Appendix H

Calculation of Risk-Based Concentrations for Wildlife for the Baseline Ecological Risk Assessment

Halaco Superfund Site, Oxnard, California

Remedial Investigation

Prepared for

U.S. Environmental Protection Agency Region 9

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Acronyms and Abbreviations

AUF	area use factor
BAF	bioaccumulation factor
BERA	baseline ecological risk assessment
COPEC	constituent of potential ecological concern
FIR	food ingestion rate
Halaco	Halaco Engineering Co.
HQ	hazard quotient
kg	kilogram(s)
L	liter(s)
LOAEL	lowest observed adverse effect level
mg/kg	milligrams per kilogram
mg/kg/day	milligrams per kilograms per day
mg/L	milligrams per liter
NiPERA	Nickel Producers Environmental Research Association
$NiSO^4$	nickel sulfate
NOAEL	no observed adverse effect level
RAF	relative absorption factor
RBC	Risk-based concentration
Site	Halaco Engineering Co. Superfund Site
TRV	toxicity reference value
WIR	water ingestion rate

APPENDIX H

Calculation of Risk-Based Concentrations for Wildlife

H.1 Objectives

Risk-based concentrations (RBCs) for wildlife are media concentrations associated with exposure equal to the no observed adverse effect level (NOAEL) or the lowest observed adverse effect level (LOAEL). Exposure and risk estimate equations for California vole, ornate shrew Belding's savannah sparrow (aquatic- and terrestrial-feeding), and western snowy plover were back-calculated to obtain an applicable RBC for soil or sediment.

RBCs were calculated using the following generalized exposure model modified from Suter et al. (2000):

$$E_t = \left[\left[\sum_{i=1}^{n} B_{ij} \times P_i \times FIR\right] + \left[Soil_j \times P_s \times FIR\right] + \left[Water_j \times WIR\right]\right] x\, AUF$$

Where:

E_t	=	total exposure (milligrams per kilograms per day [mg/kg/day])
$Soil_j$	=	chemical concentration in sediment/soil (milligrams per kilogram [mg/kg] dry weight)
P_s	=	sediment/soil ingestion rate as proportion of diet (unitless)
FIR	=	food ingestion rate (kilograms [kg] food/kg body weight/day)
B_{ij}	=	chemical concentration in biota type (i) (mg/kg wet weight)
P_i	=	proportion of biota type (i) in diet (unitless)
$Water_j$	=	chemical concentration in water (milligrams per liter [mg/L])
WIR	=	water ingestion rate (liters [L] water/kg body weight/day)
AUF	=	area use factor (area of site/home range of receptor) (unitless)

Site-use was assumed to be 100 percent (AUF = 1); therefore, the AUF was removed from the equation. Because the remedial investigation data did not identify a clear impact from the former Halaco Engineering Co. (Halaco) operations to surface water and a soil or sediment RBC was calculated, the water portion of this equation was also removed and the equation rewritten as follows:

$$E_t = \left[\left[\sum_{i=1}^{n} B_{ij} \times P_i \times FIR\right] + \left[Soil_j \times P_s \times FIR\right]\right]$$

Model Parameterization

Life History Parameters: The specific life history parameters required to estimate exposure of each receptor to constituents of potential ecological concern (COPECs) include body weight, ingestion rates of food and water, dietary components and percentage of the overall diet represented by each major food type, and approximate amount of soil and/or sediment that may be incidentally ingested based on feeding habits. These parameters, as well as foraging or home range information, were obtained from the literature and are presented in Table 6-1 of the main text of the baseline ecological risk assessment (BERA).

Bioaccumulation Models: Site-specific bioaccumulation factors (BAFs; ratio between biota concentration and soil/sediment concentration) are needed to estimate biota concentrations (B_{ij}). BAFs were calculated for bioaccumulation to benthic invertebrates from sediment and for bioaccumulation to terrestrial

invertebrates from soil using soil, sediment, and biota collected at the Halaco Engineering Co. Superfund Site (Halaco Site, or Site). Sufficient data were available to develop models for two types of terrestrial invertebrates: arthropods and molluscs (snails). For analytes and food types (for example, plants) lacking site-specific data, bioaccumulation models derived from the literature were applied to develop risk estimates. Significant regressions or median BAFs were used. (Note: in cases where the regression model was not recommended by the study authors, the BAF was used.) The site-specific and literature-based bioaccumulation models that describe uptake from sediment-to-aquatic or benthic invertebrates, soil-to-plants, soil-to-terrestrial invertebrates (arthropods), and soil-to-terrestrial invertebrates (molluscs) are presented in Tables 6-2, 6-3, 6-4, and 6-5 in the main text of the BERA.

The resulting total oral dose from this equation (that is, the exposure) is then divided by the NOAEL or LOAEL to obtain either a NOAEL-based hazard quotient (HQ) or a LOAEL-based HQ (that is, the risk). To calculate the RBC, the exposure and risk calculation is solved by determining the soil or sediment concentration that results in either a NOAEL HQ or LOAEL HQ of 1.0. This was done in Microsoft Excel using the goal seek function where the HQ is set to 1 and the equations are solved by changing the soil or sediment concentration.

Tables H-1 through H-8 show the exposure and risk estimates for each bird and mammal receptor with the calculated RBC assuming either a NOAEL HQ of 1.0 or a LOAEL HQ of 1.0. RBCs were calculated using NOAELs for the special-status birds (Tables H-3, H-5, and H-7) and LOAELs for the mammals (Tables H-1 and H-2). To better quantify risk ranges at the Halaco Site, LOAEL-based RBCs were also calculated for special-status avian species (Tables H-4, H-6, and H-8). RBCs for each bird and mammal receptor are summarized in Table H-9.

Bioavailability: The preceding RBC calculations assume 100 percent bioavailability of analytes. However, COPECs present in media consumed by wildlife receptors are not absorbed with perfect (100 percent) efficiency; to assume so overestimates both exposure and risk. Instead, the absorption efficiency or bioavailability of a chemical varies as a function of many factors, including the chemical form of the COPEC, medium in which the COPEC is present, interactions with other COPECs, interactions with ingested food, the environment within the receptor's gastrointestinal tract, etc. The following bioavailability information was available in the open literature:

- **Copper** – In mammals, oral absorption of copper decreases as intake increases (Hrudey et al., 1995). The highest rates of copper absorption (71 percent) were observed when copper deficiency in the diet was present. Absorption of copper was 20 to 40 percent when present at daily-required levels. Turnlund et al. (1985, 1989) reported a range of 30 to 40 percent bioavailability for copper from a typical diet for humans in industrialized countries. These studies used stable isotopes to determine the percent of copper absorbed. Data for birds were not located; for the purposes of developing RBCs, bioavailability of copper to birds and mammals was assumed to be 40 percent.
- **Lead** – Bioavailability studies conducted in Idaho in the Coeur d'Alene Basin (another area affected by mining activities) were available for lead for both birds and mammals. Maddaloni et al. (1998) evaluated lead bioavailability in the Coeur d'Alene Basin by dosing human volunteers with lead-contaminated soil. Fasted individuals absorbed 26.2 percent of ingested lead, but only 2.52 percent was absorbed by individuals who had eaten prior to ingesting lead. For the purposes of developing RBCs, lead bioavailability for mammals was assumed to be 26.2 percent. Hoffman et al. (2000) fed mallard ducklings diets containing lead-contaminated sediments from the Coeur d'Alene Basin and an equivalent concentration of lead acetate for 6 weeks. Concentrations of lead in blood, liver, and kidney were measured in both sets of birds. Lead concentrations in all three tissues were 2.01 to 2.25 times higher in birds exposed to lead acetate as compared to those exposed to contaminated sediments. This indicates that the bioavailability of lead in sediment is about 50 percent relative to lead acetate. For the purposes of developing RBCs, lead bioavailability for birds was assumed to be 50 percent.

- **Nickel** – An approach to determining more realistic exposure estimates in risk assessment was presented by the Nickel Producers Environmental Research Association (NiPERA) of the Nickel Institute (NiPERA, 2013). This approach considers bioavailability, which is accounted for by relative absorption factors (RAFs). These factors were developed by comparing absorption between a standard nickel test compound (for example, nickel sulfate [$NiSO^4$]) and the relevant exposure matrix (for example, soil or food). RAFs for mammals were presented as 2.4 percent for soil and 10 percent for diet (for example, earthworms). In the Halaco BERA, avian and mammalian toxicity reference values (TRVs) for nickel are based on nickel chloride. It was assumed the ratio of absorption between $NiSO^4$ and soil or diet is similar to that of absorption between nickel chloride and soil or diet. Avian RAFs were not available; for the purposes of calculating RBCs, bioavailability of nickel to birds and mammals was assumed to be 2.4 percent of soil and 10 percent of diet.
- **Barium, Selenium, and Zinc** – Finally, Owen (1990) reported the oral bioavailability of barium, selenium, and zinc in mammals to be 10, 60, and 50 percent, respectively. Data for birds were unavailable; therefore, for the purposes of calculating RBCs, bioavailability of barium, selenium, and zinc to birds and mammals was assumed to be 10, 60, and 50 percent, respectively.

To account for the bioavailability of COPECs at the Site being less than 100 percent, total exposure estimates for analytes with bioavailability data, except nickel, were adjusted by bioavailability fractions specific for each COPEC determined to be a risk. For nickel only, the total exposure from the diet was adjusted using literature-based dietary bioavailability data and exposure from soil or sediment was adjusted using literature-based soil bioavailability data. RBCs were then recalculated using the literature-based bioavailability information. Note that bioavailability may differ between soil or sediment and diet. For the purpose of this assessment, unless otherwise stated (that is, for nickel), all ingested media were pooled and only a single bioavailability value was employed.

Tables H-10 through H-14 show the exposure and risk estimates for each bird and mammal receptor with the calculated RBC assuming a LOAEL HQ of 1.0. The LOAEL was used for birds in these bioavailability-adjusted RBCs because population data indicate risks are unlikely. Bioavailability-adjusted RBCs for each bird and mammal receptor are summarized in Table H-15. Of the analytes with bioavailability data (copper, lead, nickel, barium, selenium, and zinc), only those analytes that were determined to be a potential risk in the BERA are included in the bioavailability-adjusted RBC table for each receptor.

H.2 References

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Tables

TABLE H-1

LOAEL-Based California Vole Risk-Based Concentrations (mg/kg)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Plant Uptake				Soil Uptake			TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	**RBC[a]**	**Body Weight (kg)**	**Food Intake (kg/kg-BW/day)**	**Area Use Factor**	**Daily Food Ingestion from Site (kg/kg-BW/day)**	**Diet Proportion**	**Soil to Plant BAF**	**Plant Concentration (mg/kg)**	**Plant Dose (mg/kg-BW/day)**	**Diet Proportion**	**Incidental Soil Dose (mg/kg-BW/day)**	**Total Dose (kg/kg-BW/day)**	**NOAEL**	**LOAEL**	**NOAEL HQ**	**LOAEL HQ**
Aluminum	3487	0.043	0.206	1	0.206	1	0.00287	10.01	2.1	0.024	17.24	19.30	1.93	19.3	10.00	1.00
Antimony	52.2	0.043	0.206	1	0.206	1	Regression	1.61	0.3	0.024	0.26	0.59	0.059	0.59	10.00	1.00
Arsenic	131	0.043	0.206	1	0.206	1	0.0375	4.91	1.0	0.024	0.65	1.66	1.04	1.66	1.60	1.00
Barium	2023	0.043	0.206	1	0.206	1	0.156	315.53	65.0	0.024	10.00	75.00	51.8	75	1.45	1.00
Beryllium[b]	6.90	0.043	0.206	1	0.206	1	Regression	2.42	0.5	0.024	0.034	0.53	0.532	NA	1.00	NA
Cadmium	661	0.043	0.206	1	0.206	1	Regression	21.53	4.4	0.024	3.27	7.70	0.77	7.7	10.00	1.00
Chromium	718	0.043	0.206	1	0.206	1	0.041	29.46	6.1	0.024	3.55	9.62	2.4	9.62	4.01	1.00
Cobalt	1680	0.043	0.206	1	0.206	1	0.0075	12.60	2.6	0.024	8.30	10.90	7.33	10.9	1.49	1.00
Copper	773	0.043	0.206	1	0.206	1	Regression	26.82	5.5	0.024	3.82	9.35	5.6	9.34	1.67	1.00
Lead	1208	0.043	0.206	1	0.206	1	Regression	14.20	2.9	0.024	5.97	8.90	4.7	8.9	1.89	1.00
Manganese	3346	0.043	0.206	1	0.206	1	0.079	264.35	54.5	0.024	16.54	71.00	51.5	71	1.38	1.00
Mercury	3.23	0.043	0.206	1	0.206	1	Regression	0.70	0.1	0.024	0.016	0.16	0.032	0.16	5.00	1.00
Nickel	337	0.043	0.206	1	0.206	1	Regression	8.41	1.7	0.024	1.67	3.40	1.7	3.4	2.00	1.00
Selenium	1.85	0.043	0.206	1	0.206	1	Regression	1.00	0.2	0.024	0.009	0.22	0.143	0.215	1.50	1.00
Silver	7690	0.043	0.206	1	0.206	1	0.014	107.66	22.2	0.024	38.02	60.20	6.02	60.2	10.00	1.00
Thallium	13.0	0.043	0.206	1	0.206	1	0.004	0.05	0.0	0.024	0.064	0.07	0.015	0.075	5.00	1.00
Vanadium	1398	0.043	0.206	1	0.206	1	0.00485	6.78	1.4	0.024	6.91	8.31	4.16	8.31	2.00	1.00
Zinc	1932	0.043	0.206	1	0.206	1	Regression	321.96	66.3	0.024	9.55	75.88	75.4	75.9	1.01	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

[b] RBC determined by back-calculation of the exposure and risk equation to achieve a NOAEL HQ of 1.0 because a LOAEL was lacking.

TABLE H-2

LOAEL-Based Ornate Shrew Risk-Based Concentrations (mg/kg)

Baseline Ecological Risk Assessment

Halaco Site, Oxnard, California

		Life History Parameters				Invertebrate Uptake				Soil Uptake			TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	**RBC[a]**	**Body Weight (kg)**	**Food Intake (kg/kg-BW/day)**	**Area Use Factor**	**Daily Food Ingestion from Site (kg/kg-BW/day)**	**Diet Proportion**	**Soil to Invertebrate BAF**	**Invertebrate Concentration (mg/kg)**	**Invertebrate Dose (mg/kg-BW/day)**	**Diet Proportion**	**Incidental Soil Dose (mg/kg-BW/day)**	**Total Dose (kg/kg-BW/day)**	**NOAEL**	**LOAEL**	**NOAEL HQ**	**LOAEL HQ**
Aluminum	220	0.005	0.259	1	0.259	1	0.308	67.83	17.6	0.03	1.713017751	19.3	1.93	19.3	10.00	1.00
Antimony	2.21	0.005	0.259	1	0.259	1	1	2.21	0.6	0.03	0.017184466	0.590	0.059	0.59	10.00	1.00
Arsenic	70.0	0.005	0.259	1	0.259	1	0.06146	4.30	1.1	0.03	0.544500328	1.66	1.04	1.66	1.60	1.00
Barium	246	0.005	0.259	1	0.259	1	1.148	281.91	73.1	0.03	1.910016978	75.0	51.8	75	1.45	1.00
Beryllium[b]	27.4	0.005	0.259	1	0.259	1	0.045	1.23	0.3	0.03	0.2128	0.532	0.532	NA	1.00	NA
Cadmium	8.73	0.005	0.259	1	0.259	1	3.371	29.44	7.6	0.03	0.0679212	7.70	0.77	7.7	10.00	1.00
Chromium	78.9	0.005	0.259	1	0.259	1	0.44	34.74	9.0	0.03	0.614042553	9.620	2.4	9.62	4.01	1.00
Cobalt	277	0.005	0.259	1	0.259	1	0.122	33.74	8.7	0.03	2.151315789	10.9	7.33	10.9	1.49	1.00
Copper	16.8	0.005	0.259	1	0.259	1	2.113	35.52	9.2	0.03	0.130751283	9.34	5.6	9.34	1.67	1.00
Lead	53.4	0.005	0.259	1	0.259	1	0.613	32.73	8.5	0.03	0.415241058	8.90	4.7	8.9	1.89	1.00
Manganese	700	0.005	0.259	1	0.259	1	0.361	252.84	65.6	0.03	5.447570332	71.0	51.5	71	1.38	1.00
Mercury	0.27	0.005	0.259	1	0.259	1	2.25	0.61	0.2	0.03	0.002105263	0.160	0.032	0.16	5.00	1.00
Nickel	10.8	0.005	0.259	1	0.259	1	1.189	12.79	3.3	0.03	0.083675144	3.40	1.7	3.4	2.00	1.00
Selenium	0.82	0.005	0.259	1	0.259	1	Regression	0.80	0.2	0.03	0.006406697	0.2	0.143	0.215	1.50	1.00
Silver	112	0.005	0.259	1	0.259	1	2.045	228.84	59.3	0.03	0.870361446	60.2	6.02	60.2	10.00	1.00
Thallium	3.44	0.005	0.259	1	0.259	1	0.0541	0.19	0.0	0.03	0.026753864	0.075	0.015	0.075	5.00	1.00
Vanadium	148	0.005	0.259	1	0.259	1	0.187	27.62	7.2	0.03	1.148847926	8.31	4.16	8.31	2.00	1.00
Zinc	239	0.005	0.259	1	0.259	1	1.195	285.58	74.0	0.03	1.85877551	75.9	75.4	75.9	1.01	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

[b] RBC determined by back-calculation of the exposure and risk equation to achieve a NOAEL HQ of 1.0 because a LOAEL was lacking.

TABLE H-3

NOAEL-Based Terrestrial-Feeding Belding's Savannah Sparrow Risk-Based Concentrations (mg/kg)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Plant Uptake				Arthropod				Mollusc				Soil Uptake			TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	RBC[a]	Body Weight (kg)	Food Intake (kg/kg-BW/day)	Area Use Factor	Daily Food Ingestion from Site (kg/kg-BW/day)	Diet Proportion	Soil to Plant BAF	Plant Concentration (mg/kg)	Plant Dose (mg/kg-BW/day)	Diet Proportion	Soil to Arthropod BAF	Arthropod Concentration (mg/kg)	Arthropod Dose (mg/kg-BW/day)	Diet Proportion	Soil to Mollusc BAF	Mollusc Concentration (mg/kg)	Mollusc Dose (mg/kg-BW/day)	Diet Proportion	Incidental Soil Dose (mg/kg-BW/day)	Total Dose (kg/kg-BW/day)	NOAEL	LOAEL	NOAEL HQ	LOAEL HQ
Aluminum	2596	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.124	0.45	0.308	799.47	89.6	0.05	0.219	568.45	7.08	0.02	12.93	109.7	109.7	NA	1.00	NA
Arsenic	582	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.124	0.45	0.06146	35.74	4.00	0.05	0.31429	182.77	2.28	0.02	2.90	9.30	9.3	40.3	1.00	0.23
Barium	122	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.124	0.45	1.148	140.48	15.7	0.05	2.84	347.53	4.33	0.02	0.61	20.8	20.8	41.7	1.00	0.50
Cadmium	2.85	0.0187	0.249	1	0.249	0.5	Regression	1.10	0.137	0.45	3.371	9.61	1.08	0.05	6.837	19.48	0.24	0.02	0.0142	1.47	1.47	2.37	1.00	0.62
Chromium	41.0	0.0187	0.249	1	0.249	0.5	0.041	1.68	0.209	0.45	0.44	18.05	2.02	0.05	0.44	18.05	0.22	0.02	0.20	2.66	2.66	2.78	1.00	0.96
Cobalt	361	0.0187	0.249	1	0.249	0.5	0.0075	2.70	0.337	0.45	0.122	44.00	4.93	0.05	0.122	44.00	0.55	0.02	1.80	7.61	7.61	7.8	1.00	0.98
Copper	10.2	0.0187	0.249	1	0.249	0.5	Regression	4.88	0.607	0.45	2.113	21.57	2.42	0.05	7.681	78.39	0.98	0.02	0.0508	4.05	4.05	12.1	1.00	0.33
Lead	18.3	0.0187	0.249	1	0.249	0.5	Regression	1.35	0.168	0.45	0.613	11.21	1.26	0.05	0.5	9.15	0.11	0.02	0.0911	1.63	1.63	3.26	1.00	0.50
Manganese	2959	0.0187	0.249	1	0.249	0.5	0.079	233.73	29.1	0.45	0.361	1068.04	119.7	0.05	0.421	1245.55	15.51	0.02	14.73	179.0	179	348	1.00	0.51
Mercury	0.176	0.0187	0.249	1	0.249	0.5	Regression	0.14	0.018	0.45	2.25	0.40	0.044	0.05	2.25	0.40	0.0049	0.02	0.0009	0.068	0.068	0.37	1.00	0.18
Nickel	42.4	0.0187	0.249	1	0.249	0.5	Regression	1.78	0.222	0.45	1.189	50.42	5.65	0.05	1.189	50.42	0.63	0.02	0.21	6.71	6.71	11.5	1.00	0.58
Selenium	1.68	0.0187	0.249	1	0.249	0.5	Regression	0.90	0.112	0.45	Regression	1.36	0.152	0.05	Regression	1.36	0.02	0.02	0.0084	0.3	0.29	0.579	1.00	0.50
Silver	7.73	0.0187	0.249	1	0.249	0.5	0.014	0.11	0.013	0.45	2.045	15.81	1.77	0.05	2.045	15.81	0.20	0.02	0.0385	2.02	2.02	20.2	1.00	0.10
Vanadium	11.3	0.0187	0.249	1	0.249	0.5	0.00485	0.05	0.007	0.45	0.187	2.11	0.236	0.05	0.317	3.58	0.04	0.02	0.0562	0.34	0.344	0.688	1.00	0.50
Zinc	293	0.0187	0.249	1	0.249	0.5	Regression	112.96	14.1	0.45	1.195	349.85	39.2	0.05	3.122	913.99	11.38	0.02	1.46	66.1	66.1	66.5	1.00	0.99

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a NOAEL HQ of 1.0.

TABLE H-4

LOAEL-Based Terrestrial-Feeding Belding's Savannah Sparrow Risk-Based Concentrations (mg/kg)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Plant Uptake				Arthropod				Mollusc				Soil Uptake			TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	RBC[a]	Body Weight (kg)	Food Intake (kg/kg-BW/day)	Area Use Factor	Daily Food Ingestion from Site (kg/kg-BW/day)	Diet Proportion	Soil to Plant BAF	Plant Concentration (mg/kg)	Plant Dose (mg/kg-BW/day)	Diet Proportion	Soil to Invertebrate BAF	Invertebrate Concentration (mg/kg)	Invertebrate Dose (mg/kg-BW/day)	Diet Proportion	Soil to Arthropod BAF	Arthropod Concentration (mg/kg)	Arthropod Dose (mg/kg-BW/day)	Diet Proportion	Incidental Soil Dose (mg/kg-BW/day)	Total Dose (kg/kg-BW/day)	NOAEL	LOAEL	NOAEL HQ	LOAEL HQ
Aluminum[b]	2596	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.124	0.45	0.308	799.47	89.6	0.05	0.219	568.45	7.08	0.02	12.93	109.7	109.7	NA	1.00	NA
Arsenic	2546	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.124	0.45	0.06146	156.49	17.53	0.05	0.31429	800.26	9.96	0.02	12.68	40.30	9.3	40.3	4.33	1.00
Barium	246	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.124	0.45	1.148	282.49	31.7	0.05	2.84	698.84	8.70	0.02	1.23	41.7	20.8	41.7	2.00	1.00
Cadmium	4.68	0.0187	0.249	1	0.249	0.5	Regression	1.44	0.180	0.45	3.371	15.77	1.77	0.05	6.837	31.99	0.40	0.02	0.0233	2.37	1.47	2.37	1.61	1.00
Chromium	42.9	0.0187	0.249	1	0.249	0.5	0.041	1.76	0.219	0.45	0.44	18.86	2.11	0.05	0.44	18.86	0.23	0.02	0.21	2.78	2.66	2.78	1.05	1.00
Cobalt	370	0.0187	0.249	1	0.249	0.5	0.0075	2.77	0.345	0.45	0.122	45.10	5.05	0.05	0.122	45.10	0.56	0.02	1.84	7.80	7.61	7.8	1.02	1.00
Copper	33.0	0.0187	0.249	1	0.249	0.5	Regression	7.74	0.964	0.45	2.113	69.75	7.82	0.05	7.681	253.56	3.16	0.02	0.1644	12.10	4.05	12.1	2.99	1.00
Lead	37.6	0.0187	0.249	1	0.249	0.5	Regression	2.03	0.252	0.45	0.613	23.06	2.58	0.05	0.5	18.81	0.23	0.02	0.1873	3.26	1.63	3.26	2.00	1.00
Manganese	5752	0.0187	0.249	1	0.249	0.5	0.079	454.39	56.6	0.45	0.361	2076.41	232.6	0.05	0.421	2421.52	30.15	0.02	28.64	348.0	179	348	1.94	1.00
Mercury	1.126	0.0187	0.249	1	0.249	0.5	Regression	0.39	0.049	0.45	2.25	2.53	0.284	0.05	2.25	2.53	0.0315	0.02	0.0056	0.370	0.068	0.37	5.44	1.00
Nickel	73.0	0.0187	0.249	1	0.249	0.5	Regression	2.68	0.333	0.45	1.189	86.78	9.72	0.05	1.189	86.78	1.08	0.02	0.36	11.50	6.71	11.5	1.71	1.00
Selenium	3.64	0.0187	0.249	1	0.249	0.5	Regression	2.11	0.263	0.45	Regression	2.39	0.268	0.05	Regression	2.39	0.03	0.02	0.0181	0.6	0.29	0.579	2.00	1.00
Silver	77.30	0.0187	0.249	1	0.249	0.5	0.014	1.08	0.135	0.45	2.045	158.09	17.71	0.05	2.045	158.09	1.97	0.02	0.3849	20.20	2.02	20.2	10.00	1.00
Vanadium	22.6	0.0187	0.249	1	0.249	0.5	0.00485	0.11	0.014	0.45	0.187	4.22	0.473	0.05	0.317	7.16	0.09	0.02	0.1124	0.69	0.344	0.688	2.00	1.00
Zinc	295	0.0187	0.249	1	0.249	0.5	Regression	113.38	14.1	0.45	1.195	352.21	39.5	0.05	3.122	920.16	11.46	0.02	1.47	66.5	66.1	66.5	1.01	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

[b] RBC determined by back-calculation of the exposure and risk equation to achieve a NOAEL HQ of 1.0 because a LOAEL was lacking.

TABLE H-5

NOAEL-Based Aquatic-Feeding Belding's Savannah Sparrow Risk-Based Concentrations (mg/kg)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Plant Uptake				Benthic Invertebrate Uptake				Sediment Uptake			TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	RBC[a]	Body Weight (kg)	Food Intake (kg/kg-BW/day)	Area Use Factor	Daily Food Ingestion from Site (kg/kg-BW/day)	Diet Proportion	Sediment to Plant BAF	Plant Concentration (mg/kg)	Plant Dose (mg/kg-BW/day)	Diet Proportion	Sediment to Invertebrate BAF	Invertebrate Concentration (mg/kg)	Invertebrate Dose (mg/kg-BW/day)	Diet Proportion	Incidental Sediment Dose (mg/kg-BW/day)	Total Dose (kg/kg-BW/day)	NOAEL	LOAEL	NOAEL HQ	LOAEL HQ
Aluminum	17259	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.1	0.5	0.011	189.85	23.6	0.02	85.94	109.7	109.7	NA	1.00	NA
Arsenic	178	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.1	0.5	0.373	66.57	8.29	0.02	0.89	9.30	9.3	40.3	1.00	0.23
Barium	1318	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.1	0.5	0.086	113.36	14.1	0.02	6.56	20.8	20.8	41.7	1.00	0.50
Cadmium	17.69	0.0187	0.249	1	0.249	0.5	Regression	2.98	0.4	0.5	0.459	8.12	1.01	0.02	0.0881	1.47	1.47	2.37	1.00	0.62
Chromium	154.7	0.0187	0.249	1	0.249	0.5	0.041	6.34	0.8	0.5	0.057	8.82	1.10	0.02	0.77	2.66	2.66	2.78	1.00	0.96
Cobalt	361	0.0187	0.249	1	0.249	0.5	0.0075	2.70	0.3	0.5	0.122	44.00	5.48	0.02	1.80	7.61	7.61	7.8	1.00	0.98
Copper	132.2	0.0187	0.249	1	0.249	0.5	Regression	13.37	1.7	0.5	0.105	13.88	1.73	0.02	0.6581	4.05	4.05	12.1	1.00	0.33
Lead	80.5	0.0187	0.249	1	0.249	0.5	Regression	3.11	0.4	0.5	0.084	6.76	0.84	0.02	0.4010	1.63	1.63	3.26	1.00	0.50
Manganese	3217	0.0187	0.249	1	0.249	0.5	0.079	254.12	31.6	0.5	0.328	1055.07	131.3	0.02	16.02	179.0	179	348	1.00	0.51
Mercury	0.145	0.0187	0.249	1	0.249	0.5	Regression	0.13	0.0	0.5	2.837	0.41	0.051	0.02	0.0007	0.068	0.068	0.37	1.00	0.18
Nickel	262.2	0.0187	0.249	1	0.249	0.5	Regression	6.97	0.9	0.5	0.139	36.44	4.54	0.02	1.31	6.71	6.71	11.5	1.00	0.58
Selenium	0.56	0.0187	0.249	1	0.249	0.5	Regression	0.27	0.0	0.5	3.607	2.04	0.254	0.02	0.0028	0.3	0.29	0.579	1.00	0.50
Silver	7.73	0.0187	0.249	1	0.249	0.5	0.014	0.11	0.0	0.5	2.045	15.81	1.97	0.02	0.0385	2.02	2.02	20.2	1.00	0.10
Vanadium	27.4	0.0187	0.249	1	0.249	0.5	0.00485	0.13	0.0	0.5	0.056	1.53	0.191	0.02	0.1364	0.34	0.344	0.688	1.00	0.50
Zinc	441	0.0187	0.249	1	0.249	0.5	Regression	141.82	17.7	0.5	0.842	371.42	46.2	0.02	2.20	66.1	66.1	66.5	1.00	0.99
TEQ-Bird	9.99E-05	0.0187	0.249	1	0.249	0.5	0.26	0.00	0.0	0.5	0.85	8.49E-05	1.06E-05	0.02	4.97E-07	1.43E-05	0.0000143	0.000143	1.00	0.10

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TEQ-Bird = Toxic Equivalency Quotient for Birds (calculated using avian toxic equivalency factors)

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a NOAEL HQ of 1.0.

TABLE H-6

LOAEL-Based Aquatic-Feeding Belding's Savannah Sparrow Risk-Based Concentrations (mg/kg)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Plant Uptake				Benthic Invertebrate Uptake				Sediment Uptake			TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	RBC[a]	Body Weight (kg)	Food Intake (kg/kg-BW/day)	Area Use Factor	Daily Food Ingestion from Site (kg/kg-BW/day)	Diet Proportion	Sediment to Plant BAF	Plant Concentration (mg/kg)	Plant Dose (mg/kg-BW/day)	Diet Proportion	Sediment to Invertebrate BAF	Invertebrate Concentration (mg/kg)	Invertebrate Dose (mg/kg-BW/day)	Diet Proportion	Incidental Sediment Dose (mg/kg-BW/day)	Total Dose (kg/kg-BW/day)	NOAEL	LOAEL	NOAEL HQ	LOAEL HQ
Aluminum[b]	17259	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.1	0.5	0.011	189.85	23.6	0.02	85.94	109.7	109.7	NA	1.00	NA
Arsenic	781	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.1	0.5	0.373	291.46	36.28	0.02	3.89	40.30	9.3	40.3	4.33	1.00
Barium	2651	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.1	0.5	0.086	227.94	28.4	0.02	13.20	41.7	20.8	41.7	2.00	1.00
Cadmium	30.15	0.0187	0.249	1	0.249	0.5	Regression	3.99	0.5	0.5	0.459	13.84	1.72	0.02	0.1502	2.37	1.47	2.37	1.61	1.00
Chromium	161.8	0.0187	0.249	1	0.249	0.5	0.041	6.63	0.8	0.5	0.057	9.22	1.15	0.02	0.81	2.78	2.66	2.78	1.05	1.00
Cobalt	370	0.0187	0.249	1	0.249	0.5	0.0075	2.77	0.3	0.5	0.122	45.10	5.61	0.02	1.84	7.80	7.61	7.8	1.02	1.00
Copper	512.9	0.0187	0.249	1	0.249	0.5	Regression	22.82	2.8	0.5	0.105	53.85	6.70	0.02	2.5538	12.10	4.05	12.1	2.99	1.00
Lead	172.7	0.0187	0.249	1	0.249	0.5	Regression	4.77	0.6	0.5	0.084	14.51	1.81	0.02	0.8601	3.26	1.63	3.26	2.00	1.00
Manganese	6254	0.0187	0.249	1	0.249	0.5	0.079	494.04	61.5	0.5	0.328	2051	255.4	0.02	31.14	348.0	179	348	1.94	1.00
Mercury	0.911	0.0187	0.249	1	0.249	0.5	Regression	0.35	0.0	0.5	2.837	2.58	0.322	0.02	0.0045	0.370	0.068	0.37	5.44	1.00
Nickel	457.0	0.0187	0.249	1	0.249	0.5	Regression	10.56	1.3	0.5	0.139	63.53	7.91	0.02	2.28	11.50	6.71	11.5	1.71	1.00
Selenium	1.12	0.0187	0.249	1	0.249	0.5	Regression	0.57	0.1	0.5	3.607	4.03	0.502	0.02	0.0056	0.6	0.29	0.579	2.00	1.00
Silver	77.30	0.0187	0.249	1	0.249	0.5	0.014	1.08	0.1	0.5	2.045	158.09	19.68	0.02	0.3849	20.20	2.02	20.2	10.00	1.00
Vanadium	54.8	0.0187	0.249	1	0.249	0.5	0.00485	0.27	0.0	0.5	0.056	3.07	0.382	0.02	0.2729	0.69	0.344	0.688	2.00	1.00
Zinc	444	0.0187	0.249	1	0.249	0.5	Regression	142.37	17.7	0.5	0.842	374.03	46.6	0.02	2.21	66.5	66.1	66.5	1.01	1.00
TEQ-Bird	9.99E-04	0.0187	0.249	1	0.249	0.5	0.26	0.00	0.0	0.5	0.85	8.49E-04	1.06E-04	0.02	4.97E-06	1.43E-04	0.0000143	0.000143	10.00	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

TEQ-Bird = Toxic Equivalency Quotient for Birds (calculated using avian toxic equivalency factors)

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

[b] RBC determined by back-calculation of the exposure and risk equation to achieve a NOAEL HQ of 1.0 because a LOAEL was lacking.

TABLE H-7

NOAEL-Based Western Snowy Plover Risk-Based Concentrations (mg/kg)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Invertebrate Uptake				Sediment Uptake			TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	**RBC[a]**	**Body Weight (kg)**	**Food Intake (kg/kg-BW/day)**	**Area Use Factor**	**Daily Food Ingestion from Site (kg/kg-BW/day)**	**Diet Proportion**	**Sediment to Invertebrate BAF**	**Invertebrate Concentration (mg/kg)**	**Invertebrate Dose (mg/kg-BW/day)**	**Diet Proportion**	**Incidental Sediment Dose (mg/kg-BW/day)**	**Total Dose (kg/kg-BW/day)**	**NOAEL**	**LOAEL**	**NOAEL HQ**	**LOAEL HQ**
Aluminum	2891.482152	0.046	0.216	1	0.216	1	0.011	31.81	6.9	0.165	102.84	109.7	109.7	NA	1.00	NA
Arsenic	80.19129539	0.046	0.216	1	0.216	1	0.373	29.91	6.45	0.165	2.85	9.30	9.3	40.3	1.00	0.23
Barium	384.4290245	0.046	0.216	1	0.216	1	0.086	33.06	7.1	0.165	13.67	20.8	20.8	41.7	1.00	0.50
Cadmium	10.92846841	0.046	0.216	1	0.216	1	0.459	5.02	1.08	0.165	0.3887	1.47	1.47	2.37	1.00	0.62
Chromium	55.58469389	0.046	0.216	1	0.216	1	0.057	3.17	0.68	0.165	1.98	2.66	2.66	2.78	1.00	0.96
Cobalt	123.0068554	0.046	0.216	1	0.216	1	0.122	15.01	3.23	0.165	4.38	7.61	7.61	7.8	1.00	0.98
Copper	69.58534987	0.046	0.216	1	0.216	1	0.105	7.31	1.58	0.165	2.4750	4.05	4.05	12.1	1.00	0.33
Lead	30.36790369	0.046	0.216	1	0.216	1	0.084	2.55	0.55	0.165	1.0801	1.63	1.63	3.26	1.00	0.50
Manganese	1684.351268	0.046	0.216	1	0.216	1	0.328	552	119.1	0.165	59.91	179.0	179	348	1.00	0.51
Mercury	0.105081141	0.046	0.216	1	0.216	1	2.837	0.30	0.064	0.165	0.0037	0.068	0.068	0.37	1.00	0.18
Nickel	102.3942319	0.046	0.216	1	0.216	1	0.139	14.23	3.07	0.165	3.64	6.71	6.71	11.5	1.00	0.58
Selenium	0.356658739	0.046	0.216	1	0.216	1	3.607	1.29	0.277	0.165	0.0127	0.290	0.29	0.579	1.00	0.50
Silver	4.240193265	0.046	0.216	1	0.216	1	2.045	8.67	1.87	0.165	0.1508	2.02	2.02	20.2	1.00	0.10
Vanadium	7.220923184	0.046	0.216	1	0.216	1	0.056	0.40	0.087	0.165	0.2568	0.34	0.344	0.688	1.00	0.50
Zinc	304.5078865	0.046	0.216	1	0.216	1	0.842	256.40	55.3	0.165	10.83	66.1	66.1	66.5	1.00	0.99
TEQ-Bird	6.54E-05	0.046	0.216	1	0.216	1	0.85	5.56E-05	1.20E-05	0.165	2.32E-06	1.43E-05	0.0000143	0.000143	1.00	0.10

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TEQ-Bird = Toxic Equivalency Quotient for Birds (calculated using avian toxic equivalency factors)

TRV = toxicity reference value

[a] RBC determined by back calculation of the exposure and risk equation to achieve a NOAEL HQ of 1.0.

TABLE H-8

LOAEL-Based Western Snowy Plover Risk-Based Concentrations (mg/kg)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Invertebrate Uptake				Sediment Uptake			TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	**RBC[a]**	**Body Weight (kg)**	**Food Intake (kg/kg-BW/day)**	**Area Use Factor**	**Daily Food Ingestion from Site (kg/kg-BW/day)**	**Diet Proportion**	**Sediment to Invertebrate BAF**	**Invertebrate Concentration (mg/kg)**	**Invertebrate Dose (mg/kg-BW/day)**	**Diet Proportion**	**Incidental Sediment Dose (mg/kg-BW/day)**	**Total Dose (kg/kg-BW/day)**	**NOAEL**	**LOAEL**	**NOAEL HQ**	**LOAEL HQ**
Aluminum[b]	2891.482152	0.046	0.216	1	0.216	1	0.011	31.81	6.9	0.165	102.84	109.7	109.7	NA	1.00	NA
Arsenic	347.4956133	0.046	0.216	1	0.216	1	0.373	129.62	27.94	0.165	12.36	40.30	9.3	40.3	4.33	1.00
Barium	770.7062655	0.046	0.216	1	0.216	1	0.086	66.28	14.3	0.165	27.41	41.7	20.8	41.7	2.00	1.00
Cadmium	17.61936743	0.046	0.216	1	0.216	1	0.459	8.09	1.74	0.165	0.6267	2.37	1.47	2.37	1.61	1.00
Chromium	58.09227406	0.046	0.216	1	0.216	1	0.057	3.31	0.71	0.165	2.07	2.78	2.66	2.78	1.05	1.00
Cobalt	126.0779858	0.046	0.216	1	0.216	1	0.122	15.38	3.32	0.165	4.48	7.80	7.61	7.8	1.02	1.00
Copper	207.8969712	0.046	0.216	1	0.216	1	0.105	21.83	4.71	0.165	7.3944	12.10	4.05	12.1	2.99	1.00
Lead	60.73580738	0.046	0.216	1	0.216	1	0.084	5.10	1.10	0.165	2.1602	3.26	1.63	3.26	2.00	1.00
Manganese	3274.6047	0.046	0.216	1	0.216	1	0.328	1074	231.5	0.165	116.47	348.0	179	348	1.94	1.00
Mercury	0.571765033	0.046	0.216	1	0.216	1	2.837	1.62	0.350	0.165	0.0203	0.370	0.068	0.37	5.44	1.00
Nickel	175.4893692	0.046	0.216	1	0.216	1	0.139	24.39	5.26	0.165	6.24	11.50	6.71	11.5	1.71	1.00
Selenium	0.712087621	0.046	0.216	1	0.216	1	3.607	2.57	0.554	0.165	0.0253	0.579	0.29	0.579	2.00	1.00
Silver	42.40193265	0.046	0.216	1	0.216	1	2.045	86.71	18.69	0.165	1.5081	20.20	2.02	20.2	10.00	1.00
Vanadium	14.44184637	0.046	0.216	1	0.216	1	0.056	0.81	0.174	0.165	0.5137	0.69	0.344	0.688	2.00	1.00
Zinc	306.3505969	0.046	0.216	1	0.216	1	0.842	257.95	55.6	0.165	10.90	66.5	66.1	66.5	1.01	1.00
TEQ-Bird	6.54E-04	0.046	0.216	1	0.216	1	0.85	5.56E-04	1.20E-04	0.165	2.32E-05	1.43E-04	0.0000143	0.000143	10.00	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

TEQ-Bird = Toxic Equivalency Quotient for Birds (calculated using avian toxic equivalency factors)

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

[b] RBC determined by back-calculation of the exposure and risk equation to achieve a NOAEL HQ of 1.0 because a LOAEL was lacking.

TABLE H-9

Risk-Based Concentrations for Wildlife (mg/kg)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

	LOAEL-Based Mammal RBCs		NOAEL-Based Bird RBCs			LOAEL-Based Bird RBCs		
Analyte	**California Vole**	**Ornate Shrew**	**Terrestrial-Feeding Belding's Savannah Sparrow**	**Aquatic-Feeding Belding's Savannah Sparrow**	**Western Snowy Plover**	**Terrestrial-Feeding Belding's Savannah Sparrow**	**Aquatic-Feeding Belding's Savannah Sparrow**	**Western Snowy Plover**
Aluminum	3487	220	2596	17259	2891	--	--	--
Antimony	52.2	2.21	--	--	--	--	--	--
Arsenic	131	70.0	582	178	80.2	2546	781	347
Barium	2023	246	122	1318	384	246	2651	771
Beryllium	6.90	27.4	--	--	--	--	--	--
Cadmium	661	8.73	2.85	17.7	10.9	4.68	30.2	17.6
Chromium	718	78.9	41.0	155	55.58	42.9	162	58.1
Cobalt	1680	277	361	361	123	370	370	126
Copper	773	16.8	10.2	132	69.6	33.0	513	208
Iron	--	--	--	--	--	--	--	--
Lead	1208	53.4	18.3	80.5	30.4	37.6	173	60.7
Manganese	3346	700	2959	3217	1684	5752	6254	3275
Mercury	3.23	0.271	0.176	0.145	0.105	1.13	0.911	0.572
Nickel	337	10.8	42.4	262	102	73.0	457	175
Selenium	1.85	0.824	1.68	0.565	0.357	3.64	1.12	0.712
Silver	7690	112	7.73	7.73	4.24	77.3	77.3	42.4
Thallium	13.0	3.44	--	--	--	--	--	--
Vanadium	1398	148	11.3	27.4	7.22	22.6	54.8	14.4
Zinc	1932	239	293	441	305	295	444	306
TEQ - Bird	na	na	na	0.00009989	0.00006536	na	0.000999	0.00065

Notes:

-- = RBC not calculated due to a lack of TRVs for that receptor/analyte combination

LOAEL = lowest observed adverse effect level

na = not applicable; TEQs were not calculated for soil-associated birds and mammals because dioxin/furans were only a concern in sediment.

NOAEL = no observed adverse effect level

RBC = risk-based concentration; developed by back-calculation of the exposure and risk estimate to obtain a hazard quotient of one

TEQ-Bird = Toxic Equivalency Quotient for Birds (calculated using avian toxic equivalency factors)

TRV = toxicity reference value

Risk-based concentrations for mammals were calculated using the LOAEL.

Risk-based concentrations for birds were calculated using both the NOAEL and the LOAEL to provide a range of effects for these special-status species.

TABLE H-10

LOAEL-Based California Vole Risk-Based Concentrations (mg/kg) Adjusted for Bioavailability of Analytes

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Plant Uptake				Soil Uptake					TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	**RBC[a]**	**Body Weight (kg)**	**Food Intake (kg/kg-BW/day)**	**Area Use Factor**	**Daily Food Ingestion from Site (kg/kg-BW/day)**	**Diet Proportion**	**Soil to Plant BAF**	**Plant Concentration (mg/kg)**	**Plant Dose (mg/kg-BW/day)**	**Diet Proportion**	**Incidental Soil Dose (mg/kg-BW/day)**	**Total Dose (kg/kg-BW/day)**	**Bioavailability**	**Total Dose Adjusted for Bioavailability (kg/kg-BW/day)**	**NOAEL**	**LOAEL**	**NOAEL HQ**	**LOAEL HQ**
Copper	2852	0.043	0.206	1	0.206	1	Regression	44.86	9.2	0.024	14.101	23.342	0.40	9.337	5.6	9.34	1.67	1.00
Selenium	2.9	0.043	0.206	1	0.206	1	Regression	1.67	0.3	0.024	0.015	0.358	0.60	0.2	0.143	0.215	1.50	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

TABLE H-11

LOAEL-Based Ornate Shrew Risk-Based Concentrations (mg/kg) Adjusted for Bioavailability of Analytes

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Invertebrate Uptake						Soil Uptake					TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	RBC[a]	Body Weight (kg)	Food Intake (kg/kg-BW/day)	Area Use Factor	Daily Food Ingestion from Site (kg/kg-BW/day)	Diet Proportion	Soil to Invertebrate BAF	Invertebrate Concentration (mg/kg)	Invertebrate Dose (mg/kg-BW/day)	Bioavailability from Diet	Bioavailability-Adjusted Invertebrate Dose (mg/kg-BW/day	Diet Proportion	Incidental Soil Dose (mg/kg-BW/day)	Bioavailability from Soil Ingestion	Bioavailability-Adjusted Dose from Incidental Soil Ingestion (mg/kg-BW/day)	Total Dose (kg/kg-BW/day)	NOAEL	LOAEL	NOAEL	LOAEL
Barium	2455.694639	0.005	0.259	1	0.259	1	1.148	2819.14	730.9	0.1	73.09	0.03	19.100	0.1	1.91	75.000	51.8	75	1.45	1.00
Copper	42.02648838	0.005	0.259	1	0.259	1	2.113	88.80	23.0	0.4	9.21	0.03	0.327	0.4	0.13	9.340	5.6	9.34	1.67	1.00
Lead	203.7680698	0.005	0.259	1	0.259	1	0.613	124.91	32.4	0.3	8.48	0.03	1.585	0.3	0.42	8.900	4.7	8.9	1.89	1.00
Nickel	109.6310335	0.005	0.259	1	0.259	1	1.189	130.35	3.4	0.1	0.34	0.03	0.020	0.02	0.00	3.400	1.7	3.4	2.00	1.00
Selenium	1.639266337	0.005	0.259	1	0.259	1	Regression	1.33	0.3	0.6	0.21	0.03	0.013	0.6	0.01	0.215	0.143	0.215	1.50	1.00
Zinc	477.9627729	0.005	0.259	1	0.259	1	1.195	571.17	148.1	0.5	74.04	0.03	3.718	0.5	1.86	75.900	75.4	75.9	1.01	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kiliogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

TABLE H-12

LOAEL-Based Terrestrial-Feeding Belding's Savannah Sparrow Risk-Based Concentrations (mg/kg) Adjusted for Bioavailability of Analytes

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Plant Uptake				Arthropod				Mollusc							Soil Uptake					TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	RBC[a]	Body Weight (kg)	Food Intake (kg/kg-BW/day)	Area Use Factor	Daily Food Ingestion from Site (kg/kg-BW/day)	Diet Proportion	Soil to Plant BAF	Plant Concentration (mg/kg)	Plant Dose (mg/kg-BW/day)	Diet Proportion	Soil to Invertebrate BAF	Invertebrate Concentration (mg/kg)	Invertebrate Dose (mg/kg-BW/day)	Diet Proportion	Soil to Invertebrate BAF	Invertebrate Concentration (mg/kg)	Invertebrate Dose (mg/kg-BW/day)	Total Dietary Dose (kg/kg-BW/day)	Bioavailability from Diet	Bioavailability-Adjusted Dietary Dose (mg/kg-BW/day	Diet Proportion	Incidental Soil Dose (mg/kg-BW/day)	Bioavailability from Soil Ingestion	Bioavailability-Adjusted Dose from Incidental Soil Ingestion (mg/kg-BW/day)	Total Dose (kg/kg-BW/day)	NOAEL	LOAEL	NOAEL	LOAEL
Barium	2467.321632	0.0187	0.2489813	1	0.248981317	0.5	Regression	1.00	0.1	0.45	1.148	2832.49	317.4	0.05	2.84	7007.19	87.2	404.7	0.1	40.47	0.02	12.286	0.1	1.229	41.7	20.8	41.7	2.00	1.00
Copper	85.50696721	0.0187	0.2489813	1	0.248981317	0.5	Regression	11.27	1.4	0.45	2.113	180.68	20.2	0.05	7.681	656.78	8.2	29.8	0.4	11.93	0.02	0.426	0.4	0.170	12.1	4.05	12.1	2.99	1.00
Lead	76.85302361	0.0187	0.2489813	1	0.248981317	0.5	Regression	3.03	0.4	0.45	0.613	47.11	5.3	0.05	0.5	38.43	0.5	6.1	0.3	1.61	0.02	0.383	0.3	0.100	3.3	1.63	3.26	2.00	1.00
Nickel	757.4884296	0.0187	0.2489813	1	0.248981317	0.5	Regression	15.41	0.2	0.45	1.189	900.65	10.1	0.05	1.189	900.65	1.1	11.4	0.1	1.14	0.02	0.091	0.02	0.002	11.5	6.71	11.5	1.71	1.00
Zinc	627.5005067	0.0187	0.2489813	1	0.248981317	0.5	Regression	172.46	21.5	0.45	1.195	749.86	84.0	0.05	3.122	1959.06	24.4	129.9	0.5	64.94	0.02	3.125	0.5	1.562	66.5	66.1	66.5	1.01	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

TABLE H-13

LOAEL-Based Aquatic-Feeding Belding's Savannah Sparrow Risk-Based Concentrations (mg/kg) Adjusted for Bioavailability of Analytes

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Plant Uptake				Benthic Invertebrate Uptake				Sediment Uptake					TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	**RBC[a]**	**Body Weight (kg)**	**Food Intake (kg/kg-BW/day)**	**Area Use Factor**	**Daily Food Ingestion from Site (kg/kg-BW/day)**	**Diet Proportion**	**Soil to Plant BAF**	**Plant Concentration (mg/kg)**	**Plant Dose (mg/kg-BW/day)**	**Diet Proportion**	**Sediment to Invertebrate BAF**	**Invertebrate Concentration (mg/kg)**	**Invertebrate Dose (mg/kg-BW/day)**	**Diet Proportion**	**Incidental Soil Dose (mg/kg-BW/day)**	**Total Dose (kg/kg-BW/day)**	**Bioavailability**	**Total Dose Adjusted for Bioavailability (kg/kg-BW/day)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Copper	1437.99	0.0187	0.249	1	0.249	0.5	Regression	34.25	4.3	0.5	0.105	150.989	18.797	0.02	7.161	12.1	0.40	4.835	4.05	12.1	2.98	1.00
Selenium	1.85	0.0187	0.249	1	0.249	0.5	Regression	1.00	0.1	0.5	3.607	6.680	0.832	0.02	0.009	0.6	0.60	0.348	0.29	0.579	2.00	1.00
Zinc	963.23	0.0187	0.249	1	0.249	0.5	Regression	218.77	27.2	0.5	0.842	811.036	100.966	0.02	4.797	66.5	0.50	33.249	66.1	66.5	1.01	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

TABLE H-14

LOAEL-Based Western Snowy Plover Risk-Based Concentrations (mg/kg) Adjusted for Bioavailability of Analytes

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

		Life History Parameters				Invertebrate Uptake				Sediment Uptake					TRVs (mg/kg-BW/day)		Hazard Quotients	
Analyte	**RBC[a]**	**Body Weight (kg)**	**Food Intake (kg/kg-BW/day)**	**Area Use Factor**	**Daily Food Ingestion from Site (kg/kg-BW/day)**	**Diet Proportion**	**Sed to Invertebrate BAF**	**Invertebrate Concentration (mg/kg)**	**Invertebrate Dose (mg/kg-BW/day)**	**Diet Proportion**	**Incidental Soil Dose (mg/kg-BW/day)**	**Total Dose (kg/kg-BW/day)**	**Bioavailability**	**Total Dose Adjusted for Bioavailability (kg/kg-BW/day)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Barium	7707.06	0.046	0.216	1	0.216	1	0.086	662.81	142.876	0.165	274.124	41.7	0.10	4.170	20.8	41.7	2.00	1.00
Copper	519.74	0.046	0.216	1	0.216	1	0.105	54.57	11.764	0.165	18.486	12.1	0.40	4.840	4.05	12.1	2.99	1.00
Lead	121.47	0.046	0.216	1	0.216	1	0.084	10.20	2.200	0.165	4.320	3.26	0.50	1.630	1.63	3.26	2.00	1.00
Selenium	1.19	0.046	0.216	1	0.216	1	3.607	4.28	0.923	0.165	0.042	0.579	0.60	0.347	0.29	0.579	2.00	1.00
Zinc	612.70	0.046	0.216	1	0.216	1	0.842	515.89	111.208	0.165	21.792	66.5	0.50	33.250	66.1	66.5	1.01	1.00

Notes:

BAF = bioaccumulation factor

HQ = hazard quotient (total dose/TRV)

kg = kilogram

kg/kg-BW/day = kilogram per kilogram body weight per day

LOAEL = lowest observed adverse effect level

mg = milligram

mg/kg-BW/day = milligram per kilogram body weight per day

NA = TRV not available

NOAEL = no observed adverse effect level

RBC = risk-based concentration

TRV = toxicity reference value

[a] RBC determined by back-calculation of the exposure and risk equation to achieve a LOAEL HQ of 1.0.

TABLE H-15

Bioavailability-Adjusted Risk-Based Concentration Thresholds (mg/kg) for Wildlife

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

	Sediment RBCs Using 100% Bioavailability		Sediment RBCs Using Literature-Based Bioavailability[a]		Soil RBCs Using 100% Bioavailability			Soil RBCs Using Literature-Based Bioavailability[a]			
Analyte	**Aquatic-Feeding Belding's Savannah Sparrow**	**Western Snowy Plover**	**Aquatic-Feeding Belding's Savannah Sparrow**	**Western Snowy Plover**	**California Vole**	**Ornate Shrew**	**Terrestrial-Feeding Belding's Savannah Sparrow**	**California Vole**	**Ornate Shrew**	**Terrestrial-Feeding Belding's Savannah Sparrow**	**Soil and Sediment Background UTLs**
Antimony	--	--	--	--		2.21	--		2.21	--	0.37
Barium		771		7707		246	246		**2456**	**2467**	149
Chromium		58.1		58.1		78.9	42.9		78.9	42.9	17
Copper	513	208	1438	520	773	16.8	33.0	**2852**	**42.0**	**85.5**	20.2
Lead		60.7		121.5		53.4	37.6		**204**	**76.9**	14.4
Manganese						700			700		399
Nickel						10.8	73.0		**110**	**757**	21.2
Selenium	1.12	0.712	1.85	1.187	1.85	0.824		**2.90**	**1.64**		0.8
Vanadium		14.4		14.4			22.6			22.6	32.5
Zinc	444	306	963	613		239	295		**477**	**628**	69.7

Notes:

-- = TRV not available

= No risk

RBC = risk-based concentration; developed by back-calculation of the exposure and risk estimate to obtain a hazard quotient of one (see Appendix H for details)

TRV = toxicity reference value

UTL = upper tolerance limit

Aluminum, arsenic, beryllium, cadmium, cobalt, magnesium, silver, thallium, and TCDD TEQs in soil presented no risk to ecological receptors; therefore, clean-up goals are not needed for these analytes.

Mercury in Halaco wastes does not appear to be different than background; therefore, elevated mercury on-site is not likely site-related.

Bird and mammal RBCs are based on the lowest observed adverse effect level (LOAEL). LOAEL used for birds because population data indicate risks are unlikely.

Bold values are cases for which the literature-based bioavailability information was used to re-calculate the RBC.

[a] Literature-based bioavailability values (see Appendix H text for details):

Ba = 10%

Cu = 40%

Pb = 26.2% mammals and 50% birds

Ni = 2.4% soil and 10% diet

Se = 60%

Zn = 50%