 mg/kg
>EC21-<=EC40	5188 mg/kg	>EC21-<=EC40	2940 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	6.67E-06 mg/kg/day	>EC6-<=EC7	6.67E-06 mg/kg/day
>EC6-<=EC8	1.55E-04 mg/kg/day	>EC7-<=EC8	6.67E-06 mg/kg/day
>EC8-<=EC10	2.50E-04 mg/kg/day	>EC8-<=EC10	1.33E-05 mg/kg/day
>EC10-<=EC12	4.27E-04 mg/kg/day	>EC10-<=EC12	7.50E-05 mg/kg/day
>EC12-<=EC16	1.82E-03 mg/kg/day	>EC12-<=EC16	4.83E-04 mg/kg/day
>EC16-<=EC21	3.38E-03 mg/kg/day	>EC16-<=EC21	1.21E-03 mg/kg/day
>EC21-<=EC40	8.65E-03 mg/kg/day	>EC21-<=EC40	4.90E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Dewitt Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-06	>EC6-<=EC7	3.33E-05
>EC6-<=EC8	3.10E-05	>EC7-<=EC8	3.33E-05
>EC8-<=EC10	2.50E-03	>EC8-<=EC10	3.33E-04
>EC10-<=EC12	4.27E-03	>EC10-<=EC12	1.88E-03
>EC12-<=EC16	1.82E-02	>EC12-<=EC16	1.21E-02
>EC16-<=EC21	1.69E-03	>EC16-<=EC21	4.02E-02
>EC21-<=EC40	4.32E-03	>EC21-<=EC40	1.63E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.49E-01

Hyde Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	57 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	64 mg/kg	>EC8-<=EC10	10 mg/kg
>EC10-<=EC12	101 mg/kg	>EC10-<=EC12	33 mg/kg
>EC12-<=EC16	308 mg/kg	>EC12-<=EC16	135 mg/kg
>EC16-<=EC21	469 mg/kg	>EC16-<=EC21	234 mg/kg
>EC21-<=EC40	992 mg/kg	>EC21-<=EC40	470 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	6.67E-06 mg/kg/day	>EC6-<=EC7	6.67E-06 mg/kg/day
>EC6-<=EC8	9.50E-05 mg/kg/day	>EC7-<=EC8	6.67E-06 mg/kg/day
>EC8-<=EC10	1.07E-04 mg/kg/day	>EC8-<=EC10	1.67E-05 mg/kg/day
>EC10-<=EC12	1.68E-04 mg/kg/day	>EC10-<=EC12	5.50E-05 mg/kg/day
>EC12-<=EC16	5.13E-04 mg/kg/day	>EC12-<=EC16	2.25E-04 mg/kg/day
>EC16-<=EC21	7.82E-04 mg/kg/day	>EC16-<=EC21	3.90E-04 mg/kg/day
>EC21-<=EC40	1.65E-03 mg/kg/day	>EC21-<=EC40	7.83E-04 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Hyde Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-06	>EC6-<=EC7	3.33E-05
>EC6-<=EC8	1.90E-05	>EC7-<=EC8	3.33E-05
>EC8-<=EC10	1.07E-03	>EC8-<=EC10	4.17E-04
>EC10-<=EC12	1.68E-03	>EC10-<=EC12	1.38E-03
>EC12-<=EC16	5.13E-03	>EC12-<=EC16	5.63E-03
>EC16-<=EC21	3.91E-04	>EC16-<=EC21	1.30E-02
>EC21-<=EC40	8.27E-04	>EC21-<=EC40	2.61E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 5.57E-02

Lair Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	17 mg/kg
>EC8-<=EC10	11 mg/kg
>EC10-<=EC12	13 mg/kg
>EC12-<=EC16	44 mg/kg
>EC16-<=EC21	106 mg/kg
>EC21-<=EC40	425 mg/kg

Fraction

Dose

>EC5-<=EC6	6.67E-06 mg/kg/day
>EC6-<=EC8	2.83E-05 mg/kg/day
>EC8-<=EC10	1.83E-05 mg/kg/day
>EC10-<=EC12	2.17E-05 mg/kg/day
>EC12-<=EC16	7.33E-05 mg/kg/day
>EC16-<=EC21	1.77E-04 mg/kg/day
>EC21-<=EC40	7.08E-04 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	69 mg/kg
>EC21-<=EC40	470 mg/kg

Fraction

Dose

>EC6-<=EC7	6.67E-06 mg/kg/day
>EC7-<=EC8	6.67E-06 mg/kg/day
>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	6.67E-06 mg/kg/day
>EC12-<=EC16	1.67E-05 mg/kg/day
>EC16-<=EC21	1.15E-04 mg/kg/day
>EC21-<=EC40	7.83E-04 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Lair Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-06	>EC6-<=EC7	3.33E-05
>EC6-<=EC8	5.67E-06	>EC7-<=EC8	3.33E-05
>EC8-<=EC10	1.83E-04	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	2.17E-04	>EC10-<=EC12	1.67E-04
>EC12-<=EC16	7.33E-04	>EC12-<=EC16	4.17E-04
>EC16-<=EC21	8.83E-05	>EC16-<=EC21	3.83E-03
>EC21-<=EC40	3.54E-04	>EC21-<=EC40	2.61E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.23E-02

Landrum-North Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	1 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	10 mg/kg	>EC16-<=EC21	10 mg/kg
>EC21-<=EC40	25 mg/kg	>EC21-<=EC40	25 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.67E-06 mg/kg/day	>EC6-<=EC7	1.67E-06 mg/kg/day
>EC6-<=EC8	1.67E-06 mg/kg/day	>EC7-<=EC8	1.67E-06 mg/kg/day
>EC8-<=EC10	6.67E-06 mg/kg/day	>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	6.67E-06 mg/kg/day	>EC10-<=EC12	6.67E-06 mg/kg/day
>EC12-<=EC16	1.67E-05 mg/kg/day	>EC12-<=EC16	1.67E-05 mg/kg/day
>EC16-<=EC21	1.67E-05 mg/kg/day	>EC16-<=EC21	1.67E-05 mg/kg/day
>EC21-<=EC40	4.17E-05 mg/kg/day	>EC21-<=EC40	4.17E-05 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose}/\text{Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Landrum-North Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	3.33E-07	>EC6-<=EC7	8.33E-06
>EC6-<=EC8	3.33E-07	>EC7-<=EC8	8.33E-06
>EC8-<=EC10	6.67E-05	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	6.67E-05	>EC10-<=EC12	1.67E-04
>EC12-<=EC16	1.67E-04	>EC12-<=EC16	4.17E-04
>EC16-<=EC21	8.33E-06	>EC16-<=EC21	5.56E-04
>EC21-<=EC40	2.08E-05	>EC21-<=EC40	1.39E-03

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.04E-03

Landrum-South Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	47 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	72 mg/kg	>EC8-<=EC10	13 mg/kg
>EC10-<=EC12	123 mg/kg	>EC10-<=EC12	28 mg/kg
>EC12-<=EC16	319 mg/kg	>EC12-<=EC16	105 mg/kg
>EC16-<=EC21	442 mg/kg	>EC16-<=EC21	189 mg/kg
>EC21-<=EC40	1257 mg/kg	>EC21-<=EC40	628 mg/kg
<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	6.67E-06 mg/kg/day	>EC6-<=EC7	6.67E-06 mg/kg/day
>EC6-<=EC8	7.83E-05 mg/kg/day	>EC7-<=EC8	6.67E-06 mg/kg/day
>EC8-<=EC10	1.20E-04 mg/kg/day	>EC8-<=EC10	2.17E-05 mg/kg/day
>EC10-<=EC12	2.05E-04 mg/kg/day	>EC10-<=EC12	4.67E-05 mg/kg/day
>EC12-<=EC16	5.32E-04 mg/kg/day	>EC12-<=EC16	1.75E-04 mg/kg/day
>EC16-<=EC21	7.37E-04 mg/kg/day	>EC16-<=EC21	3.15E-04 mg/kg/day
>EC21-<=EC40	2.10E-03 mg/kg/day	>EC21-<=EC40	1.05E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Landrum-South Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-06	>EC6-<=EC7	3.33E-05
>EC6-<=EC8	1.57E-05	>EC7-<=EC8	3.33E-05
>EC8-<=EC10	1.20E-03	>EC8-<=EC10	5.42E-04
>EC10-<=EC12	2.05E-03	>EC10-<=EC12	1.17E-03
>EC12-<=EC16	5.32E-03	>EC12-<=EC16	4.38E-03
>EC16-<=EC21	3.68E-04	>EC16-<=EC21	1.05E-02
>EC21-<=EC40	1.05E-03	>EC21-<=EC40	3.49E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 6.15E-02

Mandrell-North Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	52 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	113 mg/kg	>EC8-<=EC10	19 mg/kg
>EC10-<=EC12	151 mg/kg	>EC10-<=EC12	51 mg/kg
>EC12-<=EC16	423 mg/kg	>EC12-<=EC16	181 mg/kg
>EC16-<=EC21	718 mg/kg	>EC16-<=EC21	342 mg/kg
>EC21-<=EC40	1799 mg/kg	>EC21-<=EC40	890 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	6.67E-06 mg/kg/day	>EC6-<=EC7	6.67E-06 mg/kg/day
>EC6-<=EC8	8.67E-05 mg/kg/day	>EC7-<=EC8	6.67E-06 mg/kg/day
>EC8-<=EC10	1.88E-04 mg/kg/day	>EC8-<=EC10	3.17E-05 mg/kg/day
>EC10-<=EC12	2.52E-04 mg/kg/day	>EC10-<=EC12	8.50E-05 mg/kg/day
>EC12-<=EC16	7.05E-04 mg/kg/day	>EC12-<=EC16	3.02E-04 mg/kg/day
>EC16-<=EC21	1.20E-03 mg/kg/day	>EC16-<=EC21	5.70E-04 mg/kg/day
>EC21-<=EC40	3.00E-03 mg/kg/day	>EC21-<=EC40	1.48E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Mandrell-North Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-06	>EC6-<=EC7	3.33E-05
>EC6-<=EC8	1.73E-05	>EC7-<=EC8	3.33E-05
>EC8-<=EC10	1.88E-03	>EC8-<=EC10	7.92E-04
>EC10-<=EC12	2.52E-03	>EC10-<=EC12	2.13E-03
>EC12-<=EC16	7.05E-03	>EC12-<=EC16	7.54E-03
>EC16-<=EC21	5.98E-04	>EC16-<=EC21	1.90E-02
>EC21-<=EC40	1.50E-03	>EC21-<=EC40	4.94E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 9.25E-02

Mandrell-South Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	2 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	31 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	115 mg/kg	>EC16-<=EC21	65 mg/kg
>EC21-<=EC40	481 mg/kg	>EC21-<=EC40	159 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.67E-06 mg/kg/day	>EC6-<=EC7	1.67E-06 mg/kg/day
>EC6-<=EC8	3.33E-06 mg/kg/day	>EC7-<=EC8	1.67E-06 mg/kg/day
>EC8-<=EC10	6.67E-06 mg/kg/day	>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	6.67E-06 mg/kg/day	>EC10-<=EC12	6.67E-06 mg/kg/day
>EC12-<=EC16	5.17E-05 mg/kg/day	>EC12-<=EC16	1.67E-05 mg/kg/day
>EC16-<=EC21	1.92E-04 mg/kg/day	>EC16-<=EC21	1.08E-04 mg/kg/day
>EC21-<=EC40	8.02E-04 mg/kg/day	>EC21-<=EC40	2.65E-04 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Mandrell-South Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	3.33E-07	>EC6-<=EC7	8.33E-06
>EC6-<=EC8	6.67E-07	>EC7-<=EC8	8.33E-06
>EC8-<=EC10	6.67E-05	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	6.67E-05	>EC10-<=EC12	1.67E-04
>EC12-<=EC16	5.17E-04	>EC12-<=EC16	4.17E-04
>EC16-<=EC21	9.58E-05	>EC16-<=EC21	3.61E-03
>EC21-<=EC40	4.01E-04	>EC21-<=EC40	8.83E-03

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.44E-02

Martin Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg	>EC6-<=EC7	2 mg/kg
>EC6-<=EC8	18 mg/kg	>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	32 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	57 mg/kg	>EC10-<=EC12	11 mg/kg
>EC12-<=EC16	164 mg/kg	>EC12-<=EC16	67 mg/kg
>EC16-<=EC21	219 mg/kg	>EC16-<=EC21	151 mg/kg
>EC21-<=EC40	682 mg/kg	>EC21-<=EC40	595 mg/kg

Aromatics

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	3.33E-06 mg/kg/day	>EC6-<=EC7	3.33E-06 mg/kg/day
>EC6-<=EC8	3.00E-05 mg/kg/day	>EC7-<=EC8	3.33E-06 mg/kg/day
>EC8-<=EC10	5.33E-05 mg/kg/day	>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	9.50E-05 mg/kg/day	>EC10-<=EC12	1.83E-05 mg/kg/day
>EC12-<=EC16	2.73E-04 mg/kg/day	>EC12-<=EC16	1.12E-04 mg/kg/day
>EC16-<=EC21	3.65E-04 mg/kg/day	>EC16-<=EC21	2.52E-04 mg/kg/day
>EC21-<=EC40	1.14E-03 mg/kg/day	>EC21-<=EC40	9.92E-04 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Martin Risk Adult Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	6.67E-07	>EC6-<=EC7	1.67E-05
>EC6-<=EC8	6.00E-06	>EC7-<=EC8	1.67E-05
>EC8-<=EC10	5.33E-04	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	9.50E-04	>EC10-<=EC12	4.58E-04
>EC12-<=EC16	2.73E-03	>EC12-<=EC16	2.79E-03
>EC16-<=EC21	1.83E-04	>EC16-<=EC21	8.39E-03
>EC21-<=EC40	5.68E-04	>EC21-<=EC40	3.31E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 4.99E-02

Pollard-East Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 F1 (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg	>EC6-<=EC7	2 mg/kg
>EC6-<=EC8	19 mg/kg	>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	82 mg/kg	>EC8-<=EC10	9 mg/kg
>EC10-<=EC12	131 mg/kg	>EC10-<=EC12	28 mg/kg
>EC12-<=EC16	332 mg/kg	>EC12-<=EC16	126 mg/kg
>EC16-<=EC21	433 mg/kg	>EC16-<=EC21	223 mg/kg
>EC21-<=EC40	911 mg/kg	>EC21-<=EC40	651 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	3.33E-06 mg/kg/day	>EC6-<=EC7	3.33E-06 mg/kg/day
>EC6-<=EC8	3.17E-05 mg/kg/day	>EC7-<=EC8	3.33E-06 mg/kg/day
>EC8-<=EC10	1.37E-04 mg/kg/day	>EC8-<=EC10	1.50E-05 mg/kg/day
>EC10-<=EC12	2.18E-04 mg/kg/day	>EC10-<=EC12	4.67E-05 mg/kg/day
>EC12-<=EC16	5.53E-04 mg/kg/day	>EC12-<=EC16	2.10E-04 mg/kg/day
>EC16-<=EC21	7.22E-04 mg/kg/day	>EC16-<=EC21	3.72E-04 mg/kg/day
>EC21-<=EC40	1.52E-03 mg/kg/day	>EC21-<=EC40	1.09E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Pollard-East Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	6.67E-07	>EC6-<=EC7	1.67E-05
>EC6-<=EC8	6.33E-06	>EC7-<=EC8	1.67E-05
>EC8-<=EC10	1.37E-03	>EC8-<=EC10	3.75E-04
>EC10-<=EC12	2.18E-03	>EC10-<=EC12	1.17E-03
>EC12-<=EC16	5.53E-03	>EC12-<=EC16	5.25E-03
>EC16-<=EC21	3.61E-04	>EC16-<=EC21	1.24E-02
>EC21-<=EC40	7.59E-04	>EC21-<=EC40	3.62E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 6.56E-02

Pollard-West Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	45 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	90 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	134 mg/kg	>EC10-<=EC12	33 mg/kg
>EC12-<=EC16	287 mg/kg	>EC12-<=EC16	139 mg/kg
>EC16-<=EC21	308 mg/kg	>EC16-<=EC21	194 mg/kg
>EC21-<=EC40	753 mg/kg	>EC21-<=EC40	550 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	6.67E-06 mg/kg/day	>EC6-<=EC7	6.67E-06 mg/kg/day
>EC6-<=EC8	7.50E-05 mg/kg/day	>EC7-<=EC8	6.67E-06 mg/kg/day
>EC8-<=EC10	1.50E-04 mg/kg/day	>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	2.23E-04 mg/kg/day	>EC10-<=EC12	5.50E-05 mg/kg/day
>EC12-<=EC16	4.78E-04 mg/kg/day	>EC12-<=EC16	2.32E-04 mg/kg/day
>EC16-<=EC21	5.13E-04 mg/kg/day	>EC16-<=EC21	3.23E-04 mg/kg/day
>EC21-<=EC40	1.26E-03 mg/kg/day	>EC21-<=EC40	9.17E-04 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Pollard-West Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-06	>EC6-<=EC7	3.33E-05
>EC6-<=EC8	1.50E-05	>EC7-<=EC8	3.33E-05
>EC8-<=EC10	1.50E-03	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	2.23E-03	>EC10-<=EC12	1.38E-03
>EC12-<=EC16	4.78E-03	>EC12-<=EC16	5.79E-03
>EC16-<=EC21	2.57E-04	>EC16-<=EC21	1.08E-02
>EC21-<=EC40	6.28E-04	>EC21-<=EC40	3.06E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 5.82E-02

Walters-East Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg
>EC6-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	34 mg/kg
>EC16-<=EC21	70 mg/kg
>EC21-<=EC40	349 mg/kg

Fraction

Dose

>EC5-<=EC6	1.67E-06 mg/kg/day
>EC6-<=EC8	1.67E-06 mg/kg/day
>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	6.67E-06 mg/kg/day
>EC12-<=EC16	5.67E-05 mg/kg/day
>EC16-<=EC21	1.17E-04 mg/kg/day
>EC21-<=EC40	5.82E-04 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	1 mg/kg
>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	89 mg/kg
>EC21-<=EC40	354 mg/kg

Fraction

Dose

>EC6-<=EC7	1.67E-06 mg/kg/day
>EC7-<=EC8	1.67E-06 mg/kg/day
>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	6.67E-06 mg/kg/day
>EC12-<=EC16	1.67E-05 mg/kg/day
>EC16-<=EC21	1.48E-04 mg/kg/day
>EC21-<=EC40	5.90E-04 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Walters-East Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	3.33E-07	>EC6-<=EC7	8.33E-06
>EC6-<=EC8	3.33E-07	>EC7-<=EC8	8.33E-06
>EC8-<=EC10	6.67E-05	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	6.67E-05	>EC10-<=EC12	1.67E-04
>EC12-<=EC16	5.67E-04	>EC12-<=EC16	4.17E-04
>EC16-<=EC21	5.83E-05	>EC16-<=EC21	4.94E-03
>EC21-<=EC40	2.91E-04	>EC21-<=EC40	1.97E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.64E-02

Walters-West Adult Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
60 BW (kg)	70 ED (years)
0.0001 IR (kg/day)	25550 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	10 mg/kg	>EC6-<=EC7	10 mg/kg
>EC6-<=EC8	101 mg/kg	>EC7-<=EC8	10 mg/kg
>EC8-<=EC10	73 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	104 mg/kg	>EC10-<=EC12	17 mg/kg
>EC12-<=EC16	256 mg/kg	>EC12-<=EC16	146 mg/kg
>EC16-<=EC21	274 mg/kg	>EC16-<=EC21	273 mg/kg
>EC21-<=EC40	775 mg/kg	>EC21-<=EC40	1149 mg/kg

Aromatics

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.67E-05 mg/kg/day	>EC6-<=EC7	1.67E-05 mg/kg/day
>EC6-<=EC8	1.68E-04 mg/kg/day	>EC7-<=EC8	1.67E-05 mg/kg/day
>EC8-<=EC10	1.22E-04 mg/kg/day	>EC8-<=EC10	6.67E-06 mg/kg/day
>EC10-<=EC12	1.73E-04 mg/kg/day	>EC10-<=EC12	2.83E-05 mg/kg/day
>EC12-<=EC16	4.27E-04 mg/kg/day	>EC12-<=EC16	2.43E-04 mg/kg/day
>EC16-<=EC21	4.57E-04 mg/kg/day	>EC16-<=EC21	4.55E-04 mg/kg/day
>EC21-<=EC40	1.29E-03 mg/kg/day	>EC21-<=EC40	1.92E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Walters-West Adult Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	3.33E-06	>EC6-<=EC7	8.33E-05
>EC6-<=EC8	3.37E-05	>EC7-<=EC8	8.33E-05
>EC8-<=EC10	1.22E-03	>EC8-<=EC10	1.67E-04
>EC10-<=EC12	1.73E-03	>EC10-<=EC12	7.08E-04
>EC12-<=EC16	4.27E-03	>EC12-<=EC16	6.08E-03
>EC16-<=EC21	2.28E-04	>EC16-<=EC21	1.52E-02
>EC21-<=EC40	6.46E-04	>EC21-<=EC40	6.38E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 9.43E-02

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS
SYSTEMIC RISK-INGESTION
CHILD RECEPTORS

Barrick Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 F1 (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg	>EC6-<=EC7	2 mg/kg
>EC6-<=EC8	26 mg/kg	>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	48 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	61 mg/kg	>EC10-<=EC12	11 mg/kg
>EC12-<=EC16	182 mg/kg	>EC12-<=EC16	54 mg/kg
>EC16-<=EC21	259 mg/kg	>EC16-<=EC21	133 mg/kg
>EC21-<=EC40	745 mg/kg	>EC21-<=EC40	612 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.50E-05 mg/kg/day	>EC6-<=EC7	2.50E-05 mg/kg/day
>EC6-<=EC8	3.25E-04 mg/kg/day	>EC7-<=EC8	2.50E-05 mg/kg/day
>EC8-<=EC10	6.00E-04 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	7.63E-04 mg/kg/day	>EC10-<=EC12	1.38E-04 mg/kg/day
>EC12-<=EC16	2.28E-03 mg/kg/day	>EC12-<=EC16	6.75E-04 mg/kg/day
>EC16-<=EC21	3.24E-03 mg/kg/day	>EC16-<=EC21	1.66E-03 mg/kg/day
>EC21-<=EC40	9.31E-03 mg/kg/day	>EC21-<=EC40	7.65E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Barrick Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.00E-06	>EC6-<=EC7	1.25E-04
>EC6-<=EC8	6.50E-05	>EC7-<=EC8	1.25E-04
>EC8-<=EC10	6.00E-03	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	7.63E-03	>EC10-<=EC12	3.44E-03
>EC12-<=EC16	2.28E-02	>EC12-<=EC16	1.69E-02
>EC16-<=EC21	1.62E-03	>EC16-<=EC21	5.54E-02
>EC21-<=EC40	4.66E-03	>EC21-<=EC40	2.55E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.75E-01

Caughlin Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	24 mg/kg
>EC8-<=EC10	112 mg/kg
>EC10-<=EC12	199 mg/kg
>EC12-<=EC16	494 mg/kg
>EC16-<=EC21	552 mg/kg
>EC21-<=EC40	1403 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	20 mg/kg
>EC10-<=EC12	56 mg/kg
>EC12-<=EC16	173 mg/kg
>EC16-<=EC21	221 mg/kg
>EC21-<=EC40	608 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.50E-05 mg/kg/day	>EC6-<=EC7	2.50E-05 mg/kg/day
>EC6-<=EC8	3.00E-04 mg/kg/day	>EC7-<=EC8	2.50E-05 mg/kg/day
>EC8-<=EC10	1.40E-03 mg/kg/day	>EC8-<=EC10	2.50E-04 mg/kg/day
>EC10-<=EC12	2.49E-03 mg/kg/day	>EC10-<=EC12	7.00E-04 mg/kg/day
>EC12-<=EC16	6.18E-03 mg/kg/day	>EC12-<=EC16	2.16E-03 mg/kg/day
>EC16-<=EC21	6.90E-03 mg/kg/day	>EC16-<=EC21	2.76E-03 mg/kg/day
>EC21-<=EC40	1.75E-02 mg/kg/day	>EC21-<=EC40	7.60E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Caughlin Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.00E-06	>EC6-<=EC7	1.25E-04
>EC6-<=EC8	6.00E-05	>EC7-<=EC8	1.25E-04
>EC8-<=EC10	1.40E-02	>EC8-<=EC10	6.25E-03
>EC10-<=EC12	2.49E-02	>EC10-<=EC12	1.75E-02
>EC12-<=EC16	6.18E-02	>EC12-<=EC16	5.41E-02
>EC16-<=EC21	3.45E-03	>EC16-<=EC21	9.21E-02
>EC21-<=EC40	8.77E-03	>EC21-<=EC40	2.53E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 5.36E-01

Choquette Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg	>EC6-<=EC7	2 mg/kg
>EC6-<=EC8	51 mg/kg	>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	71 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	82 mg/kg	>EC10-<=EC12	22 mg/kg
>EC12-<=EC16	308 mg/kg	>EC12-<=EC16	124 mg/kg
>EC16-<=EC21	890 mg/kg	>EC16-<=EC21	450 mg/kg
>EC21-<=EC40	2202 mg/kg	>EC21-<=EC40	1529 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.50E-05 mg/kg/day	>EC6-<=EC7	2.50E-05 mg/kg/day
>EC6-<=EC8	6.38E-04 mg/kg/day	>EC7-<=EC8	2.50E-05 mg/kg/day
>EC8-<=EC10	8.88E-04 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	1.03E-03 mg/kg/day	>EC10-<=EC12	2.75E-04 mg/kg/day
>EC12-<=EC16	3.85E-03 mg/kg/day	>EC12-<=EC16	1.55E-03 mg/kg/day
>EC16-<=EC21	1.11E-02 mg/kg/day	>EC16-<=EC21	5.63E-03 mg/kg/day
>EC21-<=EC40	2.75E-02 mg/kg/day	>EC21-<=EC40	1.91E-02 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Choquette Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.00E-06	>EC6-<=EC7	1.25E-04
>EC6-<=EC8	1.28E-04	>EC7-<=EC8	1.25E-04
>EC8-<=EC10	8.88E-03	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	1.03E-02	>EC10-<=EC12	6.88E-03
>EC12-<=EC16	3.85E-02	>EC12-<=EC16	3.88E-02
>EC16-<=EC21	5.56E-03	>EC16-<=EC21	1.88E-01
>EC21-<=EC40	1.38E-02	>EC21-<=EC40	6.37E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 9.49E-01

Dewitt Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	93 mg/kg
>EC8-<=EC10	150 mg/kg
>EC10-<=EC12	256 mg/kg
>EC12-<=EC16	1089 mg/kg
>EC16-<=EC21	2025 mg/kg
>EC21-<=EC40	5188 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	8 mg/kg
>EC10-<=EC12	45 mg/kg
>EC12-<=EC16	290 mg/kg
>EC16-<=EC21	724 mg/kg
>EC21-<=EC40	2940 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.00E-05 mg/kg/day	>EC6-<=EC7	5.00E-05 mg/kg/day
>EC6-<=EC8	1.16E-03 mg/kg/day	>EC7-<=EC8	5.00E-05 mg/kg/day
>EC8-<=EC10	1.88E-03 mg/kg/day	>EC8-<=EC10	1.00E-04 mg/kg/day
>EC10-<=EC12	3.20E-03 mg/kg/day	>EC10-<=EC12	5.63E-04 mg/kg/day
>EC12-<=EC16	1.36E-02 mg/kg/day	>EC12-<=EC16	3.63E-03 mg/kg/day
>EC16-<=EC21	2.53E-02 mg/kg/day	>EC16-<=EC21	9.05E-03 mg/kg/day
>EC21-<=EC40	6.49E-02 mg/kg/day	>EC21-<=EC40	3.68E-02 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Dewitt Risk Child Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.00E-05	>EC6-<=EC7	2.50E-04
>EC6-<=EC8	2.33E-04	>EC7-<=EC8	2.50E-04
>EC8-<=EC10	1.88E-02	>EC8-<=EC10	2.50E-03
>EC10-<=EC12	3.20E-02	>EC10-<=EC12	1.41E-02
>EC12-<=EC16	1.36E-01	>EC12-<=EC16	9.06E-02
>EC16-<=EC21	1.27E-02	>EC16-<=EC21	3.02E-01
>EC21-<=EC40	3.24E-02	>EC21-<=EC40	1.23E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.87E+00

Hyde Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	57 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	64 mg/kg	>EC8-<=EC10	10 mg/kg
>EC10-<=EC12	101 mg/kg	>EC10-<=EC12	33 mg/kg
>EC12-<=EC16	308 mg/kg	>EC12-<=EC16	135 mg/kg
>EC16-<=EC21	469 mg/kg	>EC16-<=EC21	234 mg/kg
>EC21-<=EC40	992 mg/kg	>EC21-<=EC40	470 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.00E-05 mg/kg/day	>EC6-<=EC7	5.00E-05 mg/kg/day
>EC6-<=EC8	7.13E-04 mg/kg/day	>EC7-<=EC8	5.00E-05 mg/kg/day
>EC8-<=EC10	8.00E-04 mg/kg/day	>EC8-<=EC10	1.25E-04 mg/kg/day
>EC10-<=EC12	1.26E-03 mg/kg/day	>EC10-<=EC12	4.13E-04 mg/kg/day
>EC12-<=EC16	3.85E-03 mg/kg/day	>EC12-<=EC16	1.69E-03 mg/kg/day
>EC16-<=EC21	5.86E-03 mg/kg/day	>EC16-<=EC21	2.93E-03 mg/kg/day
>EC21-<=EC40	1.24E-02 mg/kg/day	>EC21-<=EC40	5.88E-03 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Hyde Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.00E-05	>EC6-<=EC7	2.50E-04
>EC6-<=EC8	1.43E-04	>EC7-<=EC8	2.50E-04
>EC8-<=EC10	8.00E-03	>EC8-<=EC10	3.13E-03
>EC10-<=EC12	1.26E-02	>EC10-<=EC12	1.03E-02
>EC12-<=EC16	3.85E-02	>EC12-<=EC16	4.22E-02
>EC16-<=EC21	2.93E-03	>EC16-<=EC21	9.75E-02
>EC21-<=EC40	6.20E-03	>EC21-<=EC40	1.96E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 4.18E-01

Lair Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	17 mg/kg
>EC8-<=EC10	11 mg/kg
>EC10-<=EC12	13 mg/kg
>EC12-<=EC16	44 mg/kg
>EC16-<=EC21	106 mg/kg
>EC21-<=EC40	425 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	69 mg/kg
>EC21-<=EC40	470 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.00E-05 mg/kg/day	>EC6-<=EC7	5.00E-05 mg/kg/day
>EC6-<=EC8	2.13E-04 mg/kg/day	>EC7-<=EC8	5.00E-05 mg/kg/day
>EC8-<=EC10	1.38E-04 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	1.63E-04 mg/kg/day	>EC10-<=EC12	5.00E-05 mg/kg/day
>EC12-<=EC16	5.50E-04 mg/kg/day	>EC12-<=EC16	1.25E-04 mg/kg/day
>EC16-<=EC21	1.33E-03 mg/kg/day	>EC16-<=EC21	8.63E-04 mg/kg/day
>EC21-<=EC40	5.31E-03 mg/kg/day	>EC21-<=EC40	5.88E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Lair Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.00E-05	>EC6-<=EC7	2.50E-04
>EC6-<=EC8	4.25E-05	>EC7-<=EC8	2.50E-04
>EC8-<=EC10	1.38E-03	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	1.63E-03	>EC10-<=EC12	1.25E-03
>EC12-<=EC16	5.50E-03	>EC12-<=EC16	3.13E-03
>EC16-<=EC21	6.63E-04	>EC16-<=EC21	2.88E-02
>EC21-<=EC40	2.66E-03	>EC21-<=EC40	1.96E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.43E-01

Landrum-North Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	1 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	10 mg/kg	>EC16-<=EC21	10 mg/kg
>EC21-<=EC40	25 mg/kg	>EC21-<=EC40	25 mg/kg
<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.25E-05 mg/kg/day	>EC6-<=EC7	1.25E-05 mg/kg/day
>EC6-<=EC8	1.25E-05 mg/kg/day	>EC7-<=EC8	1.25E-05 mg/kg/day
>EC8-<=EC10	5.00E-05 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	5.00E-05 mg/kg/day	>EC10-<=EC12	5.00E-05 mg/kg/day
>EC12-<=EC16	1.25E-04 mg/kg/day	>EC12-<=EC16	1.25E-04 mg/kg/day
>EC16-<=EC21	1.25E-04 mg/kg/day	>EC16-<=EC21	1.25E-04 mg/kg/day
>EC21-<=EC40	3.13E-04 mg/kg/day	>EC21-<=EC40	3.13E-04 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Landrum-North Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.50E-06	>EC6-<=EC7	6.25E-05
>EC6-<=EC8	2.50E-06	>EC7-<=EC8	6.25E-05
>EC8-<=EC10	5.00E-04	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	5.00E-04	>EC10-<=EC12	1.25E-03
>EC12-<=EC16	1.25E-03	>EC12-<=EC16	3.13E-03
>EC16-<=EC21	6.25E-05	>EC16-<=EC21	4.17E-03
>EC21-<=EC40	1.56E-04	>EC21-<=EC40	1.04E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.28E-02

Landrum-South Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	47 mg/kg
>EC8-<=EC10	72 mg/kg
>EC10-<=EC12	123 mg/kg
>EC12-<=EC16	319 mg/kg
>EC16-<=EC21	442 mg/kg
>EC21-<=EC40	1257 mg/kg

<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.00E-05 mg/kg/day
>EC6-<=EC8	5.88E-04 mg/kg/day
>EC8-<=EC10	9.00E-04 mg/kg/day
>EC10-<=EC12	1.54E-03 mg/kg/day
>EC12-<=EC16	3.99E-03 mg/kg/day
>EC16-<=EC21	5.53E-03 mg/kg/day
>EC21-<=EC40	1.57E-02 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	13 mg/kg
>EC10-<=EC12	28 mg/kg
>EC12-<=EC16	105 mg/kg
>EC16-<=EC21	189 mg/kg
>EC21-<=EC40	628 mg/kg

<u>Fraction</u>	<u>Dose</u>
>EC6-<=EC7	5.00E-05 mg/kg/day
>EC7-<=EC8	5.00E-05 mg/kg/day
>EC8-<=EC10	1.63E-04 mg/kg/day
>EC10-<=EC12	3.50E-04 mg/kg/day
>EC12-<=EC16	1.31E-03 mg/kg/day
>EC16-<=EC21	2.36E-03 mg/kg/day
>EC21-<=EC40	7.85E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Landrum-South Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.00E-05	>EC6-<=EC7	2.50E-04
>EC6-<=EC8	1.18E-04	>EC7-<=EC8	2.50E-04
>EC8-<=EC10	9.00E-03	>EC8-<=EC10	4.06E-03
>EC10-<=EC12	1.54E-02	>EC10-<=EC12	8.75E-03
>EC12-<=EC16	3.99E-02	>EC12-<=EC16	3.28E-02
>EC16-<=EC21	2.76E-03	>EC16-<=EC21	7.88E-02
>EC21-<=EC40	7.86E-03	>EC21-<=EC40	2.62E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 4.62E-01

Mandrell-North Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	52 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	113 mg/kg	>EC8-<=EC10	19 mg/kg
>EC10-<=EC12	151 mg/kg	>EC10-<=EC12	51 mg/kg
>EC12-<=EC16	423 mg/kg	>EC12-<=EC16	181 mg/kg
>EC16-<=EC21	718 mg/kg	>EC16-<=EC21	342 mg/kg
>EC21-<=EC40	1799 mg/kg	>EC21-<=EC40	890 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.00E-05 mg/kg/day	>EC6-<=EC7	5.00E-05 mg/kg/day
>EC6-<=EC8	6.50E-04 mg/kg/day	>EC7-<=EC8	5.00E-05 mg/kg/day
>EC8-<=EC10	1.41E-03 mg/kg/day	>EC8-<=EC10	2.38E-04 mg/kg/day
>EC10-<=EC12	1.89E-03 mg/kg/day	>EC10-<=EC12	6.38E-04 mg/kg/day
>EC12-<=EC16	5.29E-03 mg/kg/day	>EC12-<=EC16	2.26E-03 mg/kg/day
>EC16-<=EC21	8.98E-03 mg/kg/day	>EC16-<=EC21	4.28E-03 mg/kg/day
>EC21-<=EC40	2.25E-02 mg/kg/day	>EC21-<=EC40	1.11E-02 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Mandrell-North Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.00E-05	>EC6-<=EC7	2.50E-04
>EC6-<=EC8	1.30E-04	>EC7-<=EC8	2.50E-04
>EC8-<=EC10	1.41E-02	>EC8-<=EC10	5.94E-03
>EC10-<=EC12	1.89E-02	>EC10-<=EC12	1.59E-02
>EC12-<=EC16	5.29E-02	>EC12-<=EC16	5.66E-02
>EC16-<=EC21	4.49E-03	>EC16-<=EC21	1.43E-01
>EC21-<=EC40	1.12E-02	>EC21-<=EC40	3.71E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 6.94E-01

Mandrell-South Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	2 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	31 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	115 mg/kg	>EC16-<=EC21	65 mg/kg
>EC21-<=EC40	481 mg/kg	>EC21-<=EC40	159 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.25E-05 mg/kg/day	>EC6-<=EC7	1.25E-05 mg/kg/day
>EC6-<=EC8	2.50E-05 mg/kg/day	>EC7-<=EC8	1.25E-05 mg/kg/day
>EC8-<=EC10	5.00E-05 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	5.00E-05 mg/kg/day	>EC10-<=EC12	5.00E-05 mg/kg/day
>EC12-<=EC16	3.88E-04 mg/kg/day	>EC12-<=EC16	1.25E-04 mg/kg/day
>EC16-<=EC21	1.44E-03 mg/kg/day	>EC16-<=EC21	8.13E-04 mg/kg/day
>EC21-<=EC40	6.01E-03 mg/kg/day	>EC21-<=EC40	1.99E-03 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Mandrell-South Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.50E-06	>EC6-<=EC7	6.25E-05
>EC6-<=EC8	5.00E-06	>EC7-<=EC8	6.25E-05
>EC8-<=EC10	5.00E-04	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	5.00E-04	>EC10-<=EC12	1.25E-03
>EC12-<=EC16	3.88E-03	>EC12-<=EC16	3.13E-03
>EC16-<=EC21	7.19E-04	>EC16-<=EC21	2.71E-02
>EC21-<=EC40	3.01E-03	>EC21-<=EC40	6.63E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.08E-01

Martin Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	18 mg/kg
>EC8-<=EC10	32 mg/kg
>EC10-<=EC12	57 mg/kg
>EC12-<=EC16	164 mg/kg
>EC16-<=EC21	219 mg/kg
>EC21-<=EC40	682 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	11 mg/kg
>EC12-<=EC16	67 mg/kg
>EC16-<=EC21	151 mg/kg
>EC21-<=EC40	595 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.50E-05 mg/kg/day	>EC6-<=EC7	2.50E-05 mg/kg/day
>EC6-<=EC8	2.25E-04 mg/kg/day	>EC7-<=EC8	2.50E-05 mg/kg/day
>EC8-<=EC10	4.00E-04 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	7.13E-04 mg/kg/day	>EC10-<=EC12	1.38E-04 mg/kg/day
>EC12-<=EC16	2.05E-03 mg/kg/day	>EC12-<=EC16	8.38E-04 mg/kg/day
>EC16-<=EC21	2.74E-03 mg/kg/day	>EC16-<=EC21	1.89E-03 mg/kg/day
>EC21-<=EC40	8.53E-03 mg/kg/day	>EC21-<=EC40	7.44E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Martin Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.00E-06	>EC6-<=EC7	1.25E-04
>EC6-<=EC8	4.50E-05	>EC7-<=EC8	1.25E-04
>EC8-<=EC10	4.00E-03	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	7.13E-03	>EC10-<=EC12	3.44E-03
>EC12-<=EC16	2.05E-02	>EC12-<=EC16	2.09E-02
>EC16-<=EC21	1.37E-03	>EC16-<=EC21	6.29E-02
>EC21-<=EC40	4.26E-03	>EC21-<=EC40	2.48E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.74E-01

Pollard-East Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	19 mg/kg
>EC8-<=EC10	82 mg/kg
>EC10-<=EC12	131 mg/kg
>EC12-<=EC16	332 mg/kg
>EC16-<=EC21	433 mg/kg
>EC21-<=EC40	911 mg/kg

<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.50E-05 mg/kg/day
>EC6-<=EC8	2.38E-04 mg/kg/day
>EC8-<=EC10	1.03E-03 mg/kg/day
>EC10-<=EC12	1.64E-03 mg/kg/day
>EC12-<=EC16	4.15E-03 mg/kg/day
>EC16-<=EC21	5.41E-03 mg/kg/day
>EC21-<=EC40	1.14E-02 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	9 mg/kg
>EC10-<=EC12	28 mg/kg
>EC12-<=EC16	126 mg/kg
>EC16-<=EC21	223 mg/kg
>EC21-<=EC40	651 mg/kg

<u>Fraction</u>	<u>Dose</u>
>EC6-<=EC7	2.50E-05 mg/kg/day
>EC7-<=EC8	2.50E-05 mg/kg/day
>EC8-<=EC10	1.13E-04 mg/kg/day
>EC10-<=EC12	3.50E-04 mg/kg/day
>EC12-<=EC16	1.58E-03 mg/kg/day
>EC16-<=EC21	2.79E-03 mg/kg/day
>EC21-<=EC40	8.14E-03 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Pollard-East Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.00E-06	>EC6-<=EC7	1.25E-04
>EC6-<=EC8	4.75E-05	>EC7-<=EC8	1.25E-04
>EC8-<=EC10	1.03E-02	>EC8-<=EC10	2.81E-03
>EC10-<=EC12	1.64E-02	>EC10-<=EC12	8.75E-03
>EC12-<=EC16	4.15E-02	>EC12-<=EC16	3.94E-02
>EC16-<=EC21	2.71E-03	>EC16-<=EC21	9.29E-02
>EC21-<=EC40	5.69E-03	>EC21-<=EC40	2.71E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 4.92E-01

Pollard-West Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	45 mg/kg
>EC8-<=EC10	90 mg/kg
>EC10-<=EC12	134 mg/kg
>EC12-<=EC16	287 mg/kg
>EC16-<=EC21	308 mg/kg
>EC21-<=EC40	753 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	33 mg/kg
>EC12-<=EC16	139 mg/kg
>EC16-<=EC21	194 mg/kg
>EC21-<=EC40	550 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.00E-05 mg/kg/day	>EC6-<=EC7	5.00E-05 mg/kg/day
>EC6-<=EC8	5.63E-04 mg/kg/day	>EC7-<=EC8	5.00E-05 mg/kg/day
>EC8-<=EC10	1.13E-03 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	1.68E-03 mg/kg/day	>EC10-<=EC12	4.13E-04 mg/kg/day
>EC12-<=EC16	3.59E-03 mg/kg/day	>EC12-<=EC16	1.74E-03 mg/kg/day
>EC16-<=EC21	3.85E-03 mg/kg/day	>EC16-<=EC21	2.43E-03 mg/kg/day
>EC21-<=EC40	9.41E-03 mg/kg/day	>EC21-<=EC40	6.88E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Pollard-West Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.00E-05	>EC6-<=EC7	2.50E-04
>EC6-<=EC8	1.13E-04	>EC7-<=EC8	2.50E-04
>EC8-<=EC10	1.13E-02	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	1.68E-02	>EC10-<=EC12	1.03E-02
>EC12-<=EC16	3.59E-02	>EC12-<=EC16	4.34E-02
>EC16-<=EC21	1.93E-03	>EC16-<=EC21	8.08E-02
>EC21-<=EC40	4.71E-03	>EC21-<=EC40	2.29E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 4.36E-01

Walters-East Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	1 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	34 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	70 mg/kg	>EC16-<=EC21	89 mg/kg
>EC21-<=EC40	349 mg/kg	>EC21-<=EC40	354 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.25E-05 mg/kg/day	>EC6-<=EC7	1.25E-05 mg/kg/day
>EC6-<=EC8	1.25E-05 mg/kg/day	>EC7-<=EC8	1.25E-05 mg/kg/day
>EC8-<=EC10	5.00E-05 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	5.00E-05 mg/kg/day	>EC10-<=EC12	5.00E-05 mg/kg/day
>EC12-<=EC16	4.25E-04 mg/kg/day	>EC12-<=EC16	1.25E-04 mg/kg/day
>EC16-<=EC21	8.75E-04 mg/kg/day	>EC16-<=EC21	1.11E-03 mg/kg/day
>EC21-<=EC40	4.36E-03 mg/kg/day	>EC21-<=EC40	4.43E-03 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Walters-East Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.50E-06	>EC6-<=EC7	6.25E-05
>EC6-<=EC8	2.50E-06	>EC7-<=EC8	6.25E-05
>EC8-<=EC10	5.00E-04	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	5.00E-04	>EC10-<=EC12	1.25E-03
>EC12-<=EC16	4.25E-03	>EC12-<=EC16	3.13E-03
>EC16-<=EC21	4.38E-04	>EC16-<=EC21	3.71E-02
>EC21-<=EC40	2.18E-03	>EC21-<=EC40	1.48E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.98E-01

Walters-West Child Risk Calculations - Soil Ingestion (Systemics)

Assumptions:

1 FI (unitless)	365 EF (days/year)
16 BW (kg)	5 ED (years)
0.0002 IR (kg/day)	1825 AT (days)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	10 mg/kg	>EC6-<=EC7	10 mg/kg
>EC6-<=EC8	101 mg/kg	>EC7-<=EC8	10 mg/kg
>EC8-<=EC10	73 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	104 mg/kg	>EC10-<=EC12	17 mg/kg
>EC12-<=EC16	256 mg/kg	>EC12-<=EC16	146 mg/kg
>EC16-<=EC21	274 mg/kg	>EC16-<=EC21	273 mg/kg
>EC21-<=EC40	775 mg/kg	>EC21-<=EC40	1149 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.25E-04 mg/kg/day	>EC6-<=EC7	1.25E-04 mg/kg/day
>EC6-<=EC8	1.26E-03 mg/kg/day	>EC7-<=EC8	1.25E-04 mg/kg/day
>EC8-<=EC10	9.13E-04 mg/kg/day	>EC8-<=EC10	5.00E-05 mg/kg/day
>EC10-<=EC12	1.30E-03 mg/kg/day	>EC10-<=EC12	2.13E-04 mg/kg/day
>EC12-<=EC16	3.20E-03 mg/kg/day	>EC12-<=EC16	1.83E-03 mg/kg/day
>EC16-<=EC21	3.43E-03 mg/kg/day	>EC16-<=EC21	3.41E-03 mg/kg/day
>EC21-<=EC40	9.69E-03 mg/kg/day	>EC21-<=EC40	1.44E-02 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Oral RfD*</u>	<u>Fraction</u>	<u>Oral RfD*</u>
>EC5-<=EC6	5.0	>EC6-<=EC7	0.20
>EC6-<=EC8	5.0	>EC7-<=EC8	0.20
>EC8-<=EC10	0.1	>EC8-<=EC10	0.04
>EC10-<=EC12	0.1	>EC10-<=EC12	0.04
>EC12-<=EC16	0.1	>EC12-<=EC16	0.04
>EC16-<=EC21	2.0	>EC16-<=EC21	0.03
>EC21-<=EC40	2.0	>EC21-<=EC40	0.03

* From TPHCWG

Walters-West Child Risk Calculations - Soil Ingestion (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.50E-05	>EC6-<=EC7	6.25E-04
>EC6-<=EC8	2.53E-04	>EC7-<=EC8	6.25E-04
>EC8-<=EC10	9.13E-03	>EC8-<=EC10	1.25E-03
>EC10-<=EC12	1.30E-02	>EC10-<=EC12	5.31E-03
>EC12-<=EC16	3.20E-02	>EC12-<=EC16	4.56E-02
>EC16-<=EC21	1.71E-03	>EC16-<=EC21	1.14E-01
>EC21-<=EC40	4.84E-03	>EC21-<=EC40	4.79E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 7.07E-01

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS

SYSTEMIC RISK-DERMAL

ADULT RECEPTORS

Barrick Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	26 mg/kg
>EC8-<=EC10	48 mg/kg
>EC10-<=EC12	61 mg/kg
>EC12-<=EC16	182 mg/kg
>EC16-<=EC21	259 mg/kg
>EC21-<=EC40	745 mg/kg

Fraction

Dose

>EC5-<=EC6	6.64E-04 mg/kg/day
>EC6-<=EC8	8.63E-03 mg/kg/day
>EC8-<=EC10	1.59E-02 mg/kg/day
>EC10-<=EC12	2.02E-02 mg/kg/day
>EC12-<=EC16	6.04E-02 mg/kg/day
>EC16-<=EC21	8.60E-02 mg/kg/day
>EC21-<=EC40	2.47E-01 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	11 mg/kg
>EC12-<=EC16	54 mg/kg
>EC16-<=EC21	133 mg/kg
>EC21-<=EC40	612 mg/kg

Fraction

Dose

>EC6-<=EC7	6.64E-04 mg/kg/day
>EC7-<=EC8	6.64E-04 mg/kg/day
>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	3.65E-03 mg/kg/day
>EC12-<=EC16	1.79E-02 mg/kg/day
>EC16-<=EC21	4.41E-02 mg/kg/day
>EC21-<=EC40	2.03E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Barrick Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.65E-05	>EC6-<=EC7	6.64E-04
>EC6-<=EC8	3.45E-04	>EC7-<=EC8	6.64E-04
>EC8-<=EC10	3.19E-02	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	4.05E-02	>EC10-<=EC12	1.83E-02
>EC12-<=EC16	1.21E-01	>EC12-<=EC16	8.96E-02
>EC16-<=EC21	8.60E-03	>EC16-<=EC21	2.94E-01
>EC21-<=EC40	2.47E-02	>EC21-<=EC40	1.35E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.99E+00

Caughlin Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	24 mg/kg
>EC8-<=EC10	112 mg/kg
>EC10-<=EC12	199 mg/kg
>EC12-<=EC16	494 mg/kg
>EC16-<=EC21	552 mg/kg
>EC21-<=EC40	1403 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	20 mg/kg
>EC10-<=EC12	56 mg/kg
>EC12-<=EC16	173 mg/kg
>EC16-<=EC21	221 mg/kg
>EC21-<=EC40	608 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	6.64E-04 mg/kg/day	>EC6-<=EC7	6.64E-04 mg/kg/day
>EC6-<=EC8	7.96E-03 mg/kg/day	>EC7-<=EC8	6.64E-04 mg/kg/day
>EC8-<=EC10	3.72E-02 mg/kg/day	>EC8-<=EC10	6.64E-03 mg/kg/day
>EC10-<=EC12	6.60E-02 mg/kg/day	>EC10-<=EC12	1.86E-02 mg/kg/day
>EC12-<=EC16	1.64E-01 mg/kg/day	>EC12-<=EC16	5.74E-02 mg/kg/day
>EC16-<=EC21	1.83E-01 mg/kg/day	>EC16-<=EC21	7.33E-02 mg/kg/day
>EC21-<=EC40	4.66E-01 mg/kg/day	>EC21-<=EC40	2.02E-01 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Caughlin Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.65E-05	>EC6-<=EC7	6.64E-04
>EC6-<=EC8	3.19E-04	>EC7-<=EC8	6.64E-04
>EC8-<=EC10	7.43E-02	>EC8-<=EC10	3.32E-02
>EC10-<=EC12	1.32E-01	>EC10-<=EC12	9.29E-02
>EC12-<=EC16	3.28E-01	>EC12-<=EC16	2.87E-01
>EC16-<=EC21	1.83E-02	>EC16-<=EC21	4.89E-01
>EC21-<=EC40	4.66E-02	>EC21-<=EC40	1.35E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.85E+00

Choquette Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg	>EC6-<=EC7	2 mg/kg
>EC6-<=EC8	51 mg/kg	>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	71 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	82 mg/kg	>EC10-<=EC12	22 mg/kg
>EC12-<=EC16	308 mg/kg	>EC12-<=EC16	124 mg/kg
>EC16-<=EC21	890 mg/kg	>EC16-<=EC21	450 mg/kg
>EC21-<=EC40	2202 mg/kg	>EC21-<=EC40	1529 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	6.64E-04 mg/kg/day	>EC6-<=EC7	6.64E-04 mg/kg/day
>EC6-<=EC8	1.69E-02 mg/kg/day	>EC7-<=EC8	6.64E-04 mg/kg/day
>EC8-<=EC10	2.36E-02 mg/kg/day	>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	2.72E-02 mg/kg/day	>EC10-<=EC12	7.30E-03 mg/kg/day
>EC12-<=EC16	1.02E-01 mg/kg/day	>EC12-<=EC16	4.12E-02 mg/kg/day
>EC16-<=EC21	2.95E-01 mg/kg/day	>EC16-<=EC21	1.49E-01 mg/kg/day
>EC21-<=EC40	7.31E-01 mg/kg/day	>EC21-<=EC40	5.07E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Choquette Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.65E-05	>EC6-<=EC7	6.64E-04
>EC6-<=EC8	6.77E-04	>EC7-<=EC8	6.64E-04
>EC8-<=EC10	4.71E-02	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	5.44E-02	>EC10-<=EC12	3.65E-02
>EC12-<=EC16	2.04E-01	>EC12-<=EC16	2.06E-01
>EC16-<=EC21	2.95E-02	>EC16-<=EC21	9.96E-01
>EC21-<=EC40	7.31E-02	>EC21-<=EC40	3.38E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 5.04E+00

Dewitt Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	93 mg/kg
>EC8-<=EC10	150 mg/kg
>EC10-<=EC12	256 mg/kg
>EC12-<=EC16	1089 mg/kg
>EC16-<=EC21	2025 mg/kg
>EC21-<=EC40	5188 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	8 mg/kg
>EC10-<=EC12	45 mg/kg
>EC12-<=EC16	290 mg/kg
>EC16-<=EC21	724 mg/kg
>EC21-<=EC40	2940 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.33E-03 mg/kg/day	>EC6-<=EC7	1.33E-03 mg/kg/day
>EC6-<=EC8	3.09E-02 mg/kg/day	>EC7-<=EC8	1.33E-03 mg/kg/day
>EC8-<=EC10	4.98E-02 mg/kg/day	>EC8-<=EC10	2.65E-03 mg/kg/day
>EC10-<=EC12	8.50E-02 mg/kg/day	>EC10-<=EC12	1.49E-02 mg/kg/day
>EC12-<=EC16	3.61E-01 mg/kg/day	>EC12-<=EC16	9.62E-02 mg/kg/day
>EC16-<=EC21	6.72E-01 mg/kg/day	>EC16-<=EC21	2.40E-01 mg/kg/day
>EC21-<=EC40	1.72E+00 mg/kg/day	>EC21-<=EC40	9.76E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Dewitt Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.31E-05	>EC6-<=EC7	1.33E-03
>EC6-<=EC8	1.23E-03	>EC7-<=EC8	1.33E-03
>EC8-<=EC10	9.96E-02	>EC8-<=EC10	1.33E-02
>EC10-<=EC12	1.70E-01	>EC10-<=EC12	7.47E-02
>EC12-<=EC16	7.23E-01	>EC12-<=EC16	4.81E-01
>EC16-<=EC21	6.72E-02	>EC16-<=EC21	1.60E+00
>EC21-<=EC40	1.72E-01	>EC21-<=EC40	6.50E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 9.91E+00

Hyde Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	57 mg/kg
>EC8-<=EC10	64 mg/kg
>EC10-<=EC12	101 mg/kg
>EC12-<=EC16	308 mg/kg
>EC16-<=EC21	469 mg/kg
>EC21-<=EC40	992 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	10 mg/kg
>EC10-<=EC12	33 mg/kg
>EC12-<=EC16	135 mg/kg
>EC16-<=EC21	234 mg/kg
>EC21-<=EC40	470 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.33E-03 mg/kg/day	>EC6-<=EC7	1.33E-03 mg/kg/day
>EC6-<=EC8	1.89E-02 mg/kg/day	>EC7-<=EC8	1.33E-03 mg/kg/day
>EC8-<=EC10	2.12E-02 mg/kg/day	>EC8-<=EC10	3.32E-03 mg/kg/day
>EC10-<=EC12	3.35E-02 mg/kg/day	>EC10-<=EC12	1.10E-02 mg/kg/day
>EC12-<=EC16	1.02E-01 mg/kg/day	>EC12-<=EC16	4.48E-02 mg/kg/day
>EC16-<=EC21	1.56E-01 mg/kg/day	>EC16-<=EC21	7.77E-02 mg/kg/day
>EC21-<=EC40	3.29E-01 mg/kg/day	>EC21-<=EC40	1.56E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Hyde Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.31E-05	>EC6-<=EC7	1.33E-03
>EC6-<=EC8	7.57E-04	>EC7-<=EC8	1.33E-03
>EC8-<=EC10	4.25E-02	>EC8-<=EC10	1.66E-02
>EC10-<=EC12	6.70E-02	>EC10-<=EC12	5.48E-02
>EC12-<=EC16	2.04E-01	>EC12-<=EC16	2.24E-01
>EC16-<=EC21	1.56E-02	>EC16-<=EC21	5.18E-01
>EC21-<=EC40	3.29E-02	>EC21-<=EC40	1.04E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.22E+00

Lair Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	17 mg/kg
>EC8-<=EC10	11 mg/kg
>EC10-<=EC12	13 mg/kg
>EC12-<=EC16	44 mg/kg
>EC16-<=EC21	106 mg/kg
>EC21-<=EC40	425 mg/kg

Fraction

>EC5-<=EC6	1.33E-03 mg/kg/day
>EC6-<=EC8	5.64E-03 mg/kg/day
>EC8-<=EC10	3.65E-03 mg/kg/day
>EC10-<=EC12	4.31E-03 mg/kg/day
>EC12-<=EC16	1.46E-02 mg/kg/day
>EC16-<=EC21	3.52E-02 mg/kg/day
>EC21-<=EC40	1.41E-01 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	69 mg/kg
>EC21-<=EC40	470 mg/kg

Fraction

>EC6-<=EC7	1.33E-03 mg/kg/day
>EC7-<=EC8	1.33E-03 mg/kg/day
>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	1.33E-03 mg/kg/day
>EC12-<=EC16	3.32E-03 mg/kg/day
>EC16-<=EC21	2.29E-02 mg/kg/day
>EC21-<=EC40	1.56E-01 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Lair Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.31E-05	>EC6-<=EC7	1.33E-03
>EC6-<=EC8	2.26E-04	>EC7-<=EC8	1.33E-03
>EC8-<=EC10	7.30E-03	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	8.63E-03	>EC10-<=EC12	6.64E-03
>EC12-<=EC16	2.92E-02	>EC12-<=EC16	1.66E-02
>EC16-<=EC21	3.52E-03	>EC16-<=EC21	1.53E-01
>EC21-<=EC40	1.41E-02	>EC21-<=EC40	1.04E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.29E+00

Landrum-North Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg
>EC6-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	10 mg/kg
>EC21-<=EC40	25 mg/kg

<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	3.32E-04 mg/kg/day
>EC6-<=EC8	3.32E-04 mg/kg/day
>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	1.33E-03 mg/kg/day
>EC12-<=EC16	3.32E-03 mg/kg/day
>EC16-<=EC21	3.32E-03 mg/kg/day
>EC21-<=EC40	8.30E-03 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	1 mg/kg
>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	10 mg/kg
>EC21-<=EC40	25 mg/kg

<u>Fraction</u>	<u>Dose</u>
>EC6-<=EC7	3.32E-04 mg/kg/day
>EC7-<=EC8	3.32E-04 mg/kg/day
>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	1.33E-03 mg/kg/day
>EC12-<=EC16	3.32E-03 mg/kg/day
>EC16-<=EC21	3.32E-03 mg/kg/day
>EC21-<=EC40	8.30E-03 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Landrum-North Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-05	>EC6-<=EC7	3.32E-04
>EC6-<=EC8	1.33E-05	>EC7-<=EC8	3.32E-04
>EC8-<=EC10	2.65E-03	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	2.65E-03	>EC10-<=EC12	6.64E-03
>EC12-<=EC16	6.64E-03	>EC12-<=EC16	1.66E-02
>EC16-<=EC21	3.32E-04	>EC16-<=EC21	2.21E-02
>EC21-<=EC40	8.30E-04	>EC21-<=EC40	5.53E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.21E-01

Landrum-South Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	47 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	72 mg/kg	>EC8-<=EC10	13 mg/kg
>EC10-<=EC12	123 mg/kg	>EC10-<=EC12	28 mg/kg
>EC12-<=EC16	319 mg/kg	>EC12-<=EC16	105 mg/kg
>EC16-<=EC21	442 mg/kg	>EC16-<=EC21	189 mg/kg
>EC21-<=EC40	1257 mg/kg	>EC21-<=EC40	628 mg/kg
<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.33E-03 mg/kg/day	>EC6-<=EC7	1.33E-03 mg/kg/day
>EC6-<=EC8	1.56E-02 mg/kg/day	>EC7-<=EC8	1.33E-03 mg/kg/day
>EC8-<=EC10	2.39E-02 mg/kg/day	>EC8-<=EC10	4.31E-03 mg/kg/day
>EC10-<=EC12	4.08E-02 mg/kg/day	>EC10-<=EC12	9.29E-03 mg/kg/day
>EC12-<=EC16	1.06E-01 mg/kg/day	>EC12-<=EC16	3.48E-02 mg/kg/day
>EC16-<=EC21	1.47E-01 mg/kg/day	>EC16-<=EC21	6.27E-02 mg/kg/day
>EC21-<=EC40	4.17E-01 mg/kg/day	>EC21-<=EC40	2.08E-01 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Landrum-South Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.31E-05	>EC6-<=EC7	1.33E-03
>EC6-<=EC8	6.24E-04	>EC7-<=EC8	1.33E-03
>EC8-<=EC10	4.78E-02	>EC8-<=EC10	2.16E-02
>EC10-<=EC12	8.16E-02	>EC10-<=EC12	4.65E-02
>EC12-<=EC16	2.12E-01	>EC12-<=EC16	1.74E-01
>EC16-<=EC21	1.47E-02	>EC16-<=EC21	4.18E-01
>EC21-<=EC40	4.17E-02	>EC21-<=EC40	1.39E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

Hi = 2.45E+00

Mandrell-North Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	52 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	113 mg/kg	>EC8-<=EC10	19 mg/kg
>EC10-<=EC12	151 mg/kg	>EC10-<=EC12	51 mg/kg
>EC12-<=EC16	423 mg/kg	>EC12-<=EC16	181 mg/kg
>EC16-<=EC21	718 mg/kg	>EC16-<=EC21	342 mg/kg
>EC21-<=EC40	1799 mg/kg	>EC21-<=EC40	890 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.33E-03 mg/kg/day	>EC6-<=EC7	1.33E-03 mg/kg/day
>EC6-<=EC8	1.73E-02 mg/kg/day	>EC7-<=EC8	1.33E-03 mg/kg/day
>EC8-<=EC10	3.75E-02 mg/kg/day	>EC8-<=EC10	6.31E-03 mg/kg/day
>EC10-<=EC12	5.01E-02 mg/kg/day	>EC10-<=EC12	1.69E-02 mg/kg/day
>EC12-<=EC16	1.40E-01 mg/kg/day	>EC12-<=EC16	6.01E-02 mg/kg/day
>EC16-<=EC21	2.38E-01 mg/kg/day	>EC16-<=EC21	1.13E-01 mg/kg/day
>EC21-<=EC40	5.97E-01 mg/kg/day	>EC21-<=EC40	2.95E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Mandrell-North Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.31E-05	>EC6-<=EC7	1.33E-03
>EC6-<=EC8	6.90E-04	>EC7-<=EC8	1.33E-03
>EC8-<=EC10	7.50E-02	>EC8-<=EC10	3.15E-02
>EC10-<=EC12	1.00E-01	>EC10-<=EC12	8.46E-02
>EC12-<=EC16	2.81E-01	>EC12-<=EC16	3.00E-01
>EC16-<=EC21	2.38E-02	>EC16-<=EC21	7.57E-01
>EC21-<=EC40	5.97E-02	>EC21-<=EC40	1.97E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.69E+00

Mandrell-South Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	2 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	31 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	115 mg/kg	>EC16-<=EC21	65 mg/kg
>EC21-<=EC40	481 mg/kg	>EC21-<=EC40	159 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	3.32E-04 mg/kg/day	>EC6-<=EC7	3.32E-04 mg/kg/day
>EC6-<=EC8	6.64E-04 mg/kg/day	>EC7-<=EC8	3.32E-04 mg/kg/day
>EC8-<=EC10	1.33E-03 mg/kg/day	>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	1.33E-03 mg/kg/day	>EC10-<=EC12	1.33E-03 mg/kg/day
>EC12-<=EC16	1.03E-02 mg/kg/day	>EC12-<=EC16	3.32E-03 mg/kg/day
>EC16-<=EC21	3.82E-02 mg/kg/day	>EC16-<=EC21	2.16E-02 mg/kg/day
>EC21-<=EC40	1.60E-01 mg/kg/day	>EC21-<=EC40	5.28E-02 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Mandrell-South Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-05	>EC6-<=EC7	3.32E-04
>EC6-<=EC8	2.65E-05	>EC7-<=EC8	3.32E-04
>EC8-<=EC10	2.65E-03	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	2.65E-03	>EC10-<=EC12	6.64E-03
>EC12-<=EC16	2.06E-02	>EC12-<=EC16	1.66E-02
>EC16-<=EC21	3.82E-03	>EC16-<=EC21	1.44E-01
>EC21-<=EC40	1.60E-02	>EC21-<=EC40	3.52E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 5.72E-01

Martin Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	18 mg/kg
>EC8-<=EC10	32 mg/kg
>EC10-<=EC12	57 mg/kg
>EC12-<=EC16	164 mg/kg
>EC16-<=EC21	219 mg/kg
>EC21-<=EC40	682 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	11 mg/kg
>EC12-<=EC16	67 mg/kg
>EC16-<=EC21	151 mg/kg
>EC21-<=EC40	595 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	6.64E-04 mg/kg/day	>EC6-<=EC7	6.64E-04 mg/kg/day
>EC6-<=EC8	5.97E-03 mg/kg/day	>EC7-<=EC8	6.64E-04 mg/kg/day
>EC8-<=EC10	1.06E-02 mg/kg/day	>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	1.89E-02 mg/kg/day	>EC10-<=EC12	3.65E-03 mg/kg/day
>EC12-<=EC16	5.44E-02 mg/kg/day	>EC12-<=EC16	2.22E-02 mg/kg/day
>EC16-<=EC21	7.27E-02 mg/kg/day	>EC16-<=EC21	5.01E-02 mg/kg/day
>EC21-<=EC40	2.26E-01 mg/kg/day	>EC21-<=EC40	1.97E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Martin Risk Adult Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.65E-05	>EC6-<=EC7	6.64E-04
>EC6-<=EC8	2.39E-04	>EC7-<=EC8	6.64E-04
>EC8-<=EC10	2.12E-02	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	3.78E-02	>EC10-<=EC12	1.83E-02
>EC12-<=EC16	1.09E-01	>EC12-<=EC16	1.11E-01
>EC16-<=EC21	7.27E-03	>EC16-<=EC21	3.34E-01
>EC21-<=EC40	2.26E-02	>EC21-<=EC40	1.32E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.99E+00

Pollard-East Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	19 mg/kg
>EC8-<=EC10	82 mg/kg
>EC10-<=EC12	131 mg/kg
>EC12-<=EC16	332 mg/kg
>EC16-<=EC21	433 mg/kg
>EC21-<=EC40	911 mg/kg

Fraction

Dose

>EC5-<=EC6	6.64E-04 mg/kg/day
>EC6-<=EC8	6.31E-03 mg/kg/day
>EC8-<=EC10	2.72E-02 mg/kg/day
>EC10-<=EC12	4.35E-02 mg/kg/day
>EC12-<=EC16	1.10E-01 mg/kg/day
>EC16-<=EC21	1.44E-01 mg/kg/day
>EC21-<=EC40	3.02E-01 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	9 mg/kg
>EC10-<=EC12	28 mg/kg
>EC12-<=EC16	126 mg/kg
>EC16-<=EC21	223 mg/kg
>EC21-<=EC40	651 mg/kg

Fraction

Dose

>EC6-<=EC7	6.64E-04 mg/kg/day
>EC7-<=EC8	6.64E-04 mg/kg/day
>EC8-<=EC10	2.99E-03 mg/kg/day
>EC10-<=EC12	9.29E-03 mg/kg/day
>EC12-<=EC16	4.18E-02 mg/kg/day
>EC16-<=EC21	7.40E-02 mg/kg/day
>EC21-<=EC40	2.16E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Pollard-East Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.65E-05	>EC6-<=EC7	6.64E-04
>EC6-<=EC8	2.52E-04	>EC7-<=EC8	6.64E-04
>EC8-<=EC10	5.44E-02	>EC8-<=EC10	1.49E-02
>EC10-<=EC12	8.69E-02	>EC10-<=EC12	4.65E-02
>EC12-<=EC16	2.20E-01	>EC12-<=EC16	2.09E-01
>EC16-<=EC21	1.44E-02	>EC16-<=EC21	4.93E-01
>EC21-<=EC40	3.02E-02	>EC21-<=EC40	1.44E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.61E+00

Pollard-West Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	45 mg/kg
>EC8-<=EC10	90 mg/kg
>EC10-<=EC12	134 mg/kg
>EC12-<=EC16	287 mg/kg
>EC16-<=EC21	308 mg/kg
>EC21-<=EC40	753 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	33 mg/kg
>EC12-<=EC16	139 mg/kg
>EC16-<=EC21	194 mg/kg
>EC21-<=EC40	550 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.33E-03 mg/kg/day	>EC6-<=EC7	1.33E-03 mg/kg/day
>EC6-<=EC8	1.49E-02 mg/kg/day	>EC7-<=EC8	1.33E-03 mg/kg/day
>EC8-<=EC10	2.99E-02 mg/kg/day	>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	4.45E-02 mg/kg/day	>EC10-<=EC12	1.10E-02 mg/kg/day
>EC12-<=EC16	9.52E-02 mg/kg/day	>EC12-<=EC16	4.61E-02 mg/kg/day
>EC16-<=EC21	1.02E-01 mg/kg/day	>EC16-<=EC21	6.44E-02 mg/kg/day
>EC21-<=EC40	2.50E-01 mg/kg/day	>EC21-<=EC40	1.83E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Pollard-West Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	5.31E-05	>EC6-<=EC7	1.33E-03
>EC6-<=EC8	5.97E-04	>EC7-<=EC8	1.33E-03
>EC8-<=EC10	5.97E-02	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	8.89E-02	>EC10-<=EC12	5.48E-02
>EC12-<=EC16	1.90E-01	>EC12-<=EC16	2.31E-01
>EC16-<=EC21	1.02E-02	>EC16-<=EC21	4.29E-01
>EC21-<=EC40	2.50E-02	>EC21-<=EC40	1.22E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.32E+00

Walters-East Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	1 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	34 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	70 mg/kg	>EC16-<=EC21	89 mg/kg
>EC21-<=EC40	349 mg/kg	>EC21-<=EC40	354 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	3.32E-04 mg/kg/day	>EC6-<=EC7	3.32E-04 mg/kg/day
>EC6-<=EC8	3.32E-04 mg/kg/day	>EC7-<=EC8	3.32E-04 mg/kg/day
>EC8-<=EC10	1.33E-03 mg/kg/day	>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	1.33E-03 mg/kg/day	>EC10-<=EC12	1.33E-03 mg/kg/day
>EC12-<=EC16	1.13E-02 mg/kg/day	>EC12-<=EC16	3.32E-03 mg/kg/day
>EC16-<=EC21	2.32E-02 mg/kg/day	>EC16-<=EC21	2.95E-02 mg/kg/day
>EC21-<=EC40	1.16E-01 mg/kg/day	>EC21-<=EC40	1.17E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Walters-East Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	1.33E-05	>EC6-<=EC7	3.32E-04
>EC6-<=EC8	1.33E-05	>EC7-<=EC8	3.32E-04
>EC8-<=EC10	2.65E-03	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	2.65E-03	>EC10-<=EC12	6.64E-03
>EC12-<=EC16	2.26E-02	>EC12-<=EC16	1.66E-02
>EC16-<=EC21	2.32E-03	>EC16-<=EC21	1.97E-01
>EC21-<=EC40	1.16E-02	>EC21-<=EC40	7.83E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.05E+00

Walters-West Adult Risk Calculations - Dermal (Systemics)

Assumptions:

8620 SA (cm ² /day)	365 EF (days/year)
60 BW (kg)	70 ED (years)
2.31E-06 AF (kg/cm ²)	25550 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	10 mg/kg
>EC6-<=EC8	101 mg/kg
>EC8-<=EC10	73 mg/kg
>EC10-<=EC12	104 mg/kg
>EC12-<=EC16	256 mg/kg
>EC16-<=EC21	274 mg/kg
>EC21-<=EC40	775 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	10 mg/kg
>EC7-<=EC8	10 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	17 mg/kg
>EC12-<=EC16	146 mg/kg
>EC16-<=EC21	273 mg/kg
>EC21-<=EC40	1149 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	3.32E-03 mg/kg/day	>EC6-<=EC7	3.32E-03 mg/kg/day
>EC6-<=EC8	3.35E-02 mg/kg/day	>EC7-<=EC8	3.32E-03 mg/kg/day
>EC8-<=EC10	2.42E-02 mg/kg/day	>EC8-<=EC10	1.33E-03 mg/kg/day
>EC10-<=EC12	3.45E-02 mg/kg/day	>EC10-<=EC12	5.64E-03 mg/kg/day
>EC12-<=EC16	8.50E-02 mg/kg/day	>EC12-<=EC16	4.85E-02 mg/kg/day
>EC16-<=EC21	9.09E-02 mg/kg/day	>EC16-<=EC21	9.06E-02 mg/kg/day
>EC21-<=EC40	2.57E-01 mg/kg/day	>EC21-<=EC40	3.81E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.00	>EC6-<=EC7	1.00
>EC6-<=EC8	25.00	>EC7-<=EC8	1.00
>EC8-<=EC10	0.50	>EC8-<=EC10	0.20
>EC10-<=EC12	0.50	>EC10-<=EC12	0.20
>EC12-<=EC16	0.50	>EC12-<=EC16	0.20
>EC16-<=EC21	10.00	>EC16-<=EC21	0.15
>EC21-<=EC40	10.00	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Walters-West Adult Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

Fraction	HQ	Fraction	HQ
>EC5-<=EC6	1.33E-04	>EC6-<=EC7	3.32E-03
>EC6-<=EC8	1.34E-03	>EC7-<=EC8	3.32E-03
>EC8-<=EC10	4.85E-02	>EC8-<=EC10	6.64E-03
>EC10-<=EC12	6.90E-02	>EC10-<=EC12	2.82E-02
>EC12-<=EC16	1.70E-01	>EC12-<=EC16	2.42E-01
>EC16-<=EC21	9.09E-03	>EC16-<=EC21	6.04E-01
>EC21-<=EC40	2.57E-02	>EC21-<=EC40	2.54E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.75E+00

APPENDIX B--RISK CHARACTERIZATION CALCULATIONS

SYSTEMIC RISK-DERMAL

CHILD RECEPTORS

Barrick Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	26 mg/kg
>EC8-<=EC10	48 mg/kg
>EC10-<=EC12	61 mg/kg
>EC12-<=EC16	182 mg/kg
>EC16-<=EC21	259 mg/kg
>EC21-<=EC40	745 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	11 mg/kg
>EC12-<=EC16	54 mg/kg
>EC16-<=EC21	133 mg/kg
>EC21-<=EC40	612 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.13E-03 mg/kg/day	>EC6-<=EC7	1.13E-03 mg/kg/day
>EC6-<=EC8	1.47E-02 mg/kg/day	>EC7-<=EC8	1.13E-03 mg/kg/day
>EC8-<=EC10	2.71E-02 mg/kg/day	>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	3.44E-02 mg/kg/day	>EC10-<=EC12	6.21E-03 mg/kg/day
>EC12-<=EC16	1.03E-01 mg/kg/day	>EC12-<=EC16	3.05E-02 mg/kg/day
>EC16-<=EC21	1.46E-01 mg/kg/day	>EC16-<=EC21	7.51E-02 mg/kg/day
>EC21-<=EC40	4.21E-01 mg/kg/day	>EC21-<=EC40	3.45E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Barrick Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	4.52E-05	>EC6-<=EC7	1.13E-03
>EC6-<=EC8	5.87E-04	>EC7-<=EC8	1.13E-03
>EC8-<=EC10	5.42E-02	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	6.89E-02	>EC10-<=EC12	3.10E-02
>EC12-<=EC16	2.05E-01	>EC12-<=EC16	1.52E-01
>EC16-<=EC21	1.46E-02	>EC16-<=EC21	5.01E-01
>EC21-<=EC40	4.21E-02	>EC21-<=EC40	2.30E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.39E+00

Caughlin Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	24 mg/kg
>EC8-<=EC10	112 mg/kg
>EC10-<=EC12	199 mg/kg
>EC12-<=EC16	494 mg/kg
>EC16-<=EC21	552 mg/kg
>EC21-<=EC40	1403 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	20 mg/kg
>EC10-<=EC12	56 mg/kg
>EC12-<=EC16	173 mg/kg
>EC16-<=EC21	221 mg/kg
>EC21-<=EC40	608 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.13E-03 mg/kg/day	>EC6-<=EC7	1.13E-03 mg/kg/day
>EC6-<=EC8	1.35E-02 mg/kg/day	>EC7-<=EC8	1.13E-03 mg/kg/day
>EC8-<=EC10	6.32E-02 mg/kg/day	>EC8-<=EC10	1.13E-02 mg/kg/day
>EC10-<=EC12	1.12E-01 mg/kg/day	>EC10-<=EC12	3.16E-02 mg/kg/day
>EC12-<=EC16	2.79E-01 mg/kg/day	>EC12-<=EC16	9.77E-02 mg/kg/day
>EC16-<=EC21	3.12E-01 mg/kg/day	>EC16-<=EC21	1.25E-01 mg/kg/day
>EC21-<=EC40	7.92E-01 mg/kg/day	>EC21-<=EC40	3.43E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Caughlin Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	4.52E-05	>EC6-<=EC7	1.13E-03
>EC6-<=EC8	5.42E-04	>EC7-<=EC8	1.13E-03
>EC8-<=EC10	1.26E-01	>EC8-<=EC10	5.65E-02
>EC10-<=EC12	2.25E-01	>EC10-<=EC12	1.58E-01
>EC12-<=EC16	5.58E-01	>EC12-<=EC16	4.88E-01
>EC16-<=EC21	3.12E-02	>EC16-<=EC21	8.32E-01
>EC21-<=EC40	7.92E-02	>EC21-<=EC40	2.29E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 4.84E+00

Choquette Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	51 mg/kg
>EC8-<=EC10	71 mg/kg
>EC10-<=EC12	82 mg/kg
>EC12-<=EC16	308 mg/kg
>EC16-<=EC21	890 mg/kg
>EC21-<=EC40	2202 mg/kg

Fraction

Dose

>EC5-<=EC6	1.13E-03 mg/kg/day
>EC6-<=EC8	2.88E-02 mg/kg/day
>EC8-<=EC10	4.01E-02 mg/kg/day
>EC10-<=EC12	4.63E-02 mg/kg/day
>EC12-<=EC16	1.74E-01 mg/kg/day
>EC16-<=EC21	5.02E-01 mg/kg/day
>EC21-<=EC40	1.24E+00 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	22 mg/kg
>EC12-<=EC16	124 mg/kg
>EC16-<=EC21	450 mg/kg
>EC21-<=EC40	1529 mg/kg

Fraction

Dose

>EC6-<=EC7	1.13E-03 mg/kg/day
>EC7-<=EC8	1.13E-03 mg/kg/day
>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	1.24E-02 mg/kg/day
>EC12-<=EC16	7.00E-02 mg/kg/day
>EC16-<=EC21	2.54E-01 mg/kg/day
>EC21-<=EC40	8.63E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Choquette Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	4.52E-05	>EC6-<=EC7	1.13E-03
>EC6-<=EC8	1.15E-03	>EC7-<=EC8	1.13E-03
>EC8-<=EC10	8.02E-02	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	9.26E-02	>EC10-<=EC12	6.21E-02
>EC12-<=EC16	3.48E-01	>EC12-<=EC16	3.50E-01
>EC16-<=EC21	5.02E-02	>EC16-<=EC21	1.69E+00
>EC21-<=EC40	1.24E-01	>EC21-<=EC40	5.75E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 8.57E+00

Dewitt Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	93 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	150 mg/kg	>EC8-<=EC10	8 mg/kg
>EC10-<=EC12	256 mg/kg	>EC10-<=EC12	45 mg/kg
>EC12-<=EC16	1089 mg/kg	>EC12-<=EC16	290 mg/kg
>EC16-<=EC21	2025 mg/kg	>EC16-<=EC21	724 mg/kg
>EC21-<=EC40	5188 mg/kg	>EC21-<=EC40	2940 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.26E-03 mg/kg/day	>EC6-<=EC7	2.26E-03 mg/kg/day
>EC6-<=EC8	5.25E-02 mg/kg/day	>EC7-<=EC8	2.26E-03 mg/kg/day
>EC8-<=EC10	8.47E-02 mg/kg/day	>EC8-<=EC10	4.52E-03 mg/kg/day
>EC10-<=EC12	1.45E-01 mg/kg/day	>EC10-<=EC12	2.54E-02 mg/kg/day
>EC12-<=EC16	6.15E-01 mg/kg/day	>EC12-<=EC16	1.64E-01 mg/kg/day
>EC16-<=EC21	1.14E+00 mg/kg/day	>EC16-<=EC21	4.09E-01 mg/kg/day
>EC21-<=EC40	2.93E+00 mg/kg/day	>EC21-<=EC40	1.66E+00 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Dewitt Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	9.03E-05	>EC6-<=EC7	2.26E-03
>EC6-<=EC8	2.10E-03	>EC7-<=EC8	2.26E-03
>EC8-<=EC10	1.69E-01	>EC8-<=EC10	2.26E-02
>EC10-<=EC12	2.89E-01	>EC10-<=EC12	1.27E-01
>EC12-<=EC16	1.23E+00	>EC12-<=EC16	8.19E-01
>EC16-<=EC21	1.14E-01	>EC16-<=EC21	2.72E+00
>EC21-<=EC40	2.93E-01	>EC21-<=EC40	1.11E+01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.69E+01

Hyde Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	57 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	64 mg/kg	>EC8-<=EC10	10 mg/kg
>EC10-<=EC12	101 mg/kg	>EC10-<=EC12	33 mg/kg
>EC12-<=EC16	308 mg/kg	>EC12-<=EC16	135 mg/kg
>EC16-<=EC21	469 mg/kg	>EC16-<=EC21	234 mg/kg
>EC21-<=EC40	992 mg/kg	>EC21-<=EC40	470 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.26E-03 mg/kg/day	>EC6-<=EC7	2.26E-03 mg/kg/day
>EC6-<=EC8	3.22E-02 mg/kg/day	>EC7-<=EC8	2.26E-03 mg/kg/day
>EC8-<=EC10	3.61E-02 mg/kg/day	>EC8-<=EC10	5.65E-03 mg/kg/day
>EC10-<=EC12	5.70E-02 mg/kg/day	>EC10-<=EC12	1.86E-02 mg/kg/day
>EC12-<=EC16	1.74E-01 mg/kg/day	>EC12-<=EC16	7.62E-02 mg/kg/day
>EC16-<=EC21	2.65E-01 mg/kg/day	>EC16-<=EC21	1.32E-01 mg/kg/day
>EC21-<=EC40	5.60E-01 mg/kg/day	>EC21-<=EC40	2.65E-01 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Hyde Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	9.03E-05	>EC6-<=EC7	2.26E-03
>EC6-<=EC8	1.29E-03	>EC7-<=EC8	2.26E-03
>EC8-<=EC10	7.23E-02	>EC8-<=EC10	2.82E-02
>EC10-<=EC12	1.14E-01	>EC10-<=EC12	9.31E-02
>EC12-<=EC16	3.48E-01	>EC12-<=EC16	3.81E-01
>EC16-<=EC21	2.65E-02	>EC16-<=EC21	8.81E-01
>EC21-<=EC40	5.60E-02	>EC21-<=EC40	1.77E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.77E+00

Lair Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	17 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	11 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	13 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	44 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	106 mg/kg	>EC16-<=EC21	69 mg/kg
>EC21-<=EC40	425 mg/kg	>EC21-<=EC40	470 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.26E-03 mg/kg/day	>EC6-<=EC7	2.26E-03 mg/kg/day
>EC6-<=EC8	9.60E-03 mg/kg/day	>EC7-<=EC8	2.26E-03 mg/kg/day
>EC8-<=EC10	6.21E-03 mg/kg/day	>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	7.34E-03 mg/kg/day	>EC10-<=EC12	2.26E-03 mg/kg/day
>EC12-<=EC16	2.48E-02 mg/kg/day	>EC12-<=EC16	5.65E-03 mg/kg/day
>EC16-<=EC21	5.98E-02 mg/kg/day	>EC16-<=EC21	3.90E-02 mg/kg/day
>EC21-<=EC40	2.40E-01 mg/kg/day	>EC21-<=EC40	2.65E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Lair Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	9.03E-05	>EC6-<=EC7	2.26E-03
>EC6-<=EC8	3.84E-04	>EC7-<=EC8	2.26E-03
>EC8-<=EC10	1.24E-02	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	1.47E-02	>EC10-<=EC12	1.13E-02
>EC12-<=EC16	4.97E-02	>EC12-<=EC16	2.82E-02
>EC16-<=EC21	5.98E-03	>EC16-<=EC21	2.60E-01
>EC21-<=EC40	2.40E-02	>EC21-<=EC40	1.77E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.19E+00

Landrum-North Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	1 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	10 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	10 mg/kg	>EC16-<=EC21	10 mg/kg
>EC21-<=EC40	25 mg/kg	>EC21-<=EC40	25 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.65E-04 mg/kg/day	>EC6-<=EC7	5.65E-04 mg/kg/day
>EC6-<=EC8	5.65E-04 mg/kg/day	>EC7-<=EC8	5.65E-04 mg/kg/day
>EC8-<=EC10	2.26E-03 mg/kg/day	>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	2.26E-03 mg/kg/day	>EC10-<=EC12	2.26E-03 mg/kg/day
>EC12-<=EC16	5.65E-03 mg/kg/day	>EC12-<=EC16	5.65E-03 mg/kg/day
>EC16-<=EC21	5.65E-03 mg/kg/day	>EC16-<=EC21	5.65E-03 mg/kg/day
>EC21-<=EC40	1.41E-02 mg/kg/day	>EC21-<=EC40	1.41E-02 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Landrum-North Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.26E-05	>EC6-<=EC7	5.65E-04
>EC6-<=EC8	2.26E-05	>EC7-<=EC8	5.65E-04
>EC8-<=EC10	4.52E-03	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	4.52E-03	>EC10-<=EC12	1.13E-02
>EC12-<=EC16	1.13E-02	>EC12-<=EC16	2.82E-02
>EC16-<=EC21	5.65E-04	>EC16-<=EC21	3.76E-02
>EC21-<=EC40	1.41E-03	>EC21-<=EC40	9.41E-02

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 2.06E-01

Landrum-South Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg
>EC6-<=EC8	47 mg/kg
>EC8-<=EC10	72 mg/kg
>EC10-<=EC12	123 mg/kg
>EC12-<=EC16	319 mg/kg
>EC16-<=EC21	442 mg/kg
>EC21-<=EC40	1257 mg/kg

Fraction

Dose

>EC5-<=EC6	2.26E-03 mg/kg/day
>EC6-<=EC8	2.65E-02 mg/kg/day
>EC8-<=EC10	4.06E-02 mg/kg/day
>EC10-<=EC12	6.94E-02 mg/kg/day
>EC12-<=EC16	1.80E-01 mg/kg/day
>EC16-<=EC21	2.50E-01 mg/kg/day
>EC21-<=EC40	7.10E-01 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	4 mg/kg
>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	13 mg/kg
>EC10-<=EC12	28 mg/kg
>EC12-<=EC16	105 mg/kg
>EC16-<=EC21	189 mg/kg
>EC21-<=EC40	628 mg/kg

Fraction

Dose

>EC6-<=EC7	2.26E-03 mg/kg/day
>EC7-<=EC8	2.26E-03 mg/kg/day
>EC8-<=EC10	7.34E-03 mg/kg/day
>EC10-<=EC12	1.58E-02 mg/kg/day
>EC12-<=EC16	5.93E-02 mg/kg/day
>EC16-<=EC21	1.07E-01 mg/kg/day
>EC21-<=EC40	3.55E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Landrum-South Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	9.03E-05	>EC6-<=EC7	2.26E-03
>EC6-<=EC8	1.06E-03	>EC7-<=EC8	2.26E-03
>EC8-<=EC10	8.13E-02	>EC8-<=EC10	3.67E-02
>EC10-<=EC12	1.39E-01	>EC10-<=EC12	7.90E-02
>EC12-<=EC16	3.60E-01	>EC12-<=EC16	2.96E-01
>EC16-<=EC21	2.50E-02	>EC16-<=EC21	7.11E-01
>EC21-<=EC40	7.10E-02	>EC21-<=EC40	2.36E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 4.17E+00

Mandrell-North Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	52 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	113 mg/kg	>EC8-<=EC10	19 mg/kg
>EC10-<=EC12	151 mg/kg	>EC10-<=EC12	51 mg/kg
>EC12-<=EC16	423 mg/kg	>EC12-<=EC16	181 mg/kg
>EC16-<=EC21	718 mg/kg	>EC16-<=EC21	342 mg/kg
>EC21-<=EC40	1799 mg/kg	>EC21-<=EC40	890 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.26E-03 mg/kg/day	>EC6-<=EC7	2.26E-03 mg/kg/day
>EC6-<=EC8	2.94E-02 mg/kg/day	>EC7-<=EC8	2.26E-03 mg/kg/day
>EC8-<=EC10	6.38E-02 mg/kg/day	>EC8-<=EC10	1.07E-02 mg/kg/day
>EC10-<=EC12	8.52E-02 mg/kg/day	>EC10-<=EC12	2.88E-02 mg/kg/day
>EC12-<=EC16	2.39E-01 mg/kg/day	>EC12-<=EC16	1.02E-01 mg/kg/day
>EC16-<=EC21	4.05E-01 mg/kg/day	>EC16-<=EC21	1.93E-01 mg/kg/day
>EC21-<=EC40	1.02E+00 mg/kg/day	>EC21-<=EC40	5.02E-01 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Mandrell-North Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	9.03E-05	>EC6-<=EC7	2.26E-03
>EC6-<=EC8	1.17E-03	>EC7-<=EC8	2.26E-03
>EC8-<=EC10	1.28E-01	>EC8-<=EC10	5.36E-02
>EC10-<=EC12	1.70E-01	>EC10-<=EC12	1.44E-01
>EC12-<=EC16	4.78E-01	>EC12-<=EC16	5.11E-01
>EC16-<=EC21	4.05E-02	>EC16-<=EC21	1.29E+00
>EC21-<=EC40	1.02E-01	>EC21-<=EC40	3.35E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 6.27E+00

Mandrell-South Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	2 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	31 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	115 mg/kg	>EC16-<=EC21	65 mg/kg
>EC21-<=EC40	481 mg/kg	>EC21-<=EC40	159 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.65E-04 mg/kg/day	>EC6-<=EC7	5.65E-04 mg/kg/day
>EC6-<=EC8	1.13E-03 mg/kg/day	>EC7-<=EC8	5.65E-04 mg/kg/day
>EC8-<=EC10	2.26E-03 mg/kg/day	>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	2.26E-03 mg/kg/day	>EC10-<=EC12	2.26E-03 mg/kg/day
>EC12-<=EC16	1.75E-02 mg/kg/day	>EC12-<=EC16	5.65E-03 mg/kg/day
>EC16-<=EC21	6.49E-02 mg/kg/day	>EC16-<=EC21	3.67E-02 mg/kg/day
>EC21-<=EC40	2.72E-01 mg/kg/day	>EC21-<=EC40	8.98E-02 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Mandrell-South Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.26E-05	>EC6-<=EC7	5.65E-04
>EC6-<=EC8	4.52E-05	>EC7-<=EC8	5.65E-04
>EC8-<=EC10	4.52E-03	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	4.52E-03	>EC10-<=EC12	1.13E-02
>EC12-<=EC16	3.50E-02	>EC12-<=EC16	2.82E-02
>EC16-<=EC21	6.49E-03	>EC16-<=EC21	2.45E-01
>EC21-<=EC40	2.72E-02	>EC21-<=EC40	5.98E-01

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 9.73E-01

Martin Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg
>EC6-<=EC8	18 mg/kg
>EC8-<=EC10	32 mg/kg
>EC10-<=EC12	57 mg/kg
>EC12-<=EC16	164 mg/kg
>EC16-<=EC21	219 mg/kg
>EC21-<=EC40	682 mg/kg

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	2 mg/kg
>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	11 mg/kg
>EC12-<=EC16	67 mg/kg
>EC16-<=EC21	151 mg/kg
>EC21-<=EC40	595 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.13E-03 mg/kg/day	>EC6-<=EC7	1.13E-03 mg/kg/day
>EC6-<=EC8	1.02E-02 mg/kg/day	>EC7-<=EC8	1.13E-03 mg/kg/day
>EC8-<=EC10	1.81E-02 mg/kg/day	>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	3.22E-02 mg/kg/day	>EC10-<=EC12	6.21E-03 mg/kg/day
>EC12-<=EC16	9.26E-02 mg/kg/day	>EC12-<=EC16	3.78E-02 mg/kg/day
>EC16-<=EC21	1.24E-01 mg/kg/day	>EC16-<=EC21	8.52E-02 mg/kg/day
>EC21-<=EC40	3.85E-01 mg/kg/day	>EC21-<=EC40	3.36E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Martin Risk Child Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	4.52E-05	>EC6-<=EC7	1.13E-03
>EC6-<=EC8	4.06E-04	>EC7-<=EC8	1.13E-03
>EC8-<=EC10	3.61E-02	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	6.44E-02	>EC10-<=EC12	3.10E-02
>EC12-<=EC16	1.85E-01	>EC12-<=EC16	1.89E-01
>EC16-<=EC21	1.24E-02	>EC16-<=EC21	5.68E-01
>EC21-<=EC40	3.85E-02	>EC21-<=EC40	2.24E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.38E+00

Pollard-East Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

<u>Aliphatics</u>		<u>Aromatics</u>	
<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	2 mg/kg	>EC6-<=EC7	2 mg/kg
>EC6-<=EC8	19 mg/kg	>EC7-<=EC8	2 mg/kg
>EC8-<=EC10	82 mg/kg	>EC8-<=EC10	9 mg/kg
>EC10-<=EC12	131 mg/kg	>EC10-<=EC12	28 mg/kg
>EC12-<=EC16	332 mg/kg	>EC12-<=EC16	126 mg/kg
>EC16-<=EC21	433 mg/kg	>EC16-<=EC21	223 mg/kg
>EC21-<=EC40	911 mg/kg	>EC21-<=EC40	651 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	1.13E-03 mg/kg/day	>EC6-<=EC7	1.13E-03 mg/kg/day
>EC6-<=EC8	1.07E-02 mg/kg/day	>EC7-<=EC8	1.13E-03 mg/kg/day
>EC8-<=EC10	4.63E-02 mg/kg/day	>EC8-<=EC10	5.08E-03 mg/kg/day
>EC10-<=EC12	7.40E-02 mg/kg/day	>EC10-<=EC12	1.58E-02 mg/kg/day
>EC12-<=EC16	1.87E-01 mg/kg/day	>EC12-<=EC16	7.11E-02 mg/kg/day
>EC16-<=EC21	2.44E-01 mg/kg/day	>EC16-<=EC21	1.26E-01 mg/kg/day
>EC21-<=EC40	5.14E-01 mg/kg/day	>EC21-<=EC40	3.67E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Pollard-East Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	4.52E-05	>EC6-<=EC7	1.13E-03
>EC6-<=EC8	4.29E-04	>EC7-<=EC8	1.13E-03
>EC8-<=EC10	9.26E-02	>EC8-<=EC10	2.54E-02
>EC10-<=EC12	1.48E-01	>EC10-<=EC12	7.90E-02
>EC12-<=EC16	3.75E-01	>EC12-<=EC16	3.56E-01
>EC16-<=EC21	2.44E-02	>EC16-<=EC21	8.39E-01
>EC21-<=EC40	5.14E-02	>EC21-<=EC40	2.45E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's



HI = 4.44E+00

Pollard-West Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	4 mg/kg	>EC6-<=EC7	4 mg/kg
>EC6-<=EC8	45 mg/kg	>EC7-<=EC8	4 mg/kg
>EC8-<=EC10	90 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	134 mg/kg	>EC10-<=EC12	33 mg/kg
>EC12-<=EC16	287 mg/kg	>EC12-<=EC16	139 mg/kg
>EC16-<=EC21	308 mg/kg	>EC16-<=EC21	194 mg/kg
>EC21-<=EC40	753 mg/kg	>EC21-<=EC40	550 mg/kg

Aromatics

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	2.26E-03 mg/kg/day	>EC6-<=EC7	2.26E-03 mg/kg/day
>EC6-<=EC8	2.54E-02 mg/kg/day	>EC7-<=EC8	2.26E-03 mg/kg/day
>EC8-<=EC10	5.08E-02 mg/kg/day	>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	7.56E-02 mg/kg/day	>EC10-<=EC12	1.86E-02 mg/kg/day
>EC12-<=EC16	1.62E-01 mg/kg/day	>EC12-<=EC16	7.85E-02 mg/kg/day
>EC16-<=EC21	1.74E-01 mg/kg/day	>EC16-<=EC21	1.10E-01 mg/kg/day
>EC21-<=EC40	4.25E-01 mg/kg/day	>EC21-<=EC40	3.10E-01 mg/kg/day

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Pollard-West Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	9.03E-05	>EC6-<=EC7	2.26E-03
>EC6-<=EC8	1.02E-03	>EC7-<=EC8	2.26E-03
>EC8-<=EC10	1.02E-01	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	1.51E-01	>EC10-<=EC12	9.31E-02
>EC12-<=EC16	3.24E-01	>EC12-<=EC16	3.92E-01
>EC16-<=EC21	1.74E-02	>EC16-<=EC21	7.30E-01
>EC21-<=EC40	4.25E-02	>EC21-<=EC40	2.07E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 3.94E+00

Walters-East Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

Aromatics

<u>Fraction</u>	<u>Concentration</u>	<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	1 mg/kg	>EC6-<=EC7	1 mg/kg
>EC6-<=EC8	1 mg/kg	>EC7-<=EC8	1 mg/kg
>EC8-<=EC10	4 mg/kg	>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	4 mg/kg	>EC10-<=EC12	4 mg/kg
>EC12-<=EC16	34 mg/kg	>EC12-<=EC16	10 mg/kg
>EC16-<=EC21	70 mg/kg	>EC16-<=EC21	89 mg/kg
>EC21-<=EC40	349 mg/kg	>EC21-<=EC40	354 mg/kg

<u>Fraction</u>	<u>Dose</u>	<u>Fraction</u>	<u>Dose</u>
>EC5-<=EC6	5.65E-04 mg/kg/day	>EC6-<=EC7	5.65E-04 mg/kg/day
>EC6-<=EC8	5.65E-04 mg/kg/day	>EC7-<=EC8	5.65E-04 mg/kg/day
>EC8-<=EC10	2.26E-03 mg/kg/day	>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	2.26E-03 mg/kg/day	>EC10-<=EC12	2.26E-03 mg/kg/day
>EC12-<=EC16	1.92E-02 mg/kg/day	>EC12-<=EC16	5.65E-03 mg/kg/day
>EC16-<=EC21	3.95E-02 mg/kg/day	>EC16-<=EC21	5.02E-02 mg/kg/day
>EC21-<=EC40	1.97E-01 mg/kg/day	>EC21-<=EC40	2.00E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.0	>EC6-<=EC7	1.00
>EC6-<=EC8	25.0	>EC7-<=EC8	1.00
>EC8-<=EC10	0.5	>EC8-<=EC10	0.20
>EC10-<=EC12	0.5	>EC10-<=EC12	0.20
>EC12-<=EC16	0.5	>EC12-<=EC16	0.20
>EC16-<=EC21	10.0	>EC16-<=EC21	0.15
>EC21-<=EC40	10.0	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Walters-East Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.26E-05	>EC6-<=EC7	5.65E-04
>EC6-<=EC8	2.26E-05	>EC7-<=EC8	5.65E-04
>EC8-<=EC10	4.52E-03	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	4.52E-03	>EC10-<=EC12	1.13E-02
>EC12-<=EC16	3.84E-02	>EC12-<=EC16	2.82E-02
>EC16-<=EC21	3.95E-03	>EC16-<=EC21	3.35E-01
>EC21-<=EC40	1.97E-02	>EC21-<=EC40	1.33E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 1.79E+00

Walters-West Child Risk Calculations - Dermal (Systemics)

Assumptions:

3910 SA (cm ² /day)	365 EF (days/year)
16 BW (kg)	5 ED (years)
2.31E-06 AF (kg/cm ²)	1825 AT (days)
	1 ABS (unitless)

Dose (mg/kg/day)

Aliphatics

<u>Fraction</u>	<u>Concentration</u>
>EC5-<=EC6	10 mg/kg
>EC6-<=EC8	101 mg/kg
>EC8-<=EC10	73 mg/kg
>EC10-<=EC12	104 mg/kg
>EC12-<=EC16	256 mg/kg
>EC16-<=EC21	274 mg/kg
>EC21-<=EC40	775 mg/kg

Fraction

Dose

>EC5-<=EC6	5.65E-03 mg/kg/day
>EC6-<=EC8	5.70E-02 mg/kg/day
>EC8-<=EC10	4.12E-02 mg/kg/day
>EC10-<=EC12	5.87E-02 mg/kg/day
>EC12-<=EC16	1.45E-01 mg/kg/day
>EC16-<=EC21	1.55E-01 mg/kg/day
>EC21-<=EC40	4.37E-01 mg/kg/day

Aromatics

<u>Fraction</u>	<u>Concentration</u>
>EC6-<=EC7	10 mg/kg
>EC7-<=EC8	10 mg/kg
>EC8-<=EC10	4 mg/kg
>EC10-<=EC12	17 mg/kg
>EC12-<=EC16	146 mg/kg
>EC16-<=EC21	273 mg/kg
>EC21-<=EC40	1149 mg/kg

Fraction

Dose

>EC6-<=EC7	5.65E-03 mg/kg/day
>EC7-<=EC8	5.65E-03 mg/kg/day
>EC8-<=EC10	2.26E-03 mg/kg/day
>EC10-<=EC12	9.60E-03 mg/kg/day
>EC12-<=EC16	8.24E-02 mg/kg/day
>EC16-<=EC21	1.54E-01 mg/kg/day
>EC21-<=EC40	6.49E-01 mg/kg/day

Risk Calculations:

$$\text{Hazard Quotient (HQ)} = \text{Dose/Reference Dose (RfD)}$$

<u>Fraction</u>	<u>Dermal RfD*</u>	<u>Fraction</u>	<u>Dermal RfD*</u>
>EC5-<=EC6	25.00	>EC6-<=EC7	1.00
>EC6-<=EC8	25.00	>EC7-<=EC8	1.00
>EC8-<=EC10	0.50	>EC8-<=EC10	0.20
>EC10-<=EC12	0.50	>EC10-<=EC12	0.20
>EC12-<=EC16	0.50	>EC12-<=EC16	0.20
>EC16-<=EC21	10.00	>EC16-<=EC21	0.15
>EC21-<=EC40	10.00	>EC21-<=EC40	0.15

* From TPHCWG and adjusted to absorbed dose

Walters-West Child Risk Calculations - Dermal (Systemics)

Risk Calculations:

Hazard Quotient (HQ) = Dose/Reference Dose (RfD)

<u>Fraction</u>	<u>HQ</u>	<u>Fraction</u>	<u>HQ</u>
>EC5-<=EC6	2.26E-04	>EC6-<=EC7	5.65E-03
>EC6-<=EC8	2.28E-03	>EC7-<=EC8	5.65E-03
>EC8-<=EC10	8.24E-02	>EC8-<=EC10	1.13E-02
>EC10-<=EC12	1.17E-01	>EC10-<=EC12	4.80E-02
>EC12-<=EC16	2.89E-01	>EC12-<=EC16	4.12E-01
>EC16-<=EC21	1.55E-02	>EC16-<=EC21	1.03E+00
>EC21-<=EC40	4.37E-02	>EC21-<=EC40	4.32E+00

Cumulative Systemic Risk:

Hazard Index (HI) = Sum HQ's

HI = 6.38E+00

VITA

Dustin Cruikshank

Candidate for the Degree of

Master of Science

Thesis: AN INVESTIGATION INTO RISK-BASED SITE RESTORATION OF
ABANDONED CRUDE OIL PITS IN OKLAHOMA

Major Field: Geology

Biographical:

Education: Graduated from Arcadia High School, Arcadia, Nebraska in May 1989; received Bachelor of Science degree in Geology from the University of Nebraska - Lincoln in August 1994. Completed the requirements for the Master of Science degree with a major in Geology at Oklahoma State University in July 1998.

Experience: Raised on family farm near Arcadia, Nebraska; employed by the University of Nebraska - Lincoln, Department of Chemistry as an undergraduate research assistant in summer 1993; employed by Oklahoma State University, Department of Geology as a graduate teaching assistant 1994 to 1995; recipient of Skinner Fellowship Award 1994 to 1995; employed by BEACON Environmental Assistance Corporation as a consulting geologist 1995 to present.

Professional Memberships: National Groundwater Association, Phi Kappa Phi Honor Society Member.