
APPENDIX B

Selection of Screening Criteria

Table of Contents

1	Introduction.....	1
2	Screening Criteria For Contaminants in Soil.....	1
2.1	Screening Criteria from The Ontario Ministry of the Environment	1
2.2	Screening Criteria from the US EPA.....	1
2.3	Derivation of an Interim Screening Criterion for Picloram.....	2
2.4	Summary of Soil Screening Criteria.....	4
3	Screening Criteria for Chemicals in Groundwater and Surface Water.....	5
4	References.....	7

Appendix B

Selection of Chemical Screening Criteria

1 Introduction

The objective of the chemical screening process is to determine which chemicals are present in the environment at levels that may pose a potential risk to human health or the environment. The identification of chemicals of concern is based on a comparison of chemical concentrations and applicable screening guidelines. Guidelines have been established for several environmental media including soil, groundwater, surface water and ambient air. Guidelines have been established by regulatory agencies such as the Canadian Council of Ministers of the Environment (CCME), Health Canada, the Ontario Ministry of the Environment, and the U.S. Environmental Protection Agency. It is important to note that most agencies develop guidelines that are based on human health and ecological effects. Where both values are available, the lower of the two values is selected as the generic or common guideline value. This approach provides protection for both human and ecological receptors. Because the focus of the risk assessment is human health, the screening guidelines selected from the various agencies are those that are based on the protection of human health. The CCME was used as the primary source of guidelines (CCME, 2004). When guidelines were not available from either the CCME, screening guidelines from the Ontario Ministry of the Environment (MOE) *Guideline for Use at Contaminated Sites in Ontario* (MOE, 1996) were used. If human health based guidelines were not available from these Canadian sources, the US EPA Region III *Risk Based Concentration Tables* (USEPA, 2006) was used as an additional source of human health based screening guideline values.

2 Screening Criteria For Contaminants in Soil

2.1 Screening Criteria from The Ontario Ministry of the Environment

When selecting screening criteria for soil for non-carcinogenic chemicals from sources other than CCME, current Health Canada guidance recommends that the guideline values must be based on a hazard index value of 0.2 to ensure consistency with the CCME guideline development process (Health Canada, 2004). The MOE guidelines for non-carcinogenic chemicals are based on a hazard index of 0.2 for site-related exposures. Therefore, these values can be used without adjustment.

2.2 Screening Criteria from the US EPA

Screening criteria for several of the contaminants identified in the *Environmental Site Assessment* (ESA) are not available from either the CCME or the MOE. Therefore it was necessary to select soil screening criteria developed by the US EPA. The *Risk Based Concentration* (RBC) tables from the US EPA Region III were used as the source of screening criteria from the US EPA (USEPA, 2006). When selecting guidelines from other agencies, such as the US EPA, it is necessary that the adopted screening guideline values be based on the same

HI value of 0.2 to ensure consistency with the Health Canada guidance. The US EPA Region III screening guidelines as based on a HI of 1.0 Therefore it is necessary to adjust the US EPA Region III values by a factor of 0.2. For each contaminant, the US EPA Region III RBC concentrations for residential and industrial land-uses are listed along with the adjusted values for use in the HHRA.

Screening Criteria for Chemicals in Soil

Contaminant	US EPA	Land Use	Adjusted Value
2,4,5-T	780 µg/g	Residential	160 µg/g
	10,000 µg/g	Industrial	2,000 µg/g
2,4-D	780 µg/g	Residential	160 µg/g
	10,000 µg/g	Industrial	2,000 µg/g
Dicamba	2300 µg/g	Residential	470 µg/g
	31,000 µg/g	Industrial	6,100 µg/g
1,2,4,5-Tetrachlorobenzene	23 µg/g	Residential	4.7 µg/g
	310 µg/g	Industrial	61 µg/g
1,2,3,4-Tetrachlorobenzene (Surrogate values)	23 µg/g	Residential	4.7 µg/g
	310 µg/g	Industrial	61 µg/g

A screening criterion is not available for 1,2,3,4-tetrachlorobenzene from CCME, the MOE, or the US EPA. In the absence of a criterion specifically for 1,2,3,4-tetrachlorobenzene, the screening criteria for 1,2,4,5-tetrachlorobenzene have been used as a surrogate screening value.

2.3 Derivation of an Interim Screening Criterion for Picloram

The chemical analysis presented in the ESA lists several chemicals for which screening criteria are not available from the CCME, the MOE or the US EPA. These chemicals include:

- Bromoxynil;
- Hexazonon;
- Imazapyr;
- Triclopyr;
- 1,2,3-Trichlorobenzene;
- 1,3,5-Trchlorobenzene,
- 2,3,6-Trichlorotoluene;
- 2,4,5-Trichlorotoluene;
- 2,6-Dichlorobenzylchloride;
- Bromacil;
- Dichlofop (Methyl);
- Dichloroprop (2,4-DP)
- Octachlorostyrene
- Picloram

A review of the data provided in Appendix A and the *Exposure Point Concentration* (EPC) values presented in Section 3 of the Main Report shows that Picloram is the only member of this group that was actually detected in soil samples from CFB Gagetown. Picloram was detected in 1 of 249 samples collected from across the base (sample A14-C2). This sample is located in risk assessment Subject Area 8. The remaining chemicals were reported as *Not Detected* (ND) in all soil samples collected on CFB Gagetown. Therefore, these chemicals are considered not to be present and do not need to be considered further in the HHRA. Although the fact that picloram was detected in a single sample at a concentration that is marginally below the maximum detection limit suggests that picloram may not be present on the site, an interim screening

criterion was developed as a precaution to ensure that the presence of picloram in this single sample does not pose a concern for human exposure. The derivation of the interim screening criterion, and the rationale upon which the value is based are provided below.

Health Canada and the US EPA have developed TRVs for picloram of 20µg/kg-day and 70 µg/kg-day respectively (Health Canada, 1990, Health Canada, 2004, US EPA, 1992). The Health Canada TRV was developed by the Foods Directorate and represents a *Negligible Daily Intake* (NDI) that is based on the results of a two-year feeding study that examined both chronic toxicity and oncogenicity in rats (Health Canada, 1990). The US EPA TRV is based on increases in liver weights following a 6-month feeding study in dogs (US EPA, 1992). Although the Health Canada TRV pre-dates the US EPA TRV, the Health Canada TRV is based on the results of a 1986 toxicity study, while the US EPA TRV is based on a study conducted in 1982. The Health Canada TRV is based on more recent toxicity data than the US EPA TRV and is lower than the US EPA TRV. Therefore, the Health Canada TRV has been used to develop an interim screening criterion for picloram for use in the human health risk assessment for CFB Gagetown. The screening criterion for picloram has been developed using the Health Canada receptor parameters for the toddler receptor. The toddler was chosen because children in this age group (6 months through 4 years of age) have the highest soil ingestion to body weight ratio (80 mg/16.5 kg = 4.86 mg soil/kg body weight per day). Soil ingestion rates for the infant, child, teen and adult are 2.4 mg/kg, 0.61 mg/kg, 0.34 mg/kg and 0.28 mg/kg respectively. Potential exposures from the incidental ingestion of soil and dermal contact were incorporated into the interim screening criterion for picloram as shown in Equation C-1. To be consistent with Health Canada requirements, the interim screening criterion of 442 µg/g is based on a hazard acceptability benchmark of 0.2.

$$Exposure = Incidental_Soil_Ingestion + Dermal_Contact$$

$$EQ\ C-1: \quad Exposure = \frac{C_{soil} \times IR \times EF}{BW \times ED \times CF} + \frac{C_{soil} \times SA \times SAF \times DAF \times EF}{BW \times ED \times CF} = \frac{C_{soil} \times EF \times (IR + (SA \times SAF \times DAF))}{BW \times ED \times CF}$$

$$C_{soil} = \frac{Exposure \times BW \times ED \times CF}{EF \times (IR + (SA \times SAF \times DAF))}$$

$$C_{soil} = \frac{\frac{20\mu g}{kg - day} \times \frac{16.5kg}{year} \times \frac{365days}{year} \times \frac{10^6 \mu g}{g}}{\frac{365days}{year} \times \left(\frac{80,000\mu g}{day} + \left(\frac{3010cm^2}{day} \times \frac{23\mu g}{cm^2} \times 1 \right) \right)} = 2210\mu g / g$$

$$C_{soil} = 2.20\mu g / g \times Hazard_Benchmark(0.2) = 442\mu g / g$$

Where:

Exposure	= Exposure (TRV)	20 µg/kg-day
C _{soil}	= Screening Criterion in Soil	µg/g
IR	= Incidental soil ingestion rate	80,000 µg/day (80 mg/day)
EF	= Exposure Frequency	365 days/year
ED	= Exposure Duration	365 days/year
SA	= Exposed skin surface area	3010 cm ² /day
SAF	= Soil Adhesion Factor	23 µg/cm ²
DAF	= Dermal Absorption Factor	1 (unitless)
BW	= Body Weight	16.5 kg
CF	= µg to g conversion factor	10 ⁶

2.4 Summary of Soil Screening Criteria

A summary of the screening criteria used to identify chemicals of concern for the HHRA for CFB Gagetown, the land-use designation, and the source agencies, is provided below.

Summary of Soil Screening Criteria for Use in the CFB Gagetown HHRA

Chemical	Screening Value		Source Agency
	Residential Land Use (µg/g)	Industrial Land Use (µg/g)	
Diquat	34	450	US EPA, 2006
Paraquat	70	920	US EPA, 2006
PCDD/PCDF TEQ	4.0 (pg TEQ/g)	4.0 (pg TEQ/g)	CCME, 2004
1,2,3,4-Tetrachlorobenzene	4.7	61	Surrogate Value
1,2,3,5+1,2,4,5-Tetrachlorobenzene	4.7	61	US EPA, 2006
1,2,4-Trichlorobenzene	30	30	MOE, 2004
2,4,5-T	160	2,000	US EPA, 2006
2,4,5-Trichlorophenol	3.2	3.2	MOE, 2004
2,4-D	160	2,000	US EPA, 2006
Dalapon	470	610	US EPA, 2006
Dicamba	469	6,100	US EPA, 2006
Dinoseb	16	200	US EPA, 2006
Hexachlorobenzene	0.46	0.76	MOE, 2004
Hexachlorobutadiene	0.38	0.38	MOE, 2004
Hexachlorocyclopentadiene	94	1,200	US EPA, 2006
Hexachloroethane	3.8	3.8	MOE, 2004
Pentachlorobenzene	13	160	US EPA, 2006
Pentachlorophenol	7.6	7.6	CCME, 2004
Picloram	442	442	Interim value
Silvex (2,4,5-TP)	130	1,600	US EPA, 2006

3 Screening Criteria for Chemicals in Groundwater and Surface Water

Health Canada and other regulatory agencies have not developed human health based screening criteria for non-potable groundwater or recreational surface water use. Human health based screening criteria are available for potable water use. In Canada, these take the general form of Canadian Drinking Water Quality Guidelines. Where these values are available for the contaminants of concern at CFB Gagetown, these values have been used. A summary of the screening criteria from the CCME and those that have been adopted from other agencies is provided below. The CCME drinking water guidelines are based on the Canadian Drinking Water Quality Guidelines. These drinking water guidelines do not incorporate a Hazard Index of 0.2. Therefore, drinking water screening criteria from the MOE and the US EPA have been used without modification.

Screening Criteria for Contaminants in Potable Water

Chemical	Screening Value (µg/L)	Source Agency
Diquat	70	CCME, 2004
Paraquat	10	CCME, 2004
TEQ	0.015	CCME, 2004
Bromoxynil	5	CCME, 2004
Diuron	150	CCME, 2004
Glyphosate	280	CCME, 2004
1,2,3,4-Tetrachlorobenzene	11	Surrogate Value
1,2,3,5+1,2,4,5-Tetrachlorobenzene	11	CCME, 2004
1,2,4-Trichlorobenzene	70	MOE, 2004
2,4,5-T	370	US EPA, 2006
2,4,5-Trichlorophenol	200	MOE, 2004
2,4-D	100	CCME, 2004
Dalapon	1,100	US EPA, 2006
Dicamba	120	CCME, 2004
Dichlofop Methyl	9	CCME, 2004
Dinoseb	10	CCME, 2004
Hexachlorobenzene	0.62	MOE, 2004
Hexachlorobutadiene	0.45	MOE, 2004
Hexachlorocyclopentadiene	2.5	MOE, 2004
Hexachloroethane	4.80	US EPA, 2006
Pentachlorobenzene	29	CCME, 2004
Pentachlorophenol	60	CCME, 2004
Picloram	190	CCME, 2004
Silvex (2,4,5-TP)	290	US EPA, 2006

Drinking water screening criteria are available for hexachlorobenzene, pentachlorobenzene and 1,2,4,5-tetrachlorobenzene. A screening criterion could not be located for 1,2,3,5-tetrachlorobenzene. In the absence of a criterion specifically for 1,2,3,4-tetrachlorobenzene, the screening criteria for 1,2,4,5-tetrachlorobenzene have been used as a surrogate screening value.

The chemical analysis of groundwater and surface water presented in the ESA lists several chemicals for which drinking water screening criteria are not available from the CCME, the MOE or the US EPA. These chemicals include:

- 1,2,3-Trichlorobenzene;
- 1,3,5-Trichlorobenzene;
- 2,3,6-Trichlorotoluene;
- 2,6-Dichlorobenzylchloride;
- Dichloroprop (2,4-DP);
- Octachlorostyrene

These chemicals were reported as *Not Detected* (ND) in all groundwater and surface water samples collected on CFB Gagetown. Therefore, these chemicals are considered not to be present and do not need to be considered further in the HHRA.

4 References

CCME, 2004

Canadian Environmental Quality Guidelines, Canadian Council of Ministers of the Environment. 2004.

ESA, 2006

Environmental Site Assessment of CFB Gagetown, N.B.: Task 2B- Stage 3, Field Program, Report prepared for Public Works and Government Services Canada on behalf of the Department of National Defence, Jacques Whitford, May 19, 2006

Health Canada, 1990

Canadian Drinking Water Quality Guideline Supporting Documentation for Picloram, http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/picloram-piclorame/index_e.html

Health Canada, 2004

Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) and Part II: Health Canada Toxicological Reference Values (TRVs). Health Canada, 2004 ISBN 0-662-38244-7 http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_i/index_e.html

MOE, 1996

Rationale for the Development and Application of Generic Soil, Groundwater and Sediment Criteria for Use at Contaminated Sites in Ontario, Ontario Ministry of the Environment, December 1996. PIBS 3250E01

MOE, 2004

Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Ontario Ministry of the Environment, March, 2004 <http://www.ene.gov.on.ca/envision/gp/4697e.pdf>

USEPA RIII, 2006

Risk Based Concentration Tables, United States Environmental Protection Agency, Region III, April 2006. <http://www.epa.gov/reg3hwmd/risk/human/index.htm>

USEPA, 1992

United States Environmental Protection Agency: Integrated Risk Information System (IRIS). Substance File for Picloram, May, 1992. <http://www.epa.gov/iris/subst/0256.htm>