FICHTNER
Consulting Engineers Limited

THE NEXT GENERATION NSW PTY LTD

ENERGY FROM WASTE FACILITY, EASTERN CREEK

HUMAN HEALTH RISK ASSESSMENT

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REFERENCES

AEA Technology (2012) Review of research into health effects of Energy from Waste facilities.

Commonwealth of Australia (2012) Environmental Health Risk Assessment – Guidelines for assessing human health risks from environmental hazards.

HMIP (1996) Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes.

National Health and Medical Research Council (2002) Dioxins: Recommendation for a Tolerable Monthly Intake for Australians

National Health and Medical Research Council (2010) Cancer Risk Assessment Methodology: A Review and Recommendations – Draft for public consultation.

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Van den Berg et al (2006) The 2005 World Health Organization Re-evaluation of Human and

Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds

Kutz et al.(1990) The International Toxicity Equivalency Factor (I-TEF) method for estimating risks associated with exposures to complex mixtures of dioxins and related compounds.

1 INTRODUCTION

1.1 Background

The Next Generation NSW Pty Ltd (TNG NSW) is intending to construct an Energy from Waste (EFW) Electricity Generation Plant (the facility) in Eastern Creek, approximately 36km west of the Sydney CBD. The development involves the construction and operation of an Electricity Generation Plant, which will allow for unsalvageable and uneconomic residue waste from the Genesis Xero Material Processing Centre (MPC) and Waste Transfer Station (WTS) to be used for generation of electrical power.

The Facility will be designed to meet the emission limits contained within the Chapter IV and Annex VI of the Industrial Emissions Directive (IED) (Directive 2010/75/EU)[1] for waste incineration and co-incineration plants.

1.2 Approach

In 2012, the enHealth committee in Australia published the document "Environmental Health Risk Assessment – Guidelines for assessing human health risks from environmental hazards"[2], referred to as the enHealth Guidelines. The enHealth Guidelines describe the five stages of Environmental Health Risk Assessment:

(1) Issue identification;

(2) Hazard identification;

(3) Dose-response assessment;

(4) Exposure assessment for the relevant population; and

(5) Risk characterisation.

The enHealth guidelines note that for planning purposes the amount of detail required when identifying the hazard will be limited to the identification of the relevant national or international guideline values for each substance identified as requiring assessment. These are outlined in section 3.

The enHealth guidelines state that the "dose-response assessment" should examine the qualitative relationships between exposure and the effects of concern. This assessment uses national and international guideline values when quantifying the long term impact of the facility on human health. As these values are well established and based on dose-response research, it is not considered necessary to provide a review of underpinning research for the purposes of this assessment.

The "exposure assessment" can be split into a number of subsections namely:

(1) A conceptual site model – where source and pathways should be identified;

(2) Identification of sensitive receptors; and

(3) Quantification of exposure – where the exposure via the different pathways identified should be quantified.

The conceptual site model is contained in section 4. This identifies the pathways considered within the assessment.

The receptors sensitive to the long term effects of the COPCs released from the facility are identified in section 5.

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[1] Official Journal of the European Union (2010) Directive 2010/75/EU on Industrial Emissions (integrated pollution prevention and control).

[2] Commonwealth of Australia (2012) Environmental Health Risk Assessment – Guidelines for assessing human health risks from environmental hazards.

In order to quantify the exposure, modelling has been undertaken using the software package IRAP. The modelling assumptions and user defined inputs are outlined in section 6. This includes modifications to account for differences between the Australian and American lifestyle. The raw model outputs which quantify the exposure are contained in Appendix C.

The enHealth guidelines state that the risk characterisation is the final step in which all the previous information is integrated. Section 7 provides the assessment of the risk based on the quantified exposure and the national and international guideline values.

It is noted that a risk assessment should includes details of the uncertainty and a sensitivity analysis. This is included in section 7.

2 ISSUE IDENTIFICATION

2.1 Issue

The key issue is the release of substances from the proposed EfW to atmosphere which have the potential to harm human health. The Facility is to be located in Eastern Creek, approximately 36km west of the Sydney CBD and surrounded by the residential areas of Minchinbury, Mt Druitt and Rooty Hill to the northwest. The closest of these residential areas is approximately 1km to the north of the facility. Due to the proximity of the residential receptors there is the potential for emissions to impact upon human health.

The Facility will be designed to meet the emission limits outlined in the Industrial Emissions Directive (2010/75/EU). Limits have been set for pollutants known to be produced during the combustion of waste which have the potential to impact upon the local environment either on human health or ecological receptors. These pollutants include:

- nitrogen dioxide, sulphur dioxide, particulate matter, carbon monoxide, ammonia;
- acid gases - hydrogen chloride, and hydrogen fluoride;
- total organic carbon;
- metals - mercury, cadmium, thallium, antimony, arsenic, lead, cobalt, copper, manganese, nickel and vanadium;
- dioxin and furans;
- dioxin like PCBs; and
- polycyclic aromatic hydrocarbons (PAHs).

For most substances released from the Facility, the most significant effects on human health will arise by inhalation. An Air Quality Assessment has been undertaken to determine the impact of atmospheric concentrations of the pollutants listed above for which the Council of Australian Governments (COAG) Standing Council on Environment and Water (SCEW) incorporating the National Environmental Protection Council (NEPC)have set limit levels within the National Environmental Protection Measure for Ambient Air Quality (Ambient Air-NEPM). These levels have been set at a level which is considered to present minimum or zero risk to human health. The pollutants which have been set a limit in the Ambient Air-NEPM are oxides of nitrogen, oxides of sulphur, carbon monoxide, hydrogen fluoride, and particulates. Details of the impacts of these pollutants on local air quality can be found in the Air Quality Assessment, which has been submitted as part of the overall planning application.

Some pollutants, including dioxins, furans, dioxin-like polychlorinated biphenyls (PCBs) and heavy metals, accumulate in the environment, which means that inhalation is only one of the potential exposure routes. Therefore, impacts cannot be evaluated in terms of their effects on human health by simply reference to ambient air quality standards. An assessment needs to be made of the overall human exposure to the substances by the local population and the risk that this exposure causes.

2.2 Chemicals of Potential Concern (COPC)

The substances which have been considered within this assessment are those which are authorised (as listed above), and are included in the NSW guidance document[3] as "toxic air pollutants", or included in the USEPA HHRAP COPC database for the assessment of long term health effects. Although Emission Limit Values for PAHs are not currently set from installations[4], monitoring is required by legislation in the UK. Therefore, benzo(a)pyrene has been included in the assessment to represent PAH emissions. The following have been considered COPCs for the purpose of this assessment:

- PCDD/Fs (individual congeners) and dioxin like PCBs;
- Hydrogen chloride
- Benzene
- Benzo(a)pyrene
- Mercury (Hg)
- Mercuric chloride
- Cadmium (Cd)
- Thallium (Tl)
- Antimony (Sb)
- Arsenic (As)
- Chromium (Cr), trivalent and hexavalent
- Lead (Pb); and
- Nickel (Ni).

This risk assessment investigates the potential for long term health effect of these COPCs through other routes than just inhalation.

[3] NSW Environmental Protection Agency (2005) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales

[4] An AQO has been set at 1ng/m^3 as an annual mean but an ELV for emissions from an individual source has not been set.

3 HAZARD IDENTIFICATION

This section identifies the relevant national or international guideline values for each COPC identified.

3.1 Dioxins, furans and dioxin like PCBs

The Australian National Health and Medical Research Council set a level of dioxin intake it has judged to be free of health effects, in the report "Dioxins: Recommendation for a Tolerable Monthly Intake for Australians" [5], published in October 2002. The recommended Tolerable Monthly Intake (TMI) was 70 pg TEQ/kg bw/month. This report was rescinded in 2013 and does not appear to have been replaced. However, the TMI is of the same order as the Tolerable Daily Intake (TDI) used in the UK of 2 pg TEQ/kg bw/day, and of the recommended TDI from the World Health Organisation of 1-4 pg TEQ/kg bw/day. Therefore, we have used the Australian TMI in this assessment.

A Mean Monthly Intake (MMI) is also defined, which is the typical intake from background sources (including dietary intake) across Australia. In order to assess the impact of the facility, the predicted intake of a substance due to emissions from the facility is added to the MMI and compared with the TMI.

The following table outlines the MMIs (the typical intake from existing background sources) for the dioxins and furans. These figures are taken from a study undertaken by the Australian Government on mean dioxin intake. No significant sources of dioxins, furans or dioxin like PCBs have been identified in the area. As such use of the Australian mean data is considered appropriate for this assessment.

Table 3.1: Mean Monthly Intake

	Mean Monthly Intake (pg WHO-TEQ/kg bw/month)	Mean Monthly Intake (as % of TMI)
Adult	15.6	22%
Child	37.5	54%

Source:

National Health and Medical Research Council (2002) Dioxins: Recommendation for a Tolerable Monthly Intake for Australians

3.2 Other carcinogenic and non-carcinogenic COPCs

The National Health and Medical Research Council have undertaken a review of cancer risk assessment methodologies and provided recommendations for the approach to be undertaken in Australia[6]. This states the preferred approach is to use the modified Benchmark Dose (BMD) approach. This combines toxicology dose-response data and a conventional mathematical model to generate a dose-response curve for the chemical in question. However, it is also noted that the modified BMD approach has failed to be implemented in Australia, so the NHMRC recommends that alternative toxicity criteria should be sourced.

[5] National Health and Medical Research Council (2002) Dioxins: Recommendation for a Tolerable Monthly Intake for Australians.

[6] National Health and Medical Research Council (2010) Cancer Risk Assessment Methodology: A Review and Recommendations – Draft for public consultation.

The NHMRC[7] states that a sensible approach would be to adopt a position in which:

"Incremental risks that are less than one in a million (10^{-6}) theoretical upper-bound cancer risks are considered to be negligible. Incremental risks greater than one in 10,000 (10^{-4}) are considered to be unacceptable. Risks between these two limits are judged on a case-by-case basis taking into consideration various factors that can vary an acceptable risk."

The NSW Government document Risk Criteria for Land Use Safety Planning[8] states that:

"The one in a million criteria assumes that residents will be at their place of residence and exposed to the risk 24 hours a day and continuously day after day from the whole year. In practice this is not the case and this criterion is therefore conservative."

The report goes on to state the following risk ratings for different land use types:

a. *Hospitals, schools, child-care facilities and old age housing development should not be exposed to individual fatality risk levels in excess of half in one million per year ($0.5x\ 10^{-6}$)*
b. *Residential developments and places of continuous occupancy, such as hotels and tourist resorts, should not be exposed to individual fatality risk levels in excess of one in a million per year ($1\ x\ 10^{-6}$ per year).*

As shown the risk rating is stated on a per year basis. Therefore the results have also been presented on this basis.

3.2.1 USEPA approach

The incremental risk approach is akin to the USEPA approach of defining a Reference Dose (RfD) and Reference Concentration (RfC) for threshold substances and Cancer Slope Factors (CSFs) or Unit Risk Factors (URFs) for non-threshold substances.

- A threshold substance is one which there is an acceptable exposure level below which no toxic effect is thought to occur. Threshold substances are generally considered to include most non-carcinogenic substances.
- A non-threshold substance is one where there is considered to be no dose below which no adverse effect will occur. In theory, any level of exposure could results in a response. Non-threshold substances include carcinogenic substances.

The USEPA approach to assessing the risk to human health for threshold and non-threshold substances is outlined in the following sections:

3.2.1.1 Threshold substances - non-carcinogenic risk

The non-carcinogenic effect of emissions on human health can be assessed in terms of the Hazard Quotient (HQ).

For ingestion, the Hazard Quotient is calculated as the Average Daily Dose (ADD) divided by the Reference Dose (RfD).

$$HQ_{ing} = \frac{ADD_{ing}}{RfD_{ing}}$$

[7] National Health and Medical Research Council (2010) Cancer Risk Assessment Methodology: A Review and Recommendations – Draft for public consultation.

[8] Hazardous Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use Safety Planning, NSW Government, January 2011.

ADD_{ing} is calculated as follows:

$$ADD_{ing} = \frac{I_{ing}\ x\ ED\ x\ EF}{AT\ x\ 365}$$

In these formulae, ADD_{ing} is the ingestion dose, ED is the exposure duration (which is dependent on the receptor type), EF is the exposure frequency, and AT is the averaging time.

For inhalation, the Hazard Quotient is calculated as the exposure concentration (EC) divided by the Reference Concentration (RfC).

$$HQ_{inh} = \frac{EC\ x\ 0.001}{RfC_{inh}}$$

EC is calculated as follows:

$$EC = \frac{C_a\ x\ ED\ x\ EF}{AT\ x\ 365}$$

In these formulae, EC is the exposure concentration (µg/m^3), RfC_{inh} is the reference concentration for the pollutant (mg/m^3) and Ca is the concentration of the pollutant in the air.

The Reference Doses (RfDs) and Reference Concentrations (RfCs) have been set based on extensive dose-response research for each COPC and are set at a level below which no adverse non-carcinogenic health effects should result from a lifetime of exposure. Therefore, if the HQ is 1 or greater this indicates the potential for a health effect. It should be noted that this does not mean a HQ above 1 means there will be a health effect, but that there is the potential for a health effect.

When determining the cumulative impact of non-carcinogenic substances the Hazard Index (HI) should be used. This is the sum or the individual COPC pathway Hazard Quotients. The smaller the Hazard Index, the less risk to human health is implied. The risk based approach does not consider existing levels as it considers the increased risk associated with the facility only.

3.2.1.2 Non-threshold substances - carcinogenic risk

For those substances which there is considered to be no dose below which no adverse effect will occur, a Cancer Slope Factor (CSF) is calculated for ingestion pathways and the Unit Risk Factors for inhalation pathways.

- A Cancer Slope Factor (CSF) is a plausible upper-bound estimate of the probability of a response per unit of intake of a chemical over a lifetime. The CSF is used in risk assessments to estimate an upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen (US EPA, 1989).
- The Unit Risk Factor (URF) is an expression of carcinogenic potency in concentration terms, such as a probability of cancer per 1.0 µg/m^3 of air. The inhalation URF is developed directly from a dose-response analysis using equivalent human concentration already expressed in units of µg/m^3. Derivation of URFs often assumes a standard intake rake and body weight. When a theoretical upper-bond cancer risk estimate is calculated using a URF instead of a CSF, it is often termed the unit risk.

The risk associated with the ingestion exposure is calculated as follows:

$$Risk_{ing} = ADD_{ing}\ x\ CSF_{ing}$$

where ADD_{ing} is the sum of the average daily dose from all ingestion exposure routes.

The risk associated with the inhalation exposure is calculated as follows:

$$Risk_{inh} = EC\ x\ URF_{inh}$$

3.2.1.3 Toxicity factors

The Reference Doses (RfDs) and Reference Concentrations (RfCs) for each COPC and exposure pathway are provided in the following table. These are taken from the USEPA Human Health Risk Assessment Protocol (HHRAP) and are based on the USEPA Integrated Risk Information System (IRIS). The Reference Doses and Reference Concentrations are set that they are protective of human health such that doses at or greater than the Reference Dose or Reference Concentration indicate the potential for effect rather than a clear certain indication of an effect. Where the Cancer Slope Factor (CSF) or Unit Risk Factors (URF) is zero, this indicates that the COPC is non-carcinogenic via that exposure route.

These RfDs and RfCs have been developed based on extensive research in to the toxicity effect of each COPC on human health. The USEPA toxicity factors are listed as being a level 1 source of toxicological and environmental health criteria in enHealth. In lieu of any Australian specific sources these are considered to be appropriate to use especially as the toxicity factors are based on the effect of the COPC on human health and do not take into account background sources in the diet.

Table 3.2: Toxicity Factors for the COPCs Considered				
COPC	**Ingestion Reference Dose (RfD)**	**Inhalation Reference Conc. (RfC)**	**Ingestion Carcinogenic Slope Factor (CSF)**	**Inhalation Unit Risk Factor (URF)**
Units	**mg/kg/day**	**mg/m^3**	**1 / (mg/kg/day)**	**1 / ($\mu g/m^3$)**
Hydrogen chloride	0.00571	0.02	0	0
Benzene	0.004	0.03	0.055	7.8×10^{-6}
Benzo(a)pyrene	0	0	0.73	0.0011
Elemental mercury	8.57×10^{-5}	0.0003	0	0
Mercuric chloride	0.0003	0.0011	0	0
Methyl mercury	0.0001	0.00035	0	0
Cadmium	0.0004	0.0002	0.38	0.0018
Thallium	0.0046	0.0034	0.017	0.012
Antimony	0.0004	0.0014	0	0
Arsenic	0.0003	3 x 10-5	1.5	0.0043
Chromium III	1.5	5.3	0	0
Chromium VI	0.003	8 x 10-6	0	0.012
Lead	0.000429	0.0015	0.0085	1.2 x 10-5
Nickel	0.02	0.0002	0	0.00024

Source:
USEPA Integrated Risk Information System extracted from IRAP model interface.

Table 3.3: Toxicity Factors for Dioxin and Furans				
COPC	**Ingestion Reference Dose (RfD)**	**Inhalation Reference Conc. (RfC)**	**Ingestion Carcinogenic Slope Factor (CSF)**	**Inhalation Unit Risk Factor (URF)**
Units	**mg/kg/day**	**mg/m^3**	**$(mg/kg/day)^{-1}$**	**$(\mu g/m^3)^{-1}$**
TetraCDD,2,3,7,8	1.00×10^{-9}	0	150000	0
HexaCDD,1,2,3,7,8,9	0	0	6200	1.3
OctaCDD,1,2,3,4,6,7,8,9	0	0	15	0
HeptaCDD,1,2,3,4,6,7,8	0	0	1500	0
OctaCDF,1,2,3,4,6,7,8,9	0	0	15	0
HexaCDD,1,2,3,4,7,8	0	0	15000	0
PentaCDD,1,2,3,7,8	0	0	150000	0
TetraCDF,2,3,7,8	0	0	15000	0
HeptaCDF,1,2,3,4,7,8,9	0	0	1500	0
PentaCDF,2,3,4,7,8	0	0	75000	0
PentaCDF,1,2,3,7,8	0	0	7500	0
HexaCDF,1,2,3,6,7,8	0	0	15000	0
HexaCDD,1,2,3,6,7,8	0	0	6200	1.3
HexaCDF,2,3,4,6,7,8	0	0	15000	0
HeptaCDF,1,2,3,4,6,7,8	0	0	1500	0
HexaCDF,1,2,3,4,7,8	0	0	15000	0
HexaCDF,1,2,3,7,8,9	0	0	15000	0
Aroclor 1016	7.00×10^{-5}	0.00025	0	0
Aroclor 1254	2.00×10^{-5}	7.00×10^{-7}	0	0

Source:
USEPA Integrated Risk Information System extracted from IRAP model interface.

4 CONCEPTUAL SITE MODEL

4.1 Conceptual site model

A detailed Health Risk Assessment has been carried out using the Industrial Risk Assessment Program-Human Health (IRAP-h View – Version 4.0). The programme, created by Lakes Environmental, is based on the United States Environment Protection Agency (USEPA) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities[9]. This Protocol is a development of the approach defined by Her Majesties Inspectorate on Pollution (HMIP) in the UK in 1996[10], taking account of further research since that date. The exposure pathways included in the IRAP model are shown in Figure 1.

IRAP implements the exposure assessment calculations described in Section 4.6 of the enHealth guidelines (as explained in Section 6).

Exposure to gaseous contaminants has the potential to occur by direct inhalation or vapour phase transfer to plants. In addition, exposure to particulate phase contaminants may occur via indirect pathways following the deposition of particles to soil. These pathways include:

- Ingestion of soil and dust;
- Uptake of contaminants from soil into the food-chain (through home-grown produce and crops); and
- Direct deposition of particles onto above ground crops.

The pathways through which inhalation and ingestion occur and the receptors that have been considered to be impacted via each pathway are:

• Direct inhalation	All receptors
• Ingestion of soil	All receptors
• Ingestion of home-grown produce	All receptors
• Ingestion of drinking water	All receptors
• Ingestion of eggs from home-grown chickens	Only farms
• Ingestion of home-grown chickens	Only farms
• Ingestion of home-grown beef	Only farms
• Ingestion of home-grown pork	Only farms
• Ingestion of home-grown milk	Only farms
• Ingestion of breast milk	Infants only

It is noted that some households may keep chickens and consume eggs and potentially the birds. The impact on these households is considered to be between the impact at a farmer receptor and a standard receptor. The approach used considers a farmer receptor at the point of maximum impact as a complete worst case.

As shown in Figure 1, the pathway from the ingestion of mother's milk in infants is considered within the assessment. This considers all dioxins and dioxin-like PCBs. The IRAP model calculates the amount of these COPCs entering the mother's milk and being passed on to the infants. The impacts are then compared against the TMI.

[9] USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

[10] HMIP (1996) Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes.

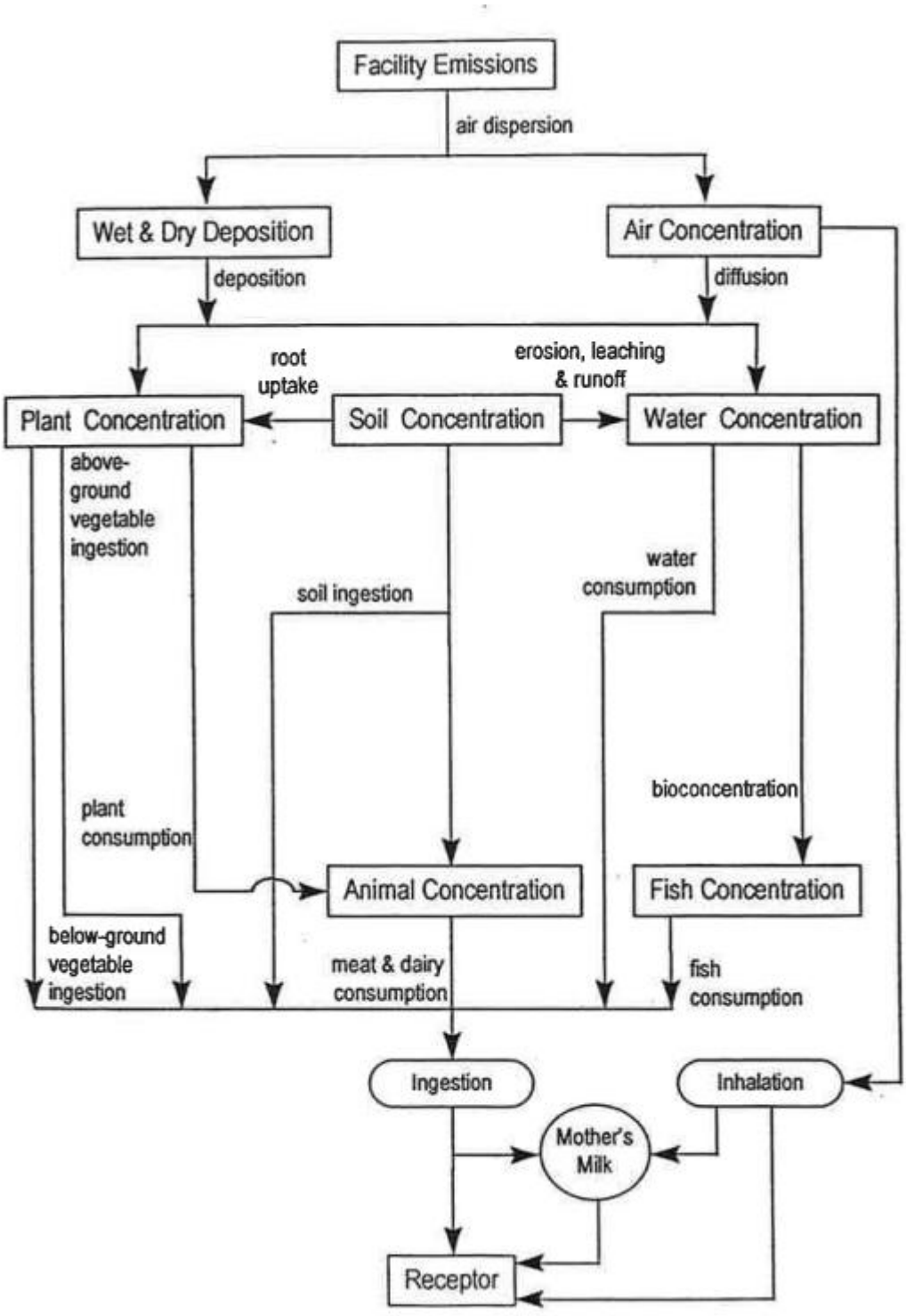


Figure 1: Conceptual Site Model

4.2 Pathways excluded from assessment

The intake of dioxins via dermal absorption, groundwater and surface water exposure pathways is very limited and as such these pathways are excluded from the HHRA. The justification for excluding these pathways is highlighted in the following sections.

4.2.1 Dermal absorption

Both the HMIP and the USEPA note that the contribution from dermal exposure to soils impacted from waste combustion facilities is typically a very minor pathway and is typically very small relative to contributions resulting from exposures via the food chain.

The USEPA[11] provide an example from the risk assessment conducted for the Waste Technologies, Inc. hazardous waste incinerator in East Liverpool, Ohio. This indicated that for an adult subsidence farmer in a subarea with high exposures, the risk resulting from soil ingestion and dermal contact was 50-fold less than the risk from any other pathway and 300-fold less than the total estimated risk.

The HMIP document[12] provides a screening calculation using conservative assumptions, which states for a 1 pg I-TEQ/m^3 the intake via dermal absorption is 30 times lower than the intake via inhalation, which is itself a minor contributor to the total risk.

As such the pathway from dermal absorption is deemed to be an insignificant risk and has been excluded from this assessment.

4.2.2 Groundwater

Exposure via groundwater can only occur if the groundwater is contaminated and consumed untreated by an individual.

The USEPA[13] have concluded that the build up of dioxins in the aquifer over realistic travel times relevant to human exposure was predicted to be so small as to be essentially zero.

As such the pathway from groundwater is deemed to be an insignificant risk and has been excluded from this assessment.

4.2.3 Surface water

It is noted that a possible pathway is via deposition of emissions directly onto surface water – i.e local drinking water supplies or rainwater storage tanks.

Surface water generally goes through several treatment steps and as such any contaminants would be removed from the water before consumption. It is noted that run off to rainwater tanks may not go through the same treatment. However, rain water tanks have a very small surface area and as such the potential for deposition and build up of COPCs is limited. As such the pathway from contaminated surface water is deemed to be an insignificant risk and has been excluded from this assessment.

[11] USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

[12] HMIP (1996) Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes.

[13] USEPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

4.2.4 Fish consumption

The consumption of locally caught fish has been excluded from the assessment. It is noted that fish makes up a proportion of the Australian diet. However, it is not likely that this would be sourced from close proximity to the facility and as such the pathway has been excluded from the assessment.

5 SENSITIVE RECEPTORS

This assessment considers the possible effects on human health within the residential areas of Minchinbury to the north, Erskine Park to the west, and Horsley Park to the south

It is also noted that the adjacent Eastern Creek Industrial Estate will include workers. These will be exposed to emissions via inhalation. However, at Eastern Creek Industrial Estate other pathways such as locally grown produce are not considered appropriate to include as food will not be grown here. The Eastern Creek Industrial Estate is not included as a sensitive receptor, but a worst case scenario has been considered, which is a receptor at the point of maximum impact from annual mean process emissions. This is located to the north west of the facility at 298280, 6258100 AGM.

IRAP allows for sensitive areas to be defined. The maximum impact over the defined area is then used for the basis of the calculations. The point of maximum impact has been determined based on the maximum predicted annual mean process contribution. This point is not within the residential areas. For the purpose of this worst case assessment, two receptors have been considered - a farmer and a general resident. The farmer receptor is assumed to consume a higher fraction of locally-produced food, as discussed in section 4.This farmer is considered to be a mixed farmer consuming locally produced meat and vegetables.

6 IRAP MODEL ASSUMPTIONS AND INPUTS

The following section details the user defined assumptions used within the IRAP model and provides justifications where appropriate. A table with all the IRAP input parameters for each receptor type is provided in Appendix B.

The IRAP model is underpinned by the USEPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. The equations which are used to estimate the media concentrations are defined in Appendix E of this document which can also be downloaded from:

www.epa.gov/osw/hazard/tsd/td/combust/risk.htm

6.1 Concentration in soil

The concentration of each chemical in the soil is calculated from the deposition results of the air quality modelling for vapour phase and particle phase deposition. The critical variables in calculating the accumulation of pollutants in the soil are as follows:

- The lifetime of the facility is taken as 30 years.
- The soil mixing depth is taken as 2 cm in general and 15 cm for produce.

The split between the solid and vapour phase for the substance considered depends on the specific physical properties of each chemical.

In order to assess the amount of substance which is lost from the soil each year through volatilisation, leaching and surface run-off, a soil loss constant is calculated. The rates for leaching and surface runoff are taken as constant, while the rate for volatilisation is calculated from the physical properties of each substance.

6.2 Concentration in plants

The concentrations in plants are determined by considering direct deposition and air-to-plant transfer for above ground produce, and root uptake for above ground and below ground produce. The calculation takes account of the different types of plant; for example, uptake of substances through the roots will differ for below ground and above ground vegetables, and deposition onto plants will be more significant for above ground vegetables.

6.3 Concentration in animals

The concentrations in animals, based on consumption of plants, are calculated from the concentrations in plants, assumed consumption rates and bio-concentration factors. These vary for different animals and different substances, since the transfer of chemicals between the plants consumed and animal tissue varies.

It is also assumed that 100% of the plant materials eaten by animals is grown on soil contaminated by emission sources. This is likely to be a highly pessimistic assumption.

6.4 Concentration in humans

The following table outlines the IRAP inputs with relation to calculating the concentration of COPCs in humans. The modified parameters are based on those outlined in the Australian Government Department of Health and Ageing document "Guidelines for assessing human health risks from environmental hazards" (2012) [14]. This states that a child aged 2 -3 is the most sensitive receptor. Therefore for the purpose of this assessment the child has been assumed to be aged 2-3.

[14] Commonwealth of Australia (2012) Environmental Health Risk Assessment – Guidelines for assessing human health risks from environmental hazards.

Table 6.1: Ground Type Dependent Properties					
Parameter	**Units**	**Adult**		**Child**	
		Resident	**Farmer**	**Resident**	**Farmer**
Body weight	kg	70		17	
Inhalation rate	m^3/hour	0.83		0.66	
Soil ingestion rate	kg/day	0.00006	0.0001	0.00010	0.0002
Drinking water intake	L/d	2		0.4	

It should be noted that the Department of Health and Ageing document is based on a standard person. The IRAP standard soil ingestion rate is greater than that specified in this document. As a conservative assumption, the IRAP soil ingestion rate for a farmer has been used.

6.4.1 Ingestion of food

The calculation of exposure due to ingestion of food draws on the calculations of concentrations in animals and plants and takes account of different ingestion rates for the various food groups by different age groups.

For most people, locally-produced food is only a fraction of their diet and so exposure factors are applied to allow for this.

The Australian Exposure Factor Guidance[15] is produced by enHealth and contains assumptions on the dietary intake of major and sub-major food groups for the Australian population split by gender and age. These are stated as the average intake in grams per person per day. This is not comparable with the consumption rate inputs within IRAP which uses kg fresh weight per kg bodyweight per day for beef, poultry, eggs, fish, milk and port, and kg dry weight per kg bodyweight per day for produce. Nor are there any factors to account for the fraction of the diet which is locally-produced. Therefore, the default factors within IRAP have been used. These are conservatively set and as such are considered appropriate for use in Australia in lieu of any more specific data.

6.4.2 Breast milk ingestion

For infants, the primary route of exposure is through breast milk. The calculation draws on the exposure calculation for adults and then allows for the transfer of chemicals in breast milk to an infant who is exclusively breast-fed.

The only pathway considered for dioxins for a breast feeding infant is through breast milk. The modelled scenario consists of the accumulation of pollutants in the food chain up to an adult receptor, the accumulation of pollutants in breast milk and finally the consumption of breast milk by an infant.

The assumptions used were:

- Exposure duration of infant to breast milk 1 year
- Proportion of ingested dioxin that is stored in fat 0.9%
- Proportion of mothers weight that is stored in fat 0.3%
- Fraction of fat in breast milk 0.04%
- Fraction of ingested contaminant that is absorbed 0.9%

[15] Commonwealth of Australia (2012) Environmental Health Risk Assessment – Guidelines for assessing human health risks from environmental hazards.

- Half life of dioxins in adults 2,555 days
- Ingestion rate of breast milk 0.688 kg/day

6.5 Estimation of COPC concentration in media

The IRAP-h model uses a database of physical and chemical parameters to calculate the COPC concentrations through each of the different pathways identified. The base physical and chemical parameters have been used in this assessment.

In order to calculate the COPC concentrations, a number of site specific pieces of information are required.

- Data has been taken from the Bureau of Meteorology monthly climatic statistics for rainfall and evaporation rates for the 30 year period 1981-2010 from Prospect Reservoir monitoring station.

Table 6.2: Ground Type Dependent Properties

Input Variable	Assumption	Value (cm/year)
Annual average evapo-transpiration	annual average precipitation from Prospect Reservoir (1981-2010)	131.4
Annual average irrigation	Total rainfall – evapo-transpiration – runoff.	52.65
Annual average precipitation	annual average precipitation from Prospect Reservoir (1981-2010)	87.51
Annual average runoff	10% of annual average precipitation	8.751

- The average wind speed was taken as 3 m/s, calculated from the average of the 2013 weather data from the St Marys weather station.

A review has also been undertaken of the BOM data for Horsley Park Equestrian Centre. This site was only opened in 1997 and therefore a 30 year average cannot be extracted. Over the period 1997 to 2015 the data is similar to Prospect Reservoir. As the Prospect Reservoir has a full 30 year dataset this has been used for the purpose of the assessment. The monthly 30 year average mean rainfall and evapo-transpiration rate is provided in Figure 2.

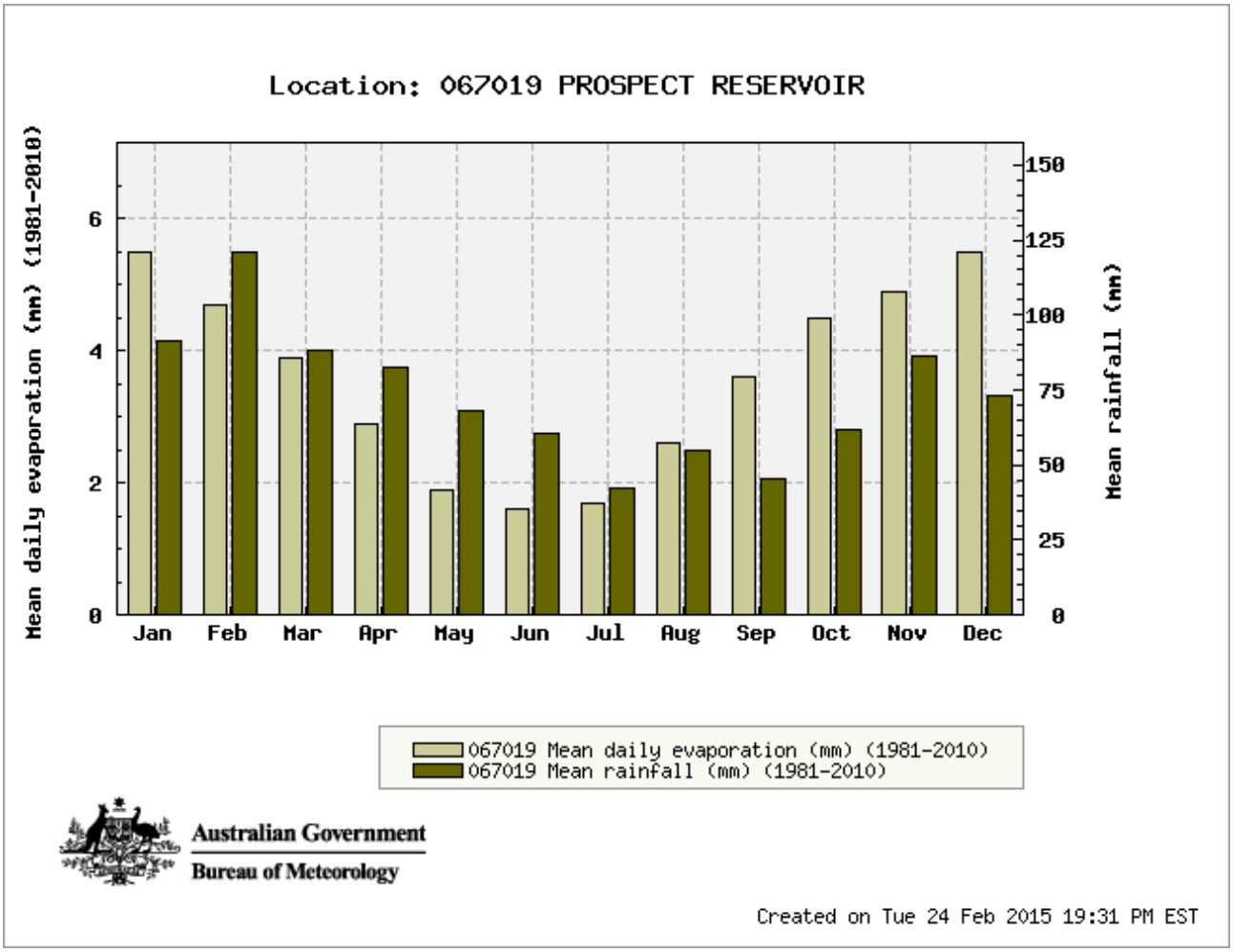


Figure 2: Prospect Reservoir BOM Climatic Data

A number of assumptions have been made with regard to the deposition of the different phases. These are summarised in the following table.

Table 6.3: Deposition Assumptions

Deposition Phase	Dry Deposition Velocities (m/s)	Ratio Dry deposition to Wet deposition	
		Dry Deposition	Wet Deposition
Vapour	0.005	1.0	2.0
Particle	0.010	1.0	2.0
Bound particle	0.010	1.0	2.0
Mercury vapour	0.029	1.0	0.0
The above deposition velocities have been agreed with the UK Environment Agency for all IRAP based assessments where modelling of specific deposition of pollutants is not undertaken. These are considered to be conservative.			

These deposition assumptions have been applied to the annual mean concentrations predicted using the dispersion modelling which was undertaken as part of the air quality assessment, to generate the inputs needed for the IRAP modelling. For details of the air quality modelling methodology please refer to the air quality assessment. Appendix D contains IRAP calculations and assumptions.

6.6 Modelled emissions

For the purpose of this assessment it is assumed that the facility operates at the IED Emission Limit Values for its entire operational life. In actual fact the facility will be shut down for periods of maintenance and monitoring of similar facilities in the UK shows they do not operate at the Emission Limit Values.

The following table gives the emissions rates of each COPC modelled and the associated Emission Limit Values which have been used to derive the emission rate. .

Table 6.4: COPC Emissions Modelled		
COPC	**Emission Limit Value**	**Emission rate (µg/s)**
Hydrogen chloride	10	1392.8
Benzene	10	1392.8
PAHs (Benzo(a)pyrene)	0.0002	0.028
Elemental mercury	3.34E-03	0.014
Mercuric chloride	1.39E-05	3.343
Cadmium	0.0250	3.482
Thallium (l)	0.0250	3.482
Antimony	0.0550	7.660
Arsenic	0.0550	7.660
Chromium	0.0250	7.660
Chromium, hexavalent	0.000130	0.018
Lead	0.0550	7.660
Nickel	0.0550	7.660
TetraCDD,2,3,7,8	0.1 ng I-TEQ/Nm³	0.432
HexaCDD,1,2,3,7,8,9		0.286
OctaCDD,1,2,3,4,6,7,8,9		0.056
HeptaCDD,1,2,3,4,6,7,8		0.237
OctaCDF,1,2,3,4,6,7,8,9		0.050
HexaCDD,1,2,3,4,7,8		0.400
PentaCDD,1,2,3,7,8		1.706
TetraCDF,2,3,7,8		0.386
HeptaCDF,1,2,3,4,7,8,9		0.060
PentaCDF,2,3,4,7,8		3.726
PentaCDF,1,2,3,7,8		0.193
HexaCDF,1,2,3,6,7,8		1.124
HexaCDD,1,2,3,6,7,8		0.359
HexaCDF,2,3,4,6,7,8		1.213
HeptaCDF,1,2,3,4,6,7,8		0.612
HexaCDF,1,2,3,4,7,8		3.035
HexaCDF,1,2,3,7,8,9		0.058
Dioxin like PCBs	0.0092 ng I-TEQ/Nm³	1.281

A number of points should be noted for each group of COPCs:

(1) Hydrogen chloride.

a) It has been assumed that HCl is emitted at the daily ELV.

(2) Benzene.

a) It has been assumed that the entire TOC emissions consist of only benzene.

b) It has been assumed that TOC emissions are emitted at the daily ELV.

(3) PAHs.

a) It has been assumed that the entire PAH emissions consist of only benzo(a)pyrene.

b) Benzo(a)pyrene is not a regulated pollutant within the IED. The highest recorded emission concentration of Benzo(a)pyrene from the UK Environment Agency's public register was 0.105 ug/m³, or 0.000105 mg/m³ (dry, 11% oxygen, 273K). As this is not a regulated pollutant and only monitored periodically we have applied a safety factor of 2.

(4) Group 1 metals - mercury and compounds.

a) It has been assumed that the ELV of total mercury is 0.05mg/Nm^3

b) The concentration of elemental mercury has been taken as 0.2% of the total mercury and compounds ELV

c) The concentration of mercury chloride has been taken as 48% of the total mercury and compounds ELV.

d) The losses to the global cycle have been taken as 51.8% of the total mercury and compounds ELV.

(5) Group 2 metals - cadmium, thallium and compounds.

a) The assessment is based on the IED ELV of 0.05 mg/Nm³ for cadmium, thallium and compounds.

b) It is assumed that the emissions of cadmium and thallium are each half of the combined ELV.

(6) Group 3 metals – antimony, arsenic, chromium, lead and nickel.

a) The assessment is based on the IED ELV of 0.5 mg/Nm³ for "other metals".

b) The emissions of each of the nine "other metals" in the third group have been taken as one-ninth of the combined limit. The Environment Agency "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012" considers this to be a "worst case" scenario.

c) The emission rate of Chromium (VI) has been taken as equal to 0.026% (0.00013/0.5 mg/Nm^3) of the total chromium emission from the facility. This value is from the Environment Agency "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2011" which is based on the speciation of chromium emissions at ten municipal waste incinerators operating under IED in the UK.

(7) Dioxins and furans

These are a group of similar halogenated organic compounds, which are generally found as a complex mixture. The toxicity of each compound is different and is generally expressed as a Toxic Equivalent Factor (TEF), which relates the toxicity of each individual compound to the toxicity of 2,3,7,8-TCDD, the most toxic dioxin. A full list of the TEF values for each dioxin is provided in Appendix A. The total concentration is then expressed as a Toxic Equivalent (TEQ).

The split of the different dioxins and furans is based on split of congeners for a release of 0.1 ng I-TEQ/Nm³ as presented in Appendix A.

To determine the Emission Rate, the split of the different dioxins for a 0.1 ng I-TEQ/Nm³ has been multiplied by the TEF value for the specific compound and then multiplied by the normalised flow rate as shown in Table 6.5.

(8) Dioxin like PCBs

There are a total of 209 PCBs, which act in a similar manner to dioxins, are generally found in complex mixtures and also have TEFs.

The UK Environment Agency has advised that 44 measurements of dioxin like PCBs have been taken at 24 MWIs between 2008 and 2010. The following data summarises the measurements, all at 11% reference oxygen content:

- Maximum = 9.2 x 10^{-3} ng[TEQ]/m^3

- Mean = 2.6 x 10^{-3} ng[TEQ]/m^3
- Minimum = 5.6 x 10^{-5} ng[TEQ]/m^3

For the purpose of this assessment, as a conservative assumption, the maximum monitored PCB concentration has been used which has been converted to an emission rate using the volumetric flow rate at reference conditions.

The IRAP software, and the HHRAP database which underpins it, does not include any data on individual PCBs, but it does include data for take-up and accumulation rates within the food chain for two groups of PCBs, known as Aroclor 1254 and Aroclor 1016. Each Arocolor is based on a fixed composition of PCBs. Since we are not aware of any data on the specification of PCBs within incinerator emissions, we have assumed that the PCBs are released in each of the two Aroclor compositions.

Table 6.5: Basis for the Emission Rate of Dioxins and Furans

Dioxin / furan	Split of Congeners for a release of 0.1 ng I-TEQ/Nm³	I-TEFs for the congeners[16]	Total (I-TEQ) ng/Nm³	Emission rate (pg/s)
2,3,7,8-TCDD	0.0031	1	0.0031	0.432
1,2,3,7,8-PeCDD	0.0245	0.5	0.0123	1.706
1,2,3,4,7,8-HxCDD	0.0287	0.1	0.0029	0.400
1,2,3,6,7,8-HxCDD	0.0258	0.1	0.0026	0.359
1,2,3,7,8,9-HxCDD	0.0205	0.1	0.0021	0.286
1,2,3,4,6,7,8-HpCDD	0.1704	0.01	0.0017	0.237
1,2,3,4,6,7,8,9-OctaCDD	0.4042	0.001	0.0004	0.056
2,3,7,8-TCDF	0.0277	0.1	0.0028	0.386
1,2,3,7,8-PCDF	0.0277	0.05	0.0014	0.193
2,3,4,7,8-PCDF	0.0535	0.5	0.0268	3.726
1,2,3,4,7,8-HxCDD	0.2179	0.1	0.0218	3.035
1,2,3,6,7,8-HxCDF	0.0807	0.1	0.0081	1.124
1,2,3,7,8,9-HxCDF	0.0042	0.1	0.0004	0.058
2,3,4,6,7,8-HxCDF	0.0871	0.1	0.0087	1.213
1,2,3,4,6,7,8-HpCDF	0.4395	0.01	0.0044	0.612
1,2,3,4,7,8,9-HpCDF	0.0429	0.01	0.0004	0.060
1,2,3,4,6,7,8,9-OctaCDF	0.3566	0.001	0.0004	0.050
Total (I-TEQ)	2.0150	-	0.1000	-

[16] Kutz et al.(1990) The International Toxicity Equivalency Factor (I-TEF) method for estimating risks associated with exposures to complex mixtures of dioxins and related compounds.

7 RISK CHARACTERISATION

This section details the results of the IRAP modelling and compares them to the relevant levels outlined in section 3.

The impact has been predicted for a residential receptor in the following areas:

- Minchinbury residential area to the north;
- Erskine Park residential area to the west; and
- Horsley Park residential area to the south.

The impacts are based on the maximum modelled predictions in each of these areas.

In addition a worst-case scenario has been considered in which a residential and farmer receptor are present at the point of maximum impact. This scenario has been considered to provide an upper maximum of the predicted impact of the facility.

7.1 Dioxins, furans and dioxin like PCBs

The following table shows the results of the IRAP modelling and a comparison has been made with the relevant assessment value. The process contribution is the sum of the process contribution from dioxins and dioxin-like PCBs (TEQ). This is a conservative approach, as the TMI is only defined for dioxins, but is the approach currently recommended in the UK.

Table 7.1: Impact of Dioxins

Receptor	Dioxin and Dioxin-Like PCBs (pg TEQ/kg bw/month)				Overall as % TMI
	Mean Monthly Intake (MMI)	Process Contribution (PC)	Overall (MMI + PC)	Tolerable Monthly Intake (TMI)	
Maximum within Minchinbury Residential Area to the North					
Adult Resident	15.6	0.012	15.612	70	22.30%
Child Resident	37.5	0.029	37.529	70	53.61%
Maximum within Erskine Park Residential Area to the West					
Adult Resident	15.6	0.008	15.608	70	22.30%
Child Resident	37.5	0.019	37.519	70	53.60%
Maximum within Horsley Park Residential Area to the South					
Adult Resident	15.6	0.005	15.605	70	22.29%
Child Resident	37.5	0.013	37.513	70	53.59%
Point of Maximum Impact					
Adult Resident	15.6	0.016	15.616	70	22.31%
Child Resident	37.5	0.041	37.541	70	53.63%
Adult Farmer	15.6	0.800	16.400	70	23.43%
Child Farmer	37.5	1.111	38.611	70	55.16%

It can be seen that the total intake for all receptors is well below the Tolerable Monthly Intake (TMI). The maximum process contribution at a residential receptor is 0.04% for a child receptor within the Minchinbury residential area to the north. The Overall TMI includes consideration of the background intake (MMI) of dioxins. As shown for the worst-case scenario (the point of maximum impact), the total intake remains well below the Tolerable Monthly Intake (TMI). The maximum process contribution is 1.58% of the TMI for a farmer child receptor.

Table 7.2: Impact of Dioxins in Breast Milk

Receptor	Process Contribution (pg TEQ/kg bw/month)	Process Contribution as % of TMI
Maximum within Minchinbury Residential Area to the North		
Resident	0.1269	0.18%
Maximum within Erskine Park Residential Area to the West		
Resident	0.0838	0.12%
Maximum within Horsley Park Residential Area to the South		
Resident	0.0548	0.08%
Point of Maximum Impact		
Resident	10.6433	15.20%
Farmer	0.1780	0.25%

It can be seen that the maximum total accumulation of dioxins in an infant, considering the breast milk pathway, at a receptor is 0.18% of the TMI.

For the worst-case scenario (the point of maximum impact), the total accumulation of dioxins in an infant, considering the breast milk pathway, is 15.20% of the TMI.

7.2 Non-carcinogenic effects

The Hazard Index calculated by IRAP for the COPCs from the facility for each receptor is presented in the following table. This is the sum of the Hazard Quotient inhalation and ingestion for each COPC. The Hazard Quotient for each COPC and receptor is provided in Appendix C.

The Hazard Quotient for each COPC is well below 1 so no adverse non-carcinogenic health effects should result from a lifetime of exposure to any COPC.

Table 7.3: Hazard Index		
Receptor	**Hazard Index**	
	Adult	**Child**
Maximum within Minchinbury Residential Area to the North		
Resident	0.028	0.037
Maximum within Erskine Park Residential Area to the West		
Resident	0.019	0.024
Maximum within Horsley Park Residential Area to the South		
Resident	0.012	0.016
Point of Maximum Impact		
Resident	0.040	0.052
Farmer	0.066	0.092

As shown the Hazard Index is well below 1 and so it is highly unlikely that the COPC emissions from the facility would cause an adverse non-carcinogenic health risk. Detailed results tables are provided in Appendix C.

7.3 Carcinogenic effects

The total lifetime risk calculated by IRAP for the COPCs from the facility for each receptor is presented in the following table. This is the sum of the risk associated with inhalation and ingestion for each COPC. In addition, the annualised risk is presented which is directly comparable to the acceptable risk levels. The annualised risk is calculated based on the lifetime cancer risk divided by the exposure period. It is noted that benzo(a)pyrene is considered to have a mutagenic mode of action, and as such an age adjustment factor (an extra 3 fold) has been applied when assessing the risk for a child.

Table 7.4: Cancer Risk				
Receptor	**Lifetime Cancer Risk**		**Annualised Cancer Risk**	
	Adult	**Child**	**Adult**	**Child**
Maximum within Minchinbury Residential Area to the North				
Resident	2.53×10^{-6}	6.37×10^{-7}	8.44×10^{-8}	1.06×10^{-7}
Maximum within Erskine Park Residential Area to the West				
Resident	1.67×10^{-6}	4.21×10^{-7}	5.88×10^{-8}	7.02×10^{-7}
Maximum within Horsley Park Residential Area to the South				
Resident	1.09×10^{-6}	2.75×10^{-7}	3.64×10^{-8}	4.58×10^{-8}
Point of Maximum Impact				
Resident	3.55×10^{-6}	8.94×10^{-7}	1.18×10^{-7}	1.49×10^{-7}
Farmer	1.15×10^{-5}	2.94×10^{-6}	2.88×10^{-7}	4.90×10^{-7}
NOTES: Adult resident exposure 30 years, adult farmer exposure 40 years and child exposure 6 years.				

As shown, the Lifetime Cancer Risk for all sensitive receptors is less than one in a million (10^{-6}). The carcinogenic effect of COPCs released from the facility is therefore considered negligible. As noted in Section 3.2 the NSW Government document Risk Criteria for Land Use Safety Planning[17]states that the risk rating is on a per year basis and that the most sensitive land-use types (hospitals etc) should not be exposed to an individual risk level in excess of half in one million per year (0.5×10^{-6}). As shown in Table 7.4 the maximum annualised cancer risk is 4.90×10^{-7} for a child famer receptor at the point of maximum impact. This is 98% of the recommended risk for the most sensitive land use type. The maximum annualised cancer risk within the residential areas is 1.06×10^{-7} for a child in the area to the North. This is 21% of the recommended risk for the most sensitive land use type and 11% for the residential land use.

This shows that the carcinogenic effect of COPCs released from the facility is considered negligible even considering the worst-case scenario.

7.4 Uncertainty and sensitivity analysis

To account for uncertainty in the modelling the impact on human health was assessed for a receptor at the point of maximum impact.

To account for uncertainty in the dietary intake of a person, both a residential and farmer receptor has been assessed. The farmer receptor is assumed to consume a greater proportion of home grown produce, which has the potential to be contaminated by the COPCs released, than for a residential receptor. In addition, the farmer receptor includes the pathway from consuming animals grazed on land contaminated by the emission source. This assumes that 100% of the plant materials eaten by the animals is grown on soil contaminated by emission sources.

The farmer receptor at the point of maximum impact is considered the upper maximum of the impact of the facility.

As shown in the results for breast milk the point of maximum impact for a residential receptor is 3 times greater, and a famer receptor is 84 times greater than for the most impacted residential receptor.

As shown even for the upper maximum impact:

- the predicted impact of dioxins is well below the TMI;
- the predicted impact of non-carcinogenic COPCs is less than 1; and
- the predicted Cancer Risk from cumulative carcinogenic COPCs is less than one in a million.

7.5 Upset process conditions

Article 46(6) of the IED (Directive 2010/75/EU) states that:

> *"… the waste incineration plant … shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded.*
>
> *The cumulative duration or operation in such conditions over 1 year shall not exceed 60 hours."*

Article 47 continues with:

> *"In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored."*

In addition Annex VI, Part 3, 2 of the IED states the emission limit values applicable in the circumstances described in Article 46(6) and Article 47:

[17] NSW Government (2011) Hazardous Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use Safety Planning.

> *"The total dust concentration in the emissions into the air of a waste incineration plant shall under no circumstances exceed 150 mg/Nm^3 expressed as a half-hourly average. The air emission limit values for TOC and CO set out in points 1.2 and 1.5(b) shall not be exceeded."*

The conditions detailed in Article 46(6) are considered to be "Upset Operating Conditions". As identified these periods are short term events which can only occur for a maximum of 60 hours per year.

Start-up of the facility from cold will be conducted with clean support fuel (low sulphur light fuel oil). During start-up waste will not be introduced onto the grate unless the temperature within the oxidation zone is above the 850ºC as required by Article 50, paragraph 4(a) of the IED. During start-up, the flue gas treatment plant will be operational as will be the combustion control systems and emissions monitoring equipment.

The same is true during plant shutdown where waste will cease to be introduced to the grate. The waste remaining on the grate will be combusted, the temperature not being permitted to drop below 850ºC through the combustion of clean support auxiliary fuel. During this period the flue gas treatment equipment is fully operational, as will be the control systems and monitoring equipment. After complete combustion of the waste, the auxiliary burners will be turned off and the plant will be allowed to cool.

Start-up and shutdown are infrequent events. The facility is designed to operate continuously, and ideally only shutdown for its annual maintenance programme.

In relation to the magnitude of dioxin emissions during plant start-up and shutdown, research has been undertaken by AEA Technology on behalf of the Environment Agency[18]. Whilst elevated emissions of dioxins (within one order of magnitude) were found during shutdown and start-up phases where the waste was not fully established in the combustion chamber, the report concluded that:

"The mass of dioxin emitted during start-up and shutdown for a 4-5 day planned outage was similar to the emission which would have occurred during normal operation in the same period. The emission during the shutdown and restart is equivalent to less than 1 % of the estimated annual emission (if operating normally all year)."

There is therefore no reason why such start-up and shutdown operations or upset operating conditions will affect the long term impact of the facility.

[18] AEA Technology (2012) Review of research into health effects of Energy from Waste facilities.

8 CONCLUSIONS

8.1 Dioxins and furans

(1) The Tolerable Monthly Intake (TMI) for dioxins is set at a level which is considered to be free of adverse health effects.

a) The predicted monthly intake for a farmer living at the point of maximum impact and consuming some locally produced food is estimated to be 23.5% of the Tolerable Monthly Intake. This takes account of background sources of dioxins as well as the contribution from the proposed facility.

b) For a 2-3 year-old child of a farmer, the predicted monthly intake is 55% of the Tolerable Monthly Intake.

(2) Hence, it is concluded that emissions of dioxins from the facility will not lead to adverse health effects.

8.2 Non-carcinogenic effects

(1) The non-carcinogenic effect of emissions on human health can be assessed in terms of the Hazard Quotient (HQ). This is calculated as the Average Daily Dose as a proportion of the Reference Concentration or Dose which have been developed based on dose-response research. If the Hazard Quotient is less than 1 no adverse non-carcinogenic health effects should result from a lifetime of exposure of any COPC.

(2) The HQ for all COPCs released is well below 1 and so no adverse non-carcinogenic health effects should result from a lifetime of exposure of any COPC.

(3) It is noted that the cumulative impact of COPCs should be considered. For this purpose the HI has been developed. This is the sum of the HQs for each substance and exposure pathway. The lower the HI the lower the less risk to human health is implied.

8.3 Carcinogenic effects

(1) The carcinogenic effect of emissions on human health can be assessed in terms of the Cancer Risk. This is calculated as the Average Daily Dose as a proportion of the Cancer Slope Factor or Unit Risk Factor which have been developed based on dose-response research. If the combined Cancer Risk is less than one in a million, the cancer risks are considered to be negligible.

(2) The combined Cancer Risk for the COPCs considered at residential receptors is less than one in a million (10^{-6}). Therefore, the carcinogenic effect of COPCs released from the facility is considered negligible.

(3) Even using the worst-case assessment for the point of maximum impact when the combined Cancer Risk is annualised the impact is less than one in a million. Therefore, even for the worst-case assessment the carcinogenic effect of COPCs released from the facility is considered negligible.

Appendix A - Basis for the Emission Rate of Dioxins and Furans

Table A.1: Basis for the Emission Rate of Dioxins and Furans	
Compound	**WHO-TEF Multiplier[19]**
HeptaCDD, 1,2,3,4,6,7,8-	0.0031
HeptaCDF, 1,2,3,4,6,7,8-	0.0245
HeptaCDF, 1,2,3,4,7,8,9-	0.0287
HexaCDD, 1,2,3,4,7,8-	0.0258
HexaCDD, 1,2,3,6,7,8-	0.0205
HexaCDD, 1,2,3,7,8,9-	0.1704
HexaCDF, 1,2,3,4,7,8-	0.4042
HexaCDF, 1,2,3,6,7,8-	0.0277
HexaCDF, 1,2,3,7,8,9-	0.0277
HexaCDF, 2,3,4,6,7,8-	0.0535
OctaCDD, 1,2,3,4,6,7,8,9-	0.2179
PentaCDD, 1,2,3,7,8-	0.0807
PentaCDF, 1,2,3,7,8-	0.0042
PentaCDF, 2,3,4,7,8-	0.0871
TetraCDD, 2,3,7,8-	0.4395
TetraCDF, 2,3,7,8-	0.0429

19 Van den Berg et al. (2006) The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds.

Appendix B – IRAP Inputs

Table B.1: Site Parameters Defined for the Health Risk Assessment

Parameter	Value	IRAP Symbol	Units
Soil dry bulk density	1.5	bd	g/cm^3
Forage fraction grown on contam. soil eaten by CATTLE	1	beef_fi_forage	--
Grain fraction grown on contam. soil eaten by CATTLE	1	beef_fi_grain	--
Silage fraction grown on contam. eaten by CATTLE	1	beef_fi_silage	--
Qty of forage eaten by CATTLE each day	8.8	beef_qp_forage	kg DW/day
Qty of grain eaten by CATTLE each day	0.47	beef_qp_grain	kg DW/day
Qty of silage eaten by CATTLE each day	2.5	beef_qp_silage	kg DW/day
Grain fraction grown on contam. soil eaten by CHICKEN	1	chick_fi_grain	--
Qty of grain eaten by CHICKEN each day	0.2	chick_qp_grain	kg DW/day
Average annual evapotranspiration	82	e_v	cm/yr
Fish lipid content	0.07	f_lipid	--
Fraction of CHICKEN's diet that is soil	0.1	fd_chicken	--
Universal gas constant	8.21E-05	gas_r	atm-m^3/mol-K
Average annual irrigation	160	i	cm/yr
Plant surface loss coefficient	18	kp	yr^-1
Fraction of mercury emissions NOT lost to the global cycle	0.48	merc_q_corr	--
Fraction of mercury speciated into methyl mercury in produce	0.22	mercmethyl_ag	--
Fraction of mercury speciated into methyl mercury in soil	0.02	mercmethyl_sc	--
Forage fraction grown contam. soil, eaten by MILK CATTLE	1	milk_fi_forage	--
Grain fraction grown contam. soil, eaten by MILK CATTLE	1	milk_fi_grain	--
Silage fraction grown contam. soil, eaten by MILK CATTLE	1	milk_fi_silage	--
Qty of forage eaten by MILK CATTLE each day	13.2	milk_qp_forage	kg DW/day
Qty of grain eaten by MILK CATTLE each day	3	milk_qp_grain	kg DW/day
Qty of silage eaten by MILK CATTLE each day	4.1	milk_qp_silage	kg DW/day
Averaging time	1	milkfat_at	yr
Body weight of infant	9.4	milfat_bw_infant	kg
Exposure duration of infant to breast milk	1	milkfat_ed	yr
Proportion of ingested dioxin that is stored in fat	0.9	milkfat_f1	--
Proportion of mothers weight that is fat	0.3	milkfat_f2	--
Fraction of fat in breast milk	0.04	milkfat_f3	--
Fraction of ingested contaminant that is absorbed	0.9	milkfat_f4	--

Table B.1: Site Parameters Defined for the Health Risk Assessment			
Parameter	**Value**	**IRAP Symbol**	**Units**
Half-life of dioxin in adults	2555	milkfat_h	days
Ingestion rate of breast milk	0.688	milkfat_ir_milk	kg/day
Viscosity of air corresponding to air temp.	1.81E-04	mu_a	g/cm-s
Average annual precipitation	86.2	p	cm/yr
Fraction of grain grown on contam. soil eaten by PIGS	1	pork_fi_grain	--
Fraction of silage grown on contam. soil and eaten by PIGS	1	pork_fi_silage	--
Qty of grain eaten by PIGS each day	3.3	pork_qp_grain	kg DW/day
Qty of silage eaten by PIGS each day	1.4	pork_qp_silage	kg DW/day
Qty of soil eaten by CATTLE	0.5	qs_beef	kg/day
Qty of soil eaten by CHICKEN	0.022	qs_chick	kg/day
Qty of soil eaten by DAIRY CATTLE	0.4	qs_milk	kg/day
Qty of soil eaten by PIGS	0.37	qs_pork	kg/day
Average annual runoff	8.2	r	cm/yr
Density of air	1.20E-03	rho_a	g/cm^3
Solids particle density	2.7	rho_s	g/cm^3
Interception fraction - edible portion ABOVEGROUND	0.39	rp	--
Interception fraction - edible portion FORAGE	0.5	rp_forage	--
Interception fraction - edible portion SILAGE	0.46	rp_silage	--
Ambient air temperature	298	t	K
Temperature correction factor	1.026	theta	--
Soil volumetric water content	0.2	theta_s	mL/cm^3
Length of plant expos. to depos. - ABOVEGROUND	0.16	tp	Yr
Length of plant expos. to depos. - FORAGE	0.12	tp_forage	Yr
Length of plant expos. to depos. - SILAGE	0.16	tp_silage	Yr
Dry deposition velocity	0.5	vdv	cm/s
Dry deposition velocity for mercury	2.9	vdv_hg	cm/s
Wind velocity	3	w	m/s
Yield/standing crop biomass - edible portion ABOVEGROUND	2.24	yp	kg DW/m^2
Yield/standing crop biomass - edible portion FORAGE	0.24	yp_forage	kg DW/m^2
Yield/standing crop biomass - edible portion SILAGE	0.8	yp_silage	kg DW/m^2
Soil mixing zone depth	2	z	cm
Soil mixing zone depth for produce	15	z_p	cm

Table B.2: Scenario Parameters Defined for the Health Risk Assessment					
Parameter	**Resident Adult**	**Resident Child**	**Farmer Adult**	**Farmer Child**	**Units**
Averaging time for carcinogens	70	70	70	70	yr
Averaging time for noncarcinogens	30	6	40	6	yr
Consumption rate of BEEF	0	0	0.00122	0.00075	kg/kg-day FW
Body weight	70	17	70	17	kg
Consumption rate of POULTRY	0	0	0.00066	0.00045	kg/kg-day FW
Consumption rate of ABOVEGROUND PRODUCE	0.00032	0.00077	0.00047	0.00113	kg/kg-day DW
Consumption rate of BELOWGROUND PRODUCE	0.00014	0.00023	0.00017	0.00028	kg/kg-day DW
Consumption rate of DRINKING WATER	2	0.66	2	0.66	L/day
Consumption rate of PROTECTED ABOVEGROUND PRODUCE	0.00061	0.0015	0.00064	0.00157	kg/kg-day DW
Consumption rate of SOIL	0.00006	0.0001	0.0001	0.0002	kg/d
Exposure duration	30	6	40	6	yr
Exposure frequency	350	350	350	350	day/yr
Consumption rate of EGGS	0	0	0.00075	0.00054	kg/kg-day FW
Fraction of contaminated ABOVEGROUND PRODUCE	1	1	1	1	--
Fraction of contaminated DRINKING WATER	1	1	1	1	--
Fraction contaminated SOIL	1	1	1	1	--
Consumption rate of FISH	0	0	0	0	kg/kg-day FW
Fraction of contaminated FISH	1	1	1	1	--
Inhalation exposure duration	30	6	40	6	yr
Inhalation exposure frequency	350	350	350	350	day/yr
Inhalation exposure time	24	24	24	24	hr/day
Fraction of contaminated BEEF	1	1	1	1	--
Fraction of contaminated POULTRY	1	1	1	1	--
Fraction of contaminated EGGS	1	1	1	1	--
Fraction of contaminated MILK	1	1	1	1	--
Fraction of contaminated PORK	1	1	1	1	--
Inhalation rate	0.83	0.66	0.83	0.66	m^3/hr
Consumption rate of MILK	0	0	0.01367	0.02268	kg/kg-day FW
Consumption rate of PORK	0	0	0.00055	0.00042	kg/kg-day FW
Time period at the beginning of combustion	0	0	0	0	yr
Length of exposure duration	30	6	40	6	yr

Appendix C – IRAP Results

Table C.1: Point of Maximum Impact –Hazard Quotient				
COPC Name	**Adult Farmer**	**Adult Resident**	**Child Farmer**	**Child Resident**
Arsenic	5.13E-03	5.12E-03	5.26E-03	5.18E-03
Mercuric chloride	3.64E-03	3.59E-03	3.82E-03	3.74E-03
Lead	3.40E-06	3.40E-06	3.40E-06	3.40E-06
Hydrogen chloride	1.16E-02	1.77E-03	2.14E-02	5.05E-03
Benzene	1.26E-03	5.11E-04	2.70E-03	1.28E-03
TetraCDD, 2,3,7,8-	2.57E-03	2.10E-03	4.28E-03	3.27E-03
Nickel	3.45E-03	1.77E-04	4.06E-03	4.36E-04
Cadmium	4.05E-04	4.04E-04	4.09E-04	4.07E-04
Thallium (I)	2.52E-02	2.11E-02	3.00E-02	2.45E-02
Methyl mercury	8.17E-06	8.32E-07	1.35E-05	2.13E-06
Antimony	1.76E-04	1.67E-04	1.82E-04	1.68E-04
Chromium, hexavalent	5.99E-03	2.09E-03	1.13E-02	4.50E-03
Chromium	3.20E-03	2.84E-03	3.40E-03	2.89E-03
Mercury	3.49E-03	4.59E-05	5.02E-03	1.56E-04
Aroclor 1254	3.86E-08	1.86E-09	5.36E-08	5.42E-09
Aroclor 1016	1.16E-07	4.20E-09	1.62E-07	1.36E-08
Total	0.066	0.040	0.092	0.052

Table C.2: Hazard Quotient – North Receptor		
COPC Name	**Adult Resident**	**Child Resident**
Arsenic	3.65E-03	3.69E-03
Mercuric chloride	2.56E-03	2.66E-03
Lead	2.43E-06	2.43E-06
Hydrogen chloride	1.26E-03	3.60E-03
Benzene	3.64E-04	9.12E-04
TetraCDD, 2,3,7,8-	1.50E-03	2.33E-03
Nickel	1.26E-04	3.10E-04
Cadmium	2.88E-04	2.90E-04
Thallium (I)	1.51E-02	1.75E-02
Methyl mercury	5.93E-07	1.52E-06
Antimony	1.19E-04	1.20E-04
Chromium, hexavalent	1.49E-03	3.21E-03
Chromium	2.03E-03	2.06E-03
Mercury	3.27E-05	1.11E-04
Aroclor 1254	1.33E-09	3.86E-09
Aroclor 1016	2.99E-09	9.72E-09
Total	0.015	0.017

Table C.3: Hazard Quotient – West Receptor		
COPC Name	**Adult Resident**	**Child Resident**
Arsenic	2.41E-03	2.44E-03
Mercuric chloride	1.69E-03	1.76E-03
Lead	1.60E-06	1.60E-06
Hydrogen chloride	8.32E-04	2.38E-03
Benzene	2.41E-04	6.03E-04
TetraCDD, 2,3,7,8-	9.90E-04	1.54E-03
Nickel	8.34E-05	2.05E-04
Cadmium	1.90E-04	1.92E-04
Thallium (I)	9.94E-03	1.15E-02
Methyl mercury	3.92E-07	1.00E-06
Antimony	7.85E-05	7.92E-05
Chromium, hexavalent	9.84E-04	2.12E-03
Chromium	1.34E-03	1.36E-03
Mercury	2.16E-05	7.35E-05
Aroclor 1254	8.76E-10	2.55E-09
Aroclor 1016	1.98E-09	6.42E-09
Total	0.010	0.012

Table C.4: Hazard Quotient – South Receptor		
COPC Name	**Adult Resident**	**Child Resident**
Arsenic	1.57E-03	1.59E-03
Mercuric chloride	1.10E-03	1.15E-03
Lead	1.05E-06	1.05E-06
Hydrogen chloride	5.44E-04	1.55E-03
Benzene	1.57E-04	3.94E-04
TetraCDD, 2,3,7,8-	6.47E-04	1.00E-03
Nickel	5.45E-05	1.34E-04
Cadmium	1.24E-04	1.25E-04
Thallium (I)	6.50E-03	7.54E-03
Methyl mercury	2.56E-07	6.56E-07
Antimony	5.13E-05	5.18E-05
Chromium, hexavalent	6.43E-04	1.39E-03
Chromium	8.75E-04	8.90E-04
Mercury	1.41E-05	4.81E-05
Aroclor 1254	5.73E-10	1.67E-09
Aroclor 1016	1.29E-09	4.20E-09
Total	0.006	0.008

Table C.5: Point of Maximum Impact – Cancer Risk				
COPC Name	**Adult Farmer**	**Adult Resident**	**Child Farmer**	**Child Resident**
Benzene	4.77E-07	3.59E-07	7.61E-08	7.45E-08
Benzo(a)pyrene	1.46E-06	1.16E-08	9.50E-07	1.67E-08
Cadmium	3.74E-07	2.51E-07	7.85E-08	6.53E-08
Thallium (I)	1.88E-06	1.32E-06	2.86E-07	2.64E-07
Arsenic	3.05E-06	1.50E-06	6.44E-07	4.30E-07
Chromium, hexavalent	9.10E-09	6.83E-09	1.37E-09	1.37E-09
Lead	1.55E-08	5.57E-09	4.01E-09	1.87E-09
Nickel	7.70E-08	5.78E-08	1.16E-08	1.16E-08
PentaCDF, 2,3,4,7,8-	1.75E-06	1.97E-08	3.71E-07	1.15E-08
PentaCDD, 1,2,3,7,8-	1.72E-06	1.98E-08	3.66E-07	1.15E-08
TetraCDD, 2,3,7,8-	2.78E-07	2.39E-09	5.91E-08	1.50E-09
HexaCDF, 1,2,3,4,7,8-	2.15E-07	3.52E-09	4.61E-08	2.06E-09
HexaCDF, 2,3,4,6,7,8-	8.64E-08	1.40E-09	1.85E-08	8.20E-10
HexaCDF, 1,2,3,6,7,8-	7.99E-08	1.30E-09	1.71E-08	7.62E-10
TetraCDF, 2,3,7,8-	2.74E-08	2.04E-10	5.75E-09	1.27E-10
HexaCDD, 1,2,3,6,7,8-	9.07E-09	1.87E-10	1.96E-09	1.04E-10
PentaCDF, 1,2,3,7,8-	7.73E-09	9.35E-11	1.64E-09	5.54E-11
HexaCDD, 1,2,3,7,8,9-	6.88E-09	1.50E-10	1.49E-09	8.34E-11
HexaCDF, 1,2,3,7,8,9-	4.23E-09	6.51E-11	9.05E-10	3.82E-11
HeptaCDF, 1,2,3,4,6,7,8-	3.28E-09	7.14E-11	7.13E-10	4.20E-11
HeptaCDD, 1,2,3,4,6,7,8-	6.72E-10	2.69E-11	1.52E-10	1.60E-11
HeptaCDF, 1,2,3,4,7,8,9-	4.23E-10	6.99E-12	9.16E-11	4.10E-12
OctaCDF, 1,2,3,4,6,7,8,9-	1.44E-12	5.74E-14	3.27E-13	3.39E-14
OctaCDD, 1,2,3,4,6,7,8,9-	1.29E-12	6.35E-14	3.00E-13	3.76E-14
Total	1.15E-05	3.55E-06	2.94E-06	8.94E-07

Table C.6: Cancer Risk – South Receptor		
COPC Name	**Adult Resident**	**Child Resident**
Benzene	2.56E-07	5.31E-08
Benzo(a)pyrene	8.24E-09	1.19E-08
Cadmium	1.79E-07	4.65E-08
Thallium (I)	9.38E-07	1.88E-07
Arsenic	1.07E-06	3.06E-07
Chromium, hexavalent	4.86E-09	9.73E-10
Lead	3.97E-09	1.33E-09
Nickel	4.12E-08	8.23E-09
PentaCDF, 2,3,4,7,8-	1.41E-08	8.23E-09
PentaCDD, 1,2,3,7,8-	1.41E-08	8.19E-09
TetraCDD, 2,3,7,8-	1.70E-09	1.07E-09
HexaCDF, 1,2,3,4,7,8-	2.51E-09	1.47E-09
HexaCDF, 2,3,4,6,7,8-	9.97E-10	5.85E-10
HexaCDF, 1,2,3,6,7,8-	9.26E-10	5.43E-10
TetraCDF, 2,3,7,8-	1.45E-10	9.02E-11
HexaCDD, 1,2,3,6,7,8-	1.33E-10	7.42E-11
PentaCDF, 1,2,3,7,8-	6.66E-11	3.95E-11
HexaCDD, 1,2,3,7,8,9-	1.07E-10	5.94E-11
HexaCDF, 1,2,3,7,8,9-	4.64E-11	2.73E-11
HeptaCDF, 1,2,3,4,6,7,8-	5.08E-11	2.99E-11
HeptaCDD, 1,2,3,4,6,7,8-	1.92E-11	1.14E-11
HeptaCDF, 1,2,3,4,7,8,9-	4.98E-12	2.92E-12
OctaCDF, 1,2,3,4,6,7,8,9-	4.09E-14	2.41E-14
OctaCDD, 1,2,3,4,6,7,8,9-	4.52E-14	2.68E-14
Total	2.53E-06	6.37E-07

Table C.7: Cancer Risk – West Receptor		
COPC Name	**Adult Resident**	**Child Resident**
Benzene	1.69E-07	3.51E-08
Benzo(a)pyrene	5.44E-09	7.84E-09
Cadmium	1.18E-07	3.07E-08
Thallium (I)	6.19E-07	1.25E-07
Arsenic	7.05E-07	2.02E-07
Chromium, hexavalent	3.21E-09	6.43E-10
Lead	2.62E-09	8.79E-10
Nickel	2.72E-08	5.44E-09
PentaCDF, 2,3,4,7,8-	9.29E-09	5.44E-09
PentaCDD, 1,2,3,7,8-	9.30E-09	5.41E-09
TetraCDD, 2,3,7,8-	1.13E-09	7.04E-10
HexaCDF, 1,2,3,4,7,8-	1.66E-09	9.70E-10
HexaCDF, 2,3,4,6,7,8-	6.59E-10	3.86E-10
HexaCDF, 1,2,3,6,7,8-	6.12E-10	3.59E-10
TetraCDF, 2,3,7,8-	9.59E-11	5.96E-11
HexaCDD, 1,2,3,6,7,8-	8.80E-11	4.90E-11
PentaCDF, 1,2,3,7,8-	4.40E-11	2.61E-11
HexaCDD, 1,2,3,7,8,9-	7.04E-11	3.92E-11
HexaCDF, 1,2,3,7,8,9-	3.07E-11	1.80E-11
HeptaCDF, 1,2,3,4,6,7,8-	3.36E-11	1.98E-11
HeptaCDD, 1,2,3,4,6,7,8-	1.27E-11	7.51E-12
HeptaCDF, 1,2,3,4,7,8,9-	3.29E-12	1.93E-12
OctaCDF, 1,2,3,4,6,7,8,9-	2.70E-14	1.59E-14
OctaCDD, 1,2,3,4,6,7,8,9-	2.99E-14	1.77E-14
Total	1.67E-06	4.21E-07

Table C.8: Cancer Risk – South Receptor		
COPC Name	**Adult Resident**	**Child Resident**
Benzene	1.10E-07	2.29E-08
Benzo(a)pyrene	3.56E-09	5.12E-09
Cadmium	7.72E-08	2.01E-08
Thallium (l)	4.05E-07	8.14E-08
Arsenic	4.61E-07	1.32E-07
Chromium, hexavalent	2.10E-09	4.20E-10
Lead	1.71E-09	5.74E-10
Nickel	1.78E-08	3.55E-09
PentaCDF, 2,3,4,7,8-	6.07E-09	3.55E-09
PentaCDD, 1,2,3,7,8-	6.08E-09	3.54E-09
TetraCDD, 2,3,7,8-	7.36E-10	4.60E-10
HexaCDF, 1,2,3,4,7,8-	1.08E-09	6.34E-10
HexaCDF, 2,3,4,6,7,8-	4.30E-10	2.52E-10
HexaCDF, 1,2,3,6,7,8-	4.00E-10	2.34E-10
TetraCDF, 2,3,7,8-	6.27E-11	3.90E-11
HexaCDD, 1,2,3,6,7,8-	5.75E-11	3.20E-11
PentaCDF, 1,2,3,7,8-	2.88E-11	1.70E-11
HexaCDD, 1,2,3,7,8,9-	4.60E-11	2.56E-11
HexaCDF, 1,2,3,7,8,9-	2.00E-11	1.18E-11
HeptaCDF, 1,2,3,4,6,7,8-	2.20E-11	1.29E-11
HeptaCDD, 1,2,3,4,6,7,8-	8.29E-12	4.91E-12
HeptaCDF, 1,2,3,4,7,8,9-	2.15E-12	1.26E-12
OctaCDF, 1,2,3,4,6,7,8,9-	1.76E-14	1.04E-14
OctaCDD, 1,2,3,4,6,7,8,9-	1.95E-14	1.16E-14
Total	1.09E-06	2.75E-07

Appendix D – IRAP Outputs

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

SOURCE: SK1

AIR PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Hourly air concentration - particle phase	0	chp	ug-s/g-m^3
Hourly air concentration - particle bound	0	chp_pb	ug-s/g-m^3
Hourly air concentration - vapor phase	0	chv	ug-s/g-m^3
Hourly air concentration - vapor phase hg	0	chv_hg	ug-s/g-m^3
Air concentration - particle phase	0.07646	cyp	ug-s/g-m^3
Air concentration - particle bound	0.07646	cyp_pb	ug-s/g-m^3
Air concentration - vapor phase	0.07646	cyv	ug-s/g-m^3
Air concentration - vapor phase hg	0.07646	cyv_hg	ug-s/g-m^3
Dry deposition - particle phase	0.02411	dydp	s/m^2 year
Dry deposition - particle bound	0.02411	dydp_pb	s/m^2 year
Dry deposition - vapor phase	0.01206	dydv	s/m^2 year
Dry deposition - vapor phase hg	0.02411	dydv_hg	s/m^2 year
Wet deposition - particle phase	0.04822	dywp	s/m^2 year
Wet deposition - particle bound	0.04822	dywp_pb	s/m^2 year
Wet deposition - vapor phase	0.02411	dywv	s/m^2 year
Wet deposition - vapor phase hg	0	dywv_hg	s/m^2 year

RECEPTOR : Max_Resi **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Resi

SOURCE: SK1

AIR PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Hourly air concentration - particle phase	0	chp	ug-s/g-m^3
Hourly air concentration - particle bound	0	chp_pb	ug-s/g-m^3
Hourly air concentration - vapor phase	0	chv	ug-s/g-m^3
Hourly air concentration - vapor phase hg	0	chv_hg	ug-s/g-m^3
Air concentration - particle phase	0.07646	cyp	ug-s/g-m^3
Air concentration - particle bound	0.07646	cyp_pb	ug-s/g-m^3
Air concentration - vapor phase	0.07646	cyv	ug-s/g-m^3
Air concentration - vapor phase hg	0.07646	cyv_hg	ug-s/g-m^3
Dry deposition - particle phase	0.02411	dydp	s/m^2 year
Dry deposition - particle bound	0.02411	dydp_pb	s/m^2 year
Dry deposition - vapor phase	0.01206	dydv	s/m^2 year
Dry deposition - vapor phase hg	0.02411	dydv_hg	s/m^2 year
Wet deposition - particle phase	0.04822	dywp	s/m^2 year
Wet deposition - particle bound	0.04822	dywp_pb	s/m^2 year
Wet deposition - vapor phase	0.02411	dywv	s/m^2 year
Wet deposition - vapor phase hg	0	dywv_hg	s/m^2 year

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

SOURCE: SK1

AIR PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Hourly air concentration - particle phase	0	chp	ug-s/g-m^3
Hourly air concentration - particle bound	0	chp_pb	ug-s/g-m^3
Hourly air concentration - vapor phase	0	chv	ug-s/g-m^3
Hourly air concentration - vapor phase hg	0	chv_hg	ug-s/g-m^3
Air concentration - particle phase	0.05448	cyp	ug-s/g-m^3
Air concentration - particle bound	0.05448	cyp_pb	ug-s/g-m^3
Air concentration - vapor phase	0.05448	cyv	ug-s/g-m^3
Air concentration - vapor phase hg	0.05448	cyv_hg	ug-s/g-m^3
Dry deposition - particle phase	0.01718	dydp	s/m^2 year
Dry deposition - particle bound	0.01718	dydp_pb	s/m^2 year
Dry deposition - vapor phase	0.00859	dydv	s/m^2 year
Dry deposition - vapor phase hg	0.01718	dydv_hg	s/m^2 year
Wet deposition - particle phase	0.03436	dywp	s/m^2 year
Wet deposition - particle bound	0.03436	dywp_pb	s/m^2 year
Wet deposition - vapor phase	0.01718	dywv	s/m^2 year
Wet deposition - vapor phase hg	0	dywv_hg	s/m^2 year

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

SOURCE: SK1

AIR PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Hourly air concentration - particle phase	0	chp	ug-s/g-m^3
Hourly air concentration - particle bound	0	chp_pb	ug-s/g-m^3
Hourly air concentration - vapor phase	0	chv	ug-s/g-m^3
Hourly air concentration - vapor phase hg	0	chv_hg	ug-s/g-m^3
Air concentration - particle phase	0.02352	cyp	ug-s/g-m^3
Air concentration - particle bound	0.02352	cyp_pb	ug-s/g-m^3
Air concentration - vapor phase	0.02352	cyv	ug-s/g-m^3
Air concentration - vapor phase hg	0.02352	cyv_hg	ug-s/g-m^3
Dry deposition - particle phase	0.00742	dydp	s/m^2 year
Dry deposition - particle bound	0.00742	dydp_pb	s/m^2 year
Dry deposition - vapor phase	0.00371	dydv	s/m^2 year
Dry deposition - vapor phase hg	0.00742	dydv_hg	s/m^2 year
Wet deposition - particle phase	0.01483	dywp	s/m^2 year
Wet deposition - particle bound	0.01483	dywp_pb	s/m^2 year
Wet deposition - vapor phase	0.00742	dywv	s/m^2 year
Wet deposition - vapor phase hg	0	dywv_hg	s/m^2 year

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

SOURCE: SK1

AIR PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Hourly air concentration - particle phase	0	chp	ug-s/g-m^3
Hourly air concentration - particle bound	0	chp_pb	ug-s/g-m^3
Hourly air concentration - vapor phase	0	chv	ug-s/g-m^3
Hourly air concentration - vapor phase hg	0	chv_hg	ug-s/g-m^3
Air concentration - particle phase	0.03599	cyp	ug-s/g-m^3
Air concentration - particle bound	0.03599	cyp_pb	ug-s/g-m^3
Air concentration - vapor phase	0.03599	cyv	ug-s/g-m^3
Air concentration - vapor phase hg	0.03599	cyv_hg	ug-s/g-m^3
Dry deposition - particle phase	0.01135	dydp	s/m^2 year
Dry deposition - particle bound	0.01135	dydp_pb	s/m^2 year
Dry deposition - vapor phase	0.00567	dydv	s/m^2 year
Dry deposition - vapor phase hg	0.01135	dydv_hg	s/m^2 year
Wet deposition - particle phase	0.0227	dywp	s/m^2 year
Wet deposition - particle bound	0.0227	dywp_pb	s/m^2 year
Wet deposition - vapor phase	0.01135	dywv	s/m^2 year
Wet deposition - vapor phase hg	0	dywv_hg	s/m^2 year

SITE PARAMETERS

Date : 24/02/2015

RECEPTOR:	Max_Farmer	UTM X:	298,280.00	UTM Y:	6,258,100.00

SITE PARAMETER	VALUE	SYMBOL	UNITS
Soil dry bulk density	1.5	bd	g/cm^3
Forage fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_forage	--
Grain fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_grain	--
Silage fraction grown on contam. eaten by CATTLE	1.0	beef_fi_silage	--
Qty of forage eaten by CATTLE each day	8.8	beef_qp_forage	kg DW/day
Qty of grain eaten by CATTLE each day	0.47	beef_qp_grain	kg DW/day
Qty of silage eaten by CATTLE each day	2.5	beef_qp_silage	kg DW/day
Grain fraction grown on contam. soil eaten by CHICKEN	1.0	chick_fi_grain	--
Qty of grain eaten by CHICKEN each day	0.2	chick_qp_grain	kg DW/day
Average annual evapotranspiration	131.4	e_v	cm/yr
Fish lipid content	0.07	f_lipid	--
Fraction of CHICKEN's diet that is soil	0.1	fd_chicken	--
Universal gas constant	8.205e-5	gas_r	atm-m^3/mol-K
Average annual irrigation	52.65	i	cm/yr
Plant surface loss coefficient	18	kp	yr^-1
Fraction of mercury emissions NOT lost to the global cycle	0.48	merc_q_corr	--
Fraction of mercury speciated into methyl mercury in produce	0.22	mercmethyl_ag	--
Fraction of mercury speciated into methyl mercury in soil	0.02	mercmethyl_sc	--
Forage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_forage	--
Grain fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_grain	--
Silage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_silage	--
Qty of forage eaten by MILK CATTLE each day	13.2	milk_qp_forage	kg DW/day
Qty of grain eaten by MILK CATTLE each day	3.0	milk_qp_grain	kg DW/day
Qty of silage eaten by MILK CATTLE each day	4.1	milk_qp_silage	kg DW/day
Averaging time	1	milkfat_at	yr
Body weight of infant	9.4	milfat_bw_infant	kg
Exposure duration of infant to breast milk	1	milkfat_ed	yr
Proportion of ingested dioxin that is stored in fat	0.9	milkfat_f1	--
Proportion of mothers weight that is fat	0.3	milkfat_f2	--
Fraction of fat in breast milk	0.04	milkfat_f3	--
Fraction of ingested contaminant that is absorbed	0.9	milkfat_f4	--
Half-life of dioxin in adults	2555	milkfat_h	days
Ingestion rate of breast milk	0.688	milkfat_ir_milk	kg/day
Viscosity of air corresponding to air temp.	1.81e-04	mu_a	g/cm-s
Average annual precipitation	87.51	p	cm/yr

RECEPTOR:	Max_Farmer	UTM X:	298,280.00	UTM Y:	6,258,100.00

SITE PARAMETER	VALUE	SYMBOL	UNITS
Fraction of grain grown on contam. soil eaten by PIGS	1.0	pork_fi_grain	--
Fraction of silage grown on contam. soil and eaten by PIGS	1.0	pork_fi_silage	--
Qty of grain eaten by PIGS each day	3.3	pork_qp_grain	kg DW/day
Qty of silage eaten by PIGS each day	1.4	pork_qp_silage	kg DW/day
Qty of soil eaten by CATTLE	0.5	qs_beef	kg/day
Qty of soil eaten by CHICKEN	0.022	qs_chick	kg/day
Qty of soil eaten by DAIRY CATTLE	0.4	qs_milk	kg/day
Qty of soil eaten by PIGS	0.37	qs_pork	kg/day
Average annual runoff	8.751	r	cm/yr
Density of air	1.2e-3	rho_a	g/cm^3
Solids particle density	2.7	rho_s	g/cm^3
Interception fraction - edible portion ABOVEGROUND	0.39	rp	--
Interception fraction - edible portion FORAGE	0.5	rp_forage	--
Interception fraction - edible portion SILAGE	0.46	rp_silage	--
Ambient air temperature	298	t	K
Temperature correction factor	1.026	theta	--
Soil volumetric water content	0.2	theta_s	mL/cm^3
Length of plant expos. to depos. - ABOVEGROUND	0.16	tp	Yr
Length of plant expos. to depos. - FORAGE	0.12	tp_forage	Yr
Length of plant expos. to depos. - SILAGE	0.16	tp_silage	Yr
Dry deposition velocity	0.5	vdv	cm/s
Dry deposition velocity for mercury	2.9	vdv_hg	cm/s
Wind velocity	3	w	m/s
Yield/standing crop biomass - edible portion ABOVEGROUND	2.24	yp	kg DW/m^2
Yield/standing crop biomass - edible portion FORAGE	0.24	yp_forage	kg DW/m^2
Yield/standing crop biomass - edible portion SILAGE	0.8	yp_silage	kg DW/m^2
Soil mixing zone depth	2.0	z	cm
Soil mixing zone depth for produce	15	z_p	cm

RECEPTOR:	Max_Resi	UTM X:	298,280.00	UTM Y:	6,258,100.00

SITE PARAMETER	VALUE	SYMBOL	UNITS
Soil dry bulk density	1.5	bd	g/cm^3
Forage fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_forage	--
Grain fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_grain	--
Silage fraction grown on contam. eaten by CATTLE	1.0	beef_fi_silage	--
Qty of forage eaten by CATTLE each day	8.8	beef_qp_forage	kg DW/day
Qty of grain eaten by CATTLE each day	0.47	beef_qp_grain	kg DW/day
Qty of silage eaten by CATTLE each day	2.5	beef_qp_silage	kg DW/day
Grain fraction grown on contam. soil eaten by CHICKEN	1.0	chick_fi_grain	--
Qty of grain eaten by CHICKEN each day	0.2	chick_qp_grain	kg DW/day
Average annual evapotranspiration	131.4	e_v	cm/yr
Fish lipid content	0.07	f_lipid	--
Fraction of CHICKEN's diet that is soil	0.1	fd_chicken	--
Universal gas constant	8.205e-5	gas_r	atm-m^3/mol-K
Average annual irrigation	52.65	i	cm/yr
Plant surface loss coefficient	18	kp	yr^-1
Fraction of mercury emissions NOT lost to the global cycle	0.48	merc_q_corr	--
Fraction of mercury speciated into methyl mercury in produce	0.22	mercmethyl_ag	--
Fraction of mercury speciated into methyl mercury in soil	0.02	mercmethyl_sc	--
Forage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_forage	--
Grain fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_grain	--
Silage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_silage	--
Qty of forage eaten by MILK CATTLE each day	13.2	milk_qp_forage	kg DW/day
Qty of grain eaten by MILK CATTLE each day	3.0	milk_qp_grain	kg DW/day
Qty of silage eaten by MILK CATTLE each day	4.1	milk_qp_silage	kg DW/day
Averaging time	1	milkfat_at	yr
Body weight of infant	9.4	milfat_bw_infant	kg
Exposure duration of infant to breast milk	1	milkfat_ed	yr
Proportion of ingested dioxin that is stored in fat	0.9	milkfat_f1	--
Proportion of mothers weight that is fat	0.3	milkfat_f2	--
Fraction of fat in breast milk	0.04	milkfat_f3	--
Fraction of ingested contaminant that is absorbed	0.9	milkfat_f4	--
Half-life of dioxin in adults	2555	milkfat_h	days
Ingestion rate of breast milk	0.688	milkfat_ir_milk	kg/day
Viscosity of air corresponding to air temp.	1.81e-04	mu_a	g/cm-s
Average annual precipitation	87.51	p	cm/yr

RECEPTOR:	Max_Resi	UTM X:	298,280.00	UTM Y:	6,258,100.00

SITE PARAMETER	VALUE	SYMBOL	UNITS
Fraction of grain grown on contam. soil eaten by PIGS	1.0	pork_fi_grain	--
Fraction of silage grown on contam. soil and eaten by PIGS	1.0	pork_fi_silage	--
Qty of grain eaten by PIGS each day	3.3	pork_qp_grain	kg DW/day
Qty of silage eaten by PIGS each day	1.4	pork_qp_silage	kg DW/day
Qty of soil eaten by CATTLE	0.5	qs_beef	kg/day
Qty of soil eaten by CHICKEN	0.022	qs_chick	kg/day
Qty of soil eaten by DAIRY CATTLE	0.4	qs_milk	kg/day
Qty of soil eaten by PIGS	0.37	qs_pork	kg/day
Average annual runoff	8.751	r	cm/yr
Density of air	1.2e-3	rho_a	g/cm^3
Solids particle density	2.7	rho_s	g/cm^3
Interception fraction - edible portion ABOVEGROUND	0.39	rp	--
Interception fraction - edible portion FORAGE	0.5	rp_forage	--
Interception fraction - edible portion SILAGE	0.46	rp_silage	--
Ambient air temperature	298	t	K
Temperature correction factor	1.026	theta	--
Soil volumetric water content	0.2	theta_s	mL/cm^3
Length of plant expos. to depos. - ABOVEGROUND	0.16	tp	Yr
Length of plant expos. to depos. - FORAGE	0.12	tp_forage	Yr
Length of plant expos. to depos. - SILAGE	0.16	tp_silage	Yr
Dry deposition velocity	0.5	vdv	cm/s
Dry deposition velocity for mercury	2.9	vdv_hg	cm/s
Wind velocity	3	w	m/s
Yield/standing crop biomass - edible portion ABOVEGROUND	2.24	yp	kg DW/m^2
Yield/standing crop biomass - edible portion FORAGE	0.24	yp_forage	kg DW/m^2
Yield/standing crop biomass - edible portion SILAGE	0.8	yp_silage	kg DW/m^2
Soil mixing zone depth	2.0	z	cm
Soil mixing zone depth for produce	15	z_p	cm

RECEPTOR:	North	UTM X:	299,011.54	UTM Y:	6,258,896.74

SITE PARAMETER	VALUE	SYMBOL	UNITS
Soil dry bulk density	1.5	bd	g/cm^3
Forage fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_forage	--
Grain fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_grain	--
Silage fraction grown on contam. eaten by CATTLE	1.0	beef_fi_silage	--
Qty of forage eaten by CATTLE each day	8.8	beef_qp_forage	kg DW/day
Qty of grain eaten by CATTLE each day	0.47	beef_qp_grain	kg DW/day
Qty of silage eaten by CATTLE each day	2.5	beef_qp_silage	kg DW/day
Grain fraction grown on contam. soil eaten by CHICKEN	1.0	chick_fi_grain	--
Qty of grain eaten by CHICKEN each day	0.2	chick_qp_grain	kg DW/day
Average annual evapotranspiration	131.4	e_v	cm/yr
Fish lipid content	0.07	f_lipid	--
Fraction of CHICKEN's diet that is soil	0.1	fd_chicken	--
Universal gas constant	8.205e-5	gas_r	atm-m^3/mol-K
Average annual irrigation	52.65	i	cm/yr
Plant surface loss coefficient	18	kp	yr^-1
Fraction of mercury emissions NOT lost to the global cycle	0.48	merc_q_corr	--
Fraction of mercury speciated into methyl mercury in produce	0.22	mercmethyl_ag	--
Fraction of mercury speciated into methyl mercury in soil	0.02	mercmethyl_sc	--
Forage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_forage	--
Grain fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_grain	--
Silage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_silage	--
Qty of forage eaten by MILK CATTLE each day	13.2	milk_qp_forage	kg DW/day
Qty of grain eaten by MILK CATTLE each day	3.0	milk_qp_grain	kg DW/day
Qty of silage eaten by MILK CATTLE each day	4.1	milk_qp_silage	kg DW/day
Averaging time	1	milkfat_at	yr
Body weight of infant	9.4	milfat_bw_infant	kg
Exposure duration of infant to breast milk	1	milkfat_ed	yr
Proportion of ingested dioxin that is stored in fat	0.9	milkfat_f1	--
Proportion of mothers weight that is fat	0.3	milkfat_f2	--
Fraction of fat in breast milk	0.04	milkfat_f3	--
Fraction of ingested contaminant that is absorbed	0.9	milkfat_f4	--
Half-life of dioxin in adults	2555	milkfat_h	days
Ingestion rate of breast milk	0.688	milkfat_ir_milk	kg/day
Viscosity of air corresponding to air temp.	1.81e-04	mu_a	g/cm-s
Average annual precipitation	87.51	p	cm/yr

RECEPTOR:	North	UTM X:	299,011.54	UTM Y:	6,258,896.74

SITE PARAMETER	VALUE	SYMBOL	UNITS
Fraction of grain grown on contam. soil eaten by PIGS	1.0	pork_fi_grain	--
Fraction of silage grown on contam. soil and eaten by PIGS	1.0	pork_fi_silage	--
Qty of grain eaten by PIGS each day	3.3	pork_qp_grain	kg DW/day
Qty of silage eaten by PIGS each day	1.4	pork_qp_silage	kg DW/day
Qty of soil eaten by CATTLE	0.5	qs_beef	kg/day
Qty of soil eaten by CHICKEN	0.022	qs_chick	kg/day
Qty of soil eaten by DAIRY CATTLE	0.4	qs_milk	kg/day
Qty of soil eaten by PIGS	0.37	qs_pork	kg/day
Average annual runoff	8.751	r	cm/yr
Density of air	1.2e-3	rho_a	g/cm^3
Solids particle density	2.7	rho_s	g/cm^3
Interception fraction - edible portion ABOVEGROUND	0.39	rp	--
Interception fraction - edible portion FORAGE	0.5	rp_forage	--
Interception fraction - edible portion SILAGE	0.46	rp_silage	--
Ambient air temperature	298	t	K
Temperature correction factor	1.026	theta	--
Soil volumetric water content	0.2	theta_s	mL/cm^3
Length of plant expos. to depos. - ABOVEGROUND	0.16	tp	Yr
Length of plant expos. to depos. - FORAGE	0.12	tp_forage	Yr
Length of plant expos. to depos. - SILAGE	0.16	tp_silage	Yr
Dry deposition velocity	0.5	vdv	cm/s
Dry deposition velocity for mercury	2.9	vdv_hg	cm/s
Wind velocity	3	w	m/s
Yield/standing crop biomass - edible portion ABOVEGROUND	2.24	yp	kg DW/m^2
Yield/standing crop biomass - edible portion FORAGE	0.24	yp_forage	kg DW/m^2
Yield/standing crop biomass - edible portion SILAGE	0.8	yp_silage	kg DW/m^2
Soil mixing zone depth	2.0	z	cm
Soil mixing zone depth for produce	15	z_p	cm

RECEPTOR:	South	UTM X:	299,220.93	UTM Y:	6,254,721.26

SITE PARAMETER	VALUE	SYMBOL	UNITS
Soil dry bulk density	1.5	bd	g/cm^3
Forage fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_forage	--
Grain fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_grain	--
Silage fraction grown on contam. eaten by CATTLE	1.0	beef_fi_silage	--
Qty of forage eaten by CATTLE each day	8.8	beef_qp_forage	kg DW/day
Qty of grain eaten by CATTLE each day	0.47	beef_qp_grain	kg DW/day
Qty of silage eaten by CATTLE each day	2.5	beef_qp_silage	kg DW/day
Grain fraction grown on contam. soil eaten by CHICKEN	1.0	chick_fi_grain	--
Qty of grain eaten by CHICKEN each day	0.2	chick_qp_grain	kg DW/day
Average annual evapotranspiration	131.4	e_v	cm/yr
Fish lipid content	0.07	f_lipid	--
Fraction of CHICKEN's diet that is soil	0.1	fd_chicken	--
Universal gas constant	8.205e-5	gas_r	atm-m^3/mol-K
Average annual irrigation	52.65	i	cm/yr
Plant surface loss coefficient	18	kp	yr^-1
Fraction of mercury emissions NOT lost to the global cycle	0.48	merc_q_corr	--
Fraction of mercury speciated into methyl mercury in produce	0.22	mercmethyl_ag	--
Fraction of mercury speciated into methyl mercury in soil	0.02	mercmethyl_sc	--
Forage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_forage	--
Grain fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_grain	--
Silage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_silage	--
Qty of forage eaten by MILK CATTLE each day	13.2	milk_qp_forage	kg DW/day
Qty of grain eaten by MILK CATTLE each day	3.0	milk_qp_grain	kg DW/day
Qty of silage eaten by MILK CATTLE each day	4.1	milk_qp_silage	kg DW/day
Averaging time	1	milkfat_at	yr
Body weight of infant	9.4	milfat_bw_infant	kg
Exposure duration of infant to breast milk	1	milkfat_ed	yr
Proportion of ingested dioxin that is stored in fat	0.9	milkfat_f1	--
Proportion of mothers weight that is fat	0.3	milkfat_f2	--
Fraction of fat in breast milk	0.04	milkfat_f3	--
Fraction of ingested contaminant that is absorbed	0.9	milkfat_f4	--
Half-life of dioxin in adults	2555	milkfat_h	days
Ingestion rate of breast milk	0.688	milkfat_ir_milk	kg/day
Viscosity of air corresponding to air temp.	1.81e-04	mu_a	g/cm-s
Average annual precipitation	87.51	p	cm/yr

RECEPTOR:	South	UTM X:	299,220.93	UTM Y:	6,254,721.26

SITE PARAMETER	VALUE	SYMBOL	UNITS
Fraction of grain grown on contam. soil eaten by PIGS	1.0	pork_fi_grain	--
Fraction of silage grown on contam. soil and eaten by PIGS	1.0	pork_fi_silage	--
Qty of grain eaten by PIGS each day	3.3	pork_qp_grain	kg DW/day
Qty of silage eaten by PIGS each day	1.4	pork_qp_silage	kg DW/day
Qty of soil eaten by CATTLE	0.5	qs_beef	kg/day
Qty of soil eaten by CHICKEN	0.022	qs_chick	kg/day
Qty of soil eaten by DAIRY CATTLE	0.4	qs_milk	kg/day
Qty of soil eaten by PIGS	0.37	qs_pork	kg/day
Average annual runoff	8.751	r	cm/yr
Density of air	1.2e-3	rho_a	g/cm^3
Solids particle density	2.7	rho_s	g/cm^3
Interception fraction - edible portion ABOVEGROUND	0.39	rp	--
Interception fraction - edible portion FORAGE	0.5	rp_forage	--
Interception fraction - edible portion SILAGE	0.46	rp_silage	--
Ambient air temperature	298	t	K
Temperature correction factor	1.026	theta	--
Soil volumetric water content	0.2	theta_s	mL/cm^3
Length of plant expos. to depos. - ABOVEGROUND	0.16	tp	Yr
Length of plant expos. to depos. - FORAGE	0.12	tp_forage	Yr
Length of plant expos. to depos. - SILAGE	0.16	tp_silage	Yr
Dry deposition velocity	0.5	vdv	cm/s
Dry deposition velocity for mercury	2.9	vdv_hg	cm/s
Wind velocity	3	w	m/s
Yield/standing crop biomass - edible portion ABOVEGROUND	2.24	yp	kg DW/m^2
Yield/standing crop biomass - edible portion FORAGE	0.24	yp_forage	kg DW/m^2
Yield/standing crop biomass - edible portion SILAGE	0.8	yp_silage	kg DW/m^2
Soil mixing zone depth	2.0	z	cm
Soil mixing zone depth for produce	15	z_p	cm

RECEPTOR:	West	UTM X:	297,250.00	UTM Y:	6,258,354.00

SITE PARAMETER	VALUE	SYMBOL	UNITS
Soil dry bulk density	1.5	bd	g/cm^3
Forage fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_forage	--
Grain fraction grown on contam. soil eaten by CATTLE	1.0	beef_fi_grain	--
Silage fraction grown on contam. eaten by CATTLE	1.0	beef_fi_silage	--
Qty of forage eaten by CATTLE each day	8.8	beef_qp_forage	kg DW/day
Qty of grain eaten by CATTLE each day	0.47	beef_qp_grain	kg DW/day
Qty of silage eaten by CATTLE each day	2.5	beef_qp_silage	kg DW/day
Grain fraction grown on contam. soil eaten by CHICKEN	1.0	chick_fi_grain	--
Qty of grain eaten by CHICKEN each day	0.2	chick_qp_grain	kg DW/day
Average annual evapotranspiration	131.4	e_v	cm/yr
Fish lipid content	0.07	f_lipid	--
Fraction of CHICKEN's diet that is soil	0.1	fd_chicken	--
Universal gas constant	8.205e-5	gas_r	atm-m^3/mol-K
Average annual irrigation	52.65	i	cm/yr
Plant surface loss coefficient	18	kp	yr^-1
Fraction of mercury emissions NOT lost to the global cycle	0.48	merc_q_corr	--
Fraction of mercury speciated into methyl mercury in produce	0.22	mercmethyl_ag	--
Fraction of mercury speciated into methyl mercury in soil	0.02	mercmethyl_sc	--
Forage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_forage	--
Grain fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_grain	--
Silage fraction grown contam. soil, eaten by MILK CATTLE	1.0	milk_fi_silage	--
Qty of forage eaten by MILK CATTLE each day	13.2	milk_qp_forage	kg DW/day
Qty of grain eaten by MILK CATTLE each day	3.0	milk_qp_grain	kg DW/day
Qty of silage eaten by MILK CATTLE each day	4.1	milk_qp_silage	kg DW/day
Averaging time	1	milkfat_at	yr
Body weight of infant	9.4	milfat_bw_infant	kg
Exposure duration of infant to breast milk	1	milkfat_ed	yr
Proportion of ingested dioxin that is stored in fat	0.9	milkfat_f1	--
Proportion of mothers weight that is fat	0.3	milkfat_f2	--
Fraction of fat in breast milk	0.04	milkfat_f3	--
Fraction of ingested contaminant that is absorbed	0.9	milkfat_f4	--
Half-life of dioxin in adults	2555	milkfat_h	days
Ingestion rate of breast milk	0.688	milkfat_ir_milk	kg/day
Viscosity of air corresponding to air temp.	1.81e-04	mu_a	g/cm-s
Average annual precipitation	87.51	p	cm/yr

RECEPTOR:	West	UTM X:	297,250.00	UTM Y:	6,258,354.00

SITE PARAMETER	VALUE	SYMBOL	UNITS
Fraction of grain grown on contam. soil eaten by PIGS	1.0	pork_fi_grain	--
Fraction of silage grown on contam. soil and eaten by PIGS	1.0	pork_fi_silage	--
Qty of grain eaten by PIGS each day	3.3	pork_qp_grain	kg DW/day
Qty of silage eaten by PIGS each day	1.4	pork_qp_silage	kg DW/day
Qty of soil eaten by CATTLE	0.5	qs_beef	kg/day
Qty of soil eaten by CHICKEN	0.022	qs_chick	kg/day
Qty of soil eaten by DAIRY CATTLE	0.4	qs_milk	kg/day
Qty of soil eaten by PIGS	0.37	qs_pork	kg/day
Average annual runoff	8.751	r	cm/yr
Density of air	1.2e-3	rho_a	g/cm^3
Solids particle density	2.7	rho_s	g/cm^3
Interception fraction - edible portion ABOVEGROUND	0.39	rp	--
Interception fraction - edible portion FORAGE	0.5	rp_forage	--
Interception fraction - edible portion SILAGE	0.46	rp_silage	--
Ambient air temperature	298	t	K
Temperature correction factor	1.026	theta	--
Soil volumetric water content	0.2	theta_s	mL/cm^3
Length of plant expos. to depos. - ABOVEGROUND	0.16	tp	Yr
Length of plant expos. to depos. - FORAGE	0.12	tp_forage	Yr
Length of plant expos. to depos. - SILAGE	0.16	tp_silage	Yr
Dry deposition velocity	0.5	vdv	cm/s
Dry deposition velocity for mercury	2.9	vdv_hg	cm/s
Wind velocity	3	w	m/s
Yield/standing crop biomass - edible portion ABOVEGROUND	2.24	yp	kg DW/m^2
Yield/standing crop biomass - edible portion FORAGE	0.24	yp_forage	kg DW/m^2
Yield/standing crop biomass - edible portion SILAGE	0.8	yp_silage	kg DW/m^2
Soil mixing zone depth	2.0	z	cm
Soil mixing zone depth for produce	15	z_p	cm

EXPOSURE SCENARIO PARAMETERS

RECEPTOR: Max_Farmer **UTM X:** 298,280.00 **UTM Y:** 6,258,100.00

Resident Adult	Resident Child	Farmer Adult	Farmer Child	Fisher Adult	Fisher Child
No	No	Yes	Yes	No	No

DESCRIPTION							UNITS
Averaging time for carcinogens	70	70	70	70	70	70	yr
Averaging time for noncarcinogens	30	6	40	6	30	6	yr
Consumption rate of BEEF	0.0	0.0	0.00122	0.00075	0.0	0.0	kg/kg-day FW
Body weight	70	17	70	17	70	15	kg
Consumption rate of POULTRY	0.0	0.0	0.00066	0.00045	0.0	0.0	kg/kg-day FW
Consumption rate of ABOVEGROUND PRODUCE	0.00032	0.00077	0.00047	0.00113	0.00032	0.00077	kg/kg-day DW
Consumption rate of BELOWGROUND PRODUCE	0.00014	0.00023	0.00017	0.00028	0.00014	0.00023	kg/kg-day DW
Consumption rate of DRINKING WATER	2	0.66	2	0.66	1.4	0.67	L/day
Consumption rate of PROTECTED ABOVEGROUND PRODU	0.00061	0.0015	0.00064	0.00157	0.00061	0.00150	kg/kg-day DW
Consumption rate of SOIL	0.00006	0.00010	0.0001	0.0002	0.0001	0.0002	kg/d
Exposure duration	30	6	40	6	30	6	yr
Exposure frequency	350	350	350	350	350	350	day/yr
Consumption rate of EGGS	0.0	0.0	0.00075	0.00054	0.0	0.0	kg/kg-day FW
Fraction of contaminated ABOVEGROUND PRODUCE	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction of contaminated DRINKING WATER	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction contaminated SOIL	1.0	1.0	1.0	1.0	1.0	1.0	--
Consumption rate of FISH	0.0	0.0	0.0	0.0	0.00125	0.00088	kg/kg-day FW
Fraction of contaminated FISH	1.0	1.0	1.0	1.0	1.0	1.0	--
Inhalation exposure duration	30	6	40	6	30	6	yr
Inhalation exposure frequency	350	350	350	350	350	350	day/yr
Inhalation exposure time	24	24	24	24	24	24	hr/day
Fraction of contaminated BEEF	1	1	1	1	1	1	--
Fraction of contaminated POULTRY	1	1	1	1	1	1	--
Fraction of contaminated EGGS	1	1	1	1	1	1	--
Fraction of contaminated MILK	1	1	1	1	1	1	--
Fraction of contaminated PORK	1	1	1	1	1	1	--
Inhalation rate	0.83	0.66	0.83	0.66	0.83	0.30	m^3/hr
Consumption rate of MILK	0.0	0.0	0.01367	0.02268	0.0	0.0	kg/kg-day FW
Consumption rate of PORK	0.0	0.0	0.00055	0.00042	0.0	0.0	kg/kg-day FW
Time period at the beginning of combustion	0	0	0	0	0	0	yr
Length of exposure duration	30	6	40	6	30	6	yr

EXPOSURE SCENARIO PARAMETERS

RECEPTOR: Max_Resi **UTM X:** 298,280.00 **UTM Y:** 6,258,100.00

Resident Adult	Resident Child	Farmer Adult	Farmer Child	Fisher Adult	Fisher Child
Yes	Yes	No	No	No	No

DESCRIPTION							UNITS
Averaging time for carcinogens	70	70	70	70	70	70	yr
Averaging time for noncarcinogens	30	6	40	6	30	6	yr
Consumption rate of BEEF	0.0	0.0	0.00122	0.00075	0.0	0.0	kg/kg-day FW
Body weight	70	17	70	17	70	15	kg
Consumption rate of POULTRY	0.0	0.0	0.00066	0.00045	0.0	0.0	kg/kg-day FW
Consumption rate of ABOVEGROUND PRODUCE	0.00032	0.00077	0.00047	0.00113	0.00032	0.00077	kg/kg-day DW
Consumption rate of BELOWGROUND PRODUCE	0.00014	0.00023	0.00017	0.00028	0.00014	0.00023	kg/kg-day DW
Consumption rate of DRINKING WATER	2	0.66	2	0.66	1.4	0.67	L/day
Consumption rate of PROTECTED ABOVEGROUND PRODU	0.00061	0.0015	0.00064	0.00157	0.00061	0.00150	kg/kg-day DW
Consumption rate of SOIL	0.00006	0.00010	0.0001	0.0002	0.0001	0.0002	kg/d
Exposure duration	30	6	40	6	30	6	yr
Exposure frequency	350	350	350	350	350	350	day/yr
Consumption rate of EGGS	0.0	0.0	0.00075	0.00054	0.0	0.0	kg/kg-day FW
Fraction of contaminated ABOVEGROUND PRODUCE	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction of contaminated DRINKING WATER	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction contaminated SOIL	1.0	1.0	1.0	1.0	1.0	1.0	--
Consumption rate of FISH	0.0	0.0	0.0	0.0	0.00125	0.00088	kg/kg-day FW
Fraction of contaminated FISH	1.0	1.0	1.0	1.0	1.0	1.0	--
Inhalation exposure duration	30	6	40	6	30	6	yr
Inhalation exposure frequency	350	350	350	350	350	350	day/yr
Inhalation exposure time	24	24	24	24	24	24	hr/day
Fraction of contaminated BEEF	1	1	1	1	1	1	--
Fraction of contaminated POULTRY	1	1	1	1	1	1	--
Fraction of contaminated EGGS	1	1	1	1	1	1	--
Fraction of contaminated MILK	1	1	1	1	1	1	--
Fraction of contaminated PORK	1	1	1	1	1	1	--
Inhalation rate	0.83	0.66	0.83	0.66	0.83	0.30	m^3/hr
Consumption rate of MILK	0.0	0.0	0.01367	0.02268	0.0	0.0	kg/kg-day FW
Consumption rate of PORK	0.0	0.0	0.00055	0.00042	0.0	0.0	kg/kg-day FW
Time period at the beginning of combustion	0	0	0	0	0	0	yr
Length of exposure duration	30	6	40	6	30	6	yr

EXPOSURE SCENARIO PARAMETERS

RECEPTOR: North **UTM X:** 299,011.54 **UTM Y:** 6,258,896.74

Resident Adult	Resident Child	Farmer Adult	Farmer Child	Fisher Adult	Fisher Child
Yes	Yes	No	No	No	No

DESCRIPTION							UNITS
Averaging time for carcinogens	70	70	70	70	70	70	yr
Averaging time for noncarcinogens	30	6	40	6	30	6	yr
Consumption rate of BEEF	0.0	0.0	0.00122	0.00075	0.0	0.0	kg/kg-day FW
Body weight	70	17	70	17	70	15	kg
Consumption rate of POULTRY	0.0	0.0	0.00066	0.00045	0.0	0.0	kg/kg-day FW
Consumption rate of ABOVEGROUND PRODUCE	0.00032	0.00077	0.00047	0.00113	0.00032	0.00077	kg/kg-day DW
Consumption rate of BELOWGROUND PRODUCE	0.00014	0.00023	0.00017	0.00028	0.00014	0.00023	kg/kg-day DW
Consumption rate of DRINKING WATER	2	0.66	2	0.66	1.4	0.67	L/day
Consumption rate of PROTECTED ABOVEGROUND PRODU	0.00061	0.0015	0.00064	0.00157	0.00061	0.00150	kg/kg-day DW
Consumption rate of SOIL	0.00006	0.00010	0.0001	0.0002	0.0001	0.0002	kg/d
Exposure duration	30	6	40	6	30	6	yr
Exposure frequency	350	350	350	350	350	350	day/yr
Consumption rate of EGGS	0.0	0.0	0.00075	0.00054	0.0	0.0	kg/kg-day FW
Fraction of contaminated ABOVEGROUND PRODUCE	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction of contaminated DRINKING WATER	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction contaminated SOIL	1.0	1.0	1.0	1.0	1.0	1.0	--
Consumption rate of FISH	0.0	0.0	0.0	0.0	0.00125	0.00088	kg/kg-day FW
Fraction of contaminated FISH	1.0	1.0	1.0	1.0	1.0	1.0	--
Inhalation exposure duration	30	6	40	6	30	6	yr
Inhalation exposure frequency	350	350	350	350	350	350	day/yr
Inhalation exposure time	24	24	24	24	24	24	hr/day
Fraction of contaminated BEEF	1	1	1	1	1	1	--
Fraction of contaminated POULTRY	1	1	1	1	1	1	--
Fraction of contaminated EGGS	1	1	1	1	1	1	--
Fraction of contaminated MILK	1	1	1	1	1	1	--
Fraction of contaminated PORK	1	1	1	1	1	1	--
Inhalation rate	0.83	0.66	0.83	0.66	0.83	0.30	m^3/hr
Consumption rate of MILK	0.0	0.0	0.01367	0.02268	0.0	0.0	kg/kg-day FW
Consumption rate of PORK	0.0	0.0	0.00055	0.00042	0.0	0.0	kg/kg-day FW
Time period at the beginning of combustion	0	0	0	0	0	0	yr
Length of exposure duration	30	6	40	6	30	6	yr

EXPOSURE SCENARIO PARAMETERS

RECEPTOR: South **UTM X:** 299,220.93 **UTM Y:** 6,254,721.26

Resident Adult	Resident Child	Farmer Adult	Farmer Child	Fisher Adult	Fisher Child
Yes	Yes	No	No	No	No

DESCRIPTION							UNITS
Averaging time for carcinogens	70	70	70	70	70	70	yr
Averaging time for noncarcinogens	30	6	40	6	30	6	yr
Consumption rate of BEEF	0.0	0.0	0.00122	0.00075	0.0	0.0	kg/kg-day FW
Body weight	70	17	70	17	70	15	kg
Consumption rate of POULTRY	0.0	0.0	0.00066	0.00045	0.0	0.0	kg/kg-day FW
Consumption rate of ABOVEGROUND PRODUCE	0.00032	0.00077	0.00047	0.00113	0.00032	0.00077	kg/kg-day DW
Consumption rate of BELOWGROUND PRODUCE	0.00014	0.00023	0.00017	0.00028	0.00014	0.00023	kg/kg-day DW
Consumption rate of DRINKING WATER	2	0.66	2	0.66	1.4	0.67	L/day
Consumption rate of PROTECTED ABOVEGROUND PRODU	0.00061	0.0015	0.00064	0.00157	0.00061	0.00150	kg/kg-day DW
Consumption rate of SOIL	0.00006	0.00010	0.0001	0.0002	0.0001	0.0002	kg/d
Exposure duration	30	6	40	6	30	6	yr
Exposure frequency	350	350	350	350	350	350	day/yr
Consumption rate of EGGS	0.0	0.0	0.00075	0.00054	0.0	0.0	kg/kg-day FW
Fraction of contaminated ABOVEGROUND PRODUCE	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction of contaminated DRINKING WATER	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction contaminated SOIL	1.0	1.0	1.0	1.0	1.0	1.0	--
Consumption rate of FISH	0.0	0.0	0.0	0.0	0.00125	0.00088	kg/kg-day FW
Fraction of contaminated FISH	1.0	1.0	1.0	1.0	1.0	1.0	--
Inhalation exposure duration	30	6	40	6	30	6	yr
Inhalation exposure frequency	350	350	350	350	350	350	day/yr
Inhalation exposure time	24	24	24	24	24	24	hr/day
Fraction of contaminated BEEF	1	1	1	1	1	1	--
Fraction of contaminated POULTRY	1	1	1	1	1	1	--
Fraction of contaminated EGGS	1	1	1	1	1	1	--
Fraction of contaminated MILK	1	1	1	1	1	1	--
Fraction of contaminated PORK	1	1	1	1	1	1	--
Inhalation rate	0.83	0.66	0.83	0.66	0.83	0.30	m^3/hr
Consumption rate of MILK	0.0	0.0	0.01367	0.02268	0.0	0.0	kg/kg-day FW
Consumption rate of PORK	0.0	0.0	0.00055	0.00042	0.0	0.0	kg/kg-day FW
Time period at the beginning of combustion	0	0	0	0	0	0	yr
Length of exposure duration	30	6	40	6	30	6	yr

EXPOSURE SCENARIO PARAMETERS

RECEPTOR: West **UTM X:** 297,250.00 **UTM Y:** 6,258,354.00

Resident Adult	Resident Child	Farmer Adult	Farmer Child	Fisher Adult	Fisher Child
Yes	Yes	No	No	No	No

DESCRIPTION							UNITS
Averaging time for carcinogens	70	70	70	70	70	70	yr
Averaging time for noncarcinogens	30	6	40	6	30	6	yr
Consumption rate of BEEF	0.0	0.0	0.00122	0.00075	0.0	0.0	kg/kg-day FW
Body weight	70	17	70	17	70	15	kg
Consumption rate of POULTRY	0.0	0.0	0.00066	0.00045	0.0	0.0	kg/kg-day FW
Consumption rate of ABOVEGROUND PRODUCE	0.00032	0.00077	0.00047	0.00113	0.00032	0.00077	kg/kg-day DW
Consumption rate of BELOWGROUND PRODUCE	0.00014	0.00023	0.00017	0.00028	0.00014	0.00023	kg/kg-day DW
Consumption rate of DRINKING WATER	2	0.66	2	0.66	1.4	0.67	L/day
Consumption rate of PROTECTED ABOVEGROUND PRODU	0.00061	0.0015	0.00064	0.00157	0.00061	0.00150	kg/kg-day DW
Consumption rate of SOIL	0.00006	0.00010	0.0001	0.0002	0.0001	0.0002	kg/d
Exposure duration	30	6	40	6	30	6	yr
Exposure frequency	350	350	350	350	350	350	day/yr
Consumption rate of EGGS	0.0	0.0	0.00075	0.00054	0.0	0.0	kg/kg-day FW
Fraction of contaminated ABOVEGROUND PRODUCE	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction of contaminated DRINKING WATER	1.0	1.0	1.0	1.0	1.0	1.0	--
Fraction contaminated SOIL	1.0	1.0	1.0	1.0	1.0	1.0	--
Consumption rate of FISH	0.0	0.0	0.0	0.0	0.00125	0.00088	kg/kg-day FW
Fraction of contaminated FISH	1.0	1.0	1.0	1.0	1.0	1.0	--
Inhalation exposure duration	30	6	40	6	30	6	yr
Inhalation exposure frequency	350	350	350	350	350	350	day/yr
Inhalation exposure time	24	24	24	24	24	24	hr/day
Fraction of contaminated BEEF	1	1	1	1	1	1	--
Fraction of contaminated POULTRY	1	1	1	1	1	1	--
Fraction of contaminated EGGS	1	1	1	1	1	1	--
Fraction of contaminated MILK	1	1	1	1	1	1	--
Fraction of contaminated PORK	1	1	1	1	1	1	--
Inhalation rate	0.83	0.66	0.83	0.66	0.83	0.30	m^3/hr
Consumption rate of MILK	0.0	0.0	0.01367	0.02268	0.0	0.0	kg/kg-day FW
Consumption rate of PORK	0.0	0.0	0.00055	0.00042	0.0	0.0	kg/kg-day FW
Time period at the beginning of combustion	0	0	0	0	0	0	yr
Length of exposure duration	30	6	40	6	30	6	yr

Desc

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

COPC: Aroclor 1254 **11097-69-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Aroclor 1016 **12674-11-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDD, 2,3,7,8- **1746-01-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Chromium, hexavalent **18540-29-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDD, 1,2,3,7,8,9- 19408-74-3

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Methyl mercury 22967-92-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: OctaCDD, 1,2,3,4,6,7,8,9- 3268-87-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

COPC: HeptaCDD, 1,2,3,4,6,7,8- 35822-46-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: OctaCDF, 1,2,3,4,6,7,8,9- 39001-02-0

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,4,7,8- 39227-28-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDD, 1,2,3,7,8- 40321-76-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Benzo(a)pyrene **50-32-8**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDF, 2,3,7,8- **51207-31-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,7,8,9- **55673-89-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : Max_Farmer UTM X: 298,280.00 UTM Y: 6,258,100.00

Max_Farmer

COPC: PentaCDF, 2,3,4,7,8- 57117-31-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDF, 1,2,3,7,8- 57117-41-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,6,7,8- 57117-44-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,6,7,8- 57653-85-7

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 2,3,4,6,7,8- 60851-34-5

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,6,7,8- 67562-39-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,4,7,8- 70648-26-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

COPC: Benzene **71-43-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDF, 1,2,3,7,8,9- **72918-21-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Lead **7439-92-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercury **7439-97-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Nickel **7440-02-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Thallium (I) **7440-28-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Antimony **7440-36-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : Max_Farmer **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Farmer

COPC: Arsenic **7440-38-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Cadmium **7440-43-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Chromium **7440-47-3**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercuric chloride **7487-94-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR :	**Max_Farmer**	**UTM X:**	**298,280.00**	**UTM Y:**	**6,258,100.00**

Max_Farmer

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Hydrogen chloride **7647-01-0**

COPC-Site PARAMETER DESCRIPTION	**VALUE**	**SYMBOL**	**UNITS**
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : Max_Resi **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Resi

COPC: Aroclor 1254 **11097-69-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Aroclor 1016 **12674-11-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDD, 2,3,7,8- **1746-01-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Chromium, hexavalent **18540-29-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : Max_Resi **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Resi

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDD, 1,2,3,7,8,9- 19408-74-3

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Methyl mercury 22967-92-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: OctaCDD, 1,2,3,4,6,7,8,9- 3268-87-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : Max_Resi UTM X: 298,280.00 UTM Y: 6,258,100.00

Max_Resi

COPC: HeptaCDD, 1,2,3,4,6,7,8- 35822-46-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: OctaCDF, 1,2,3,4,6,7,8,9- 39001-02-0

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,4,7,8- 39227-28-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDD, 1,2,3,7,8- 40321-76-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : Max_Resi **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Resi

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Benzo(a)pyrene **50-32-8**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDF, 2,3,7,8- **51207-31-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,7,8,9- **55673-89-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : Max_Resi UTM X: 298,280.00 UTM Y: 6,258,100.00

Max_Resi

COPC: PentaCDF, 2,3,4,7,8- 57117-31-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDF, 1,2,3,7,8- 57117-41-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,6,7,8- 57117-44-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,6,7,8- 57653-85-7

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : Max_Resi **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Resi

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 2,3,4,6,7,8- 60851-34-5

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,6,7,8- 67562-39-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,4,7,8- 70648-26-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : Max_Resi UTM X: 298,280.00 UTM Y: 6,258,100.00

Max_Resi

COPC: Benzene 71-43-2

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDF, 1,2,3,7,8,9- 72918-21-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Lead 7439-92-1

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercury 7439-97-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : Max_Resi **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Resi

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Nickel **7440-02-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Thallium (I) **7440-28-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Antimony **7440-36-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : Max_Resi **UTM X: 298,280.00** **UTM Y: 6,258,100.00**

Max_Resi

COPC: Arsenic **7440-38-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Cadmium **7440-43-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Chromium **7440-47-3**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercuric chloride **7487-94-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR :	**Max_Resi**	**UTM X:**	**298,280.00**	**UTM Y:**	**6,258,100.00**

Max_Resi

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Hydrogen chloride **7647-01-0**

COPC-Site PARAMETER DESCRIPTION	**VALUE**	**SYMBOL**	**UNITS**
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

COPC: Aroclor 1254 **11097-69-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Aroclor 1016 **12674-11-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDD, 2,3,7,8- **1746-01-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Chromium, hexavalent **18540-29-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDD, 1,2,3,7,8,9- 19408-74-3

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Methyl mercury 22967-92-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: OctaCDD, 1,2,3,4,6,7,8,9- 3268-87-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

COPC: HeptaCDD, 1,2,3,4,6,7,8- 35822-46-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: OctaCDF, 1,2,3,4,6,7,8,9- 39001-02-0

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,4,7,8- 39227-28-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDD, 1,2,3,7,8- 40321-76-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Benzo(a)pyrene **50-32-8**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDF, 2,3,7,8- **51207-31-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,7,8,9- **55673-89-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

COPC: PentaCDF, 2,3,4,7,8- 57117-31-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDF, 1,2,3,7,8- 57117-41-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,6,7,8- 57117-44-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,6,7,8- 57653-85-7

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 2,3,4,6,7,8- 60851-34-5

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,6,7,8- 67562-39-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,4,7,8- 70648-26-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

COPC: Benzene **71-43-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDF, 1,2,3,7,8,9- **72918-21-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Lead **7439-92-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercury **7439-97-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Nickel **7440-02-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Thallium (I) **7440-28-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Antimony **7440-36-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

COPC: Arsenic **7440-38-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Cadmium **7440-43-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Chromium **7440-47-3**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercuric chloride **7487-94-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : North **UTM X: 299,011.54** **UTM Y: 6,258,896.74**

Based on Receptor I.D. : RI_1

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Hydrogen chloride **7647-01-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

COPC: Aroclor 1254 **11097-69-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Aroclor 1016 **12674-11-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDD, 2,3,7,8- **1746-01-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Chromium, hexavalent **18540-29-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDD, 1,2,3,7,8,9- 19408-74-3

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Methyl mercury 22967-92-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: OctaCDD, 1,2,3,4,6,7,8,9- 3268-87-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

COPC: HeptaCDD, 1,2,3,4,6,7,8- 35822-46-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: OctaCDF, 1,2,3,4,6,7,8,9- 39001-02-0

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,4,7,8- 39227-28-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDD, 1,2,3,7,8- 40321-76-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Benzo(a)pyrene **50-32-8**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDF, 2,3,7,8- **51207-31-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,7,8,9- **55673-89-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

COPC: PentaCDF, 2,3,4,7,8- 57117-31-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDF, 1,2,3,7,8- 57117-41-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,6,7,8- 57117-44-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,6,7,8- 57653-85-7

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 2,3,4,6,7,8- 60851-34-5

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,6,7,8- 67562-39-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,4,7,8- 70648-26-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

COPC: Benzene **71-43-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDF, 1,2,3,7,8,9- **72918-21-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Lead **7439-92-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercury **7439-97-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Nickel **7440-02-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Thallium (I) **7440-28-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Antimony **7440-36-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : South **UTM X: 299,220.93** **UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

COPC: Arsenic **7440-38-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Cadmium **7440-43-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Chromium **7440-47-3**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercuric chloride **7487-94-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : South	**UTM X: 299,220.93**	**UTM Y: 6,254,721.26**

Based on Receptor I.D. : RI_3

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Hydrogen chloride **7647-01-0**

COPC-Site PARAMETER DESCRIPTION	**VALUE**	**SYMBOL**	**UNITS**
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

COPC: Aroclor 1254 **11097-69-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Aroclor 1016 **12674-11-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDD, 2,3,7,8- **1746-01-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Chromium, hexavalent **18540-29-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDD, 1,2,3,7,8,9- 19408-74-3

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Methyl mercury 22967-92-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: OctaCDD, 1,2,3,4,6,7,8,9- 3268-87-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

COPC: HeptaCDD, 1,2,3,4,6,7,8- 35822-46-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: OctaCDF, 1,2,3,4,6,7,8,9- 39001-02-0

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,4,7,8- 39227-28-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDD, 1,2,3,7,8- 40321-76-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Benzo(a)pyrene **50-32-8**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: TetraCDF, 2,3,7,8- **51207-31-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,7,8,9- **55673-89-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

COPC: PentaCDF, 2,3,4,7,8- 57117-31-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: PentaCDF, 1,2,3,7,8- 57117-41-6

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,6,7,8- 57117-44-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDD, 1,2,3,6,7,8- 57653-85-7

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 2,3,4,6,7,8- 60851-34-5

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HeptaCDF, 1,2,3,4,6,7,8- 67562-39-4

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: HexaCDF, 1,2,3,4,7,8- 70648-26-9

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

COPC: Benzene **71-43-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: HexaCDF, 1,2,3,7,8,9- **72918-21-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	3	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	0.01	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	0.01	vg_bg	--

COPC: Lead **7439-92-1**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercury **7439-97-6**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Nickel **7440-02-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Thallium (I) **7440-28-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Antimony **7440-36-0**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

Desc

RECEPTOR : West **UTM X: 297,250.00** **UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

COPC: Arsenic **7440-38-2**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Cadmium **7440-43-9**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Chromium **7440-47-3**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.2	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Mercuric chloride **7487-94-7**

COPC-Site PARAMETER DESCRIPTION	VALUE	SYMBOL	UNITS
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--

Desc

RECEPTOR : West	**UTM X: 297,250.00**	**UTM Y: 6,258,354.00**

Based on Receptor I.D. : RI_2

Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

COPC: Hydrogen chloride **7647-01-0**

COPC-Site PARAMETER DESCRIPTION	**VALUE**	**SYMBOL**	**UNITS**
Soil bioavailability factor	1	bs_avail	--
Soil enrichment ratio	1	er	--
Fraction of COPC wet deposition that adheres to plant surfaces	0.6	fw	--
Metabolism factor	1	mf	--
Empirical correction factor for ABOVEGROUND PRODUCE	1	vg_ag	--
Empirical correction factor for FORAGE	1	vg_ag_forage	--
Empirical correction factor for SILAGE	0.5	vg_ag_silage	--
Empirical correction factor for BELOWGROUND PRODUCE	1	vg_bg	--

EXPOSURE SCENARIOS EVALUATED

Date : 24/02/2015

 Resident Adult  Resident Child  Farmer Adult  Farmer Child  Fisher Adultt  Fisher Child

RECEPTOR	UTM X	UTM Y	WB TYPE	WB ID						
Max_Farmer	298,280.00	6,258,100.00		None	No	No	Yes	Yes	No	No
Max_Farmer										
Max_Resi	298,280.00	6,258,100.00		None	Yes	Yes	No	No	No	No
Max_Resi										
North	299,011.54	6,258,896.74		None	Yes	Yes	No	No	No	No
Based on Receptor I.D. : RI_1										
South	299,220.93	6,254,721.26		None	Yes	Yes	No	No	No	No
Based on Receptor I.D. : RI_3										
West	297,250.00	6,258,354.00		None	Yes	Yes	No	No	No	No
Based on Receptor I.D. : RI_2										

RISK SUMMARY

Date : 24/02/2015

RECEPTOR NAME	SCENARIO	TOTAL CANCER RISK	TOTAL HAZARD QUOTIENT
Max_Farmer	farmer_adult	1.1548E-005	6.6106E-002
Max_Farmer	farmer_child	2.3112E-006	9.1911E-002
Max_Resi	resident_adult	3.5547E-006	3.9944E-002
Max_Resi	resident_child	8.8334E-007	5.1575E-002
North	resident_adult	2.5329E-006	2.8461E-002
North	resident_child	6.2942E-007	3.6749E-002
South	resident_adult	1.0935E-006	1.2288E-002
South	resident_child	2.7175E-007	1.5867E-002
West	resident_adult	1.6732E-006	1.8802E-002
West	resident_child	4.1581E-007	2.4277E-002

Appendix E – IRAP Calculations

Chapter 5
Estimating Media Concentrations

What's Covered in Chapter 5:

The purpose of this chapter is to describe the equations (and associated parameters) for estimating media concentration that we recommend using to evaluate the exposure scenarios presented in Chapter 4. In most cases, we include the origin and development of each of these equations, and describe the associated parameters. We also present the equations in Appendix B in a more condensed form (i.e. without derivation), and organize them according to exposure pathway. Discussions of ISCST3-modeled unitized air parameters are presented in Chapter 3. Appendix B also includes equations for modeling phase allocation and speciation of mercury concentrations. Appendix A-2 lists compound-specific parameters the equations need to estimate media concentrations, as well as our recommended hierarchies of sources. The HHRAP companion database provides recommended values for compound-specific parameters.

PLEASE NOTE: for the purposes of this guidance, "we" refers to the U.S. EPA OSW.

The HHRAP is written for the benefit of a varied audience, including risk assessors, regulators, risk managers, and community relations personnel. However, the "you" to which we speak in this chapter is the performer of a risk assessment: the person (or persons) who will actually put the recommended methods into practice.

Section 5.1 describes the equations that estimate air concentrations for evaluating direct inhalation of COPCs. Section 5.2 describes equations for estimating COPC concentrations in soils. Section 5.3

describes equations for estimating COPC concentrations in produce. Sections 5.4 through 5.6 describe equations for estimating COPC concentrations in animal products (such as milk, beef, pork, poultry, and eggs) resulting from animals ingesting contaminated feed and soil. Section 5.7 describes equations for estimating COPC concentrations in fish through bioaccumulation (or, for some compounds, bioconcentration) from the water column, dissolved water concentration, or bed sediment—depending on the COPC.

> ***Please Note***: references made throughout Chapter 5 to particle phase are generic and made without distinction between particle and particle-bound.

5.1 CALCULATING COPC CONCENTRATIONS IN AIR FOR DIRECT INHALATION

We recommend calculating COPC concentrations in air by summing the vapor phase and particle phase air concentrations of COPCs. To evaluate long-term or chronic exposure via direct inhalation, we generally recommend using unitized ***yearly*** air parameter values to calculate air concentrations, as specified in Appendix B, Table B-5-1. To evaluate short-term or acute exposure via direct inhalation, we recommend using unitized ***hourly*** air parameter values to calculate air concentrations, as specified in Appendix B, Table B-6-1.

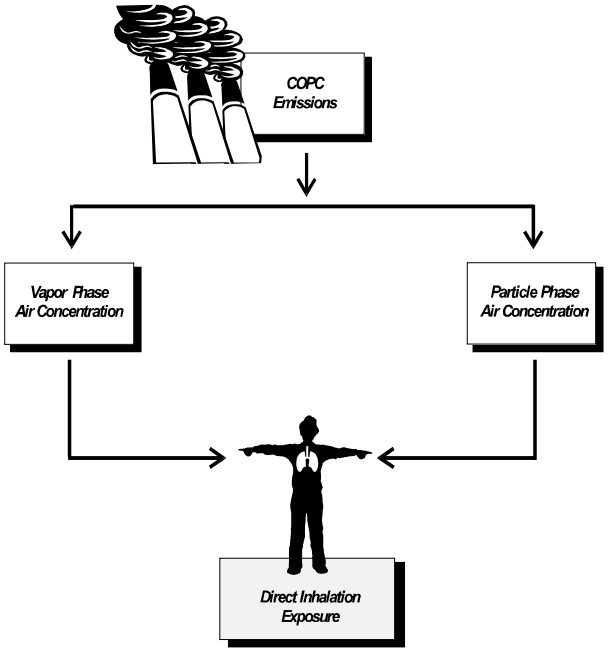
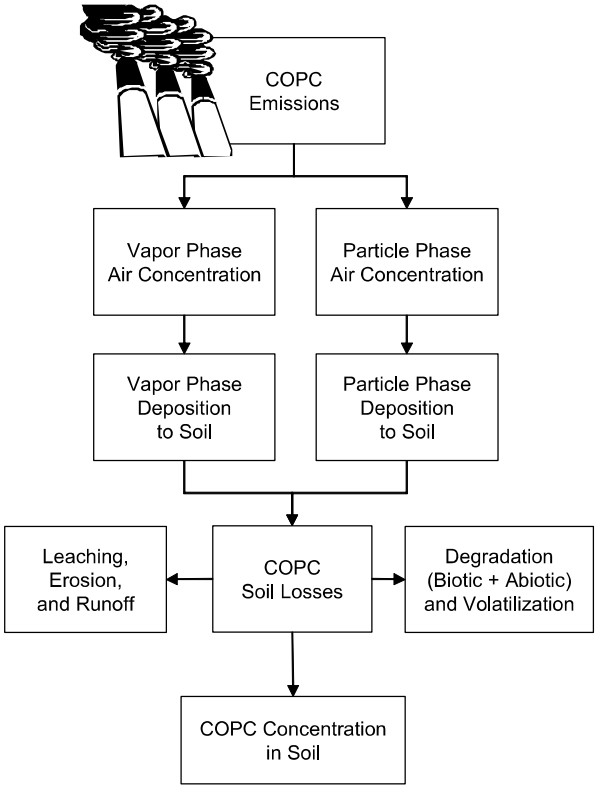


Figure 5-1 - COPC Concentration in Air for Direct Inhalation

5.2 CALCULATING COPC CONCENTRATIONS IN SOIL

We recommend estimating COPC concentrations in soil by summing the vapor phase and particle phase deposition of COPCs to the soil. We generally recommend considering wet and dry deposition of particles and vapors. Calculate dry deposition of vapors from the vapor air concentration and the dry deposition velocity. We consider it appropriate for soil concentration calculations to account for loss of COPCs by several mechanisms, including leaching, erosion, runoff, degradation (biotic and abiotic), and volatilization. These loss mechanisms all lower the soil concentration associated with the deposition rate. We present our recommended equations for calculating soil concentration and soil losses of COPCs in Appendix B, Tables B-1 for land use areas, and Tables B-4 for watersheds (see Section 5.7).

FIGURE 5-2 -
COPC CONCENTRATION IN SOIL



Soil concentrations might require many years to reach steady state. As a result, the equations we suggest to calculate the average soil concentration over the period of deposition were derived by integrating the

instantaneous soil concentration equation over the period of deposition. For carcinogenic COPCs, we recommend using two variations of the equation (average soil concentration over exposure duration):

1. one variation if the exposure duration (*T2*) is ***greater than or equal to*** the operating lifetime of the emission source or time period of combustion, and

2. the other form if the exposure duration is ***less*** than the operating lifetime of the emission source or time period of combustion.

For noncarcinogenic COPCs, we recommend using the second form of the carcinogenic equation. This equation calculates the highest annual average COPC soil concentration occurring during the exposure duration. We describe these equations in more detail in Section 5.2.1.

Soil conditions—such as pH, structure, organic matter content, and moisture content—affect the distribution and mobility of COPCs. Modeling the loss of COPCs from soil uses rates specific to the physical and chemical characteristics of the soil. We describe these variables and their use in the following subsections, along with the recommended equations.

5.2.1 Calculating Cumulative Soil Concentration (*Cs*)

U.S. EPA (1990e) recommended using Equation 5-1—adapted from Travis, et al. (1983)—to calculate cumulative soil concentration:

$$Cs = \frac{100 \cdot (Dydp + Dywv) \cdot [1.0 - \exp\ (-ks \cdot tD)]}{Z_s \cdot BD \cdot ks} \qquad \text{Equation 5-1}$$

where

Cs	=	Average soil concentration over exposure duration (mg COPC/kg soil)
100	=	Units conversion factor (mg-m^2/kg-cm^2)
Dydp	=	Unitized yearly dry deposition from particle phase (s/m^2-yr)
Dywv	=	Unitized yearly wet deposition from vapor phase (s/m^2-yr)
ks	=	COPC soil loss constant due to all processes (yr^{-1})
tD	=	Time period over which deposition occurs (time period of combustion) (yr)
Z_s	=	Soil mixing zone depth (cm)
BD	=	Soil bulk density (g soil/cm^3 soil)

U.S. EPA (1993f) stated that Equation 5-1 evaluated deposition of particle phase COPCs, but failed to consider vapor phase deposition or diffusion. To account for vapor phase diffusion, U.S. EPA (1998c) recommended using the following equation:

$$Cs = \frac{100 \cdot (Dydp + Dywv + L_{dif}) \cdot [1.0 - \exp(-ks \cdot tD)]}{Z_s \cdot BD \cdot ks}$$ Equation 5-1A

where

Cs	=	Average soil concentration over exposure duration (mg COPC/kg soil)
100	=	Units conversion factor (mg-m^2/kg-cm^2)
$Dydp$	=	Unitized yearly dry deposition from particle phase (s/m^2-yr)
$Dywv$	=	Unitized yearly wet deposition from vapor phase (s/m^2-yr)
L_{dif}	=	Dry vapor phase diffusion load to soil (g/m^2-yr)
ks	=	COPC soil loss constant due to all processes (yr^{-1})
tD	=	Time period over which deposition occurs (time period of combustion) (yr)
Z_s	=	Soil mixing zone depth (cm)
BD	=	Soil bulk density (g soil/cm^3 soil)

Other guidance (U.S. EPA 1994g) recommended the original Equation 5-1, but only for calculating *Cs* for 2,3,7,8-TCDD. U.S. EPA (1994g) also recommended setting the COPC soil loss constant (*ks*) equal to 0 for all other COPCs. For COPCs other than 2,3,7,8-TCDD, U.S. EPA (1994g) recommended Equation 5-1B—which eliminates the COPC soil loss constant:

$$Cs = 100 \cdot \frac{Dyd + Dyw}{Z_s \cdot BD} \cdot tD$$ Equation 5-1B

where

Cs	=	Average soil concentration over exposure duration (mg COPC/kg soil)
100	=	Units conversion factor (mg-m^2/kg-cm^2)
Dyd	=	Yearly dry deposition rate of pollutant (g/m^2-yr)
Dyw	=	Yearly wet deposition rate of pollutant (g/m^2-yr)
tD	=	Time period over which deposition occurs (time period of combustion) (yr)
Z_s	=	Soil mixing zone depth (cm)
BD	=	Soil bulk density (g soil/cm^3 soil)

More recent guidance documents—U.S. EPA (1994r) and NC DEHNR (1997)—recommended using two different equations (Equations 5-1C and 5-1D) with carcinogenic COPCs. Equation 5-1C was recommended for $T_2 \leq tD$ and Equation 5-1D was recommended for $T_1 < tD < T_2$. For noncarcinogenic COPCs, Equation 5-1E was recommended.

We recommend using Equations 5-1C, 5-1D, and 5-1E to calculate *Cs*. Appendix B, Table B-1-1 discusses further how to use these equations.

Recommended Equations for Calculating:
Cumulative Soil Concentration (*Cs*)

Carcinogens:

For $T_2 \leq tD$

$$Cs = \frac{Ds}{ks \cdot (tD - T_1)} \cdot \left[\left(tD + \frac{\exp(-ks \cdot tD)}{ks} \right) - \left(T_1 + \frac{\exp(-ks \cdot T_1)}{ks} \right) \right] \quad \text{Equation 5-1C}$$

For $T_1 < tD < T_2$

$$Cs = \frac{\left(\frac{Ds \cdot tD - Cs_{tD}}{ks}\right) + \left(\frac{Cs_{tD}}{ks}\right) \cdot (1 - \exp[-ks \cdot (T_2 - tD)])}{(T_2 - T_1)} \quad \text{Equation 5-1D}$$

Noncarcinogens:

$$Cs_{tD} = \frac{Ds \cdot [1 - \exp(-ks \cdot tD)]}{ks} \quad \text{Equation 5-1E}$$

where

Cs	=	Average soil concentration over exposure duration (mg COPC/kg soil)
Ds	=	Deposition term (mg COPC/kg soil/yr)
ks	=	COPC soil loss constant due to all processes (yr^{-1})
tD	=	Time period over which deposition occurs (time period of combustion) (yr)
T_1	=	Time period at the beginning of combustion (yr)
Cs_{tD}	=	Soil concentration at time tD (mg/kg)
T_2	=	Length of exposure duration (yr)

We discuss the deposition term further in this Section, as well as Section 5.2.3. Section 5.2.2 discusses the COPC-specific soil loss constant (*ks*). Chapter 2 discusses how the period of time at the beginning of combustion (T_1) relates to characterizing site conditions immediately preceding the study period. Chapter 2 also addresses the time period during which burning - and therefore deposition - occurs (*tD*), as it

relates to setting emission rates. Chapter 3 addresses air dispersion modeling aspects of *tD*. Chapter 6 further discusses how the duration of exposure (T_2) relates to characterizing exposure.

As in U.S. EPA (1994r) and NC DEHNR (1997), we recommend using Equation 5-1C when you model an exposure duration that is ***less than or equal to*** the operating lifetime of the emission source or hazardous waste combustor ($T_2 \leq tD$). We recommend using Equation 5-1D when you model an exposure duration ***greater than*** the operating lifetime of the hazardous waste combustor ($T_1 < tD < T_2$). For noncarcinogenic COPCs, we recommend Equation 5-1E.

We generally recommend using the COPC soil concentration averaged over the exposure duration (represented by *Cs*) for carcinogenic compounds. Carcinogenic risk is averaged over the lifetime of an individual. Because the hazard quotient associated with noncarcinogenic COPCs is based on a threshold dose rather than a lifetime exposure, we recommend using the highest annual average COPC soil concentration (Cs_{tD}) occurring during the exposure duration period for noncarcinogenic COPCs. Cs_{tD} typically occurs at the end of the operating life of the emission source or the time period of combustion.

As in U.S. EPA (1994r) and NC DEHNR (1997), we recommend using the highest 1-year annual average soil concentration, determined using Equation 5-1E, to evaluate risk from noncarcinogenic COPCs (see Chapter 7).

5.2.2 Calculating the COPC Soil Loss Constant (*ks*)

Organic and inorganic COPCs can be lost from the soil by several processes that may or may not occur simultaneously. The rate at which a COPC is lost from the soil is known as the soil loss constant (*ks*). We recommend determining *ks* by using the soil's physical, chemical, and biological characteristics, to estimate the COPC-specific loss resulting from:

(1) leaching,

(2) runoff,

(3) erosion,

(4) biotic and abiotic degradation, and

(5) volatilization.

U.S. EPA (1990e) recommended Equation 5-2 to calculate *ks*:

$$ks = ksl + ksg + ksv \qquad \text{Equation 5-2}$$

where

ks	=	COPC soil loss constant due to all processes (yr^{-1})
ksl	=	COPC loss constant due to leaching (yr^{-1})
ksg	=	COPC loss constant due to biotic and abiotic degradation (yr^{-1})
ksv	=	COPC loss constant due to volatilization (yr^{-1})

We recommend using Equation 5-2A to calculate *ks*. We describe this equation further in Appendix B, Table B-1-2. Using Equation 5-2A is consistent with U.S. EPA (1994g), U.S. EPA (1994r), U.S. EPA (1998c) and NC DEHNR (1997).

Recommended Equation for Calculating:
COPC Soil Loss Constant (*ks*)

$$ks = ksg + kse + ksr + ksl + ksv \qquad \text{Equation 5-2A}$$

where

ks	=	COPC soil loss constant due to all processes (yr^{-1})
ksg	=	COPC loss constant due to biotic and abiotic degradation (yr^{-1})
kse	=	COPC loss constant due to soil erosion (yr^{-1})
ksr	=	COPC loss constant due to surface runoff (yr^{-1})
ksl	=	COPC loss constant due to leaching (yr^{-1})
ksv	=	COPC loss constant due to volatilization (yr^{-1})

Section 5.2.2.1 discusses loss due to biotic and abiotic degradation (*ksg*). Section 5.2.2.2 discusses loss due to erosion (*kse*). Section 5.2.2.3 discusses loss due to surface runoff (*ksr*). Section 5.2.2.4 discusses Loss due to leaching (*ksl*). Section 5.2.2.5 discusses loss due to volatilization (*ksv*).

As highlighted in Section 5.2.1, using Equation 5-2A in Equations 5-1C and 5-1D assumes that you can define COPC loss using first-order reaction kinetics. First-order reaction rates depend on the concentration of one reactant (Bohn et al. 1985). The loss of a COPC by a first-order process depends only on the concentration of the COPC in the soil, and a constant fraction of the COPC is removed from the soil over time. Those processes that apparently exhibit first-order reaction kinetics without implying a mechanistic dependence on a first-order loss rate are termed "apparent first-order" loss rates (Sparks 1989). The assumption that COPC loss follows first-order reaction kinetics may be an oversimplification

because—at various concentrations or under various environmental conditions—the loss rates from soil systems will resemble different kinetic expressions. However, at low concentrations, a first-order loss constant may be adequate to describe the loss of the COPC from soil (U.S. EPA 1998c).

COPC loss in soil can also follow zero or second-order reaction kinetics. Zero-order reaction kinetics are independent of reactant concentrations (Bohn et al. 1985). Zero-order loss rates describe processes in which the reactants are present at very high concentrations. Under zero-order kinetics, a constant amount of a COPC is lost from the soil over time, independent of its concentration. Processes that follow second-order reaction kinetics depend on the concentrations of two reactants or the concentration of one reactant squared (Bohn et al. 1985). The loss constant of a COPC following a second-order process can be contingent on its own concentration, or on both its concentration and the concentration of another reactant, such as an enzyme or catalyst.

Because COPC loss from soil depends on many complex factors, it may be difficult to model the overall rate of loss. In addition, because the physical phenomena that cause COPC loss can occur simultaneously, using Equation 5-2A might also overestimate loss rates for each process (Valentine 1986). We recommend, when possible, taking into account the common occurrence of all loss processes. It's possible to derive combined rates of soil loss by these processes experimentally. U.S. EPA (1986c) presents values for some COPCs.

5.2.2.1 COPC Loss Constant Due to Biotic and Abiotic Degradation *(ksg)*

Soil losses resulting from biotic and abiotic degradation (*ksg*) are determined empirically from field studies and should be available in the literature (U.S. EPA 1998c). According to Lyman et al. (1982), it's reasonable to assume that degradation rates follow first order kinetics in a homogenous media. You're therefore able to relate the half-life of a compound to the degradation rate constant. Ideally, *ksg* is the sum of all biotic and abiotic rate constants in the soil media. Therefore, if the half-life of a compound (for all of the mechanisms of transformation) is known, you can calculate the degradation rate. However, literature sources don't provide sufficient data for all such mechanisms, especially for soil. Earlier Agency guidance (U.S. EPA 1994g) recommended setting *ksg* for all COPCs other than 2,3,7,8-TCDD equal to zero. The HHRAP companion database presents our recommended values for this COPC-specific variable.

Recommended Values for:
COPC Loss Constant Due to Biotic and Abiotic Degradation (ksg)

COPC-Specific
(See the HHRAP companion database)

The rate of biological degradation in soils depends on the concentration and activity levels of the microbial populations in the soil, the soil conditions, and the COPC concentration (Jury and Valentine 1986). First-order loss rates often fail to account for the high variability of these features in a single soil system. However, using simple rate expressions may be appropriate at low chemical concentrations (e.g., nanogram per kilogram soil). A first-order dependence on chemical concentration may be reasonable at low chemical concentrations. The rate of biological degradation is COPC-specific, and depends on the complexity of the COPC and the usefulness of the COPC to the microorganisms. Some substances, rather than being used by the organisms as a nutrient or energy source, are simply degraded with other similar COPCs, which can be further utilized. Environmental- and COPC-specific factors that can limit the biodegradation of COPCs in the soil environment (Valentine and Schnoor 1986) include:

- availability of the COPC;
- nutrient limitations;
- toxicity of the COPC; and
- inactivation or nonexistence of enzymes capable of degrading the COPC.

Chemical degradation of organic compounds can be a significant mechanism for removing COPCs from soil (U.S. EPA 1998c). Hydrolysis and oxidation-reduction reactions are the primary chemical transformation processes occurring in the upper layers of soils (Valentine 1986). General rate expressions describing the transformation of some COPCs by all non-biological processes are available. These expressions are helpful when division into component reactions isn't possible.

Hydrolysis in aqueous systems is characterized by three processes: acid-catalyzed, base-catalyzed, and neutral reactions. The overall rate of hydrolysis is the sum of the first-order rates of these processes (Valentine 1986). In soil systems, sorption of the COPC can increase, decrease, or not affect the rate of hydrolysis, as numerous studies cited in Valentine (1986) have shown. We recommend predicting the overall (i.e. total) rate of hydrolysis in soil by adding the rates in the soil and water phases. We recommend assuming that these rates are first-order reactions at a fixed pH (Valentine 1986). Lyman et al. (1982) describes methods for estimating these hydrolysis constants.

Organic and inorganic compounds also undergo oxidation-reduction (redox) reactions in the soil (Valentine 1986). Organic redox reactions involve the reacting molecules exchanging oxygen and hydrogen atoms. Inorganic redox reactions may involve the reactants exchanging atoms or electrons. In soil systems where the identities of oxidant and reductant species aren't known, you can acquire a first-order rate constant for describing loss by redox reactions (Valentine 1986). Redox reactions involving metals may promote losses from surface soils by making metals more mobile (e.g., leaching to subsurface soils).

5.2.2.2 COPC Loss Constant Due to Soil Erosion (*kse*)

U.S. EPA (1998c) recommended using Equation 5-3 to calculate the constant for soil loss resulting from erosion (*kse*).

$$kse = \frac{0.1 \cdot X_e \cdot SD \cdot ER}{BD \cdot Z_s} \cdot \frac{Kd_s \cdot BD}{\theta_{sw} + (Kd_s \cdot BD)} \qquad \text{Equation 5-3}$$

where

kse	=	COPC soil loss constant due to soil erosion
0.1	=	Units conversion factor (1,000 g-kg/10,000 cm^2-m^2)
X_e	=	Unit soil loss (kg/m^2-yr)
SD	=	Sediment delivery ratio (unitless)
ER	=	Soil enrichment ratio (unitless)
BD	=	Soil bulk density (g soil/cm^3 soil)
Z_s	=	Soil mixing zone depth (cm)
Kd_s	=	Soil/water partition coefficient (ml water/g soil)
θ_{sw}	=	Soil volumetric water content (ml water/cm^3 soil) = 0.2 ml/cm^3

We recommend using the Universal Soil Loss Equation (USLE) to calculate unit soil loss (X_e)(See Section 5.7.2). We describe soil bulk density (BD) in Section 5.2.4.2. We describe Soil mixing depth (Z_s) in Section 5.2.4.1. We describe soil volumetric water content (θ_{sw}) in Section 5.2.4.4. We discuss site-specific variables associated with Equation 5-3 further in Appendix B.

U.S. EPA (1994g and 1994r) recommended setting all *kse* values equal to zero. U.S. EPA (1994r) recommended setting *kse* equal to zero because contaminated soil erodes both onto and off of the site.

As in U.S. EPA (1994g and 1994r), we recommend setting *kse* equal to zero.

Recommended Value for: COPC Loss Constant Due to Erosion (*kse*)
0

For additional information on addressing *kse*, we recommend consulting U.S. EPA (1998c). We also further describe using *kse* values in Appendix B, Table B-1-3.

5.2.2.3 COPC Loss Constant Due to Runoff (*ksr*)

Earlier U.S. EPA guidance (1994g) recommended setting all *ksr* values equal to zero.

As in U.S. EPA (1994r; 1998c) and NC DEHNR (1997), we recommend using Equation 5-4 to calculate *ksr*. We further discuss using Equation 5-4 in Appendix B, Table B-1-4.

Recommended Equation for Calculating: COPC Loss Constant Due to Runoff (*ksr*)

$$ksr = \frac{RO}{\theta_{sw} \cdot Z_s} \cdot \left(\frac{1}{1 + \left(Kd_s \cdot BD / \theta_{sw} \right)} \right) \qquad \text{Equation 5-4}$$

where

ksr	=	COPC loss constant due to runoff (yr^{-1})
RO	=	Average annual surface runoff from pervious areas (cm/yr)
θ_{sw}	=	Soil volumetric water content (ml water/cm^3 soil) = 0.2 ml/cm^3
Z_s	=	Soil mixing zone depth (cm)
Kd_s	=	Soil/water partition coefficient (ml water/g soil)
BD	=	Soil bulk density (g soil/cm^3 soil) = 1.5 g/cm^3

The average annual surface runoff from pervious surfaces (RO) is a site-specific water loss term discussed in Section 5.2.4.3. Section 5.2.4.4 describes soil volumetric water content (θ_{sw}). Section 5.2.4.1 discusses the depth of soil mixing (Z_s). Appendix A-2 explains how we recommend calculating the COPC-specific soil/water partition coefficient (Kd_s). Section 5.2.4.2 describes soil bulk density (BD).

5.2.2.4 COPC Loss Constant Due to Leaching (*ksl*)

Losses of soil COPCs due to leaching (*ksl*) depend on the amount of water available to generate leachate and soil properties such as bulk density, soil moisture, soil porosity, and soil sorption properties.

U.S. EPA (1990e) recommended using Equation 5-5 to calculate *ksl*.

$$ksl = \frac{P + I - E_v}{\theta_{sw} \cdot Z_s \cdot [1.0 + (Kd_s \cdot BD / \theta_{sw})]} \qquad \text{Equation 5-5}$$

where

ksl	=	COPC loss constant due to leaching (yr^{-1})
P	=	Average annual precipitation (cm/yr)
I	=	Average annual irrigation (cm/yr)
E_v	=	Average annual evapotranspiration (cm/yr)
θ_{sw}	=	Soil volumetric water content (ml water/cm^3 soil) = 0.2 ml/cm^3
Z_s	=	Soil mixing zone depth (cm)
Kd_s	=	Soil/water partition coefficient (ml water/g soil)
BD	=	Soil bulk density (g soil/cm^3 soil)

U.S. EPA (1993f) determined that Equation 5-5 does not properly account for surface runoff. U.S. EPA (1994g) recommended setting all *ksl* values to zero.

More recent guidance (U.S. EPA 1994r; 1998c; NC DEHNR 1997) have recommended using Equation 5-5A to calculate *ksl*. As with U.S. EPA (1994r), U.S. EPA (1998c), and NC DEHNR (1997), we recommend using Equation 5-5A to account for runoff while calculating *ksl*. We further discuss the use of this equation in Appendix B, Table B-1-5.

Recommended Equation for Calculating:
COPC Loss Constant Due to Leaching (*ksl*)

$$ksl = \frac{P + I - RO - E_v}{\theta_{sw} \cdot Z_s \cdot [1.0 + (BD \cdot Kd_s / \theta_{sw})]}$$ Equation 5-5A

where

ksl	=	COPC loss constant due to leaching (yr^{-1})
P	=	Average annual precipitation (cm/yr)
I	=	Average annual irrigation (cm/yr)
RO	=	Average annual surface runoff from pervious areas (cm/yr)
E_v	=	Average annual evapotranspiration (cm/yr)
θ_{sw}	=	Soil volumetric water content (ml water/cm^3 soil) = 0.2 ml/cm^3
Z_s	=	Soil mixing zone depth (cm)
BD	=	Soil bulk density (g soil/cm^3 soil) = 1.5 g/cm^3
Kd_s	=	Soil/water partition coefficient (cm^3 water/g soil)

Appendix B describes how we suggest acquiring site-specific variables associated with Equation 5-5A. The average annual volume of water available to generate leachate is the mass balance of all water inputs and outputs from the area under consideration ($P + I - RO - E_v$). These variables are described in Section 5.2.4.3. Section 5.2.4.4 describes soil volumetric water content (θ_{sw}). Section 5.2.4.1 describes the soil mixing depth (Z_s). Section 5.2.4.2 soil bulk density (BD). Appendix A-2 describes how we recommend calculating the COPC-specific soil/water partition coefficient (Kd_s).

5.2.2.5 COPC Loss Constant Due to Volatilization (*ksv*)

Semi-volatile and volatile COPCs emitted in high concentrations may become adsorbed to soil particles and exhibit volatilization losses from soil. The loss of a COPC from the soil by volatilization depends on the rate of movement of the COPC to the soil surface, the chemical vapor concentration at the soil surface, and the rate at which vapor is carried away by the atmosphere (Jury 1986).

U.S. EPA (1990e; 1993f; 1998c) recommended using Equation 5-6 to calculate *ksv*.

$$ksv = Ke \cdot Kt$$ Equation 5-6

where

ksv	=	COPC loss constant due to volatilization (yr^{-1})
Ke	=	Equilibrium coefficient (s/cm-yr)
Kt	=	Gas phase mass transfer coefficient (cm/s)

U.S. EPA (1990e; 1993f; 1998c) don't identify a reference for Equation 5-6. U.S. EPA (1993f) stated that Equation 5-6 had been independently verified as accurately representing volatilization loss, but that the equation for *Kt* (Equation 5-8) appeared to fit to data empirically. U.S. EPA (1993f) also stated that *ksv* is modeled as a means of limiting soil concentration. Because this mass flux never experiences rain out, or washout and subsequent re-deposit, soil COPC concentrations are underestimated for soluble volatile COPCs. U.S. EPA (1993f) further recommended that additional research be conducted to determine the magnitude of the uncertainty introduced for volatile COPCs. U.S. EPA (1998c) recommended not considering the volatilized residues of semi-volatile COPCs (such as dioxin). U.S. EPA (1994g) recommended setting all *ksv* values to zero.

U.S. EPA guidance (1994r) and NC DEHNR (1997) recommended using Equation 5-6A to calculate *ksv*. Equation 5-6A appears to incorporate equations that U.S. EPA (1990e) recommended for calculating *Ke* (equilibrium coefficient) and *Kt* (gas phase mass transfer coefficient).

$$ksv = \left(\frac{3.1536\times10^{7}\cdot H}{Z_s\cdot Kd_s\cdot R\cdot T_a\cdot BD}\right)\cdot\left(0.482\cdot W^{0.78}\cdot\left[\frac{\mu_a}{\rho_a\cdot D_a}\right]^{-0.67}\cdot\left[\sqrt{\frac{4\cdot A}{\pi}}\right]^{-0.11}\right) \quad \text{Equation 5-6A}$$

where

ksv	=	COPC loss constant due to volatilization (yr^{-1})
3.1536×10^7	=	Units conversion factor (s/yr)
H	=	Henry's Law constant (atm-m^3/mol)
Z_s	=	Soil mixing zone depth (cm)
Kd_s	=	Soil/water partition coefficient (cm^3 water/g soil)
R	=	Universal gas constant (atm-m^3/mol-K)
T_a	=	Ambient air temperature (K) = 298.1 K
BD	=	Soil bulk density (g soil/cm^3 soil)
0.482	=	Empirical constant (unitless) Units conversion factor $[(3600\ s/hr)^{0.78}(100\ cm/m)/(3600\ s/hr)] \cdot$ (empirical constant 0.0292)
W	=	Average annual wind speed (m/s)
0.78	=	Empirical constant (unitless)
μ_a	=	Viscosity of air (g/cm-s)
ρ_a	=	Density of air (g/cm^3)
D_a	=	Diffusivity of COPC in air (cm^2/s)
-0.67	=	Empirical constant (unitless)
A	=	Surface area of contaminated area (m^2)
-0.11	=	Empirical constant (unitless)

U.S. EPA (1990e) recommended using Equation 5-7 to calculate *Ke* and Equation 5-8 to calculate *Kt*.

$$Ke = \frac{3.1536 \times 10^7 \cdot (H \times 10^3)}{Z_s \cdot Kd_s \cdot R \cdot T_a \cdot BD}$$ Equation 5-7

$$Kt = 0.482 \cdot W^{0.78} \cdot Sc_a^{-0.67} \cdot d_e^{-0.11}$$ Equation 5-8

where

Ke	=	Equilibrium coefficient (s/cm-yr)
3.1536×10^7	=	Units conversion factor (s/yr)
H	=	Henry's Law constant (atm-L/mol)
10^3	=	Units conversion factor (L/m^3)
Z_s	=	Soil mixing zone depth (cm)
Kd_s	=	Soil/water partition coefficient (cm^3 water/g soil)
R	=	Universal gas constant (atm-m^3/mol-K)
T_a	=	Ambient air temperature (K) = 298.1 K
BD	=	Soil bulk density (g soil/cm^3 soil)
Kt	=	Gas phase mass transfer coefficient (cm/s)
0.482	=	Units conversion factor [(3600 s/hr)$^{0.78}$(100 cm/m)/(3600 s/hr)] · (empirical constant 0.0292)
W	=	Average annual wind speed (m/s)
Sc_a	=	Schmidt number for gas phase (unitless)
d_e	=	Effective diameter of contaminated media (m)

U.S. EPA (1990e) also recommended using Equation 5-9 to calculate the Schmidt number for gas phase (Sc_a), and Equation 5-10 to calculate the effective diameter of contaminated media (d_e).

$$Sc_a = \frac{\mu_a}{\rho_a \cdot D_a}$$ Equation 5-9

$$d_e = \sqrt{\frac{4 \cdot A}{\pi}}$$ Equation 5-10

where

Sc_a	=	Schmidt number for gas phase (unitless)
μ_a	=	Viscosity of air (g/cm-s)
ρ_a	=	Density of air (g/cm^3)
D_a	=	Diffusivity of COPC in air (cm^2/s)
d_e	=	Effective diameter of contaminated media (m)
A	=	Surface area of contaminated area (m^2)

As in U.S. EPA (1998c), we recommend using Equation 5-7A to calculate *ksv*, in cases where high concentrations of volatile organic compounds are expected to be present in the soil.

Recommended Equation for Calculating:
COPC Loss Constant Due to Volatilization (*ksv*)

$$ksv = \left(\frac{3.1536 \times 10^7 \cdot H}{Z_s \cdot Kd_s \cdot R \cdot T_a \cdot BD}\right) \cdot \left(\frac{D_a}{Z_s}\right) \cdot \left[1 - \left(\frac{BD}{\rho_{soil}}\right) - \Theta_{sw}\right] \qquad \text{Equation 5-7A}$$

where

ksv	=	COPC loss constant due to volatilization (yr^{-1})
3.1536×10^7	=	Units conversion factor (s/yr)
H	=	Henry's Law constant (atm-m^3/mol)
Z_s	=	Soil mixing zone depth (cm)
Kd_s	=	Soil/water partition coefficient (ml/g)
R	=	Universal gas constant (atm-m^3/mol-K)
T_a	=	Ambient air temperature (K) = 298.1 K
BD	=	Soil bulk density (g soil/cm^3 soil) = 1.5 g/cm^3
D_a	=	Diffusivity of COPC in air (cm^2/s)
ρ_{soil}	=	Solids particle density (g/cm^3) = 2.7 g/cm^3
θ_{sw}	=	Soil volumetric water content (ml/cm^3 soil) = 0.2 ml/cm^3

Henry's Law constants are compound-specific, and we supply recommended values in the HHRAP companion database. We describe the soil mixing depth (Z_s) in. Appendix A-2 describes how we recommend calculating the COPC-specific soil/water partition coefficient (Kd_s). The Universal gas constant (R) and ambient air temperature (T_a) are discussed further in Appendix B, Table B-1-6. Soil bulk density (BD) is described below, as well as in Section 5.2.4.2. Appendix A-2 discusses the diffusivity of a COPC in air (D_a). Solids particle density (ρ_{soil}) is discussed in this Section, below. Soil volumetric water content (θ_{sw}) is further described below, as well as in Section 5.2.4.4.

Equation 5-7A is based on gas equilibrium coefficients and gas phase mass transfer, and combines Equations 5-7, 5-7B, and 5-7C. You can derive *ksv* by adapting the Hwang and Falco (1986) equation for soil vapor phase diffusion, to obtain Equation 5-6, as previously reported by U.S. EPA (1990e). Based on general soil properties, you can also write the gas-phase mass transfer coefficient, K_t, as follows (Hillel 1980; Miller and Gardiner 1998):

$$K_t = \frac{D_a \theta_v}{Z_s}$$ Equation 5-7B

where

K_t	=	Gas phase mass transfer coefficient (cm/s)
Z_s	=	Soil mixing zone depth (cm)
D_a	=	Diffusivity of COPC in air (cm^2/s)
θ_v	=	Soil void fraction (cm^3/cm^3)

We describe Soil mixing depth (Z_s) in Section 5.2.4.1. The soil void fraction (θ_v) is the volumetric fraction of a soil that does not contain solids or water, and can be expressed as:

$$\theta_v = 1 - (\frac{BD}{\rho_s}) - \theta_{SW}$$ Equation 5-7C

where

θ_v	=	Soil void fraction (cm^3/cm^3)
BD	=	Soil bulk density (g/cm^3) = 1.5 g/cm^3
ρ_{soil}	=	Solids particle density (g/cm^3) = 2.7 g/cm^3
θ_{sw}	=	Soil volumetric water content (ml water/cm^3 soil) = 0.2 ml/cm^3

The expression containing bulk density (*BD*) divided by solids particle density (ρ_{soil}) gives the volume of soil occupied by pore space or voids (Miller and Gardiner 1998). Soil bulk density is affected by the soil structure, such as looseness or compactness of the soil, and depends on the water and clay content of the soil (Hillel 1980). A range for bulk density of 0.83 to 1.84 was originally cited in Hoffman and Baes (1979). Blake and Hartge (1996) and Hillel (1980) both suggest that the mean density of solid particles is about 2.7 g/cm^3. We recommend a default soil bulk density of 1.5 g/cm^3, based on a mean value for loam soil from Carsel et al. (1988).

The soil water content (θ_{sw}) depends on both the available water and the soil structure of a particular soil. Values for θ_{sw} range from 0.03 to 0.40 ml/cm^3 depending on soil type (Hoffman and Baes 1979). The lower values are typical of sandy soils, which can't retain much water; the higher values are typical of soils such as clay or loam soils which can retain water. If site-specific information isn't available, we recommend a mid-point default value of 0.2 ml water/cm^3 soil. However, since θ_{sw} is unique for each soil type, we highly recommend using site-specific information.

We discuss *ksv* further in Appendix B, Table B-1-6.

5.2.3 Calculating the Deposition Term (*Ds*)

We recommend using Equation 5-11 to calculate the deposition term *(Ds)*. This equation is further described in Appendix B, Table B-1-1. Using Equation 5-11 to calculate *Ds* is consistent with U.S. EPA (1994r) and NC DEHNR (1997), which both incorporate *Ds* into Equation 5-1C.

Recommended Equation for Calculating:
Deposition Term (*Ds*)

$$Ds = \left[\frac{100 \cdot Q}{Z_s \cdot BD}\right] \cdot [F_v \cdot (Dydv + Dywv) + (Dydp + Dywp) \cdot (1 - F_v)] \qquad \text{Equation 5-11}$$

where

Ds	=	Deposition term (mg COPC/kg soil/yr)
100	=	Units conversion factor (mg-m^2/kg-cm^2)
Q	=	COPC emission rate (g/s)
Z_s	=	Soil mixing zone depth (cm)
BD	=	Soil bulk density (g soil/cm^3 soil) = 1.5 g/cm^3
F_v	=	Fraction of COPC air concentration in vapor phase (unitless)
Dydv	=	Unitized yearly average dry deposition from vapor phase (s/m^2-yr)
Dywv	=	Unitized yearly average wet deposition from vapor phase (s/m^2-yr)
Dydp	=	Unitized yearly average dry deposition from particle phase (s/m^2-yr)
Dywp	=	Unitized yearly average wet deposition from particle phase (s/m^2-yr)

Chapters 2 and 3 explain how we suggest quantifying the COPC emission rate (*Q*). Chapter 3 describes generating modeled air parameters *Cyv*, *Dydv, Dywv*, *Dydp*, and *Dywp*. We describe the soil mixing depth (Z_s) in Section 5.2.4.1. Soil bulk density (*BD*) is described in Sections 5.2.2.5 and 5.2.4.2, as well as Appendix B. Appendix A-2 describes how we suggest determining the COPC-specific parameter *Fv*.

5.2.4 Site-Specific Parameters for Calculating Cumulative Soil Concentration

Calculating *Cs* requires the following site-specific parameters:

- Soil mixing zone depth (Z_s)
- Soil bulk density (*BD*)
- Available water ($P + I - RO - E_v$)
- Soil volumetric water content (θ_{sw})

We discuss these parameters further in the following subsections, and in Appendix B.