

## Horseshoe Landfill Native American Subsistence Scenario Risk Assessment

The purpose of this analysis is to determine the risk levels associated with a Native American subsistence lifestyle at the Horseshoe Landfill. The contaminants of concern (COCs) are the pesticide DDT and its breakdown products, DDE and DDD. A subsistence scenario at the landfill would focus on the gathering of plants for the diet. The means by which a tribal member could potentially come in contact with DDT as a result of this activity is through:

- Inhalation of contaminated soil during the plant gathering process
- Skin exposure to contaminated soil
- Ingestion of contaminated soil while consuming the plant material
- Ingestion of contaminated plant material resulting from the uptake by plants of contaminants in the soil (assuming sufficient biomass available)

DDT is a carcinogen for the ingestion, dermal, and inhalation pathways, and has noncarcinogenic effects through the ingestion pathway. DDE and DDD are carcinogenic for the ingestion and dermal pathways and have no noncarcinogenic effects.

The Native American exposure pathways and parameters that are evaluated are contained in Harris and Harper (1997). The screening-level risk assessment methodology to be used to calculate the risks associated with the COCs follows the *Hanford Site Risk Assessment Methodology* (HSRAM), Rev. 3 (1995). Toxicity information for the COCs is obtained from the Washington State Department of Ecology's CLARCII online database, last updated February 1996.

### Carcinogenic Effects

The equation for calculating carcinogenic risk is as follows:

Incremental Cancer Risk = Intake x Slope Factor

The slope factor (SF) converts the daily intakes, averaged over a lifetime of exposure, to an estimated incremental lifetime risk of an individual developing cancer.

The equations for calculating intake from soil ingestion, soil inhalation, dermal exposure, and biota ingestion for carcinogenic effects are given below. The definitions of the terms in the equations and their values for the Native American scenario given in Harris and Harper (1997) are listed in Table 1.

Soil Ingestion Intake =

$$(C \times \{[(IR \times ED)/BW_{child}] + [(IR \times ED)/BW_{adult}]\} \times EF \times CF1) / AT$$

Soil Inhalation Intake =

$$(C \times IR \times EF \times ED) / (BW \times AT \times PEF)$$

Dermal Intake =

$$(C \times ABS \times AF \times CF1 \times \{[(SA \times EF \times ED)/BW_{child}] + [(SA \times EF \times ED)/BW_{adult}]\}) / AT$$

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$$\text{Biota Ingestion Intake} = (C \times IR \times EF \times ED \times AF \times CF2) / (BW \times AT)$$

### **Noncarcinogenic Effects**

The hazard quotient, which quantifies the harm associated with noncarcinogenic effects, is calculated differently from carcinogenic risk. It is given as:

$$\text{Hazard Quotient} = \text{Intake} / \text{Reference dose}$$

The reference dose (RfD) is a quantity that is associated with the lowest (or no) observable effect based on animal or human studies of toxicity.

The equations for calculating the intake for noncarcinogenic effects are given below:

$$\begin{aligned} \text{Soil Ingestion Intake} = \\ (C \times IR \times EF \times ED \times CF1) / (BW \times AT) \end{aligned}$$

$$\begin{aligned} \text{Dermal Intake} = \\ (C \times ABS \times AF \times CF1 \times \{[(SA \times EF \times ED)/BW_{\text{child}}] + [(SA \times EF \times ED)/BW_{\text{adult}}]\}) / AT \end{aligned}$$

$$\begin{aligned} \text{Biota Ingestion Intake} = \\ (C \times IR \times EF \times ED \times AF \times CF2) / (BW \times AT) \end{aligned}$$

The definitions of the input parameters in the equations, along with their values for the Native American scenario as given in Harris and Harper (1997) are listed in Table 1.

The risks associated with the Native American scenario will be evaluated when the analytical results of the soil sampling of Horseshoe Landfill have been completed.

**Table 1. Input Parameters for the Calculation of Risks Associated with a Native American Scenario Risk**

CLARC II Toxicity Reference Values		Non-Carc	Carc	Carc
		ORFD	OCPF	RCPF
		Oral RfD	Oral SF	Inh SF
72-54-8	ddd		0.24	
72-55-9	dde		0.34	
50-29-3	ddt	0.0005	0.34	0.34

Intake Parameters			Non-Carc Soil Ingestion Intake	Soil Dermal Dose	Carc Soil Ingestion Intake	Carc Soil Inhalation Intake	Non-Carc Biota Ingestion Intake	Carc Biota Ingestion Intake
Soil ingestion rate adult	IR	mg/d	200	NA	200	200	NA	NA
Soil ingestion rate child	IR	mg/d	NA	NA	200	NA	NA	NA
Vegetation ingestion rate	IR	g/d	NA	NA	NA	NA	TBD	TBD
Intake adjustment factor	AF	unitless	NA	NA	NA	NA	1	1
Skin Surface Area Adult	SA	(cm <sup>2</sup> )	NA	5000	NA	NA	NA	NA
Skin Surface Area Child	SA	(cm <sup>2</sup> )	NA	2500	NA	NA	NA	NA
Adherence Factor	AF	mg/cm <sup>2</sup>	NA	1.45	NA	NA	NA	NA
Absorption Factor	ABS	unitless	NA	0.01	NA	NA	NA	NA
Exposure Frequency	EF	d/yr	365	365	365	365	365	365
Exposure Duration – Adult	ED Adult	yr	70	64	64	70	70	70
Exposure Duration – Child	ED Child	yr	NA	6	6	NA	NA	NA
Conversion Factor 1	CF1	kg/mg	1.00E-06	1.00E-06	1.00E-06	NA	NA	NA
Conversion Factor 2	CF2	kg/g	NA	NA	NA	NA	1.00E-03	1.00E-03
Body Weight – Adult	BW Adult	kg	70	70	70	70	70	70
Body Weight – Child	BW Child	kg	NA	16	16	NA	NA	NA
Averaging Time	AT	D	25550	25550	25550	25550	25550	25550
Particulate Emission Factor	PEF	M <sup>3</sup> /kg	NA	NA	NA	2.00E+07	NA	NA