

5. SCREENING-LEVEL EXPOSURE ESTIMATE AND RISK CALCULATION (ERAGS STEP 2)

The screening-level exposure estimate and risk calculation comprises the second step of ecological risk screening and was conducted consistent with USEPA guidance (USEPA, 1997a). Risk to receptors is estimated by comparing maximum documented exposure concentrations with the ecotoxicity screening values selected in Step 1 (Chapter 4, Section 4.2). The screening-level assessment serves to identify exposure pathways and contaminants of potential concern (COPCs) for the BERA by eliminating those contaminants and exposure pathways that pose negligible risks (USEPA, 1997a). These estimates ensure that the appropriate COCs are selected for further evaluation, and identifies data gaps for additional sampling or uncertainties to be addressed in the BERA.

5.1 Screening-Level Exposure Estimates

5.1.1 Ratios of Contaminants to Screening Criteria

The screening evaluation was conducted by comparing the maximum detected concentration, or half of the maximum detection limit, for each medium with the minimum (i.e., most conservative) screening criterion available (Chapter 3, Section 3.4). Screening values were selected based on availability and applicability to the site and to the freshwater environment and can be found in Chapter 4, Tables 4-3 to 4-9. The data used in the screening evaluations include the analytical results for surface water, sediment, soil, and fish tissue samples collected for the RI/FS by Honeywell in 1992, 1999, and 2000, and NYSDEC fish data collected between 1992 and 2000, and NYSDEC wetland data collected in 2002. A contaminant was selected for further examination when the ratio of the maximum detected concentration, or half of the detection level, to the minimum screening criterion equaled or exceeded 1.0 (unity). Food-web modeling was used to screen contaminants for the avian and mammalian receptors identified in Chapter 4, Section 4.1.2, as described below.

5.1.2 Food-Web Modeling

Screening-level exposure estimates were calculated for avian and mammalian receptors using the conservative exposure parameters listed in Tables 5-1 and 5-2 and the toxicity reference values (TRVs) selected in Chapter 4, Section 4.2 (Tables 4-10 and 4-11). The minimum adult weight found in the literature for each receptor species was used as the body weight.

Food ingestion rates (FIRs) were calculated in grams of dry matter per day using the following equations from Nagy (1987):

$$\text{FIR (g/day)} = 0.648 \text{ Wt.}^{0.651}(\text{g}) \quad \text{all birds}$$

$$\text{FIR (g/day)} = 0.235 \text{ Wt.}^{0.822}(\text{g}) \quad \text{all mammals}$$

Water ingestion rates (WIRs) were calculated using the following equations from Calder and Braun (1983):

$$\text{WIR (L/day)} = 0.059 \text{ Wt.}^{0.67}(\text{kg}) \quad \text{all birds}$$

$$\text{WIR (L/day)} = 0.099 \text{ Wt.}^{0.90}(\text{kg}) \quad \text{all mammals}$$

Sediment ingestion rates (SIRs) were based on Beyer et al. (1994), or professional judgment if a value was not available in Beyer for a species.

FIRs, WIRs, and SIRs are presented in Table 5-1 for birds and in Table 5-2 for mammals. All ingestion rates were divided by receptor body weights to provide intake rates per kg of body weight per day.

The general structure of the model used to estimate the exposure rate for a given chemical by a wildlife receptor is as follows:

$$\text{EED} = \sum \left(\text{IR}_p \times [\text{COC}]_p + \text{IR}_w \times [\text{COC}]_w + \text{IR}_s \times [\text{COC}]_s \right)$$

where:

EED = estimated environmental dose (mg/kg body weight-day)

IR_p (or FIR) = receptor-specific prey FIR (kg dry weight/kg body weight-day)

IR_w (or WIR) = receptor-specific WIR (L/kg body weight-day)

IR_s (or SIR) = receptor-specific incidental SIR (kg dry weight/kg body weight-day)

$[\text{COC}]_p$ = COC concentration in the receptors' prey (mg/kg dry weight)

$[\text{COC}]_w$ = COC concentration in the receptors' drinking water (mg/L)

$[\text{COC}]_s$ = COC concentration in incidentally ingested sediments or soil (mg/kg dry weight)

The estimated environmental dose for each COC was divided by its TRV to calculate the hazard quotient (HQ).

5.2 Screening-Level Risk Calculations and Results

Appendix D presents the detailed results of the screening-level risk calculations conducted to identify potential COPCs for the BERA. The introduction to Appendix D contains a summary of the information contained within and the methods used in its calculations. Appendix E provides figures comparing detected levels of contaminants in Onondaga Lake surface sediments to NYSDEC sediment screening criteria (NYSDEC, 1999b).

Substances for which maximum detected site concentrations in surface water, sediment, soil, or fish tissue exceeded the lowest available screening values, or had HQs equal to or greater than 1.0, were considered COPCs and were retained for further evaluation in this BERA (Chapter 6, Section 6.1), as follows:

- Table 5-3 presents contaminants with screening ratios greater than 1.0 in Onondaga Lake surface water.
- Table 5-4 presents ratios greater than 1.0 in tributaries of Onondaga Lake for base, intermediate, and high flows. Since the tributaries of Onondaga Lake are not considered part of the site being evaluated by this BERA and therefore were not used to select COPCs, these data are provided for information only.
- Sediment screening ratios exceeding 1.0 are presented in Table 5-5.
- Soil screening ratios exceeding 1.0 are presented in Table 5-6.
- Plant screening ratios greater than 1.0 are presented in Table 5-7.
- Fish ratios greater than 1.0 are presented in Table 5-8.
- Food-web modeling results are summarized for avian and mammalian receptors in Table 5-9.
- Table 5-10 provides a summary of the contaminants exceeding HQs in the various media/receptors screened.

Based on the results of the screening-level ecological risk calculations summarized in Tables 5-3 to 5-10, it was determined that the contaminants from the site pose the risk of potential adverse effects. Therefore, the decision was made to continue with Steps 3 through 7 of the ecological risk assessment process (Chapters 6 through 11 of this report).