TABLE ES-1
Summary of Refined Screening Evaluation for Aquatic Ecological Receptors
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Aquatic Organisms [2]	Benthic Invertebrates	Swallows	Belted Kingfisher	Little Brown Bat	Mink
On-Site Gila River						
Aluminum	**r (Retain)**	r (N)	r (NU)	r (NU)	**r (L, pH)**	**r (L, pH)**
Antimony	d	d	u	u	r (N)	d
Arsenic	d	d	d	d	r (D)	d
Barium	**r (Retain)**	d	d	d	d	d
Beryllium	**r(ND/DET)**	u	u	u	**r (NU)**	d
Boron	**r (Retain)**	u	d	d	d	d
[1] Cadmium	r (ND/DET)	r (N)	r (D)	**r (L)**	d	r (D)
Calcium	r (FE low)	-	-	-	-	-
Chromium	d	d	d	d	d	d
Cobalt	r (FE low)	u	d	d	d	d
[1] Copper	r (FE low)	r (FE low)	r (D)	d	**r (L)**	d
Cyanide	**r (ND/DET)**	**r (ND, L)**	u	u	**r (ND, L)**	d
Iron	**r (Retain)**	d	**r (L)**	r (D)	**r (NU)**	**r (NU)**
[1] Lead	r (FE low)	d	r (N)	r (N)	r (D)	d
Manganese	**r (Retain)**	r (FE low)	r (D)	d	r (D)	d
[1] Mercury	**r (ND/DET)**	d	r (D)	**r (L)**	r (D)	**r (L)**
Molybdenum	d	u	d	d	r (N)	d
Nickel	d	r (N)	d	d	d	d
Selenium	r (FE low)	d	d	r (D)	r (D)	r (D)
Silver	r (FE low)	r (N)	r (D)	d	r (D)	d
Strontium	-	u	u	u	d	d
Thallium	d	u	r (N)	d	d	d
Vanadium	r (FE low)	u	r (D)	d	r (N)	d
Zinc	d	d	r (D)	r (N)	d	d
Total Dissolved Solids	r (FE low)	-	-	-	-	-
Ammonia as N	d	-	-	-	-	-
p,p'-DDE	-	r (N)	r (N)	d	d	d
On-Site San Pedro River						
Aluminum	**r (Retain)**	r (N)	r (NU)	r (NU)	**r (L, pH)**	**r (L, pH)**
Antimony	d	d	u	u	r (N)	d
Arsenic	d	d	d	d	r (D)	d
Barium	**r (Retain)**	d	d	d	d	d
Beryllium	**r (Retain)**	u	u	u	**r (NU)**	d
Boron	**r (Retain)**	u	d	d	d	d
[1] Cadmium	d	d	r (D)	**r (L)**	d	d
Calcium	**r (Retain)**	-	-	-	-	-
Chromium	d	d	d	d	d	d
Cobalt	d	u	d	d	d	d
[1] Copper	d	r (N)	r (D)	d	r (N)	d
Cyanide	**r (ND)**	**r (ND, L)**	u	u	**r (ND, L)**	d
Iron	**r (Retain)**	d	**r (L)**	d	**r (NU)**	**r (NU)**

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Summary of Refined Screening Evaluation for Aquatic Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Aquatic Organisms [2]	Benthic Invertebrates	Swallows	Belted Kingfisher	Little Brown Bat	Mink
[1] Lead	d	d	r (N)	d	r (D)	d
Manganese	**r (Retain)**	r (N)	r (D)	d	r (D)	d
[1] Mercury	**r (ND)**	d	d	r (N)	r (D)	r (D)
Molybdenum	d	u	d	d	r (N)	d
Nickel	d	d	d	d	d	d
Selenium	d	d	d	r (N)	d	d
Silver	d	d	r (D)	d	d	d
Strontium	-	u	u	u	d	d
Thallium	d	u	r (N)	d	d	d
Vanadium	**r (Retain)**	u	d	d	r (N)	d
Zinc	d	d	r (D)	d	d	d
Total Dissolved Solids	**r (Retain)**	-	-	-	-	-
Ammonia as N	d	-	-	-	-	-
p,p'-DDE	-	r (N)	r (N)	d	d	d

Notes:

[1] Dissolved fraction of some metals used for aquatic organism evaluation

[2] Site-specific fish monitoring data do not exclude or support potential for risk; column presents results of the initial assessment and the (refined assessment).

Initial Assessment

u = Uncertainty; no receptor screening value available

d = Dropped from further analysis. Exposure concentration did not exceed screening benchmarks

r = COPEC could not be excluded from presenting a potential risk to receptor and was evaluated further in the refinement

- = not evaluated

Refined Assessment

N = NOAEL/Low-TRV exceedance in refinement but not the LOAEL/High-TRV; determination of no unacceptable risks to populations or communities (as applicable).

L = LOAEL/High-TRV exceedance in refinement; possible risk to populations or communities (as applicable)

D = NOAEL not exceeded in the refinement; determination of no unacceptable risk

NU = NOAEL exceedance in refinement; a LOAEL was unavailable therefore, risk is uncertain

Retain = COPEC did not pass refined screening and could not be excluded as a risk driver

ND/Det = The maximum non-detected value exceeded the maximum detected value and both exceeded the screening benchmark; risk is possible but the spatial extent of risk is uncertain.

ND = Exceedances based on concentrations less than the detection limit. Risks are uncertain, but cannot be excluded.

FE Low = The frequency of screening value exceedances is low ($\leq$20%).The likelihood of adverse effects is low and was excluded.

pH = Although risks from exposure to aluminum were predicted, the pH in sediments at the Site are greater than 5.5. Therefore, aluminum is not expected to be bioavailable.

Bold results indicate that a contaminant could not be excluded, for various reasons (e.g. insufficient detection limits or lack of a LOAEL), from posing a risk.

Highlighted results indicate conclusion of possible risk.

TABLE ES-2

Summary of Refined Risk Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants[1]	Terrestrial Invertebrates[1]	Terrestrial Microbes[1]	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher[2]	Desert Cottontail	Desert Shrew	Coyote
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water										
Antimony	d	d	u	u	u	u	u	d	r (B)	d
Arsenic	**d (Retain GW)**	d	d	d	d	d	d	r (B)	r (B)	d
Beryllium	d	d	u	u	u	u	u	d	d	d
Boron	**r (NB)**	u	**r (NB)**	r (D)	d	d	d	r (D)	d	d
Cadmium	d	d	d	d	r (B)	d	r (B)	d	r (B)	d
Chromium	r (B)	r (B)	r (B)	d	r (B)	d	r (B)	d	r (B)	d
Copper	**r (Retain)**	**r (Retain)**	**r (Retain)**	d	r (D)	d	**r (Poss)**	d	**r (L)**	d
Cyanide	u	u	u	u	u	u	u	d	r (D)	d
Lead	d	d	d	r (B)	r (B)	r (B)	r (B)	d	r (B)	d
Mercury	d	r (FE low)	d	d	r (D)	d	**r (Poss)**	d	r (N)	d
Molybdenum	**r (Retain)**	u	d	d	d	d	r (D)	r (D)	r (N)	r (D)
Selenium	**r (ND)**	d	d	d	r (D)	d	r (D)	d	r (D)	d
Silver	d	u	d	d	r (D)	d	r (D)	d	r (D)	d
Thallium	r (B)	u	u	r (B)	r (B)	r (B)	r (B)	d	d	d
Vanadium	r (B)	u	r (B)	d	d	d	d	r (B)	r (B)	d
Zinc	r (B)	r (B)	r (B)	d	r (B)	r (B)	r (B)	d	d	d
Middle Gila River - On-Site Stable Riparian Soil and Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Barium	d	d	d	d	d	d	d	d	d	d
Cobalt	d	u	d	d	d	d	d	d	d	d
Iron	**r (NB)**	u	**r (NB)**	**r (NB)**	**r (NB)**	r (N)	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Manganese	**r (NB, Retain GW)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d
Nickel	d	d	d	d	d	d	d	d	r (B)	d
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Barium	d	d	d	d	d	d	d	d	d	d
Cobalt	r (FE low)	u	d	d	d	d	d	d	d	d
Iron	**r (NB)**	u	**r (NB)**	**r (NB)**	**r (NB)**	r (N)	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Manganese	**r (NB, Retain GW)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d
Nickel	d	d	d	d	d	d	d	d	r (B)	d

TABLE ES-2

Summary of Refined Risk Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants[1]	Terrestrial Invertebrates[1]	Terrestrial Microbes[1]	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher[2]	Desert Cottontail	Desert Shrew	Coyote
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water										
Antimony	d	d	u	u	u	u	u	d	r (B)	d
Arsenic	d	d	d	d	d	d	d	d	d	d
Beryllium	d	d	u	u	u	u	u	d	d	d
Boron	**r (NB)**	u	d	d	d	d	d	d	d	d
Cadmium	d	d	d	d	r (B)	d	r (B)	d	r (B)	d
Chromium	r (B)	r (B)	r (B)	d	r (B)	d	r (B)	d	r (B)	d
Copper	r (B)	r (B)	r (B)	d	r (B)	d	r (B)	d	r (B)	d
Cyanide	u	u	u	u	u	u	u	d	r (D)	d
Lead	d	d	d	r (B)	r (B)	r (B)	r (B)	d	r (B)	d
Mercury	d	r (FE low)	d	d	r (D)	d	**r (Poss)**	d	r (N)	d
Molybdenum	r (B)	u	d	d	d	d	d	r (B)	r (B)	d
Selenium	**r (ND)**	d	d	d	r (D)	d	**r (Poss, ND)**	d	**r (L, ND)**	d
Silver	d	u	d	d	r (D)	d	r (D)	d	r (D)	d
Thallium	r (B)	u	u	r (B)	r (B)	r (B)	r (B)	d	d	d
Vanadium	r (B)	u	r (B)	d	d	d	d	d	r (B)	d
Zinc	r (B)	d	d	d	r (B)	r (B)	**r (B, MT)**	d	d	d
San Pedro River - On-Site Stable Riparian Soil and Surface Water										
Aluminum	d	d	d	d	r (pH)	d	r (pH)	r (pH)	r (pH)	r (pH)
Barium	d	d	d	d	d	d	d	d	d	d
Cobalt	d	u	d	d	d	d	d	d	d	d
Iron	**r (NB)**	u	**r (NB)**	**r (NB)**	**r (NB)**	r (N)	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Manganese	d	d	**r (NB)**	d	d	d	d	d	d	d
Nickel	d	d	d	d	d	d	d	d	r (B)	d
San Pedro River - On-Site Untable Riparian Soil and Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Barium	d	d	d	d	d	d	d	d	d	d
Cobalt	d	u	d	d	d	d	d	d	d	d
Iron	**r (NB)**	u	**r (NB)**	**r (NB)**	**r (NB)**	r (N)	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Manganese	**r (NB)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d
Nickel	d	d	d	d	d	d	d	d	r (B)	d

TABLE ES-2

Summary of Refined Risk Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants[1]	Terrestrial Invertebrates[1]	Terrestrial Microbes[1]	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher[2]	Desert Cottontail	Desert Shrew	Coyote
Upland Soils and Gila River Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Antimony	r (FE low)	d	u	u	u	u	u	d	**r (L)**	d
Arsenic	**r (Retain)**	**r (Retain)**	r (FE low)	r (D)	d	d	d	r (N)	**r (L)**	r (D)
Barium	d	d	d	d	d	d	d	d	d	d
Beryllium	d	d	u	u	u	u	u	d	d	d
Boron	**r (NB)**	u	d	d	d	d	d	d	d	d
Cadmium	r (FE low)	d	r (FE low)	**r (L)**	**r (L)**	r (N)	**r (Prob)**	d	**r (L)**	d
Chromium	r (BC low)	r (BC low)	r (BC low)	r (D)	r (N)	d	**r (Poss)**	d	r (N)	d
Cobalt	**r (Retain)**	u	d	d	r (D)	d	r (D)	d	r (D)	d
Copper	**r (Retain)**	**r (Retain)**	**r (Retain)**	**r (L)**	**r (L)**	d	**r (Prob)**	**r (L)**	**r (L, T)**	**r (L)**
Cyanide	u	u	u	u	u	u	u	d	**r (L, ND)**	d
Iron	r (FE low)	u	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Lead	**r (Retain)**	d	d	**r (L)**	**r (L)**	**r (L)**	**r (Prob)**	**r (D, T)**	**r (L, T)**	r (D)
Manganese	**r (NB)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d
Mercury	r (FE low)	**r (Retain)**	d	d	r (N)	d	**r (Poss)**	d	r (N)	d
Molybdenum	**r (Retain)**	u	r (FE low)	**r (L)**	**r (L)**	**r (L)**	**r (Prob)**	**r (L)**	**r (L)**	**r (L)**
Nickel	r (FE low)	d	d	d	d	d	d	d	r (N)	d
Selenium	**r (Retain)**	d	d	**r (L)**	**r (L)**	d	**r (Prob)**	**r (L)**	**r (L)**	d
Silver	d	u	d	d	**r (L)**	r (D)	**r (Prob)**	d	r (N)	d
Thallium	r (FE low)	u	u	r (N)	r (N)	r (N)	**r (Poss)**	d	d	d
Vanadium	**r (Retain)**	u	**r (Retain)**	d	d	d	d	r (N)	**r (L)**	d
Zinc	**r (Retain)**	**r (Retain)**	**r (Retain)**	r (N)	**r (L)**	r (N)	**r (Prob, MT)**	d	**r (L)**	d
Wash Soils and Gila River Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Antimony	r (FE low)	d	u	u	u	u	u	r (D)	r (N)	d
Arsenic	**r (Retain)**	r (FE low)	d	d	d	d	d	r (D)	r (N)	d
Barium	d	d	d	d	d	d	d	d	d	d
Beryllium	d	d	u	u	u	u	u	d	d	d
Boron	**r (NB)**	u	d	d	d	d	d	d	d	d
Cadmium	d	d	d	r (N)	**r (L)**	d	**r (Prob)**	d	**r (L)**	d
Chromium	r (BC low)	r (BC low)	r (BC low)	r (D)	r (N)	r (D)	**r (Poss)**	d	r (D)	d
Cobalt	**r (Retain)**	u	d	d	r (D)	d	r (D)	d	r (D)	d
Copper	**r (Retain)**	**r (Retain)**	**r (Retain)**	r (D)	**r (L)**	d	**r (Prob)**	r (N)	**r (L, T)**	r (D)
Cyanide	u	u	u	u	u	u	u	d	**r (L, ND)**	d
Iron	**r (NB)**	u	r (B)	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Lead	r (FE low)	d	d	r (N)	**r (L)**	r (N)	**r (Prob)**	r (D)	**r (L)**	d
Manganese	**r (NB)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d

TABLE ES-2

Summary of Refined Risk Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants[1]	Terrestrial Invertebrates[1]	Terrestrial Microbes[1]	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher[2]	Desert Cottontail	Desert Shrew	Coyote
Mercury	r (FE low)	r (FE low)	d	d	r (N)	d	**r (Poss)**	d	r (N)	d
Molybdenum	**r (Retain)**	u	d	r (N)	r (N)	r (N)	**r (Poss)**	**r (L)**	**r (L)**	r (N)
Nickel	r (FE low)	d	d	d	d	d	r (D)	d	r (N)	d
Selenium	**r (Retain)**	d	d	r (D)	r (D)	d	**r (Poss)**	r (D)	**r (L)**	d
Silver	d	u	d	d	r (N)	r (D)	**r (Poss)**	d	r (D)	d
Thallium	**r (Retain)**	u	u	r (N)	r (N)	r (N)	**r (Poss)**	d	r (D)	d
Vanadium	**r (Retain)**	u	**r (Retain)**	d	d	d	d	r (D)	r (N)	d
Zinc	**r (Retain)**	**r (Retain)**	**r (Retain)**	r (N)	r (N)	r (N)	**r (Prob)**	d	r (D)	d

Notes:

Column presents results of the initial assessment and the (refined assessment).

[1] Potential effects only from direct contact with Site soils were evaluated for non-wildlife receptors.

[2] Special Status Species. Evaluated at the individual level. Population studies of southwestern willow flycatchers in the vicinity of the Site do not exclude or support potential for risk.

Initial Assessment

- = not evaluated

u = Uncertainty; no receptor screening value available

d = Dropped from further analysis. Exposure concentration did not exceed low-screening value

r = COPEC could not be excluded from presenting a potential risk to receptor and was evaluated further in the refinement

Refined Assessment

B = Did not differ from background concentrations and is not a site-associated contaminant

N = NOAEL exceedance in refinement but not the LOAEL; determination of no unacceptable risks to populations or communities (as applicable)

L = LOAEL exceedance in refinement; possible risk populations or communities (as applicable)

D = NOAEL not exceeded in the refinement; determination of no unacceptable risks.

Retain = COPEC did not pass refined screening and could not be excluded as a risk driver

Retain GW = Groundwater concentrations exceeded the screening benchmark; considered to pose a possible risk, even if soil data predicted no risk or if onsite soil concentrations were similar to background.

Poss = NOAEL exceedance in refinement but not the LOAEL; possible risk to individuals.

Prob = LOAEL exceedance in refinement; probable risk to individuals

MT = Measured egg tissue concentrations exceeded toxicity threshold; therefore, possible risk. (Note: Egg was collected near San Pedro River, so results were applied to the San Pedro River riparian soils and to the upland soils.)

BC Low = Confidence in the screening benchmark is low (e.g., a highly bioavailable form was used in the toxicity testing). This low confidence coupled with a low number of samples that exceed the background upper t

NB = No site-specific background data were available, but maximum concentrations were within ranges typically reported for background. Risks are uncertain, but cannot be excluded.

NU = NOAEL exceedance in refinement; a LOAEL was unavailable therefore, risk is uncertain

ND = Exceedances based on concentrations less than the detection limit. Risks are uncertain, but cannot be excluded.

FE Low = The frequency of screening value exceedances is low (≤20%).The likelihood of adverse effects is low and was excluded.

T = Estimated tissue concentrations (either kidney or liver, or both) exceeded toxicity thresholds; therefore, possible risk.

Bold results indicate that a contaminant could not be excluded, for various reasons (e.g. insufficient detection limits or lack of a LOAEL), from posing a risk.

Highlighted results indicate conclusion of possible (or probable) risk.

TABLE 2-1

Special-status Species within 3 Miles of the EPA Study Area*

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Taxon	Name	Common Name	ESA	USFS	BLM	STATE
Plant	*Eriogonum capillare*	San Carlos Wild-buckwheat	SC			SR
Plant	*Euphorbia gracillima*	Mexican Broomspurge		S		
Plant	*Penstemon superbus*	Superb Beardtongue		S		
Plant	*Lilaeopsis schaffneriana* var. *recurva*	Huachuca Water Umbel	LE			HS
Invertebrate	*Cicindela oregona maricopa*	Maricopa Tiger Beetle	SC	S	S	
Fish	*Agosia chrysogaster chrysogaster*	Gila Long fin Dace	SC		S	
Fish	*Catostomus clarki*	Desert Sucker	SC		S	
Fish	*Catostomus insignis*	Sonora Sucker	SC		S	
Reptile	*Gopherus agassizii (Sonoran Population)*	Sonoran Desert Tortoise	SC			WSC
Bird	*Asturina nitida maxima*	Northern Gray Hawk	SC	S		WSC
Bird	*Buteogallus anthracinus*	Common Black-Hawk		S		WSC
Bird	*Coccyzus americanus occidentalis*	Western Yellow-billed Cuckoo	C	S		WSC
Bird	*Empidonax traillii extimus*	Southwestern Willow Flycatcher	LE	S		WSC
Bird	*Haliaeetus leucocephalus*	Bald Eagle	LT,PDL			WSC
Bird	*Ictinia mississippiensis*	Mississippi Kite				WSC
Bird	*Tyrannus melancholicus*	Tropical Kingbird				WSC
Mammal	Bat Colony					
Mammal	*Corynorhinus townsendii pallescens*	Pale Townsend's Big-eared Bat	SC			

Notes:

* Within Designated Critical Habitat for southwestern willow flycatcher

Data from the Arizona Game and Fish Department, Heritage Data Management System, April 24, 2006. Project Evaluation Program.

Table from letter provided by the Arizona Game and Fish Department dated April 24, 2006 (Appendix C)

ESA: Endangered Species Act US Department of Interior, Fish and Wildlife Service

- LE: Listed Endangered
- LT: Listed Threatened
- C: Candidate
- SC: Species of Concern

USFS: U.S. Forest Service

- S: Sensitive

BLM: U.S. Bureau of Land Management

- S: Sensitive

STATE: Arizona

State NPL: Arizona Native Plant Law, Arizona Department of Agriculture

- SR: Salvage Restricted, collection only with permit
- HS: Highly Safeguarded, no collection allowed

State WSCA: Wildlife of Special Concern in Arizona, Arizona Game and Fish Department

- WSC: Wildlife of Special Concern in Arizona

TABLE 2-2
Summary Statistics for Concentrations of Chemicals of Potential Ecological Concern
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Surface Water														
Surface Water	--	onsite	Middle Gila	General	Ammonia as N	mg/L	0	22	0.3	0	0.3	0.3	0.3	
Surface Water	--	onsite-SP	San Pedro	General	Ammonia as N	mg/L	0	4	0.3	0	0.3	0.3	0.3	
Surface Water	--	offsite-up	Upper Gila	General	Bicarbonate Alkalinity	mg/L	7	7	191	42	155	170	257	
Surface Water	--	onsite	Middle Gila	General	Bicarbonate Alkalinity	mg/L	22	22	224	183	140	180	940	
Surface Water	--	onsite-SP	San Pedro	General	Bicarbonate Alkalinity	mg/L	4	4	288	21	270	285	310	
Surface Water	--	offsite-up	Upper Gila	General	Carbonate Alkalinity	mg/L	2	7	3.6	4.5	1	1	12	
Surface Water	--	onsite	Middle Gila	General	Carbonate Alkalinity	mg/L	1	22	9.8	0.87	5.9	10	10	
Surface Water	--	onsite-SP	San Pedro	General	Carbonate Alkalinity	mg/L	0	4	10	0	10	10	10	
Surface Water	--	offsite-up	Upper Gila	General	Chloride	mg/L	7	7	296543	220506	14800	290000	580000	
Surface Water	--	offsite-up	Upper Gila	General	Fluoride	mg/L	7	7	1443	181	1300	1400	1700	
Surface Water	--	offsite-up	Upper Gila	General	Hardness	mg/L	7	7	243	85	129	263	349	
Surface Water	--	onsite	Middle Gila	General	Hydroxide Alkalinity	mg/L	0	22	10	0	10	10	10	
Surface Water	--	onsite-SP	San Pedro	General	Hydroxide Alkalinity	mg/L	0	4	10	0	10	10	10	
Surface Water	--	offsite-up	Upper Gila	General	Sulfate	mg/L	7	7	134600	96380	32600	81600	280000	
Surface Water	--	offsite-up	Upper Gila	General	Total Alkalinity	mg/L	7	7	194	41	160	170	257	
Surface Water	--	onsite	Middle Gila	General	Total Alkalinity	mg/L	22	22	226	183	140	180	940	
Surface Water	--	onsite-SP	San Pedro	General	Total Alkalinity	mg/L	4	4	288	21	270	285	310	
Surface Water	--	offsite-up	Upper Gila	General	Total Dissolved Solids	mg/L	7	7	933	503	300	830	1610	
Surface Water	--	onsite	Middle Gila	General	Total Dissolved Solids	mg/L	22	22	550	83	430	560	780	
Surface Water	--	onsite-SP	San Pedro	General	Total Dissolved Solids	mg/L	4	4	955	30	920	960	980	
Surface Water	--	onsite	Middle Gila	General	Total Organic Carbon	mg/L	22	22	7.1	0.86	6.2	7.3	9	
Surface Water	--	onsite-SP	San Pedro	General	Total Organic Carbon	mg/L	4	4	2.8	1.3	1.6	2.8	3.9	
Surface Water	--	onsite	Middle Gila	General	Total Suspended Solids	mg/L	22	22	528	1392	8	68	5700	
Surface Water	--	onsite-SP	San Pedro	General	Total Suspended Solids	mg/L	3	4	269	307	5	235	600	
Surface Water	--	offsite-up	Upper Gila	General	pH	pH Units	7	7	8.3	0.23	7.9	8.3	8.6	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Aluminum	ug/L	20	21	768	2247	3.5	23	8200	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Aluminum	ug/L	2	4	69	39	9.8	87	90.5	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Antimony	ug/L	0	22	0.35	0.21	0.11	0.28	1.2	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Antimony	ug/L	0	4	0.25	0.08	0.17	0.25	0.35	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Arsenic	ug/L	22	22	4.7	2.3	2.4	4.3	9.8	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Arsenic	ug/L	4	4	5.0	0.90	3.7	5.4	5.6	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Barium	ug/L	22	22	83	63	52.4	58	298	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Barium	ug/L	4	4	137	82	65.4	135	212	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Beryllium	ug/L	7	22	0.56	0.33	0.02	0.66	1.3	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Beryllium	ug/L	1	4	0.5	0.32	0.02	0.66	0.66	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Boron	ug/L	11	11	120	6.3	111	120	128	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Boron	ug/L	2	2	163	18	150	163	175	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Cadmium	ug/L	3	22	0.25	0.06	0.02	0.25	0.42	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Cadmium	ug/L	0	4	0.25	0	0.25	0.25	0.25	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Calcium	ug/L	22	22	56073	13782	36500	56900	91200	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Calcium	ug/L	4	4	130000	4397	125000	130000	135000	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Chromium	ug/L	4	22	2.3	2.1	0.1	2	9.8	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Chromium	ug/L	1	4	0.63	0.91	0.09	0.22	2	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Cobalt	ug/L	21	22	1.8	2.0	0.18	0.87	8	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Cobalt	ug/L	4	4	1.8	1.5	0.54	1.7	3.3	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Copper	ug/L	22	22	6.1	10	0.61	2.7	43.5	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Copper	ug/L	4	4	3.5	3.5	0.59	2.7	8	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Iron	ug/L	22	22	935	2000	222	300	8160	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Iron	ug/L	4	4	577	320	300	565	878	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Lead	ug/L	11	22	2.8	7.0	0.06	1	27.7	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Lead	ug/L	2	4	0.6	0.47	0.09	0.66	1	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Magnesium	ug/L	22	22	15927	2567	11900	16250	21100	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Magnesium	ug/L	4	4	26925	1552	25200	26800	28900	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Manganese	ug/L	22	22	71	146	4.4	19	613	

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ASARCO LLC Hayden Plant Site, Hayden, Arizona

Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Manganese	ug/L	4	4	73	45	7.9	86	110	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Mercury	ug/L	2	22	0.12	0.08	0.037	0.14	0.2	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Mercury	ug/L	0	4	0.13	0.09	0.048	0.13	0.2	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Molybdenum	ug/L	22	22	4.8	1.2	1.2	4.7	7	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Molybdenum	ug/L	4	4	19	2.7	16.6	19	21.9	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Nickel	ug/L	22	22	2.9	2.8	1.1	2.1	13	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Nickel	ug/L	2	4	1.7	1.1	0.65	1.6	3	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Potassium	ug/L	21	22	5811	1458	4830	5260	10900	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Potassium	ug/L	4	4	7323	1452	5350	7610	8720	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Selenium	ug/L	20	22	1.3	1.5	0.2	0.78	5	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Selenium	ug/L	4	4	1.3	1.1	0.43	0.98	2.8	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Silver	ug/L	2	22	0.33	0.09	0.05	0.36	0.36	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Silver	ug/L	0	4	0.36	0	0.36	0.36	0.36	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Sodium	ug/L	22	22	109386	16559	86800	110499	129000	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Sodium	ug/L	4	4	141500	24076	119000	137000	173000	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Thallium	ug/L	2	22	0.96	0.18	0.15	1	1	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Thallium	ug/L	0	4	1	0	1	1	1	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Vanadium	ug/L	22	22	8.7	5.7	4.3	7.1	27.6	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Vanadium	ug/L	4	4	5.9	2.3	3.6	6.0	8	
Surface Water	--	onsite	Middle Gila	Metals-Dissolved	Dissolved Zinc	ug/L	18	22	9.0	17	0.66	2.7	68.5	
Surface Water	--	onsite-SP	San Pedro	Metals-Dissolved	Dissolved Zinc	ug/L	4	4	2.2	0.65	1.3	2.4	2.8	
Surface Water	--	onsite	Middle Gila	Metals-Total	Aluminum	ug/L	22	22	8058	16158	738	2595	62000	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Aluminum	ug/L	4	4	1905	1758	64.5	1948	3660	
Surface Water	--	onsite	Middle Gila	Metals-Total	Antimony	ug/L	0	22	0.29	0.31	0.05	0.25	1.6	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Antimony	ug/L	0	4	0.26	0.15	0.05	0.29	0.41	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Arsenic	ug/L	7	7	25	22	8	17	71	
Surface Water	--	onsite	Middle Gila	Metals-Total	Arsenic	ug/L	22	22	5.7	3.7	2.7	5	16.8	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Arsenic	ug/L	4	4	6.7	1.6	5.2	6.6	8.5	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Barium	ug/L	7	7	223	132	90	190	500	
Surface Water	--	onsite	Middle Gila	Metals-Total	Barium	ug/L	22	22	184	285	61.5	87	1190	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Barium	ug/L	4	4	217	165	68.1	213	373	
Surface Water	--	onsite	Middle Gila	Metals-Total	Beryllium	ug/L	13	22	1.0	1.9	0.07	0.66	8.3	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Beryllium	ug/L	2	4	0.81	0.21	0.66	0.74	1.1	
Surface Water	--	onsite	Middle Gila	Metals-Total	Boron	ug/L	22	22	126	7.6	113	127	140	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Boron	ug/L	4	4	186	29	159	180	225	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Cadmium	ug/L	2	7	5.7	1.5	5	5	9	
Surface Water	--	onsite	Middle Gila	Metals-Total	Cadmium	ug/L	11	22	0.43	0.78	0.1	0.25	3.4	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Cadmium	ug/L	3	4	0.28	0.13	0.12	0.31	0.4	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Calcium	ug/L	7	7	68814	23949	38600	65100	102000	
Surface Water	--	onsite	Middle Gila	Metals-Total	Calcium	ug/L	22	22	84577	79825	46400	59000	381999	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Calcium	ug/L	4	4	147500	22457	123000	147500	171999	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Chromium	ug/L	6	7	31	25	10	20	80	
Surface Water	--	onsite	Middle Gila	Metals-Total	Chromium	ug/L	22	22	4.3	7.9	0.52	1.7	31.4	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Chromium	ug/L	4	4	3.9	4.0	0.24	3.6	8.1	
Surface Water	--	onsite	Middle Gila	Metals-Total	Cobalt	ug/L	22	22	4.6	9.6	0.43	1.5	39.2	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Cobalt	ug/L	4	4	3.0	3.0	0.2	2.8	6.1	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Copper	ug/L	6	7	63	68	20	30	210	
Surface Water	--	onsite	Middle Gila	Metals-Total	Copper	ug/L	22	22	26	43	4.5	12	172	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Copper	ug/L	4	4	36	25	8.8	33	70.2	
Surface Water	--	onsite	Middle Gila	Metals-Total	Cyanide	ug/L	1	22	8.3	2.5	3.8	10	10	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Cyanide	ug/L	0	4	10	0	10	10	10	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Iron	ug/L	7	7	23549	27620	1100	13500	83300	
Surface Water	--	onsite	Middle Gila	Metals-Total	Iron	ug/L	22	22	4766	9069	505	1704	34500	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Iron	ug/L	3	4	4187	4553	47.3	3866	8970	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Lead	ug/L	6	7	17	27	2	8	78	

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Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Surface Water	--	onsite	Middle Gila	Metals-Total	Lead	ug/L	22	22	16	42	0.66	2.5	163	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Lead	ug/L	4	4	12	12	0.14	13	24.3	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Magnesium	ug/L	7	7	17371	8937	8000	15800	33700	
Surface Water	--	onsite	Middle Gila	Metals-Total	Magnesium	ug/L	22	22	19432	8178	13500	17100	44900	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Magnesium	ug/L	4	4	29150	1279	27400	29500	30200	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Manganese	ug/L	7	7	8430	20547	160	460	55000	
Surface Water	--	onsite	Middle Gila	Metals-Total	Manganese	ug/L	22	22	475	851	80.5	215	3540	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Manganese	ug/L	4	4	283	258	31.6	282	538	
Surface Water	--	onsite	Middle Gila	Metals-Total	Mercury	ug/L	3	22	0.21	0.07	0.034	0.2	0.42	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Mercury	ug/L	1	4	0.16	0.08	0.033	0.2	0.2	
Surface Water	--	onsite	Middle Gila	Metals-Total	Molybdenum	ug/L	22	22	3.9	1.3	0.33	4.3	5.4	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Molybdenum	ug/L	4	4	15	4.3	11.4	15	20.1	
Surface Water	--	onsite	Middle Gila	Metals-Total	Nickel	ug/L	22	22	8.1	12	1.9	4.3	50.1	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Nickel	ug/L	4	4	5.3	5.1	0.55	5.1	10.6	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Nitrate as Nitrogen	mg/L	6	7	640	410	60	600	1300	
Surface Water	--	onsite	Middle Gila	Metals-Total	Potassium	ug/L	22	22	7396	4816	4670	5800	22300	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Potassium	ug/L	4	4	8628	3255	5140	8935	11500	
Surface Water	--	onsite	Middle Gila	Metals-Total	Selenium	ug/L	22	22	0.70	0.38	0.38	0.54	2	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Selenium	ug/L	4	4	0.77	0.50	0.29	0.79	1.2	
Surface Water	--	onsite	Middle Gila	Metals-Total	Silver	ug/L	3	22	0.22	0.22	0.02	0.09	0.77	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Silver	ug/L	1	4	0.16	0.14	0.05	0.11	0.36	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Sodium	ug/L	7	7	231086	166484	34600	164000	458000	
Surface Water	--	onsite	Middle Gila	Metals-Total	Sodium	ug/L	22	22	114341	15040	93900	115500	135000	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Sodium	ug/L	4	4	146250	22156	126000	142000	174999	
Surface Water	--	onsite	Middle Gila	Metals-Total	Thallium	ug/L	8	22	0.60	0.45	0.05	0.93	1	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Thallium	ug/L	1	4	0.61	0.46	0.18	0.62	1	
Surface Water	--	onsite	Middle Gila	Metals-Total	Vanadium	ug/L	22	22	14	13	5.6	10	56.6	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Vanadium	ug/L	4	4	12	9.1	4.4	12	21.7	
Surface Water	--	offsite-up	Upper Gila	Metals-Total	Zinc	ug/L	6	7	86	102	10	50	310	
Surface Water	--	onsite	Middle Gila	Metals-Total	Zinc	ug/L	22	22	29	60	2.2	7.9	237	
Surface Water	--	onsite-SP	San Pedro	Metals-Total	Zinc	ug/L	4	4	25	24	2.4	25	49.7	
Sediment														
Sediment	--	onsite	Middle Gila	General	% Solids	Precent	22	22	70	14	40	69	91	
Sediment	--	onsite-SP	San Pedro	General	% Solids	Precent	4	4	85	8.6	72	88	91	
Sediment	--	onsite	Middle Gila	General	Total Organic Carbon	Precent DW	21	22	1.4	0.97	0.12	1.5	3.1	
Sediment	--	onsite-SP	San Pedro	General	Total Organic Carbon	Precent DW	4	4	0.19	0.12	0.07	0.17	0.35	
Sediment	--	onsite	Middle Gila	General	pH	pH Units	22	22	8.0	0.34	7.6	7.9	8.7	
Sediment	--	onsite-SP	San Pedro	General	pH	pH Units	4	4	8.5	0.33	8.1	8.5	8.9	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Aluminum	mg/kg DW	11	11	20161	8431	7393	17995	34963	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Aluminum	mg/kg DW	9	9	4238	2525	1250	3610	8540	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Aluminum	mg/kg DW	1	1	25376		25376	25376	25376	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Aluminum	mg/kg DW	7	7	17552	7860	5437	16640	25695	
Sediment	--	onsite	Middle Gila	Metals-Total	Aluminum	mg/kg DW	24	24	15812	4936	4240	16750	26679	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Aluminum	mg/kg DW	5	5	10180	9655	4250	4540	26678	
Sediment	--	onsite	Middle Gila	Metals-Total	Antimony	mg/kg DW	21	22	0.78	0.28	0.4	0.71	1.2	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Antimony	mg/kg DW	4	4	0.43	0.15	0.21	0.47	0.56	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Arsenic	mg/kg DW	11	11	6.7	4.4	2.37	6.7	17.97	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Arsenic	mg/kg DW	9	9	4.1	1.9	1.6	3.5	6.6	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Arsenic	mg/kg DW	1	1	6.2		6.22	6.2	6.22	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Arsenic	mg/kg DW	7	7	5.9	2.9	1.9	5	10.4	
Sediment	--	onsite	Middle Gila	Metals-Total	Arsenic	mg/kg DW	24	24	3.6	1.4	1.1	3.9	5.5	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Arsenic	mg/kg DW	5	5	3.4	2.2	1.4	2.6	6.83	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Barium	mg/kg DW	4	4	134	42	82	135	185	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Barium	mg/kg DW	9	9	107	84	26	86	288	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Barium	mg/kg DW	7	7	186	52	106	199	244	

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ASARCO LLC Hayden Plant Site, Hayden, Arizona

Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Sediment	--	onsite	Middle Gila	Metals-Total	Barium	mg/kg DW	22	22	129	41	51.8	141	180	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Barium	mg/kg DW	4	4	102	53	61.4	85	177	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Beryllium	mg/kg DW	18	18	56	73	0.43	1.5	200	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Beryllium	mg/kg DW	9	9	0.36	0.24	0.1	0.25	0.78	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Beryllium	mg/kg DW	2	2	66	93	0.75	66	132	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Beryllium	mg/kg DW	7	7	1.1	0.37	0.6	1	1.8	
Sediment	--	onsite	Middle Gila	Metals-Total	Beryllium	mg/kg DW	25	26	14	47	0.09	0.57	205	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Beryllium	mg/kg DW	6	6	27	66	0.15	0.55	161	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Boron	mg/kg DW	11	11	6.2	3.4	1.6	8	11.37	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Boron	mg/kg DW	1	9	4.0	4.5	1	1	10	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Boron	mg/kg DW	1	1	4.1		4.1	4.1	4.1	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Boron	mg/kg DW	6	7	8.8	4.8	3.1	8	18.4	
Sediment	--	onsite	Middle Gila	Metals-Total	Boron	mg/kg DW	24	24	5.7	3.2	0.81	5.5	10.9	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Boron	mg/kg DW	5	5	3.8	4.0	0.9	1.9	10.6	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Cadmium	mg/kg DW	10	11	0.78	1.0	0.23	0.46	3.91	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Cadmium	mg/kg DW	1	1	0.65		0.65	0.65	0.65	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Cadmium	mg/kg DW	6	7	4.9	2.8	0.4	5.1	8.6	
Sediment	--	onsite	Middle Gila	Metals-Total	Cadmium	mg/kg DW	6	24	0.48	0.25	0.03	0.5	1.1	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Cadmium	mg/kg DW	2	5	0.39	0.16	0.12	0.43	0.52	
Sediment	--	onsite	Middle Gila	Metals-Total	Calcium	mg/kg DW	22	22	27981	9274	8140	31550	41900	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Calcium	mg/kg DW	4	4	16125	16317	7800	8050	40600	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Chromium	mg/kg DW	11	11	15	6.0	5.85	15	29.34	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Chromium	mg/kg DW	9	9	3.3	2.0	1.4	2.3	6.9	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Chromium	mg/kg DW	1	1	13		13	13	13	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Chromium	mg/kg DW	7	7	18	7.1	9	17	31	
Sediment	--	onsite	Middle Gila	Metals-Total	Chromium	mg/kg DW	24	24	13	4.3	4.3	13	21	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Chromium	mg/kg DW	5	5	7.6	5.4	2.9	4.3	14.8	
Sediment	--	onsite	Middle Gila	Metals-Total	Cobalt	mg/kg DW	22	22	11	3.2	3.2	10	16.2	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Cobalt	mg/kg DW	4	4	4.5	1.6	3.2	4.2	6.6	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Copper	mg/kg DW	11	11	469	801	44	137	2660	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Copper	mg/kg DW	9	9	16	12	3.4	13	40	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Copper	mg/kg DW	1	1	137		137	137	137	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Copper	mg/kg DW	7	7	64	44	12	77	135	
Sediment	--	onsite	Middle Gila	Metals-Total	Copper	mg/kg DW	24	24	112	76	11.6	95	392	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Copper	mg/kg DW	5	5	54	54	9.1	35	143	
Sediment	--	onsite	Middle Gila	Metals-Total	Cyanide	mg/kg DW	0	22	4.0	1.1	2.6	3.8	6.9	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Cyanide	mg/kg DW	0	4	3.0	0.25	2.7	3.0	3.3	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Iron	mg/kg DW	11	11	19920	5399	9344	18696	28043	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Iron	mg/kg DW	9	9	5100	2507	1920	4790	8720	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Iron	mg/kg DW	1	1	17419		17419	17419	17419	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Iron	mg/kg DW	7	7	19298	7380	8930	17860	30573	
Sediment	--	onsite	Middle Gila	Metals-Total	Iron	mg/kg DW	24	24	19220	5145	6890	19300	28500	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Iron	mg/kg DW	5	5	10757	5710	5480	8710	19277	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Lead	mg/kg DW	11	11	25	17	8.32	21	72.37	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Lead	mg/kg DW	7	9	12	11	5	6.1	36	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Lead	mg/kg DW	1	1	22		22.4	22	22.4	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Lead	mg/kg DW	7	7	15	6.0	7	16	22	
Sediment	--	onsite	Middle Gila	Metals-Total	Lead	mg/kg DW	24	24	14	6.2	3.4	14	30.6	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Lead	mg/kg DW	5	5	12	6.1	6.7	11	20.8	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Magnesium	mg/kg DW	11	11	9028	2318	4740	8504	12365	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Magnesium	mg/kg DW	9	9	2878	1757	1130	2130	5940	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Magnesium	mg/kg DW	1	1	11075		11075	11075	11075	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Magnesium	mg/kg DW	7	7	9423	4118	3530	10660	13885	
Sediment	--	onsite	Middle Gila	Metals-Total	Magnesium	mg/kg DW	24	24	7610	2244	2260	7980	11530	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Magnesium	mg/kg DW	5	5	4600	3170	2110	2890	9518	

TABLE 2-2
Summary Statistics for Concentrations of Chemicals of Potential Ecological Concern
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Sediment	--	offsite-down	Middle Gila	Metals-Total	Manganese	mg/kg DW	11	11	611	188	414	597	1073	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Manganese	mg/kg DW	9	9	306	224	128	219	825	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Manganese	mg/kg DW	1	1	566		566	566	566	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Manganese	mg/kg DW	7	7	690	295	197	708	1072	
Sediment	--	onsite	Middle Gila	Metals-Total	Manganese	mg/kg DW	24	24	789	592	113	547	2410	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Manganese	mg/kg DW	5	5	388	373	155	183	1031	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Mercury	mg/kg DW	10	11	0.04	0.02	0.015	0.04	0.09	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Mercury	mg/kg DW	1	1	0.05		0.05	0.05	0.05	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Mercury	mg/kg DW	1	7	0.05	0.02	0.03	0.05	0.09	
Sediment	--	onsite	Middle Gila	Metals-Total	Mercury	mg/kg DW	12	24	0.06	0.02	0.021	0.06	0.1	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Mercury	mg/kg DW	1	5	0.05	0.02	0.023	0.06	0.066	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Molybdenum	mg/kg DW	6	11	5.8	12	1.5	2.0	41.6	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Molybdenum	mg/kg DW	0	1	2.1		2.1	2.1	2.1	
Sediment	--	onsite	Middle Gila	Metals-Total	Molybdenum	mg/kg DW	10	24	1.4	0.84	0.09	1.5	2.5	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Molybdenum	mg/kg DW	2	5	1.5	0.69	0.34	1.7	2.1	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Nickel	mg/kg DW	11	11	20	7.6	10.63	17	36.19	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Nickel	mg/kg DW	9	9	5.0	2.4	2.3	4.3	8.8	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Nickel	mg/kg DW	1	1	23		22.8	23	22.8	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Nickel	mg/kg DW	7	7	25	9.5	11	31	34	
Sediment	--	onsite	Middle Gila	Metals-Total	Nickel	mg/kg DW	24	24	16	4.5	6.1	15	26.5	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Nickel	mg/kg DW	5	5	9.7	4.6	5.2	7.3	16.3	
Sediment	--	onsite	Middle Gila	Metals-Total	Potassium	mg/kg DW	22	22	2345	1006	585	2545	3760	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Potassium	mg/kg DW	4	4	1363	993	715	948	2840	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Selenium	mg/kg DW	6	11	0.45	0.58	0.15	0.26	2.16	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Selenium	mg/kg DW	0	1	0.22		0.22	0.22	0.22	
Sediment	--	onsite	Middle Gila	Metals-Total	Selenium	mg/kg DW	14	24	0.79	0.29	0.17	0.8	1.4	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Selenium	mg/kg DW	0	5	0.51	0.19	0.17	0.58	0.66	
Sediment	--	onsite	Middle Gila	Metals-Total	Silver	mg/kg DW	1	22	0.77	0.25	0.15	0.73	1.4	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Silver	mg/kg DW	0	4	0.59	0.05	0.53	0.59	0.66	
Sediment	--	onsite	Middle Gila	Metals-Total	Sodium	mg/kg DW	15	22	963	575	406	829	2790	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Sodium	mg/kg DW	2	4	361	70	265	376	429	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Strontium	mg/kg DW	11	11	118	36	46	119	165	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Strontium	mg/kg DW	9	9	3004	5787	28	101	13310	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Strontium	mg/kg DW	1	1	141		141	141	141	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Strontium	mg/kg DW	7	7	206	68	88	206	289	
Sediment	--	onsite	Middle Gila	Metals-Total	Strontium	mg/kg DW	2	2	183	16	172	183	194	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Strontium	mg/kg DW	1	1	213		213	213	213	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Thallium	mg/kg DW	4	7	111	86	14	159	189	
Sediment	--	onsite	Middle Gila	Metals-Total	Thallium	mg/kg DW	6	22	1.1	0.32	0.57	1.1	1.9	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Thallium	mg/kg DW	1	4	0.75	0.10	0.6	0.78	0.83	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Vanadium	mg/kg DW	11	11	50	19	17.84	51	91.7	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Vanadium	mg/kg DW	9	9	6.9	2.6	3	7.2	10	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Vanadium	mg/kg DW	1	1	53		52.7	53	52.7	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Vanadium	mg/kg DW	7	7	39	22	5	36	72	
Sediment	--	onsite	Middle Gila	Metals-Total	Vanadium	mg/kg DW	24	24	47	17	14.6	45	91.2	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Vanadium	mg/kg DW	5	5	21	16	8.7	14	46.3	
Sediment	--	offsite-down	Middle Gila	Metals-Total	Zinc	mg/kg DW	11	11	105	72	35.06	82	281.17	
Sediment	--	offsite-SP	San Pedro	Metals-Total	Zinc	mg/kg DW	9	9	24	13	8	20	46	
Sediment	--	offsite-up	Middle Gila	Metals-Total	Zinc	mg/kg DW	1	1	81		81.3	81	81.3	
Sediment	--	offsite-up	Upper Gila	Metals-Total	Zinc	mg/kg DW	7	7	68	26	31	68	102	
Sediment	--	onsite	Middle Gila	Metals-Total	Zinc	mg/kg DW	24	24	53	18	14.5	51	89.9	
Sediment	--	onsite-SP	San Pedro	Metals-Total	Zinc	mg/kg DW	5	5	36	27	17	20	78.5	
Sediment	--	offsite-SP	San Pedro	Organic	p,p'-DDE	mg/kg WW		0						
Sediment	--	offsite-down	Middle Gila	Organic	p,p'-DDE	mg/kg WW		7	0.01	0	0.01	0.01	0.01	
Sediment	--	offsite-up	Middle Gila	Organic	p,p'-DDE	mg/kg WW		1	0.01		0.01	0.01	0.01	

TABLE 2-2
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Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Sediment	--	onsite	Middle Gila	Organic	p,p'-DDE	mg/kg WW		2	0.01	0	0.01	0.01	0.01	
Sediment	--	onsite-SP	San Pedro	Organic	p,p'-DDE	mg/kg WW		1	0.01		0.01	0.01	0.01	
Soil														
Soil	stable	onsite	Middle Gila	General	% Solids	Precent	17	17	94	9.4	69	98	100	stable > unstable
Soil	stable	onsite-SP	San Pedro	General	% Solids	Precent	2	2	99	0	99	99	99	
Soil	unstable	onsite	Middle Gila	General	% Solids	Precent	12	12	77	10	60	74	95	
Soil	unstable	onsite-SP	San Pedro	General	% Solids	Precent	2	2	96	1.4	95	96	97	
Soil	stable	onsite	Middle Gila	General	pH	pH Units	17	17	7.8	0.35	7.3	7.8	8.5	NS
Soil	stable	onsite-SP	San Pedro	General	pH	pH Units	2	2	8.6	0.28	8.4	8.6	8.8	P=0.769
Soil	unstable	onsite	Middle Gila	General	pH	pH Units	12	12	7.9	0.40	7.5	7.8	8.7	
Soil	unstable	onsite-SP	San Pedro	General	pH	pH Units	2	2	8.3	0.71	7.8	8.3	8.8	
Soil	stable	onsite	Middle Gila	General	Total Organic Carbon	Precent DW	17	17	1.1	0.94	0.08	0.81	3.7	NS
Soil	stable	onsite-SP	San Pedro	General	Total Organic Carbon	Precent DW	2	2	0.42	0.30	0.21	0.42	0.63	P=0.0631
Soil	unstable	onsite	Middle Gila	General	Total Organic Carbon	Precent DW	12	12	1.7	0.88	0.17	1.8	3.2	
Soil	unstable	onsite-SP	San Pedro	General	Total Organic Carbon	Precent DW	1	2	1.8	2.4	0.12	1.8	3.5	
Soil	stable	onsite	Middle Gila	Metals-Total	Aluminum	mg/kg	17	17	12352	4634	5820	12700	23400	unstable > stable
Soil	stable	onsite-SP	San Pedro	Metals-Total	Aluminum	mg/kg	2	2	6885	417	6590	6885	7180	
Soil	unstable	onsite	Middle Gila	Metals-Total	Aluminum	mg/kg	12	12	17533	3707	10500	17150	23400	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Aluminum	mg/kg	2	2	9870	7396	4640	9870	15100	
Soil	stable	onsite	Middle Gila	Metals-Total	Antimony	mg/kg	17	17	0.55	0.18	0.32	0.48	0.87	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Antimony	mg/kg	2	2	0.32	0.03	0.3	0.32	0.34	P=0.0534
Soil	unstable	onsite	Middle Gila	Metals-Total	Antimony	mg/kg	12	12	0.64	0.15	0.39	0.62	0.92	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Antimony	mg/kg	2	2	0.48	0.14	0.38	0.48	0.58	
Soil	stable	onsite	Middle Gila	Metals-Total	Arsenic	mg/kg	17	17	3.7	2.0	1.2	3	8.1	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Arsenic	mg/kg	2	2	2.1	0.28	1.9	2.1	2.3	P=0.1211
Soil	unstable	onsite	Middle Gila	Metals-Total	Arsenic	mg/kg	12	12	4.2	1.5	1.2	4.2	6.7	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Arsenic	mg/kg	2	2	3.6	1.7	2.4	3.6	4.8	
Soil	stable	onsite	Middle Gila	Metals-Total	Barium	mg/kg	17	17	107	43	38.4	103	202	unstable > stable
Soil	stable	onsite-SP	San Pedro	Metals-Total	Barium	mg/kg	2	2	100	19	86.8	100	114	
Soil	unstable	onsite	Middle Gila	Metals-Total	Barium	mg/kg	12	12	134	39	44.6	134	203	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Barium	mg/kg	2	2	99	67	51.2	99	146	
Soil	stable	onsite	Middle Gila	Metals-Total	Beryllium	mg/kg	11	17	0.65	0.29	0.5	0.52	1.6	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Beryllium	mg/kg	2	2	0.52	0.01	0.51	0.52	0.53	P=0.1443
Soil	unstable	onsite	Middle Gila	Metals-Total	Beryllium	mg/kg	9	12	0.77	0.25	0.5	0.76	1.3	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Beryllium	mg/kg	1	2	0.73	0.33	0.5	0.73	0.96	
Soil	stable	onsite	Middle Gila	Metals-Total	Boron	mg/kg	17	17	5.8	7.8	0.48	3.1	32.5	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Boron	mg/kg	2	2	1.4	0	1.4	1.4	1.4	P=0.2154
Soil	unstable	onsite	Middle Gila	Metals-Total	Boron	mg/kg	12	12	5.0	2.5	0.62	5.5	8.8	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Boron	mg/kg	2	2	3.3	3.4	0.88	3.3	5.7	
Soil	stable	onsite	Middle Gila	Metals-Total	Cadmium	mg/kg	5	17	0.43	0.18	0.04	0.5	0.7	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Cadmium	mg/kg		2	0.5	0	0.5	0.5	0.5	P=0.5610
Soil	unstable	onsite	Middle Gila	Metals-Total	Cadmium	mg/kg	3	12	0.49	0.19	0.17	0.5	0.95	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Cadmium	mg/kg		2	0.5	0	0.5	0.5	0.5	
Soil	stable	onsite	Middle Gila	Metals-Total	Calcium	mg/kg	17	17	24699	10199	5390	22600	48600	unstable > stable
Soil	stable	onsite-SP	San Pedro	Metals-Total	Calcium	mg/kg	2	2	14150	2333	12500	14150	15800	
Soil	unstable	onsite	Middle Gila	Metals-Total	Calcium	mg/kg	12	12	36983	7773	22700	36850	50400	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Calcium	mg/kg	2	2	17825	14955	7250	17825	28400	
Soil	stable	onsite	Middle Gila	Metals-Total	Chromium	mg/kg	17	17	11	2.8	4.1	11	16.6	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Chromium	mg/kg	2	2	7.5	1.1	6.7	7.5	8.2	P=0.1351
Soil	unstable	onsite	Middle Gila	Metals-Total	Chromium	mg/kg	12	12	12	2.3	8.4	12	16.8	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Chromium	mg/kg	2	2	9.0	6.9	4.1	9.0	13.8	
Soil	stable	onsite	Middle Gila	Metals-Total	Cobalt	mg/kg	16	17	8.5	2.0	5	8.8	11.5	unstable > stable
Soil	stable	onsite-SP	San Pedro	Metals-Total	Cobalt	mg/kg		2	5	0	5	5	5	
Soil	unstable	onsite	Middle Gila	Metals-Total	Cobalt	mg/kg	12	12	11	2.5	7.4	11	17	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Cobalt	mg/kg	1	2	7.0	2.8	5	7.0	8.9	

TABLE 2-2
Summary Statistics for Concentrations of Chemicals of Potential Ecological Concern
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Soil	stable	onsite	Middle Gila	Metals-Total	Copper	mg/kg	17	17	199	265	51.8	102	1150	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Copper	mg/kg	2	2	29	11	21.6	29	36.6	P=0.4335
Soil	unstable	onsite	Middle Gila	Metals-Total	Copper	mg/kg	12	12	187	213	40.2	95	696	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Copper	mg/kg	2	2	207	163	91.5	207	322	
Soil	stable	onsite	Middle Gila	Metals-Total	Cyanide	mg/kg	1	17	2.4	0.54	0.26	2.5	2.5	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Cyanide	mg/kg		2	2.5	0	2.5	2.5	2.5	P=0.4217
Soil	unstable	onsite	Middle Gila	Metals-Total	Cyanide	mg/kg	1	12	2.3	0.65	0.26	2.5	2.5	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Cyanide	mg/kg	1	2	1.4	1.5	0.34	1.4	2.5	
Soil	stable	onsite	Middle Gila	Metals-Total	Iron	mg/kg	17	17	15881	3541	8480	16600	20700	unstable > stable
Soil	stable	onsite-SP	San Pedro	Metals-Total	Iron	mg/kg	2	2	9680	269	9490	9680	9870	
Soil	unstable	onsite	Middle Gila	Metals-Total	Iron	mg/kg	12	12	19192	3546	13200	18550	27200	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Iron	mg/kg	2	2	12285	8082	6570	12285	18000	
Soil	stable	onsite	Middle Gila	Metals-Total	Lead	mg/kg	17	17	18	12	8.4	15	60.8	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Lead	mg/kg	2	2	9.6	0.85	9	9.6	10.2	P=0.1663
Soil	unstable	onsite	Middle Gila	Metals-Total	Lead	mg/kg	12	12	18	6.5	10.3	18	32.8	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Lead	mg/kg	2	2	17	7.7	11.4	17	22.3	
Soil	stable	onsite	Middle Gila	Metals-Total	Magnesium	mg/kg	17	17	7119	2442	3160	6940	12100	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Magnesium	mg/kg	2	2	3610	113	3530	3610	3690	P=0.0558
Soil	unstable	onsite	Middle Gila	Metals-Total	Magnesium	mg/kg	12	12	9321	2392	5500	9010	15600	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Magnesium	mg/kg	2	2	4730	3097	2540	4730	6920	
Soil	stable	onsite	Middle Gila	Metals-Total	Manganese	mg/kg	17	17	410	144	210	381	794	unstable > stable
Soil	stable	onsite-SP	San Pedro	Metals-Total	Manganese	mg/kg	2	2	190	5.7	186	190	194	
Soil	unstable	onsite	Middle Gila	Metals-Total	Manganese	mg/kg	12	12	581	136	339	598	879	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Manganese	mg/kg	2	2	375	306	158	375	591	
Soil	stable	onsite	Middle Gila	Metals-Total	Mercury	mg/kg	6	17	0.09	0.03	0.033	0.1	0.15	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Mercury	mg/kg	2	2	0.04	0.02	0.023	0.04	0.051	P=0.7096
Soil	unstable	onsite	Middle Gila	Metals-Total	Mercury	mg/kg	7	12	0.08	0.03	0.032	0.1	0.12	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Mercury	mg/kg	1	2	0.07	0.04	0.043	0.07	0.1	
Soil	stable	onsite	Middle Gila	Metals-Total	Molybdenum	mg/kg	17	17	2.1	1.8	0.16	2	7.1	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Molybdenum	mg/kg	2	2	2	0	2	2	2	P=0.0759
Soil	unstable	onsite	Middle Gila	Metals-Total	Molybdenum	mg/kg	12	12	1.2	1.0	0.1	0.5	2.8	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Molybdenum	mg/kg	2	2	1.1	0.88	0.46	1.1	1.7	
Soil	stable	onsite	Middle Gila	Metals-Total	Nickel	mg/kg	17	17	14	3.4	5.2	14	19.9	unstable > stable
Soil	stable	onsite-SP	San Pedro	Metals-Total	Nickel	mg/kg	2	2	9.2	0.49	8.8	9.2	9.5	
Soil	unstable	onsite	Middle Gila	Metals-Total	Nickel	mg/kg	12	12	17	2.5	11.6	17	22.1	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Nickel	mg/kg	2	2	11	6.5	6.8	11	16	
Soil	stable	onsite	Middle Gila	Metals-Total	Potassium	mg/kg	17	17	2891	1287	1470	2400	5570	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Potassium	mg/kg	2	2	1735	21	1720	1735	1750	P=0.4335
Soil	unstable	onsite	Middle Gila	Metals-Total	Potassium	mg/kg	12	12	2864	1045	580	2810	4690	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Potassium	mg/kg	2	2	2467	2267	864	2467	4070	
Soil	stable	onsite	Middle Gila	Metals-Total	Selenium	mg/kg	1	17	3.3	0.69	0.67	3.5	3.5	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Selenium	mg/kg		2	3.5	0	3.5	3.5	3.5	P=0.4254
Soil	unstable	onsite	Middle Gila	Metals-Total	Selenium	mg/kg		12	3.5	0	3.5	3.5	3.5	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Selenium	mg/kg		2	3.5	0	3.5	3.5	3.5	
Soil	stable	onsite	Middle Gila	Metals-Total	Silver	mg/kg	2	17	0.98	0.18	0.36	1	1.3	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Silver	mg/kg		2	1	0	1	1	1	P=0.1150
Soil	unstable	onsite	Middle Gila	Metals-Total	Silver	mg/kg	2	12	0.89	0.25	0.34	1	1	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Silver	mg/kg	1	2	0.62	0.54	0.24	0.62	1	
Soil	stable	onsite	Middle Gila	Metals-Total	Sodium	mg/kg	17	17	1792	2520	237	843	10700	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Sodium	mg/kg	2	2	333	146	230	333	436	P=0.2666
Soil	unstable	onsite	Middle Gila	Metals-Total	Sodium	mg/kg	12	12	1366	913	600	1065	3900	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Sodium	mg/kg	2	2	674	361	419	674	929	
Soil	stable	onsite	Middle Gila	Metals-Total	Thallium	mg/kg		17	2.5	0	2.5	2.5	2.5	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Thallium	mg/kg		2	2.5	0	2.5	2.5	2.5	P=1.00
Soil	unstable	onsite	Middle Gila	Metals-Total	Thallium	mg/kg		12	2.5	0	2.5	2.5	2.5	

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Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Thallium	mg/kg		2	2.5	0	2.5	2.5	2.5	
Soil	stable	onsite	Middle Gila	Metals-Total	Vanadium	mg/kg	17	17	35	11	11.1	34	57.6	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Vanadium	mg/kg	2	2	19	1.9	17.9	19	20.6	P=0.3166
Soil	unstable	onsite	Middle Gila	Metals-Total	Vanadium	mg/kg	12	12	42	15	29.6	37	83.1	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Vanadium	mg/kg	2	2	22	15	10.9	22	32.2	
Soil	stable	onsite	Middle Gila	Metals-Total	Zinc	mg/kg	17	17	62	21	42.8	54	112	NS
Soil	stable	onsite-SP	San Pedro	Metals-Total	Zinc	mg/kg	2	2	32	4.7	28.7	32	35.3	P=0.1608
Soil	unstable	onsite	Middle Gila	Metals-Total	Zinc	mg/kg	12	12	68	13	40.1	68	93.3	
Soil	unstable	onsite-SP	San Pedro	Metals-Total	Zinc	mg/kg	2	2	49	28	29	49	69.3	
Soil	--	onsite	Upland soil	General	% Solids	Precent	7	7	99	0.6	98	99	100	
Soil	--	onsite	Upland soil	General	Cyanide, Total	mg/kg	0	10	2.5	0	2.5	2.5	2.5	
Soil	--	onsite	Upland soil	General	pH	pH Units	7	7	7.8	0.86	6.2	7.8	8.6	
Soil	--	onsite	Upland soil	General	Total Organic Carbon	Precent DW	7	7	0.68	0.70	0.07	0.39	2.1	
Soil	--	onsite	Upland soil	Metals-Total	Aluminum	mg/kg	10	10	15748	8405	1220	16900	30000	
Soil	--	onsite	Upland soil	Metals-Total	Antimony	mg/kg	10	10	3.3	3.2	0.39	2.5	10.4	
Soil	--	onsite	Upland soil	Metals-Total	Arsenic	mg/kg	10	10	77	121	1.8	19	361	
Soil	--	onsite	Upland soil	Metals-Total	Barium	mg/kg	10	10	103	55	27.8	88	217	
Soil	--	onsite	Upland soil	Metals-Total	Beryllium	mg/kg	2	10	0.36	0.11	0.14	0.37	0.52	
Soil	--	onsite	Upland soil	Metals-Total	Boron	mg/kg	10	10	3.3	1.7	1.5	2.9	7.3	
Soil	--	onsite	Upland soil	Metals-Total	Cadmium	mg/kg	9	10	22	36	0.08	5	94.7	
Soil	--	onsite	Upland soil	Metals-Total	Calcium	mg/kg	10	10	35612	29865	1850	29050	84300	
Soil	--	onsite	Upland soil	Metals-Total	Chromium	mg/kg	9	10	18	21	0.4	14	72	
Soil	--	onsite	Upland soil	Metals-Total	Cobalt	mg/kg	10	10	31	22	5.7	29	84.9	
Soil	--	onsite	Upland soil	Metals-Total	Copper	mg/kg	10	10	10991	15177	16.6	5060	47200	
Soil	--	onsite	Upland soil	Metals-Total	Iron	mg/kg	10	10	49430	50648	11500	34050	186999	
Soil	--	onsite	Upland soil	Metals-Total	Lead	mg/kg	10	10	152	151	5.1	86	468	
Soil	--	onsite	Upland soil	Metals-Total	Magnesium	mg/kg	10	10	11953	6341	3250	13150	22000	
Soil	--	onsite	Upland soil	Metals-Total	Manganese	mg/kg	10	10	476	202	232	470	797	
Soil	--	onsite	Upland soil	Metals-Total	Mercury	mg/kg	8	10	0.14	0.18	0.02	0.05	0.49	
Soil	--	onsite	Upland soil	Metals-Total	Molybdenum	mg/kg	10	10	167	322	0.25	64	1060	
Soil	--	onsite	Upland soil	Metals-Total	Nickel	mg/kg	10	10	26	11	7.2	28	40.9	
Soil	--	onsite	Upland soil	Metals-Total	Potassium	mg/kg	10	10	2045	1674	416	1555	6430	
Soil	--	onsite	Upland soil	Metals-Total	Selenium	mg/kg	9	10	6.2	6.9	0.51	3.2	18.8	
Soil	--	onsite	Upland soil	Metals-Total	Silver	mg/kg	9	10	6.2	7.7	0.37	3.5	24.5	
Soil	--	onsite	Upland soil	Metals-Total	Sodium	mg/kg	8	10	387	294	139	272	1010	
Soil	--	onsite	Upland soil	Metals-Total	Thallium	mg/kg	2	10	0.84	0.57	0.4	0.71	2.4	
Soil	--	onsite	Upland soil	Metals-Total	Vanadium	mg/kg	10	10	57	23	22.4	67	86.3	
Soil	--	onsite	Upland soil	Metals-Total	Zinc	mg/kg	10	10	1729	2282	30.3	499	5920	
Soil	--	onsite	Wash soil	General	% Solids	Precent	32	32	98	2.5	86	99	100	
Soil	--	onsite	Wash soil	General	Cyanide, Total	mg/kg	1	31	2.5	0	2.5	2.5	2.5	
Soil	--	onsite	Wash soil	General	pH	pH Units	31	31	8.1	0.28	7.6	8.1	8.6	
Soil	--	onsite	Wash soil	General	Total Organic Carbon	Precent DW	29	31	0.38	0.27	0.07	0.31	1	
Soil	--	onsite	Wash soil	Metals-Total	Aluminum	mg/kg	32	32	12367	4461	2590	13100	18800	
Soil	--	onsite	Wash soil	Metals-Total	Antimony	mg/kg	21	32	2.1	3.4	0.49	1.3	20	
Soil	--	onsite	Wash soil	Metals-Total	Arsenic	mg/kg	32	32	21	15	1.6	18	75.3	
Soil	--	onsite	Wash soil	Metals-Total	Barium	mg/kg	32	32	64	26	20.3	63	118	
Soil	--	onsite	Wash soil	Metals-Total	Beryllium	mg/kg	1	32	0.25	0.04	0.07	0.26	0.27	
Soil	--	onsite	Wash soil	Metals-Total	Boron	mg/kg	19	19	2.7	0.80	0.85	2.9	4	
Soil	--	onsite	Wash soil	Metals-Total	Cadmium	mg/kg	30	32	2.6	1.6	0.3	2.2	8.3	
Soil	--	onsite	Wash soil	Metals-Total	Calcium	mg/kg	32	32	35555	19909	2210	33850	79500	
Soil	--	onsite	Wash soil	Metals-Total	Chromium	mg/kg	32	32	18	19	3.8	16	120	
Soil	--	onsite	Wash soil	Metals-Total	Cobalt	mg/kg	32	32	24	14	7.1	22	79	
Soil	--	onsite	Wash soil	Metals-Total	Copper	mg/kg	32	32	5658	3039	926	5810	12500	
Soil	--	onsite	Wash soil	Metals-Total	Iron	mg/kg	32	32	37203	53068	9590	26900	320000	
Soil	--	onsite	Wash soil	Metals-Total	Lead	mg/kg	32	32	73	51	9.6	62	239	

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Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Soil	--	onsite	Wash soil	Metals-Total	Magnesium	mg/kg	32	32	11264	4771	1400	11650	17900	
Soil	--	onsite	Wash soil	Metals-Total	Manganese	mg/kg	32	32	397	173	61.1	399	758	
Soil	--	onsite	Wash soil	Metals-Total	Mercury	mg/kg	26	32	0.07	0.06	0.02	0.05	0.3	
Soil	--	onsite	Wash soil	Metals-Total	Molybdenum	mg/kg	20	20	41	20	3.8	39	86	
Soil	--	onsite	Wash soil	Metals-Total	Nickel	mg/kg	32	32	26	13	7	25	82	
Soil	--	onsite	Wash soil	Metals-Total	Potassium	mg/kg	32	32	1916	1349	1040	1545	8270	
Soil	--	onsite	Wash soil	Metals-Total	Selenium	mg/kg	20	32	1.5	4.2	0.15	0.56	24	
Soil	--	onsite	Wash soil	Metals-Total	Silver	mg/kg	32	32	2.7	2.4	0.23	2.4	11.7	
Soil	--	onsite	Wash soil	Metals-Total	Sodium	mg/kg	19	32	288	187	78.6	235	1130	
Soil	--	onsite	Wash soil	Metals-Total	Thallium	mg/kg	29	32	1.5	1.6	0.2	1.3	10	
Soil	--	onsite	Wash soil	Metals-Total	Vanadium	mg/kg	32	32	51	16	14.1	51	79.8	
Soil	--	onsite	Wash soil	Metals-Total	Zinc	mg/kg	32	32	285	230	34.7	231	1040	
Groundwater														
Groundwater	--	onsite	Groundwater	General	Bicarbonate Alkalinity	mg/L	10	10	246	46	170	250	310	
Groundwater	--	onsite	Groundwater	General	Carbonate Alkalinity	mg/L	0	10	10	0	10	10	10	
Groundwater	--	onsite	Groundwater	General	Cyanide, Total	ug/L	0	9	10	0	10	10	10	
Groundwater	--	onsite	Groundwater	General	Fluoride	mg/L	10	10	1.2	0.45	0.76	0.96	2.1	
Groundwater	--	onsite	Groundwater	General	Hardness, as CaCO3	mg/L	5	5	736	615	220	420	1500	
Groundwater	--	onsite	Groundwater	General	Hydroxide Alkalinity	mg/L	0	10	10	0	10	10	10	
Groundwater	--	onsite	Groundwater	General	Sulfate	mg/L	10	10	757	700	110	370	2000	
Groundwater	--	onsite	Groundwater	General	Total Alkalinity	mg/L	10	10	246	46	170	250	310	
Groundwater	--	onsite	Groundwater	General	Total Dissolved Solids	mg/L	10	10	1787	1157	680	1400	4100	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Aluminum	ug/L	0	10	110	95	20	110	200	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Antimony	ug/L	0	10	1.5	0.53	1	1.5	2	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Arsenic	ug/L	10	10	5.1	0.99	3.6	5.1	6.7	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Barium	ug/L	10	10	61	48	27	46	191	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Beryllium	ug/L	0	10	0.85	0.24	0.5	1	1	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Boron	ug/L	10	10	150	30	109	151	201	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Cadmium	ug/L	2	10	0.81	0.40	0.03	1	1	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Calcium	ug/L	10	10	262900	225270	62000	160000	731001	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Chromium	ug/L	1	10	1.4	0.66	0.18	1.5	2	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Cobalt	ug/L	6	10	2.9	2.9	0.5	1.4	9.2	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Copper	ug/L	7	10	3.2	2.0	1.9	2.4	7.8	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Hardness, as CaCO3	mg/L	5	5	754	649	220	420	1600	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Iron	ug/L	6	10	353	321	100	242	950	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Lead	ug/L	1	10	1.4	0.66	0.16	1.5	2	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Magnesium	ug/L	10	10	60290	46794	14000	43150	158001	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Manganese	ug/L	9	10	2963	3248	0.63	1505	7300	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Mercury	ug/L	2	10	0.11	0.09	0.015	0.12	0.2	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Molybdenum	ug/L	10	10	14	6.5	5.3	14	25.7	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Nickel	ug/L	5	10	20	16	1.2	13	50	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Potassium	ug/L	10	10	8294	3198	4800	7820	15400	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Selenium	ug/L	7	10	3.5	2.3	0.95	3	7.8	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Silver	ug/L	0	10	0.75	0.26	0.5	0.75	1	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Sodium	ug/L	10	10	219700	69674	120000	203000	345000	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Thallium	ug/L	0	10	1.5	0.53	1	1.5	2	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Thorium	ug/L	0	5	2.0	0	2	2	2	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Uranium	ug/L	5	5	2.2	1.1	1.4	1.7	4	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Vanadium	ug/L	6	10	4.0	1.6	1	4.2	6.8	
Groundwater	--	onsite	Groundwater	Metals-Dissolved	Dissolved Zinc	ug/L	8	10	4.4	1.9	2.5	3.8	7.9	
Groundwater	--	onsite	Groundwater	Metals-Total	Aluminum	ug/L	2	10	92	93	19	22	200	
Groundwater	--	onsite	Groundwater	Metals-Total	Antimony	ug/L	0	10	0.75	0.62	0.06	1	2	
Groundwater	--	onsite	Groundwater	Metals-Total	Arsenic	ug/L	10	10	5.3	1.2	3.6	5.1	7.4	
Groundwater	--	onsite	Groundwater	Metals-Total	Barium	ug/L	10	10	61	44	27	46	177	
Groundwater	--	onsite	Groundwater	Metals-Total	Beryllium	ug/L	0	10	0.61	0.60	0.03	0.5	2	

TABLE 2-2
Summary Statistics for Concentrations of Chemicals of Potential Ecological Concern
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Matrix	MatrixType	Area	Watershed	Analyte Group	Parameter	Unit	Detected	N	Mean	Standard Deviation	Minimum	Median	Maximum	Statistical Results (stable vs unstable)*
Groundwater	--	onsite	Groundwater	Metals-Total	Boron	ug/L	10	10	150	32	100	149	193	
Groundwater	--	onsite	Groundwater	Metals-Total	Cadmium	ug/L	1	10	0.76	0.39	0.04	1	1	
Groundwater	--	onsite	Groundwater	Metals-Total	Calcium	ug/L	10	10	253950	209207	63000	158000	678000	
Groundwater	--	onsite	Groundwater	Metals-Total	Chloride	mg/L	10	10	252	124	94	225	510	
Groundwater	--	onsite	Groundwater	Metals-Total	Chromium	ug/L	4	10	0.61	0.36	0.12	0.55	1	
Groundwater	--	onsite	Groundwater	Metals-Total	Cobalt	ug/L	7	10	2.7	3.0	0.19	1.1	8.7	
Groundwater	--	onsite	Groundwater	Metals-Total	Copper	ug/L	8	10	3.8	1.9	1.7	3.5	7.8	
Groundwater	--	onsite	Groundwater	Metals-Total	Iron	ug/L	6	10	361	311	100	272	920	
Groundwater	--	onsite	Groundwater	Metals-Total	Lead	ug/L	0	10	1.0	1.0	0.03	1.1	2	
Groundwater	--	onsite	Groundwater	Metals-Total	Magnesium	ug/L	10	10	59330	45725	15000	43300	153999	
Groundwater	--	onsite	Groundwater	Metals-Total	Manganese	ug/L	8	10	3041	3147	0.32	1520	7330	
Groundwater	--	onsite	Groundwater	Metals-Total	Mercury	ug/L	1	10	0.11	0.09	0.02	0.12	0.2	
Groundwater	--	onsite	Groundwater	Metals-Total	Molybdenum	ug/L	10	10	13	7.3	0.58	15	25	
Groundwater	--	onsite	Groundwater	Metals-Total	Nickel	ug/L	5	10	18	14	1.2	13	40	
Groundwater	--	onsite	Groundwater	Metals-Total	Potassium	ug/L	10	10	8080	2934	4800	7850	14300	
Groundwater	--	onsite	Groundwater	Metals-Total	Selenium	ug/L	7	10	3.2	1.9	0.89	2.6	6	
Groundwater	--	onsite	Groundwater	Metals-Total	Silver	ug/L	0	10	0.75	0.54	0.01	0.5	2	
Groundwater	--	onsite	Groundwater	Metals-Total	Sodium	ug/L	10	10	218200	61976	150000	204000	324999	
Groundwater	--	onsite	Groundwater	Metals-Total	Thallium	ug/L	0	10	1.1	0.97	0.03	1.5	2	
Groundwater	--	onsite	Groundwater	Metals-Total	Thorium	ug/L	0	5	2.0	0	2	2	2	
Groundwater	--	onsite	Groundwater	Metals-Total	Uranium	ug/L	5	5	2.2	1.1	1.4	1.6	4	
Groundwater	--	onsite	Groundwater	Metals-Total	Vanadium	ug/L	7	10	4.0	1.9	0.75	4.5	6.8	
Groundwater	--	onsite	Groundwater	Metals-Total	Zinc	ug/L	8	10	4.3	2.9	2.2	3.3	12	

Notes:

* Stable and unstable riparian soils collected along the Gila and San Pedro rivers were statistically compared. If there was no significant difference between stable and unstable data, they were combined for the risk evaluations (noted as combined stable and unstable riparian throughout).
DW = dry weight
mg/kg = miligram per kilogram
mg/L = miligram per liter
offsite-down = offsite and downstream in the Gila River
offsite-SP = offsite and upstream in the San Pedro River
offsite-up = offsite and upstream in the Gila River
onsite = onsite in the Gila River
onsite-SP = onsite in the San Pedro River
ug/L = microgram per liter

TABLE 2-3
Assessment Measures of Exposure and Effects
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Assessment Endpoint								
Entity	**Attribute**	**Effect Level**	**Conceptual Model Group**	**Representative Receptor**	**Assessment Level**	**Measures of Exposure**	**Available Lines of Evidence**	**Measures of Effect**
Aquatic plants, water-column invertebrates, amphibians, and fish	Growth, reproduction, or survival	NOECs for initial screen LOECs for refined screen	Aquatic Organism	NA	Community	Maximum measured detected or non-detected surface water concentrations in the initial screen or the entire distribution of data in the refined screen	Single-chemical Toxicity Data	Benchmark values for toxic effects that could affect growth, reproduction, or survival
						Measured concentrations of COPECs in fish tissue (from the literature) *	Tissue-based Toxicity Data	Whole-body concentration benchmarks associated with decreased survival, growth, or reproduction
Benthic Invertebrates	Growth, reproduction, or survival	NOECs for initial screen LOECs for refined screen	Sediment Biota	NA	Community	Maximum measured detected or non-detected sediment concentrations in the initial screen or the entire distribution of data in the refined screen	Single-chemical Toxicity Data	Benchmark values for toxic effects that could affect growth, reproduction, or survival
Terrestrial Plants	Growth, reproduction, or survival	NOECs for initial screen LOECs for refined screen	Soil Biota	NA	Community	Maximum measured detected or non-detected soil concentrations in the initial screen or the entire distribution of data in the refined screen	Single-chemical Toxicity Data	Benchmark values for toxic effects that could affect growth, reproduction, or survival
						Maximum measured detected or non-detected groundwater concentrations in the initial screen or the entire distribution of data in the refined screen		Soil solution benchmark values for toxic effects that could affect growth, reproduction, or survival
Soil Invertebrates	Growth, reproduction, or survival	NOECs for initial screen LOECs for refined screen	Soil Biota	NA	Community	Maximum measured detected or non-detected soil concentrations in the initial screen or the entire distribution of data in the refined screen	Single-chemical Toxicity Data	Benchmark values for toxic effects that could affect growth, reproduction, or survival
Soil Processes	Growth, reproduction, or survival	NOECs for initial screen LOECs for refined screen	Soil Biota	NA	Ecosystem	Maximum measured detected or non-detected soil concentrations in the initial screen or the entire distribution of data in the refined screen	Single-chemical Toxicity Data	Benchmark values for toxic effects that could affect growth or survival
Birds	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Aquatic Insectivore	Swallows	Population	Exposure estimates based on maximum measured detected or non-detected surface water and sediment concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Piscivore	Belted kingfisher	Population	Exposure estimates based on maximum measured detected or non-detected surface water and sediment concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival

TABLE 2-3
Assessment Measures of Exposure and Effects
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Assessment Endpoint								
Entity	**Attribute**	**Effect Level**	**Conceptual Model Group**	**Representative Receptor**	**Assessment Level**	**Measures of Exposure**	**Available Lines of Evidence**	**Measures of Effect**
	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Terrestrial Herbivore	Mourning dove	Population	Exposure estimates based on maximum measured detected or non-detected surface water and soil concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Terrestrial Insectivore	Curve-billed thrasher	Population	Exposure estimates based on maximum measured detected or non-detected surface water and soil concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Terrestrial Carnivore	Red-tailed hawk	Population	Exposure estimates based on maximum measured detected or non-detected surface water and soil concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
	Growth, reproduction, or survival	NOAELs for initial and refined screens	Special-status Species	Southwestern willow flycatcher	Individual	Exposure estimates based on maximum measured detected or non-detected surface water and soil concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
						Measured concentrations in eggs (from the literature)	Tissue-based Toxicity Data	Benchmark values (NOECs) for effects on growth or survival
						Field Surveys in the vicinity of the Site from the literature (reproductive/nesting success)	Field Surveys	The interpretation of these data is limited.

TABLE 2-3
Assessment Measures of Exposure and Effects
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Assessment Endpoint								
Entity	**Attribute**	**Effect Level**	**Conceptual Model Group**	**Representative Receptor**	**Assessment Level**	**Measures of Exposure**	**Available Lines of Evidence**	**Measures of Effect**
Mammals	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Aquatic Insectivore	Little brown bat	Population	Exposure estimates based on maximum measured detected or non-detected surface water and sediment concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Piscivore	Mink	Population	Exposure estimates based on maximum measured detected or non-detected surface water and sediment concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Terrestrial Herbivore	Desert cottontail	Population	Exposure estimates based on maximum measured detected or non-detected surface water and soil concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
						Estimated median, 90th percentile, and maximum concentrations of lead and cadmium in kidney and liver and zinc in kidney tissue	Tissue-based Toxicity Data	Literature-derived concentrations of these analytes in liver and kidney associated with mortality, weight loss, or clinical toxicity
	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Terrestrial Insectivore	Desert shrew	Population	Exposure estimates based on maximum measured detected or non-detected surface water and sediment concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival
						Estimated median, 90th percentile, and maximum concentrations of lead and cadmium in kidney and liver and zinc in kidney tissue	Tissue-based Toxicity Data	Literature-derived concentrations of these analytes in liver and kidney associated with mortality, weight loss, or clinical toxicity

TABLE 2-3
Assessment Measures of Exposure and Effects
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Assessment Endpoint								
Entity	**Attribute**	**Effect Level**	**Conceptual Model Group**	**Representative Receptor**	**Assessment Level**	**Measures of Exposure**	**Available Lines of Evidence**	**Measures of Effect**
	Growth, reproduction, or survival	NOAELs for initial screen LOAELs for refined screen	Terrestrial Carnivore	Coyote	Population	Exposure estimates based on maximum measured detected or non-detected surface water and sediment concentrations and biota concentrations estimated using literature-based bioaccumulation models for initial screen; 95UCL media concentrations and biota concentrations using literature-based bioaccumulation models for refined screen	Single-chemical Toxicity Data	Benchmark values (NOAELs for initial screening and LOAELs for refinement) for toxic effects that could affect growth, reproduction, or survival

Notes:

* Although fish tissue data were available for the Middle Gila River, none of the sampling locations were within the project area. Therefore, fish tissue concentrations were not evaluated.

95UCL = 95 percent upper confidence limit of the arithmetic mean

COPEC = Contaminants of potential ecological concern

NOAEL = No Observed Adverse Effect Level

NOEC = No Observed Effects Concentration

LOAEL = No Observed Adverse Effect Level

LOEC = Lowest Observed Effects Concentration

NA = Not applicable

TABLE 3-1
Wildlife Exposure Parameters for Representative Receptors
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Exposure Factors									Biotic Dietary Items (% Diet)									Abiotic Media Ingestion (% diet)			Foraging Range			
	Body Weight			Ingestion Rate - Food			Ingestion Rate - Water																		
Species	Mean (kg)	Notes	Reference	Body Weight Adjusted Rate (kg/kgbw-d)	Notes	Reference	(L/kgbw-d)	Notes	Reference	Aquatic Invertebrates	Benthic Invertebrates	Fish	Terrestrial Plants	Terrestrial Invertebrates	Amphibians/ Reptiles	Mammals/ Birds	Major food items	Reference	Soil/ Sediment	Notes	Reference	Hectares	Other (miles, km)	Reference	Notes
Birds																									
Swallow (Aquatic Insectivore)	Both sexes: **0.0216**	Data for cliff swallows from California	Dunning 1993	**0.218**	Allometric estimation for 'insectivorous birds' normalized to kg/kgbw-d using mean weight as reported by Dunning 1993	Nagy 2001	**0.145**	Allometric estimation for 'all birds' normalized to L/kgbw-d, using mean weight reported by Dunning 1993	Calder and Braun 1983	55			3	42			Mostly insects and some vegetable. Assuming swallows are using riparian habitat, aquatic prey will constitute a significant portion of their diet. It is assumed this species ingests **100 percent aquatic invertebrate** for screening-level dose calculation purpose.	Beal 1918 Blancher and McNicol 1991	**0**	22 percent grit in adult barn swallow stomachs. No grit ingestion rate was found and estimating soil ingestion from grit percent would be problematic. As an aerial insectivore, ingestion is assumed to be negligible.	Gionfriddo and Best 1996		1.5 km radius around the colony, however, may travel up to 6 km	Brown and Brown 1995	Reported for cliff swallows
Belted Kingfisher (Piscivore)	Both sexes: **0.148**	Data from Pennsylvania	Dunning 1984	**0.132**	Allometric estimation for 'all birds' normalized to kg/kgbw-d using mean weight as reported by Powdermill Nature Center (unpublished)	Nagy 2001	**0.111**	Allometric estimation for 'all birds' normalized to L/kgbw-d, using mean weight reported by Powdermill Nature Center (unpublished)	Calder and Braun 1983			**100**					Primarily a piscivore, but, depending on water body and season, will consume large numbers of crayfish. Other invertebrates, birds, reptiles, amphibians, insects, and berries are consumed in shortages of preferred prey.	Davis 1982; Salyer and Lagler 1946; Bent 1940	**0**	Assumed soil ingestion to be negligible for picsivorous species	Salyer and Lagler 1946; White 1953; Cornwell 1963		1.03 km shoreline for breeding individuals 0.39 km shoreline for non-breeding individuals 2.19 km shoreline	Brooks and Davis 1987; Davis 1980 Brooks and Davis 1987	Reported in Ohio Reported in Ohio Reported in Pennsylvania
Mourning Dove (Terrestrial Herbivore)	Male: 0.116 Female: 0.108 Mean: **0.112**	Data for western race	Mirarchi 1993b	**0.097**	Calculated from suitable food ingestion rate of 7-17 g/day range; used mean of 12 g/day ingestion rate (10.9 g DW) and mean body weight of 0.112 kg	Hanson and Kossack 1957a	0.028	Allometric estimation for 'all birds' normalized to L/kgbw-d, using mean weight of both sexes reported by Mirachi 1993b	MacMillen 1962				97	3			Primarily a granivore, but also ingests some animal matter (primarily snails) and green forage. It is assumed this species ingests 100 percent vegetation (seeds) for screening-level dose calculation purpose.	Davis 1974	**9.3**	Assumed comparable to wild turkey	Beyer et al. 1994		0.8-7.8 km-males, up to 5.4 km-females 3.1 km-adults	Sayre et al. 1980 Howe and Flake 1998	Distance from nest in Missouri Distance from nest in Idaho
Curve-billed Thrasher (Terrestrial Insectivore)	Both sexes: **0.0794**	Data from Arizona	Dunning 1984	**0.157**	Allometric estimation for 'all passerines' normalized to kg/kgbw-d using mean weight as reported by Dunning 1984	Nagy 2001	**0.136**	Allometric estimation for 'all birds' normalized to L/kgbw-d, using mean weight of both sexes reported by Dunning 1984	Calder and Braun 1983	20			6	74			Primarily Coleoptera, Araneida, Gastropoda, Crustacea, and will ingest some fruit and seeds. It is assumed this species ingests **100 percent terrestrial invertebrates** for screening-level dose calculation purpose.	Fischer 1981	**9.3**	Assumed similar to a mourning dove and comparable to a wild turkey, however, this value would be very conservative	Beyer et al. 1994	2.5 to 4.5 ha		Smith 1971	In palo verde-saguaro habitat, Arizona during a year with adequate rainfall
Ret-tailed Hawk (Terrestrial Carnivore)	Male: 0.957 Female: 1.154 Mean: **1.056**	Data from Idaho	Steenhof 1983	**0.177**	Allometric estimation for 'carnivorous birds' normalized to kg/kgbw-d using mean weight of both sexes as reported by Steenhof 1983	Nagy 2001	**0.058**	Allometric estimation for 'all birds' normalized to L/kgbw-d, using mean weight of both sexes reported by Steenhof 1983	Calder and Braun 1983						4	96	Primarily small mammals, but are opportunistic and will feed on birds, lizards, snakes, and large insects. It is assumed this species ingests **100 percent small mammals** for screening-level dose calculation purpose.	Bent 1937; Craighead and Craighead 1956; Fitch et al. 1946	**0**	Assumed negligible ingestion associated with prey consumption		60-160 ha		Fitch et al. 1946	California foothills during spring
Southwestern Willow Flycatcher (Special-status Species)	Sex unknown: **0.0127**	Data from New Mexico	Yong and Finch 1997	**0.282**	Allometric estimation for 'all passerines' normalized to kg/kgbw-d using mean weight as reported by Yong and Finch 1997	Nagy 2001	**None**	Presumably obtains adequate water needs from insect diet; drinking not reported	Sedgwick 2000	54			4	42			Primarily an insectivore, but also ingests some plant matter, largely various berries. Assumed flycatcher is similar to tree swallow's prey in a riparian habitat. It is assumed this species ingests **100 percent terrestrial invertebrates** for screening-level dose calculation purpose.	Sedgwick 2000 Blancher and McNicol 1991	**0**	As an aerial insectivore, ingestion is assumed to be negligible		mean: 0.7 ha range: 0.3 to 1.2 ha		Walkinshaw 1966	Reported as territory range in Michigan
Mammals																									
Little Brown Bat (Aquatic Insectivore)	Male: 0.00696 Female: 0.00847 Mean: **0.007715**	Adults from New Mexico	Ewing et al. 1970	**0.186**	Allometric estimation for 'Chiroptera' normalized to kg/kgbw-d using mean weight of both sexes as reported by Ewing et al. 1970	Nagy 2001	**0.161**	Allometric estimation for 'all mammals' normalized to L/kgbw-d, using mean weight of both sexes reported by Ewing et al. 1970	Calder and Braun 1983	91				9			Primarily aquatic insects. It is assumed this species ingests 100 percent aquatic invertebrates for screening-level dose calculation purpose.	Whitaker et al. 1977	**0**	As an aerial insectivore, ingestion is assumed to be negligible			12 km	La Val et al. 1977	Gray bat's, a congeneric species, foraging range

TABLE 3-1
Wildlife Exposure Parameters for Representative Receptors
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Exposure Factors									Biotic Dietary Items (% Diet)									Abiotic Media Ingestion (% diet)			Foraging Range			
	Body Weight			Ingestion Rate - Food			Ingestion Rate - Water																		
Species	**Mean (kg)**	**Notes**	**Reference**	**Body Weight Adjusted Rate (kg/kgbw-d)**	**Notes**	**Reference**	**(L/kgbw-d)**	**Notes**	**Reference**	**Aquatic Invertebrates**	**Benthic Invertebrates**	**Fish**	**Terrestrial Plants**	**Terrestrial Invertebrates**	**Amphibians/ Reptiles**	**Mammals/ Birds**	**Major food items**	**Reference**	**Soil/ Sediment**	**Notes**	**Reference**	**Hectares**	**Other (miles, km)**	**Reference**	**Notes**
Mink (Piscivore)	Male summer: 1.04 Male fall: 1.233 Female summer: 0.550 Female fall: 0.586 Mean: **0.852**	Adult males and females Montana	Mitchell 1961 in EPA 1993	**0.041**	llometric estimation for 'carnivora' normalized to kg/kgbw-d, using mean of all weights reported by Michell 1961	Nagy 2001	**0.106**	Allometric estimation for 'all mammals' normalized to L/kgbw-d, using mean of all weights as reported by Mitchell 1961	Calder and Braun 1983	7		73	9		3	8	Primarily mammals, but also fish, amphibians, crustaceans, birds, reptiles, and insects. It is assumed this species ingests **100 percent fish** for screening-level dose calculation purpose.	Alexander 1977; EPA 1993	**3**	Estimated from diet and soil/sediment intake information	adapted from Beyer et al. 1994	8-20 (F) >769 (M)		Groves et al. 1997	
Desert Cottontail (Terrestrial Herbivore)	Male: 0.725 Female: 0.860 Mean: **0.7925**	Data from Arizona	Sowls 1957	**0.053**	Allometric estimation for 'desert mammals' normalized to kg/kgbw-d using mean weight of both sexes as reported by Sowls 1957	Nagy 2001	**0.101**	Allometric estimation for 'all mammals' normalized to L/kgbw-d, using mean of all weights as reported by Sowls 1957	Calder and Braun 1983				**100**				Herbivore, grazing on grasses, forbs, tree and shrub leaves, twigs, fallen fruit, acorns, and tender bark.	Ingles 1965	**6.3**	Reported for the black-tailed jackrabbit and is assumed to be comparable to the desert cottontail soil ingestion rate	Arthur and Gates 1988	3 to 4 ha, and no larger than 6 ha		Fitch 1947	Home range averaged in Madera County
Desert Shrew (Terrestrial Insectivore)	Both sexes: **0.0052**	Data from Northern Sinaloa, Mexico	Armstrong and Jones 1972	**0.200**	Allometric estimation for 'insectivorous mammals' normalized to kg/kgbw-d using mean weight as reported by Armstrong and Jones 1972	Nagy 2001	**0.168**	Allometric estimation for 'insectivorous mammals' normalized to L/kgbw-d using mean weight as reported by Armstrong and Jones 1972	Calder and Braun 1983					**100**			Primarily insectivorous, but occasionally will eat carrion. Common prey items include crickets, cockroaches, grasshoppers, earwigs, beetles, meal worms, and cut worms.	Armstrong and Jones 1972	**13**	Reported for short-tailed shrews and is likely similar to desert shrew soil ingestion rate	Talmage and Walton 1993	0.198 ha		Preston and MarTin 1963	Estimated using allometric equation for grazing and browsing herbivores
Coyote (Terrestrial Carnivore)	Male: 11.2 Female 9.8 Mean: **10.5**	Data from NE California	Hawthorne 1971	**0.044**	Fresh weight. estimates captive female in CA to consume 0.68 kg/d (0.4624 DW) in wild. Body weight mean of 10.5 assumed	Fitch 1948	**0.078**	Allometric estimation for 'all mammals' normalized to L/kgbw-d, using mean of all weights as reported by Hawthorne 1971	Calder and Braun 1983				25	1	1	73	Mean values for coyotes from two sites in California-near Sierra Nevada mountains. It is assumed this species ingests **100 percent small mammals** for screening-level dose calculation purpose.	Barrett 1983 Hawthorne 1972	**2.8**	No data were found for coyote; soil consumption for coyote was therefore assumed to be comparable to that for red fox	Beyer et al. 1994		median=18.75 km^2 minimum=6.7 km^2 maximum=91.4 km^2	Laundre and Keller (1984)	Distribution of values from multiple studies

Notes:
Bold and underlined text indicates life-history parameters that were used in the initial screening exposure calculations. Values used for the refined screen are discussed in Section 5.
Dietary percent volume is assumed to be equivalent to dietary mass.
BW = body weight
DW = dry weight
EPA = United States Environmental Protection Agency
FW = fresh weight

Nagy 2001 regression equation format --> dry matter g/day/g body weight = *a* (grams body weight)^{b} /g body weight

Group	***a***	***b***
Birds		
all birds	0.638	0.685
Passerines	0.630	0.683
insectivorous birds	0.540	0.705
carnivorous birds	0.849	0.663
Mammals		
Carnivora	0.102	0.864
Chioptera	0.365	0.671
desert mammals	0.192	0.806
insectivorous mammals	0.373	0.622

Clder and Braum 1983 regression equation format --> L water/kg body weight/day = *a* (kilograms body weight)^{b} /kg body weight

Group	***a***	***b***
all birds	0.059	0.67
all mammals	0.099	0.90

TABLE 3-2

Summary of Bioaccumulation Models for Uptake from Sediment to Aquatic Invertebrates

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Regression Models [a]				Bioaccumulation Factors			
Analyte	**B0**	**B1**	**Source**	**Notes**	**BAF**	**Source**	**Notes**	**Surrogate (Yes/No)[b]**
Aluminum					**1**	Default Value		
Antimony					**1**	Baes et al. 1984 cited in EPA 2005	Assumed earthworm conc = soil conc as per EPA 2007a (Table 4a)	Yes
Arsenic					**4.330**	Bechtel Jacobs Company 1998b	90th percentile (Dep.) from Table 2	No
Barium					**1**	Default Value		
Beryllium					**1.182**	Sample et al. 1998a	90th percentile - taken from soil to terrestrial invert Table 3-5	Yes
Boron					**1**	Default Value	Boron accumulates in aquatic and terrestrial plants, but does not seem to biomagnify in food chain. Boron does not biomagnify in aquatic food chains and has low potential to accumulate in aquatic organisms (San Joaquin R). Marine and freshwater plants, fishes, and invertebrates (Eisler, 2000)	
Cadmium					**3.073**	Bechtel Jacobs Company 1998b	90th percentile (Dep.) from Table 2	No
Calcium					**1.896**	Sample et al. 1998a	90th percentile from Table C.1	Yes
Chromium					**0.186**	Bechtel Jacobs Company 1998b	90th percentile (Dep.) from Table 2	No
Cobalt					**1**	Default Value		
Copper					**7.957**	Bechtel Jacobs Company 1998b	90th percentile (Dep.) from Table 2	No
Cyanide					**1**	Default Value		
Iron					**1**	Default Value		
Lead					**0.326**	Bechtel Jacobs Company 1998b	90th percentile (Dep.) from Table 2	No
Magnesium					**1**	Default Value		
Manganese					**1**	Default Value		
Mercury					**3.981**	Bechtel Jacobs Company 1998b	90th percentile (Dep.) from Table 2	No
Molybdenum					**2.091**	Sample et al. 1998a	90th percentile from Table C.1	Yes
Nickel					**0.214**	Bechtel Jacobs Company 1998b	90th percentile (Dep.) from Table 2	No
Potassium					**5.964**	Sample et al. 1998a	90th percentile from Table C.1	Yes
Selenium	**-0.075**	**0.733**	Sample et al. 1998a	Equation selected by EPA 2007a	4.149	USACHPPM 2004	90th percentile from Table 4-5 (Insecta)	Yes
Silver					**15.338**	Sample et al. 1998a	90th percentile	Yes
Sodium					**64.503**	Sample et al. 1998a	90th percentile from Table C.1	Yes
Strontium					**1**	Default Value		
Thallium					**1**	Default Value		
Vanadium					**1**	Default Value		
Zinc					**4.759**	Bechtel Jacobs Company 1998b	90th percentile (Dep.) from Table 2	No
p,p'-DDE	**2.4771**	**0.8804**	EPA 2005					Yes

Notes:

Bold indicates regression or BAF selected for use in the wildlife exposure calculation

[a] Regression models are in the form of LN(invertebrate concentration) = B0 + B1(LN (sediment concentration))

[b] BAFs developed for terrestrial invertebrates were used as surrogates for analytes that lacked aquatic invertebrate BAFs

BAF data for benthic invertebrates considered to represent all aquatic invertebrates

BAF = Bioaccumulation Factor

EPA = United States Environmental Protection Agency

USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

TABLE 3-3

Summary of Bioaccumulation Models for Uptake from Surface Water to Fish

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Bioaccumulation Factors		
Analyte	**Fish BAF**	**Source**	**Notes**
Aluminum	231	Sample et al. 1996	from EPA 1988
Antimony	1	Sample et al. 1996	from EPA 1980a
Arsenic	17	Sample et al. 1996	from EPA 1984a
Barium	5.2	WDOE 1996	
Beryllium	19	Sample et al. 1996	from EPA 1980b
Boron	1	Default	
Cadmium	12,400	Sample et al. 1996	from EPA 1984b
Calcium	1	Default	
Chromium	76	EPA 1999	Hazardous Waste Combustion Site Guidance
Cobalt	1	Default	
Copper	290	Sample et al. 1996	from EPA 1985c
Cyanide	0	Sample et al. 1996	from EPA 1985b
Iron	1	Default	
Lead	45	Sample et al. 1996	from EPA 1985a
Magnesium	1	Default	
Manganese	1	Default	
Mercury	27,900	Sample et al. 1996	from EPA 1995a; Trophic Level 3
Molybdenum	1	Default	
Nickel	106	Sample et al. 1996	from EPA 1986
Potassium	1	Default	
Selenium	2,600	Sample et al. 1996	from Peterson and Nebeker 1992; Trophic level 3
Silver	351	EPA 1999	Hazardous Waste Combustion Site Guidance
Sodium	1	Default	
Strontium	1	Default	
Thallium	34	Sample et al. 1996	from EPA 1980c
Vanadium	1	Default	
Zinic	966	Sample et al. 1996	from EPA 1987
DDT (and metabolites)	1,336,000	Sample et al. 1996	from EPA 1995a and 1995b; Trophic level 3

Notes:

BAF = Bioaccumulation factor

EPA = United States Environmental Protection Agency

WDOE = Washington Department of Ecology

TABLE 3-4
Summary of Bioaccumulation Models for Uptake from Soil to Plants
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Regression Models*				Bioaccumulatioin Factors		
Analyte	**B0**	**B1**	**Source**	**Notes**	**Plant BAF**	**Source**	**Notes**
Aluminum					**0.005**	Bechtel Jacobs Company 1998a	90th percentile - Table D-1 validation data
Antimony	**-3.233**	**0.938**	EPA 2007a	Derived from measured data in Appendix A	0.011	Bechtel Jacobs Company 1998a	90th percentile
Arsenic	-1.992	0.564	Bechtel Jacobs Company 1998a	Single variable regression	**1.103**	Bechtel Jacobs Company 1998a	90th percentile; EPA 2007a used median 0.0375
Barium					**0.477**	Bechtel Jacobs Company 1998a	90th percentile; EPA 2007a used median 0.156
Beryllium	**-0.5361**	**0.7345**	EPA 2007a	Derived from measured data in Appendix A			
Boron					**18.11**	USACHPPM 2004	90th percentile - Table 4-6 leaf tissue
Cadmium	**-0.476**	**0.546**	Bechtel Jacobs Company 1998a	Cited in EPA 2007a (Table 4a)	3.43	USACHPPM 2004	90th percentile - Table 4-6 leaf tissue
Calcium					**6.0335**	Bechtel Jacobs Company 1998a	90th percentile - Table D-1 validation data
Chromium					**0.0839**	Bechtel Jacobs Company 1998a	90th percentile; EPA 2007a used median 0.041
Cobalt					**0.0248**	Bechtel Jacobs Company 1998a	90th percentile; EPA 2007a used median 0.0075
Copper	**0.669**	**0.394**	Bechtel Jacobs Company 1998a	Cited in EPA 2007a (Table 4a)	1.31	USACHPPM 2004	90th percentile - Table 4-6 leaf tissue
Cyanide					**1**	Default	
Iron					**0.01**	Bechtel Jacobs Company 1998a	90th percentile - Table D-1 validation data
Lead	**-1.328**	**0.561**		Cited in EPA 2007a (Table 4a)	1.31	USACHPPM 2004	90th percentile - Table 4-6 leaf tissue
Magnesium					**2.0597**	Bechtel Jacobs Company 1998a	90th percentile - Table D-1 validation data
Manganese					**0.234**	Bechtel Jacobs Company 1998a	90th percentile; EPA 2007a used median 0.079
Mercury	**-0.996**	**0.544**	Bechtel Jacobs Company 1998a	Single variable regression			
Molybdenum					**4.4177**	USACHPPM 2004	90th percentile - Table 4-6 leaf tissue
Nickel	**-2.224**	**0.748**	Bechtel Jacobs Company 1998a	Cited in EPA 2007a (Table 4a)	0.72	USACHPPM 2004	90th percentile - Table 4-6 leaf tissue
Potassium					**11.2630**	Bechtel Jacobs Company 1998a	90th percentile - Table D-1 validation data
Selenium	**-0.678**	**1.104**	Bechtel Jacobs Company 1998a	Cited in EPA 2007a (Table 4a)	1.9677	USACHPPM 2004	90th percentile - Table 4-6 leaf tissue
Silver					**0.0367**	Bechtel Jacobs Company 1998a	90th percentile - Table D-1 validation data
Sodium					**0.8202**	Bechtel Jacobs Company 1998a	90th percentile - Table D-1 validation data
Thallium					**0.004**	ORNL RAIS 2005	
Vanadium					**0.0097**	Bechtel Jacobs Company 1998a	90th percentile - Table D-1 validation data
Zinc	**1.575**	**0.555**	Bechtel Jacobs Company 1998a	Cited in EPA 2007a (Table 4a)	1.336	USACHPPM 2004	90th percentile - Table 4-6 leaf tissue

Notes:
* Regression models are in the form of LN(plant concentration) = B0 + B1(LN (soil concentration))
BAF = Bioaccumulation Factor
EPA = United States Environmental Protection Agency
USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

TABLE 3-5

Summary of Bioaccumulation Models for Uptake from Soil to Terrestrial Invertebrates

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Regression Models*				Bioaccumulation Factors		
Analyte	**B0**	**B1**	**Invertebrate Regression Reference**	**Notes**	**Invertebrate BAF**	**Source**	**Notes**
Aluminum					**0.118**	Sample et al. 1998a	90th percentile - Table C.1 ORR UFs
Antimony					**1**	Bases et al. 1984 cited in EPA 2007a	Assumed earthworm conc = soil conc according to (Table 4a)
Arsenic	**-1.421**	**0.706**	Sample et al. 1998a	Sample et al. 1999 cited in EPA 2007a (Table 4a)	0.1258	USACHPPM 2004	90th percentile - Table 4-5 (Insecta)
Barium					**0.16**	Sample et al. 1998a	90th percentile; EPA 2007a used median 0.091
Beryllium					**1.182**	Sample et al. 1998a	90th percentile; EPA 2007a used median 0.045
Boron					**1**	Default	
Cadmium	**2.114**	**0.795**	Sample et al. 1998a	Sample et al. 1999 cited in EPA 2007a (Table 4a)	4.078	USACHPPM 2004	90th percentile - Table 4-5 (Insecta)
Calcium					**1.896**	Sample et al. 1998a	90th percentile - Table C.1 ORR UFs
Chromium					**3.162**	Sample et al. 1998a	90th percentile; EPA 2007a used median 0.306
Cobalt					**0.291**	Sample et al. 1998a	90th percentile; EPA 2007a used median 0.122
Copper	1.675	0.264	Sample et al. 1998a	General regression	**1.531**	Sample et al. 1998a	90th percentile; EPA 2007a used median 0.515 and cited Sample et al. 1999
Cyanide					**1**	Default	
Iron					**0.078**	Sample et al. 1998a	90th percentile - Table C.1 ORR UFs
Lead	**-0.218**	**0.807**	Sample et al. 1998a	Sample et al. 1999 cited in EPA 2007a (Table 4a)			
Magnesium					**0.425**	Sample et al. 1998a	90th percentile - Table C.1 ORR UFs
Manganese	**-0.809**	**0.682**	Sample et al. 1998a	Sample et al. 1999 cited in EPA 2007a (Table 4a)	0.2267	USACHPPM 2004	90th percentile - Table 4-5 (Insecta)
Mercury	**0.0781**	**0.3369**	Sample et al. 1998a	General regression, not including validation data	2	USACHPPM 2004	90th percentile - Table 4-5 (Insecta)
Molybdenum					**2.091**	Sample et al. 1998a	90th percentile - Table C.1 ORR UFs
Nickel					**4.73**	Sample et al. 1998a	90th percentile
Potassium					**5.964**	Sample et al. 1998a	90th percentile - Table C.1 ORR UFs
Selenium	**-0.075**	**0.733**	Sample et al. 1998a	Sample et al. 1999 cited in EPA 2007a (Table 4a)	4.149	USACHPPM 2004	90th percentile - Table 4-5 (Insecta)
Silver					**15.338**	Sample et al. 1998a	90th percentile; EPA 2007a used median 2.045
Sodium					**64.503**	Sample et al. 1998a	90th percentile - Table C.1 ORR UFs
Thallium					**0.256**	USACHPPM 2004	90th percentile - Table 4-5 (Insecta)
Vanadium					**0.088**	Sample et al. 1998a	90th percentile; EPA 2007a used median 0.042
Zinc	**4.449**	**0.328**	Sample et al. 1998a	Sample et al. 1999 cited in EPA 2007a (Table 4a)			

Notes:

* Regression models are in the form of LN(invertebrate concentration) = B0 + B1(LN (soil concentration))

BAF = Bioaccumulation Factor

EPA = United States Environmental Protection Agency

USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

TABLE 3-6
Summary of Bioaccumulation Models for Uptake from Soil to Small Mammals
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Regression Models*				Bioaccumulation Factors		
Analyte	**B0**	**B1**	**Source**	**Notes**	**Mammal BAF**	**Source**	**Notes**
Aluminum					**0.0732**	Sample et al. 1998b	90th percentile (general) - Table C.1 UFs from validation data
Antimony						Baes et al. 1984 cited in EPA 2007a	**0.001* 50 * Cdiet (from Table 4a)**
Arsenic	**-4.8471**	**0.8188**	Sample et al. 1998b	cited in EPA 2007a (Table 4a) - general			
Barium					**0.1121**	Sample et al. 1998b	90th percentile general
Beryllium						Baes et al. 1984 cited in EPA 2007a (table 4a)	**0.001 * 50 * Cdiet (from Table 4a)**
Boron					**1**	Default value	Default Value
Cadmium	**-1.2571**	**0.4723**	Sample et al. 1998b	cited in EPA 2007a (Table 4a); Sample et al. 1998b recommends omnivore (B0= -1.5383, B1=0.566) , but EcoSSLs used herbivore			
Calcium					**15.5307**	Sample et al. 1998	90th percentile (general) - Table C.1 UFs from validation data
Chromium	**-1.4599**	**0.7338**	Sample et al. 1998b	cited in EPA 2007a (Table 4a) - general			
Cobalt	**-4.4669**	**1.307**	Sample et al. 1998b	cited in EPA 2007a (Table 4a) - general			
Copper	**2.042**	**0.1444**	Sample et al. 1998b	cited in EPA 2007a (Table 4a) - general			
Cyanide					**1**	Default value	
Iron	**-0.2879**	**0.5969**	Sample et al. 1998b	General regression			
Lead	**0.0761**	**0.4422**	Sample et al. 1998b	cited in EPA 2007a (Table 4a) - general			
Magnesium					**0.9925**	Sample et al. 1998b	90th percentile (general) - Table C.1 UFs from validation data
Manganese					**0.0587**	Sample et al. 1998b	90th percentile (general) - Table C.1 UFs from validation data
Mercury					**0.1920**	Sample et al. 1998b	90th percentile (general) - Table C.1 UFs from validation data
Molybdenum					**1**	Default value	
Nickel	**-0.2462**	**0.4658**	Sample et al. 1998b	cited in EPA 2007a (Table 4a) - general			
Potassium					**7.7143**	Sample et al. 1998	90th percentile (general) - Table C.1 UFs from validation data
Selenium	**-0.4158**	**0.3764**	Sample et al. 1998b	cited in EPA 2007a (Table 4a) - general			
Silver					**0.5013**	Sample et al. 1998b	90th percentile (general) - Table C.1 UFs from validation data
Sodium					**81.9473**	Sample et al. 1998b	90th percentile (general) - Table C.1 UFs from validation data
Thallium					**0.1227**	Sample et al. 1998b	90th percentile general UF
Vanadium					**0.0179**	Sample et al. 1998b	90th percentile (general) - Table C.1 UFs from validation data
Zinc	**4.3632**	**0.0706**	Sample et al. 1998b	cited in EPA 2007a (Table 4a); Sample et al. 1998b recommends omnivore (B0= 4.4713 B1=0.0738) , but EcoSSLs used herbivore			

Notes:
* Regression models are in the form of LN(small mammal concentration) = B0 + B1(LN (soil concentration))
BAF = Bioaccumulation Factor
EPA = United States Environmental Protection Agency

TABLE 3-7

Estimated Maximum Concentrations of Chemicals of Potential Ecological Concern in Small Mammal Tissue (Kidney and Liver)

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Model Type	N	Intercept	Slope	p (model)	rsquare	Maximum Concentration in Soil (mg/kg DW)	Estimated Concentration in Tissue (mg/kg DW)
Riparian* - soil-to-kidney								
Cadmium	general	56	0.77205	0.83163	0.0002	0.23		
Cadmium	insectivore	***27***	***2.21295***	***0.69078***	***0.001***	***0.35***	0.95	8.82
Cadmium	herbivore	***25***	***-0.24265***	***0.84205***	***0.007***	***0.28***	0.95	0.75
Cadmium	omnivore	4	-1.82495	0.81074	0.37	0.4		
Copper	general	49	2.0674	0.08982	0.1	0.06		
Copper	insectivore	***27***	***1.46091***	***0.2749***	***0.01***	***0.23***	1150	29.91
Copper	herbivore	***18***	***2.3482***	***0.06439***	***0.03***	***0.27***	1150	16.48
Copper	omnivore	4	-2.50027	0.74731	0.26	0.54		
Lead	general	73	-0.08331	0.43483	0.0001	0.63		
Lead	insectivore	***26***	***-1.93149***	***0.81941***	***0.0001***	***0.68***	60.8	4.20
Lead	herbivore	***31***	***0.21701***	***0.39004***	***0.0001***	***0.9***	60.8	6.17
Lead	omnivore	16	0.40252	0.26832	0.004	0.46		
Mercury	general	***8***	***0.38825***	***0.43521***	***0.03***	***0.58***	0.15	0.65
Zinc	general	46	3.79102	0.12375	0.015	0.13		
Zinc	insectivore	26	3.47906	0.20313	0.03	0.17		
Zinc	herbivore	***16***	***4.1514***	***0.06534***	***0.02***	***0.32***	112	86.46
Zinc	omnivore	4	0.05443	0.62009	0.004	0.99		
Riparian* - soil-to-liver								
Arsenic	general	17	-0.24137	0.35117	0.27	0.08		
Arsenic	omnivore	17	-0.24137	0.35117	0.27	0.08		
Cadmium	general	73	0.32081	0.89989	0.0001	0.22		
Cadmium	herbivore	***25***	***-1.49682***	***0.84079***	***0.006***	***0.29***	0.95	0.21
Cadmium	insectivore	***27***	***2.42915***	***0.78707***	***0.0004***	***0.4***	0.95	10.90
Cadmium	omnivore	21	0.19137	0.69742	0.11	0.13		
Copper	general	49	2.38278	0.12835	0.0005	0.23		
Copper	herbivore	***18***	***2.34832***	***0.0671***	***0.02***	***0.29***	1150	16.80
Copper	insectivore	***27***	***2.14592***	***0.23953***	***0.0004***	***0.4***	1150	46.25
Copper	omnivore	4	2.41303	0.15867	0.73	0.07		
Lead	general	93	-0.41167	0.30209	0.0001	0.5		
Lead	herbivore	***34***	***-0.20656***	***0.28003***	***0.0001***	***0.69***	60.8	2.57
Lead	insectivore	***26***	***-1.3655***	***0.51792***	***0.0001***	***0.61***	60.8	2.14
Lead	omnivore	33	-0.19344	0.21596	0.0014	0.28		
Mercury	general	8	0.64896	0.36749	0.54	0.07		
Mercury	herbivore	5	-0.53257	0.37069	0.39	0.25		
Mercury	omnivore	3	2.45081	0	.	.		
Zinc	general	46	4.32514	0.05434	0.06	0.08		
Zinc	herbivore	16	4.36384	0.01724	0.54	0.03		
Zinc	insectivore	26	4.05449	0.12198	0.08	0.12		
Zinc	omnivore	4	4.58473	-0.0206	0.66	0.11		
Upland - soil-to-kidney								
Cadmium	general	56	0.77205	0.83163	0.0002	0.23		
Cadmium	insectivore	***27***	***2.21295***	***0.69078***	***0.001***	***0.35***	94.7	211.98
Cadmium	herbivore	***25***	***-0.24265***	***0.84205***	***0.007***	***0.28***	94.7	36.21
Cadmium	omnivore	4	-1.82495	0.81074	0.37	0.4		
Copper	general	49	2.0674	0.08982	0.1	0.06		
Copper	insectivore	***27***	***1.46091***	***0.2749***	***0.01***	***0.23***	47200	83.05
Copper	herbivore	***18***	***2.3482***	***0.06439***	***0.03***	***0.27***	47200	20.93
Copper	omnivore	4	-2.50027	0.74731	0.26	0.54		
Lead	general	73	-0.08331	0.43483	0.0001	0.63		
Lead	insectivore	***26***	***-1.93149***	***0.81941***	***0.0001***	***0.68***	468	22.35
Lead	herbivore	***31***	***0.21701***	***0.39004***	***0.0001***	***0.9***	468	13.67
Lead	omnivore	16	0.40252	0.26832	0.004	0.46		
Mercury	general	***8***	***0.38825***	***0.43521***	***0.03***	***0.58***	0.49	1.08
Zinc	general	46	3.79102	0.12375	0.015	0.13		
Zinc	insectivore	26	3.47906	0.20313	0.03	0.17		
Zinc	herbivore	***16***	***4.1514***	***0.06534***	***0.02***	***0.32***	5920	112.05
Zinc	omnivore	4	0.05443	0.62009	0.004	0.99		

TABLE 3-7

Estimated Maximum Concentrations of Chemicals of Potential Ecological Concern in Small Mammal Tissue (Kidney and Liver)

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Model Type	N	Intercept	Slope	p (model)	rsquare	Maximum Concentration in Soil (mg/kg DW)	Estimated Concentration in Tissue (mg/kg DW)
Upland - soil-to-liver								
Arsenic	general	17	-0.24137	0.35117	0.27	0.08		
Arsenic	omnivore	17	-0.24137	0.35117	0.27	0.08		
Cadmium	general	73	0.32081	0.89989	0.0001	0.22		
Cadmium	herbivore	***25***	***-1.49682***	***0.84079***	***0.006***	***0.29***	94.7	10.27
Cadmium	insectivore	***27***	***2.42915***	***0.78707***	***0.0004***	***0.4***	94.7	407.84
Cadmium	omnivore	21	0.19137	0.69742	0.11	0.13		
Copper	general	49	2.38278	0.12835	0.0005	0.23		
Copper	herbivore	***18***	***2.34832***	***0.0671***	***0.02***	***0.29***	47200	21.55
Copper	insectivore	***27***	***2.14592***	***0.23953***	***0.0004***	***0.4***	47200	112.59
Copper	omnivore	4	2.41303	0.15867	0.73	0.07		
Lead	general	93	-0.41167	0.30209	0.0001	0.5		
Lead	herbivore	***34***	***-0.20656***	***0.28003***	***0.0001***	***0.69***	468	4.55
Lead	insectivore	***26***	***-1.3655***	***0.51792***	***0.0001***	***0.61***	468	6.17
Lead	omnivore	33	-0.19344	0.21596	0.0014	0.28		
Mercury	general	8	0.64896	0.36749	0.54	0.07		
Mercury	herbivore	5	-0.53257	0.37069	0.39	0.25		
Mercury	omnivore	3	2.45081	0	.	.		
Zinc	general	46	4.32514	0.05434	0.06	0.08		
Zinc	herbivore	16	4.36384	0.01724	0.54	0.03		
Zinc	insectivore	26	4.05449	0.12198	0.08	0.12		
Zinc	omnivore	4	4.58473	-0.0206	0.66	0.11		
Wash - soil-to-kidney								
Cadmium	general	56	0.77205	0.83163	0.0002	0.23		
Cadmium	insectivore	***27***	***2.21295***	***0.69078***	***0.001***	***0.35***	8.3	39.44
Cadmium	herbivore	***25***	***-0.24265***	***0.84205***	***0.007***	***0.28***	8.3	4.66
Cadmium	omnivore	4	-1.82495	0.81074	0.37	0.4		
Copper	general	49	2.0674	0.08982	0.1	0.06		
Copper	insectivore	***27***	***1.46091***	***0.2749***	***0.01***	***0.23***	12500	57.64
Copper	herbivore	***18***	***2.3482***	***0.06439***	***0.03***	***0.27***	12500	19.21
Copper	omnivore	4	-2.50027	0.74731	0.26	0.54		
Lead	general	73	-0.08331	0.43483	0.0001	0.63		
Lead	insectivore	***26***	***-1.93149***	***0.81941***	***0.0001***	***0.68***	239	12.88
Lead	herbivore	***31***	***0.21701***	***0.39004***	***0.0001***	***0.9***	239	10.52
Lead	omnivore	16	0.40252	0.26832	0.004	0.46		
Mercury	general	***8***	***0.38825***	***0.43521***	***0.03***	***0.58***	0.3	0.87
Zinc	general	46	3.79102	0.12375	0.015	0.13		
Zinc	insectivore	26	3.47906	0.20313	0.03	0.17		
Zinc	herbivore	***16***	***4.1514***	***0.06534***	***0.02***	***0.32***	1040	100.01
Zinc	omnivore	4	0.05443	0.62009	0.004	0.99		
Wash - soil-to-liver								
Arsenic	general	17	-0.24137	0.35117	0.27	0.08		
Arsenic	omnivore	17	-0.24137	0.35117	0.27	0.08		
Cadmium	general	73	0.32081	0.89989	0.0001	0.22		
Cadmium	herbivore	***25***	***-1.49682***	***0.84079***	***0.006***	***0.29***	8.3	1.33
Cadmium	insectivore	***27***	***2.42915***	***0.78707***	***0.0004***	***0.4***	8.3	60.03
Cadmium	omnivore	21	0.19137	0.69742	0.11	0.13		
Copper	general	49	2.38278	0.12835	0.0005	0.23		
Copper	herbivore	***18***	***2.34832***	***0.0671***	***0.02***	***0.29***	12500	19.71
Copper	insectivore	***27***	***2.14592***	***0.23953***	***0.0004***	***0.4***	12500	81.90
Copper	omnivore	4	2.41303	0.15867	0.73	0.07		
Lead	general	93	-0.41167	0.30209	0.0001	0.5		
Lead	herbivore	***34***	***-0.20656***	***0.28003***	***0.0001***	***0.69***	239	3.77
Lead	insectivore	***26***	***-1.3655***	***0.51792***	***0.0001***	***0.61***	239	4.35
Lead	omnivore	33	-0.19344	0.21596	0.0014	0.28		
Mercury	general	8	0.64896	0.36749	0.54	0.07		
Mercury	herbivore	5	-0.53257	0.37069	0.39	0.25		
Mercury	omnivore	3	2.45081	0	.	.		
Zinc	general	46	4.32514	0.05434	0.06	0.08		
Zinc	herbivore	16	4.36384	0.01724	0.54	0.03		
Zinc	insectivore	26	4.05449	0.12198	0.08	0.12		
Zinc	omnivore	4	4.58473	-0.0206	0.66	0.11		

Notes:

* The maximum riparian soil concentration across all groups (Gila River, San Pedro River, stable, and unstable) was used to estimate the small mammal tissue concentration.

Highlights and bold italics indicate regressions selected for estimating small mammal tissue concentrations. Only statistically significan regressions with an r-squared value of greater than 0.20 were selected for use.

DW = dry weight

ug/L = micrograms per liter

TABLE 3-8
Freshwater Screening Values for Aquatic Organisms (Aquatic Plants, Water-column Invertebrates, Amphibians, and Fish)
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

	ASWQS (ADEQ Draft June 2007): Benchmarks are expressed in terms of dissolved metal for A&Ww		NAWQC (EPA 2006): Benchmarks are expressed in terms of dissolved metal		ORNL Aquatic Benchmarks (Suter and Tsao 1996): Benchmarks are expressed in terms of total recoverable metal							
Analyte	**Acute A&Ww WQS (ug/L)**	**Chronic A&Ww WQS (ug/L)**	**Acute NAWQC (ug/L)**	**Chronic NAWQC (ug/L)**	**Tier II Secondary Acute Value (ug/L)**	**Tier II Secondary Chronic Value (ug/L)**	**Lowest Chronic Value for Fish (ug/L)**	**Lowest Chronic Value for Daphnids (ug/L)**	**Lowest Chronic Value for Non-daphnid Invertebrates. (ug/L)**	**Lowest Chronic Value for Aquatic Plants (ug/L)**	**Lowest Chronic Value for all Organisms (ug/L)**	**Chronic Benchmark Used in ASARCO SLERA (ug/L)**
Aluminum (pH 6.5-9.0)	-	-	750 [T]	87 [T]	-	-	3,280	1,900	-	460	460	87 T
Ammonia (mg N/L)	2.65[I]	0.568[I]	1.77[I]	0.568[I]	-	-	-	-	-	-	0.568	
Anitmony	88	30	-	-	-	-	1,600	5,400	-	610	610	30 D
Arsenic	340	150	340	150	66	3.1	892	*450*	-	48	48	150 D
Barium	-	-	-	-	110	4	-	-	-	-	-	4 T
Beryllium	-	-	-	-	35	0.66	*57*	5.3	-	100,000	5.3	0.66 T
Boron	-	-	-	-	30	1.6	-	8,830		-	8,830	1.6 T
Cadmium	10.1 [H]	0.67 [H]	2.6 [H]	0.29 [H]	-	-	1.7	0.15	-	2	0.15	0.29 D
Calcium	-	-	-	-			-	116,000	-	-	116,000	116,000 T
Chromium (III)	702 [H]	91.3 [H]	702 [H]	91.3 [H]	-	-	68.63	<44	-	397	<44	91 D
Chromium (VI)	16	11	16	11			73.18	6.132		2	2	11 D
Cobalt			-	-	1,500	23	290	5.1	-	-	5.1	23 T
Copper	17 [H]	11 [H]	17 [H]	11 [H]	-	-	3.8	0.23	6.066	1	0.23	11 D
Cyanide (as free cyanide)	41 [T]	10 [T]	22 [T]	5.2 [T]	-	-	7.8	-	18.33	30	7.8	5.2 T
Iron		1,000 [T]		1,000 [T]		-	1300	158		-	158	1,000 T
Lead	85 [H]	3.3 [H]	85 [H]	3.3 [H]	-	-	18.88	12.26	25.46	500	12.26	3.3 D
Magnesium	-	-	-	-	-	-		82,000		-	82,000	82000 T
Manganese	-	-	-	-	2,300	120	1,780	<1100	-	-	<1100	120 T
Mercury	2.4	0.01	1.4[a]	0.77[a]	-	1.3[d]	<0.23	0.96	-	5	<0.23	0.01 D
Molybdenum	-	-	-	-	16,000	370		880	-	-	880	370 T
Nickel	581 [H]	65 [H]	581 [H]	65 [H]	-	-	<35	<5	128.4	5	<5	65 D
Potassium	-	-	-					53,000	-	-	53,000	530,00 T
Selenium	-	2 [T]	24 [T,b]	5 [T]	-	-	88.32	91.65	-	100	88.32	2 T
Silver	5.0 [H]	-	5.0 [H]	-	-	0.36	0.12	2.6	-	30	0.12	0.50 T [d]
Sodium	-	-	-	-	-	-	-	680,000	-		6800,00	680,000 T
Thallium	700	150	-	-	110	12	57	130	-	100	57	150 D
Vanadium	-	-	-	-	280	20	80	1,900	-	-	80	20 T
Zinc	145 [H]	145 [H]	145 [H]	145 [H]	-	-	36.41	46.73	>5243	30	30	145 D
Total Dissolved Solids	-	723,000 [T, c]	-	-	-	-	-	-	-	-	-	723,000 T

Notes:
[a] Value for total mercury, if a substantial portion is methylmercury, this criterion will probably be under protective (EPA 2006)
[b] Acute value adjusted based on the fraction of selenite and selenate concentrations in water. For this evaluation, selenium concentrations were assumed to be 50% selenite and 50% selenate.
[c] Because there is no specific salinity benchmark for the Gila River (and its tributaries), the lowest salinity benchmark for the Colorado River (ADEQ, 2007) was selected.
[d] Because there is no chronic hardness-adjusted benchmark for silver, an uncertainty factor of 10 was applied to the acute criteria of silver (after hardness adjustment) to estimate a chronic benchmark for long-term exposure.
Benchmarks that are hardness-dependent were adjusted using the lowest hardness reported of 129 mg/L to provide conservatisms in the screening-level evaluation. For hardness-dependent equations on specific metals, please see ADEQ (2007) or EPA (2006).
Hierarchy for Benchmark Selection: Chronic benchmarks were first selected from the lower of either the ADEQ WQS or EPA NAWQC because both are applicable. If neither of these screening values were available, the lowest chronic ORNL benchmarks were selected.
Values in italics are estimates as described in Suter and Tsao 1996
ug/L = micrograms per liter
A&Ww = Aquatic and Wildlife Water Quality Standards (warm water). These are WQS that support "the use of a surface water by an animal, plant, or other organism, generally occurring at elevations less than 5,000 ft, for habitation, growth, or propagation."
ADEQ = Arizona Department of Environmental Quality
ASWQS = Arizona State Water Quality Standards
D = dissolved metal benchmark (all of ADEQ and NAWQC metals are in dissolved concentration unless otherwise indicated).
EPA = United States Environmental Protection Agency
H = benchmark is hardness-dependent
I = Temperature (22°C) and pH (8.6) dependent value for total ammonia in mg N/L (milligrams Nitrogen per liter)
NAWQC = National Ambient Water Quality Criteria
ORNL = Oak Ridge National Laboratory
SLERA = screening-level ecolgoical risk assessment
T = Total recoverable

TABLE 3-9

Sediment Screening Values for Benthic Invertebrates

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Parameters for Low TRV		Parameters for High TRV		
Analtye	**Low TRV (mg/kg)**	**Basis**	**High TRV (mg/kg)**	**Basis**	**Source**
Aluminum	14,000	ER-L	58,000	ER-M	Ingersoll et al. 1996
Antimony	2	ER-L	25	ER-M	Long and Morgan 1990
Arsenic	9.79	Consensus-based TEC	33	Consensus-based PEC	MacDonald et al. 2000
Barium	189	SQG	287	SQG	TCEQ 1996
Beryllium	--	--	--	--	--
Boron	--	--	--	--	--
Cadmium	0.99	Consensus-based TEC	4.98	Consensus-based PEC	MacDonald et al. 2000
Calcium	--	--	--	--	--
Chromium	43.4	Consensus-based TEC	111	Consensus-based PEC	MacDonald et al. 2000
Cobalt	--	--	--	--	--
Copper	31.6	Consensus-based TEC	149	Consensus-based PEC	MacDonald et al. 2000
Cyanide	0.1	Non-polluted	0.25	Heavily-polluted	EPA 1977
Iron	200,000	ER-L	280,000	ER-M	Ingersoll et al. 1996
Lead	35.8	Consensus-based TEC	128	Consensus-based PEC	MacDonald et al. 2000
Magnesium	--	--	--	--	--
Manganese	730	ER-L	1,700	ER-M	Ingersoll et al. 1996
Mercury	0.18	Consensus-based TEC	1.06	Consensus-based PEC	MacDonald et al. 2000
Molybdenum	--	--	--	--	--
Nickel	22.7	Consensus-based TEC	48.6	Consensus-based PEC	MacDonald et al., 2000
Potassium		--	--	--	--
Selenium	2.5	ER-L	4	--	NIWQP 1998
Silver	1.0	ER-L	3.7	ER-M	Long et al. 1995
Sodium	--	--	--	--	--
Strontium	--	--	--	--	--
Thallium	--	--	--	--	--
Vanadium	--	--	--	--	--
Zinc	121	Consensus-based TEC	459	Consensus-based PEC	MacDonald et al. 2000
p,p'-DDE	0.00316	Consensus-based TEC	0.0313	Consensus-based PEC	MacDonald et al. 2000

Notes:

mg/kg = milligrams per kilogram

EPA = United States Environmental Protection Agency

ER-L = Effects range-low

ER-M = Effects range-median

PEC = Probable effects concentration

SBA = Sediment background approach criterion

SQG = Sediment quality guidelines

TEC = Threshold effects concentration

TRV = Toxicity reference value

TABLE 3-10

Literature-Based Soil Benchmarks (mg/kg DW) for Terrestrial Plants, Invertebrates, and Soil Microbes

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

	Terrestrial Plants		Invertebrates		Microbes
Analyte	**Eco-SSL**	**Efroymson et al. 1997a**	**Eco-SSL**	**Efroymson et al. 1997b**	**Efroymson et al. 1997b**
Aluminum	A COPC only for soils with a pH less than 5.5	50	A COPC only for soils with a pH less than 5.5		600
Antimony		5	78		
Arsenic	18			60	100
Barium		500	330		3,000
Beryllium		10	40		
Boron		0.5			20
Cadmium	32		140		20
Calcium					
Chromium		1		0.4	10
Cobalt	13				1,000
Copper	70		80		100
Cyanide					
Iron	Not considered toxic in soils with pH between 5 and 8				200
Lead	120		1,700		900
Magnesium					
Manganese	220		450		100
Mercury		0.3		0.1	30
Molybdenum		2			200
Nickel	38		280		90
Potassium					
Selenium		1		70	100
Silver	560				50
Sodium					
Thallium		1			
Vanadium		2			20
Zinc		50		100	100

Notes:

mg/kg = milligrams per kilogram

COPC = constituent of potential concern

DW = dry weight

Eco-SSL = Ecological soil screening levels

EPA = United States Environmental Protection Agency

TABLE 3-11
Literature-based Benchmarks (mg/L) for Plants that may be exposed to Chemicals in Groundwater
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants (solution-based) Efroynsom et al. 1997a
Aluminum	0.3
Antimony	--
Arsenic	0.001
Barium	--
Beryllium	0.5
Boron	1
Cadmium	0.1
Calcium	--
Chromium	0.05
Cobalt	0.06
Copper	0.06
Cyanide	--
Iron	10
Lead	0.02
Magnesium	--
Manganese	4
Mercury	0.005
Molybdenum	0.5
Nickel	0.5
Potassium	--
Selenium	0.7
Silver	0.1
Sodium	--
Thallium	0.05
Vanadium	0.2
Zinc	0.4

Notes:
If methylmercury is suspected to be present, the solution-based benchmark for MeHg is 0.0002 milligrams per liter.

TABLE 3-12
Toxicity Reference Values for Birds and Mammals
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes
Birds														
Aluminum	Al2(SO4)3	Carriere et al. 1986	ringed dove	0.155	4 months	oral in diet	reproduction				109.7		Sample et al. 1996	
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Arsenic	Sodium arsenate	Stanley et al. 1994	mallard	1	>10 weeks	oral in diet	reproduction				9.3	40.3		
Barium	Barium hydroxide	Johnson et al. 1960	1-day old chicks	0.121	4 weeks	oral in diet	mortality		0.1	acute-chronic	20.8	41.7	Sample et al. 1996	
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Boron	Boric acid	Smith and Anders 1989	mallard	1	3 weeks pre-, during, and 3 weeks post-reproduction	oral in diet	reproduction	egg fertility, duckling growth, embry and duckling mortality			28.8	100	Sample et al. 1996	
Cadmium	Cadmium sulfate	Leach et al. 1979	chicken	1.6	1 year	oral in diet	reproduction	egg production			0.16	0.61	Sample et al. 1996	
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	Cr+3 as CrK(SO4)2	Haseltine et al. 1985	black duck	1.25	10 months	oral in diet	reproduction	duckling survival			1	5	Sample et al. 1996	
Cobalt		Hill 1979	chicken		5 weeks	oral in diet	growth	body weight			3.89	7.8	Cobalt EcoSSL/ EPA 2005b	
Copper	Copper oxide	Mehring et al. 1960	chicken	0.534	10 weeks	oral in diet	growth, mortality				47	61.7	Sample et al. 1996	
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Iron		National Academy of Science 1980	poultry		unknown		general	impaired performance, fate of residue for human consumption	0.1	LOAEL-NOAEL	7.03	70.3		
Lead	Lead acetate	Edens and Garlich 1983	Japanese quail	0.8	5 weeks	oral in diet	reproduction				0.19	1.78		Updated from Sample et al. 1996
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Manganese	Manganese Oxide	Laskey and Edens 1985	Japanese quail	0.072	75 days	oral in diet	growth, behavior				98	977	Sample et al. 1996	
Mercury	Methyl mercury	Heinz and Hoffman 1998; Heinz 1976	mallard	1	2.5 months to two generations	oral in diet	reproduction				0.068	0.37		
Molybdenum	Sodium molybdate	Lepore and Miller 1965	chicken	1.5	21 days through reproduction	oral in diet	reproduction	embryonic viability	0.1	LOAEL-NOAEL	3.53	35.3	Sample et al. 1996	
Nickel	Nickel sulfate	Cain and Pafford 1981	mallard	0.782	90 days	oral in diet	mortality, growth, behavior				77.4	106.9	Sample et al. 1996	
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Selenium	Sodium selenite	Heinz et al. 1987	mallard	1	78 days	oral in diet	reproduction	lethal embryo deformaties			0.4	0.8	Sample et al. 1996	
Silver		Peterson and Jensen 1975	chicken	1.5	subchronic		survivorship, growth	mortality, depressed growth, increased heart weight	0.1	subchronic-chronic	0.427	4.27		LOAEL-NOAEL UF of 0.1 applied to normalized LOAEL
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Strontium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Thallium		Schafer 1972	starling		single dose	oral gavage	survivorship	percent survival	0.1	LD50-LOAEL		0.053		
									0.01	LOAEL-NOAEL	0.0053			
Vanadium	Vanadyl sulfate	White and Dieter 1978	mallard	1.17	12 weeks	oral in diet	mortality, organ pathology				11.4		Sample et al. 1996	
Zinc	Zinc sulfate	Stahl et al. 1990	chicken	1.766	44 weeks	oral in diet	reproduction				14.5	131	Sample et al. 1996	
DDT (and metabolites	DDT	Anderson et al. 1975	brown pelican	3.5	5 years	oral in diet	reproduction	fledgling rate	0.1	LOAEL-NOAEL	0.009	0.09	BTAG	

TABLE 3-12
Toxicity Reference Values for Birds and Mammals
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes
Mammals														
Aluminum	AlCl3	Ondreicka et al. 1966	mouse	0.03	three generations	oral in water	reproduction		0.1	LOAEL-NOAEL	1.93	19.3	Sample et al. 1996	
Antimony		Rossi et al. 1987	rat	0.35	31 days		reproduction				0.059	0.59	EcoSSL/EPA 2003	
Arsenic	Arsenate	Nemec et al. 1998	rabbit	3.8	days 6 to 18 of gestation	oral gavage	reproduction				0.396	1.58		
Barium	Barium chloride	NTP 1994	rat	0.35	105 weeks	oral in water	nephrotoxicity				45	75		
Beryllium	Beryllium sulfate	Schroeder and Mitchener 1975	rat	0.35	lifetime	oral in water	longevity				0.66		Sample et al. 1996	
Boron	Boric acid or Borax	Weir and Fischer 1972	rat	0.35	three generations	oral in diet	reproduction	sterility			28	93.6	Sample et al. 1996	
Cadmium		Webster 1978	mouse	0.03	19 days during gestation	oral in water	reproduction	pup weight			0.77	1.42	EPA 2005a	EcoSSLs
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	K2Cr2O4 (hexavalent)	MacKenzie et al. 1958/Steven et al. 1976	rat	0.35	1 year/3 months	oral in water	body weight/mortality		0.1	subchronic-chronic	3.28	13.14	Sample et al. 1996	Based on two studies
Cobalt	Cobalt chloride	Domingo et al. 1985	rat	0.275	days 6-15 of gestation	oral gavage	reproduction				5.45	10.9	Cobalt EcoSSL/ EPA 2005b	
Copper	Copper sulfate	Aulerich et al. 1982	mink	1	357 days	oral in diet	reproduction				11.7	15.14		
Cyanide	Total cyanide	Frakes et al 1986	hamster		days 3-15 of gestation		reproduction	fetal growth			0.15	0.5		
Iron		Sobotka et al., 1996	rat	0.35	subchronic				0.1	subchronic-chronic	2.8			
Lead	Lead acetate	Kimmel et al. 1980	rat	0.35	10 weeks	oral in diet	reproduction				0.92	4.7		
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Manganese	Manganese Oxide	Laskey et al. 1982	rat	0.35	224 days	oral in diet	reproduction				88	284	Sample et al. 1996	
Mercury	Methylmercury chloride	Verschuuren et al. 1976	rat	0.35	three generations	oral in diet	reproduction	pup viability			0.032	0.16	Sample et al. 1996	
Molybdenum	Molybdate (MoO4)	Schroeder and Mitchener 1971	mouse	0.03	three generations	oral in water	reproduction	reproductive success, number of runts	0.1	LOAEL-NOAEL	0.26	2.6	Sample et al. 1996	
Nickel	Nickel chloride	Smith et al. 1993	rat	0.35	two generations	oral in water	reproduction				6.8	31.63		
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Selenium	Potassium selenate	Rosenfeld and Beath 1954	rat	0.35	two generations	oral in water	reproduction	young produced			0.2	0.33	Sample et al. 1996	
Silver	AgNO3	Rungby and Dacsher 1984	mouse	0.03	125 days	oral	behavior	activity			2.38	23.8		
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Strontium	Strontium chloride	Skoryna 1981	rat	0.35	3 years	oral in water	body weight/bone changes				263		Sample et al. 1996	
Thallium	Thalleous acetate	Downs et al. 1960	rat		15 weeks	oral	growth	body weight			0.48	1.43		
Vanadium	sodium metavanadate	Domingo et al. 1986	rat	0.35	60 days through reproduction	oral intubation	reproduction		0.1	LOAEL-NOAEL	0.21	2.1	Sample et al. 1996	
Zinc	Zinc oxide	Schlicker and Cox 1968	rat	0.35	days 1 to 16 of gestation	oral in diet	reproduction				160	320	Sample et al. 1996	
DDT (and metabolites	DDT	Fitzhugh 1948	rat	0.35	2 years	oral in diet	reproduction	number of young produced			0.8	4	Sample et al. 1996	

Notes:

Uncertainty factors were used to adjust all measured effect concentrations to chronic NOAELS and chronic LOAELs as follows:

NOAEL to LOAEL = 0.1
Subchronic to chronic = 0.1
LD50 to chronic = 0.01
subacute to chronic = 0.01
acute to chronic = 0.01

where:

chronic = >12 weeks or during critical lifestage
subchronic = 4 to 12 weeks
subacute = <4 weeks, multiple doses
acute = only one dose

kg = kilogram
mg/kg/d = milligram analyte per kilogram body weight per day
LOAEL = lowest observed adverse effect level
NA = not available
NOAEL = no observed adverse effect level

TABLE 3-13
Benchmarks for Evaluating Bird Eggs
Screening-level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

	No Observed Effect Concentration (NOEC)			Lowest Observed Effect Concentration (LOEC)		
Analyte	**NOEC**	**Toxicity Endpoint**	**Reference**	**LOEC**	**Explanation**	**Reference**
Aluminum	NA	--	--	NA	--	--
Barium	NA	--	--	NA	--	--
Boron	44.8 mg/kg dw **13 mg/kg ww**	Hatching success	NIWQP 1998	NA	--	--
Cadmium	NA [a]	--	--	NA [a]	--	--
Copper	**5.5 mg/kg dw** 1.6 mg/kg ww	--	NIWQP 1998	NA	--	--
Iron	NA [b]	--	--	NA [b]	--	--
Lead	NA [a]	--	--	NA [a]	--	--
Magnesium	NA [b]	--	--	NA [b]	--	--
Manganese	NA	--	--	NA	--	--
Mercury	0.34 mg/kg dw **0.10 mg/kg ww**	Reproductive effects	NIWQP 1998	1.7 mg/kg dw **0.5 mg/kg ww**	Decrease in hatching success	NIWQP 1998
Nickel	0.0069 mg/kg dw 0.0020 mg/kg ww	Extrapolated from LOEC (Eisler 2000) using an uncertainty factor of 10.	--	0.069 mg/kg dw 0.020 mg/kg ww	Malformation of chicks	Eisler 2000
Selenium	**6.4 mg/kg dw** 1.8 mg/kg ww	NOEC is the 95 percent lower confidence limit on the mean Se concentration associated with a 10 percent reduction in the hatchability of mallard eggs	Ohlendorf 2003	**16.5 mg/kg dw** 4.7 mg/kg ww	LOEC is the 95 percent upper confidence limit on the mean Se concentration associated with a 10 percent reduction in the hatchability of mallard eggs.	Ohlendorf 2003
Strontium	NA	--	--	NA	--	--
Zinc	**50 mg/kg dw** 14 mg/kg ww	--	NIWQP 1998	NA	--	--

Notes:
Values in bold indicate original value presented from the reference; percent water content from mallard egg of 71% (Stanley et al. 1996) was used to convert between wet-weight and dry-weight concentrations.
mg/kg = milligrams per kilogram
dw = dry weight
LOEC = lowest observed effect concentration
NA = No benchmark was available.

NA [a] = No benchmark was available. Although background concentrations of Cd and Pb have been reported to be <0.5 mg/kg dw (Ohlendorf, 1993), no toxicity studies were available to assess levels that would elicit toxic effects (or no effects) in eggs. In addition, Cd and Pb mimic Ca uptake (and disrupt other biological functions); consequently, Cd and Pb found in egg content do not correlate well with dietary exposure (Ohlendorf, 1993). Thus, concentration found in egg content would be difficult to atrribute to exposure from mine waste.

NA [b] = No toxic effect concentrations (or no effects) could be found for these chemicals. In addition, iron and magnesium are considered micro- and macronutrient, respectively. Thus, these chemicals are not considered to be risk drivers.
NIWQP = National Irrigation Water Quality Program
NOEC = no observed effect concentration
ww = wet weight

TABLE 3-14

Summary of Target Organ Effect Concentrations from the Published Literature

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Class	Species	Tissue	Concentration	Units	Reported Effect	Primary Reference
Cadmium	Mammals		Kidney	350	mg/kg dw	Toxicity threshold; no effects expected below this concentration	Cooke and Johnson 1996
Lead	Mammals		Liver	5	mg/kg dw	No toxicity observed at or below these levels	Ma 1996
Lead	Mammals		Kidney	10	mg/kg dw	No toxicity observed at or below these levels	Ma 1996
Lead	Mammals		Liver	10	mg/kg dw	Clinical toxicity (anemia, weakness, and nervous system and gastrointestinal dysfunction) is apparent at or above this level	Ma 1996
Lead	Mammals		Kidney	25	mg/kg dw	Clinical toxicity (anemia, weakness, and nervous system and gastrointestinal dysfunction) is apparent at or above this level	Ma 1996
Zinc	Mammals	Ferret	Liver	128	mg/kg ww	50% mortality observed after 197 days exposure in diet	Straube et al. 1980
Zinc	Mammals	Sheep	Liver	274	mg/kg dw	Defined as 'zinc poisoned' additional information is not provided	Eisler 2000
Zinc	Mammals	Sheep	Kidney	463	mg/kg dw	Defined as 'zinc poisoned' additional information is not provided	Eisler 2000

Notes:

mg/kg = milligram per kilogram

dw = dry weight

ww = wet weight

TABLE 4-1
Freshwater Screening for Aquatic Organisms (Aquatic Plants, Water-column Invertebrates, Amphibians, and Fish
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte[a]	Water EPC	Units	EPC Basis	Number of Detects	N	Selected Chronic Benchmark (µg/L)	Source	HQ	Screen Results
On-Site Middle Gila River									
Aluminum	62000	µg/L	Max Detect	20	21	87	EPA 2006	**713**	**Retain**
Dissolved Antimony	1.2	µg/L	Max ND	0	22	30	ADEQ 2007	0.04	Drop
Dissolved Arsenic	9.8	µg/L	Max Detect	22	22	150	ADEQ 2007; EPA 2006	0.07	Drop
Barium	1190	µg/L	Max Detect	22	22	4	Suter and Tsao 1996	**298**	**Retain**
Beryllium	8.3	µg/L	Max Detect	13	22	0.66	Suter and Tsao 1996	**13**	**Retain**
Boron	140	µg/L	Max Detect	22	22	1.6	Suter and Tsao 1996	**88**	**Retain**
Dissolved Cadmium	0.42	µg/L	Max ND	3	22	0.29	EPA 2006	**1.4**	**Retian ND/Det**
Calcium	381999	µg/L	Max Detect	22	22	116000	Suter and Tsao 1996	**3.3**	**Retain**
Dissolved Chromium [b]	9.8	µg/L	Max Detect	4	22	11	ADEQ 2007; EPA 2006	0.89	Drop
Cobalt	39.2	µg/L	Max Detect	22	22	23	Suter and Tsao 1996	**1.7**	**Retain**
Dissolved Copper	43.5	µg/L	Max Detect	22	22	11	ADEQ 2007; EPA 2006	**4.0**	**Retain**
Cyanide	10	µg/L	Max ND	1	22	5.2	EPA 2006	**1.9**	**Retain ND/Det**
Iron	34500	µg/L	Max Detect	22	22	1000	ADEQ 2007; EPA 2006	**35**	**Retain**
Dissolved Lead	27.7	µg/L	Max Detect	11	22	3.3	ADEQ 2007; EPA 2006	**8.4**	**Retain**
Magnesium	44900	µg/L	Max Detect	22	22	82000	Suter and Tsao 1996	0.55	Drop
Manganese	3540	µg/L	Max Detect	22	22	120	Suter and Tsao 1996	**30**	**Retain**
Dissolved Mercury	0.2	µg/L	Max ND	2	22	0.01	ADEQ 2007	**20**	**Retain ND/Det**
Molybdenum	5.4	µg/L	Max Detect	22	22	370	Suter and Tsao 1996	0.01	Drop
Dissolved Nickel	13	µg/L	Max Detect	22	22	65	ADEQ 2007; EPA 2006	0.20	Drop
Potassium	22300	µg/L	Max Detect	22	22	53000	Suter and Tsao 1996	0.42	Drop
Selenium	2	µg/L	Max Detect	22	22	2	ADEQ 2007	**1.0**	**Retain**
Silver	0.77	µg/L	Max ND	3	22	0.5	ADEQ 2007; EPA 2006	**1.5**	**Retain ND**
Sodium	135000	µg/L	Max Detect	22	22	680000	Suter and Tsao 1996	0.20	Drop
Dissolved Thallium	1	µg/L	Max ND	2	22	150	ADEQ 2007	0.007	Drop
Vanadium	56.6	µg/L	Max Detect	22	22	20	Suter and Tsao 1996	**2.8**	**Retain**
Dissolved Zinc	68.5	µg/L	Max Detect	18	22	145	ADEQ 2007; EPA 2006	0.47	Drop
Total Dissolved Solids	780000	µg/L	Max Detect	22	22	723000	ADEQ 2007	**1.1**	**Retain**
Ammonia as N	0.3	mg/L	Max ND	0	22	0.568	ADEQ 2007; EPA 2006	0.53	Drop
On-Site San Pedro River									
Aluminum	3660	µg/L	Max Detect	2	4	87	EPA 2006	**42**	**Retain**
Dissolved Antimony	0.35	µg/L	Max ND	0	4	30	ADEQ 2007	0.01	Drop
Dissolved Arsenic	5.6	µg/L	Max Detect	4	4	150	ADEQ 2007; EPA 2006	0.04	Drop
Barium	373	µg/L	Max Detect	4	4	4	Suter and Tsao 1996	**93**	**Retain**
Beryllium	1.1	µg/L	Max Detect	2	4	0.66	Suter and Tsao 1996	**1.7**	**Retain**
Boron	225	µg/L	Max Detect	4	4	1.6	Suter and Tsao 1996	**141**	**Retain**
Dissolved Cadmium	0.25	µg/L	Max ND	0	4	0.29	EPA 2006	0.86	Drop
Calcium	171999	µg/L	Max Detect	4	4	116000	Suter and Tsao 1996	**1.5**	**Retain**
Dissolved Chromium [b]	2	µg/L	Max ND	1	4	11	ADEQ 2007; EPA 2006	0.18	Drop
Cobalt	6.1	µg/L	Max Detect	4	4	23	Suter and Tsao 1996	0.27	Drop
Dissolved Copper	8	µg/L	Max Detect	4	4	11	ADEQ 2007; EPA 2006	0.73	Drop
Cyanide	10	µg/L	Max ND	0	4	5.2	EPA 2006	**1.9**	**Retain ND**

TABLE 4-1
Freshwater Screening for Aquatic Organisms (Aquatic Plants, Water-column Invertebrates, Amphibians, and Fish
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte[a]	Water EPC	Units	EPC Basis	Number of Detects	N	Selected Chronic Benchmark (µg/L)	Source	HQ	Screen Results
Iron	8970	µg/L	Max Detect	3	4	1000	ADEQ 2007; EPA 2006	**9.0**	**Retain**
Dissolved Lead	1	µg/L	Max ND	2	4	3.3	ADEQ 2007; EPA 2006	0.30	Drop
Magnesium	30200	µg/L	Max Detect	4	4	82000	Suter and Tsao 1996	0.37	Drop
Manganese	538	µg/L	Max Detect	4	4	120	Suter and Tsao 1996	**4.5**	**Retain**
Dissolved Mercury	0.2	µg/L	Max ND	0	4	0.01	ADEQ 2007	**20**	**Retain ND**
Molybdenum	20.1	µg/L	Max Detect	4	4	370	Suter and Tsao 1996	0.05	Drop
Dissolved Nickel	3	µg/L	Max Detect	2	4	65	ADEQ 2007; EPA 2006	0.05	Drop
Potassium	11500	µg/L	Max Detect	4	4	53000	Suter and Tsao 1996	0.22	Drop
Selenium	1.2	µg/L	Max Detect	4	4	2	ADEQ 2007	0.60	Drop
Silver	0.36	µg/L	Max ND	1	4	0.5	ADEQ 2007; EPA 2006	0.72	Drop
Sodium	174999	µg/L	Max Detect	4	4	680000	Suter and Tsao 1996	0.26	Drop
Dissolved Thallium	1	µg/L	Max ND	0	4	150	ADEQ 2007	0.007	Drop
Vanadium	21.7	µg/L	Max Detect	4	4	20	Suter and Tsao 1996	**1.1**	**Retain**
Dissolved Zinc	2.8	µg/L	Max Detect	4	4	145	ADEQ 2007; EPA 2006	0.02	Drop
Total Dissolved Solids	980000	µg/L	Max Detect	4	4	723000	ADEQ 2007	**1.4**	**Retain**
Ammonia as N	0.3	mg/L	Max ND	0	4	0.568	ADEQ 2007; EPA 2006	0.53	Drop

Notes:

[a] Bicarbonate alkalinity, carbonate alkalinity, hydroxide alkalinity, total alkalinity, total organic carbon, and total suspended solids were not screened as they were considered to represent general water quality characteristics and not toxic contaminants.

[b] The benchmarks for chromium are for the more toxic form, chromium VI.

Bold and highlight represent HQ values equal to or greater than one

µg/L = microgram per liter
ADEQ = Arizona Department of Environmental Quality
Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
HQ = hazard quotient
Max = maximum
mg/L = milligrams per liter
ND = non-detected value
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.
Retain ND = COPEC retained solely based on non-detected data; COPEC was retained for further evaluation in the refined assessment.
Retain ND/Det = The maximum non-detected value exceeded the maximum detected value and both exceeded the screening benchmark; COPEC was retained.

TABLE 4-2
Sediment Screening for Benthic Invertebrates
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte*	EPC (mg/kg)	EPC Basis	Number of Detects	N	Low TRV	High TRV	Low HQ	High HQ	Screen Results
On-site Middle Gila River									
Aluminum	26679	Max Detect	24	24	14,000	58,000	**1.9**	0.46	**Retain**
Antimony	1.2	Max Detect	21	22	2	25	0.60	0.05	Drop
Arsenic	5.5	Max Detect	24	24	9.79	33	0.56	0.17	Drop
Barium	180	Max Detect	22	22	189	287	0.95	0.63	Drop
Beryllium	205	Max Detect	25	26	--	--			Uncertainty
Boron	10.9	Max Detect	24	24	--	--			Uncertainty
Cadmium	1.1	Max ND	6	24	0.99	4.98	**1.1**	0.22	**Retain ND**
Chromium	21	Max Detect	24	24	43.4	111	0.48	0.19	Drop
Cobalt	16.2	Max Detect	22	22	--	--			Uncertainty
Copper	392	Max Detect	24	24	31.6	149	**12**	**2.6**	**Retain**
Cyanide	6.9	Max ND	0	22	0.1	0.25	**69**	**28**	**Retain ND**
Iron	28500	Max Detect	24	24	200,000	280,000	0.14	0.10	Drop
Lead	30.6	Max Detect	24	24	35.8	128	0.85	0.24	Drop
Manganese	2410	Max Detect	24	24	730	1,700	**3.3**	**1.4**	**Retain**
Mercury	0.1	Max Detect	12	24	0.18	1.06	0.56	0.09	Drop
Molybdenum	2.5	Max ND	10	24	--	--			Uncertainty
Nickel	26.5	Max Detect	24	24	22.7	48.6	**1.2**	0.55	**Retain**
Selenium	1.4	Max ND	14	24	2.5	--	0.56		Drop
Silver	1.4	Max ND	1	22	1.0	3.7	**1.4**	0.38	**Retain ND**
Strontium	194	Max Detect	2	2	--	--			Uncertainty
Thallium	1.9	Max ND	6	22	--	--			Uncertainty
Vanadium	91.2	Max Detect	24	24	--	--			Uncertainty
Zinc	89.9	Max Detect	24	24	121	459	0.74	0.20	Drop
p,p'-DDE	0.01	Max ND	0	2	0.00316	0.0313	**3.2**	0.32	**Retain ND**
On-site San Pedro River									
Aluminum	26678	Max Detect	5	5	14,000	58,000	**1.9**	0.46	**Retain**
Antimony	0.56	Max Detect	4	4	2	25	0.28	0.02	Drop
Arsenic	6.83	Max Detect	5	5	9.79	33	0.70	0.21	Drop
Barium	177	Max Detect	4	4	189	287	0.94	0.62	Drop
Beryllium	161	Max Detect	6	6	--	--			Uncertainty
Boron	10.6	Max Detect	5	5	--	--			Uncertainty
Cadmium	0.52	Max ND	2	5	0.99	4.98	0.53	0.10	Drop
Chromium	14.8	Max Detect	5	5	43.4	111	0.34	0.13	Drop
Cobalt	6.6	Max Detect	4	4	--	--			Uncertainty

TABLE 4-2

Sediment Screening for Benthic Invertebrates

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte*	EPC (mg/kg)	EPC Basis	Number of Detects	N	Low TRV	High TRV	Low HQ	High HQ	Screen Results
Copper	143	Max Detect	5	5	31.6	149	**4.5**	0.96	**Retain**
Cyanide	3.3	Max ND	0	4	0.1	0.25	**33**	**13**	**Retain ND**
Iron	19277	Max Detect	5	5	200,000	280,000	0.10	0.07	Drop
Lead	20.8	Max Detect	5	5	35.8	128	0.58	0.16	Drop
Manganese	1031	Max Detect	5	5	730	1,700	**1.4**	0.61	**Retain**
Mercury	0.066	Max ND	1	5	0.18	1.06	0.37	0.06	Drop
Molybdenum	2.1	Max ND	2	5	--	--			Uncertainty
Nickel	16.3	Max Detect	5	5	22.7	48.6	0.72	0.34	Drop
Selenium	0.66	Max ND	0	5	2.5	--	0.26	NA	Drop
Silver	0.66	Max ND	0	4	1.0	3.7	0.66	0.18	Drop
Strontium	213	Max Detect	1	1	--	--			Uncertainty
Thallium	0.83	Max ND	1	4	--	--			Uncertainty
Vanadium	46.3	Max Detect	5	5	--	--			Uncertainty
Zinc	78.5	Max Detect	5	5	121	459	0.65	0.17	Drop
p,p'-DDE	0.01	Max ND	0	1	0.00316	0.0313	**3.2**	0.32	**Retain ND**

Notes:

* Calcium, magnesium, and potassium are considered macronutrients that not likely to pose a risk to benthic invertebrates, therefore these analtyes were not evaluated. Sodium is also considered a macronutrient, although high levels of this element could preclude survival of certain freshwater species. However, no benthic invertebrate screening value for this analtye was available, so no risk evaluation was possible.

Detect = detected value

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.

EPC = exposure point concentration

Highlights represent HQ values equal to or greater than one

Max = maximum

mg/kg = milligram per kilogram

ND = non-detected value

Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

Retain ND = COPEC retained solely based on non-detected data; COPEC was retained for further evaluation in the refined assessment.

TABLE 4-3
Soil Screening for Terrestrial Organisms (Terrestrial Plants, Soil Invertebrates, and Soil Microbes)
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Plant Screening			Invertebrate Screening			Microbe Screening		
Analyte [a]	**EPC (mg/kg)**	**EPC Basis**	**Number of Detects**	**N**	**Plant Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**	**Invertebrate Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**	**Microbe Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**
On-Site Gila River - Combined Stable and Unstable Riparian Soil [b]													
Antimony	0.92	Max Detect	29	29	5	0.18	Drop	78	0.01	Drop			Uncertainty
Arsenic	8.1	Max Detect	29	29	18	0.45	Drop	60	0.14	Drop	100	0.08	Drop
Beryllium	1.6	Max Detect	20	29	10	0.16	Drop	40	0.04	Drop			Uncertainty
Boron	32.5	Max Detect	29	29	0.5	**65**	**Retain**			Uncertainty	20	**1.6**	**Retain**
Cadmium	0.95	Max Detect	8	29	32	0.03	Drop	140	0.007	Drop	20	0.05	Drop
Chromium	16.8	Max Detect	29	29	1	**17**	**Retain**	0.4	**42**	**Retain**	10	**1.7**	**Retain**
Copper	1150	Max Detect	29	29	70	**16**	**Retain**	80	**14**	**Retain**	100	**12**	**Retain**
Cyanide	2.5	Max ND	2	29			Uncertainty			Uncertainty			Uncertainty
Lead	60.8	Max Detect	29	29	120	0.51	Drop	1,700	0.04	Drop	900	0.07	Drop
Mercury	0.15	Max Detect	13	29	0.3	0.5	Drop	0.1	**1.5**	**Retain**	30	0.005	Drop
Molybdenum	7.1	Max Detect	29	29	2	**3.6**	**Retain**			Uncertainty	200	0.04	Drop
Selenium	3.5	Max ND	1	29	1	**3.5**	**Retain ND**	70	0.05	Drop	100	0.04	Drop
Silver	1.3	Max Detect	4	29	560	0.002	Drop			Uncertainty	50	0.03	Drop
Thallium	2.5	Max ND	0	29	1	**2.5**	**Retain ND**			Uncertainty			Uncertainty
Vanadium	83.1	Max Detect	29	29	2	**42**	**Retain**			Uncertainty	20	**4.2**	**Retain**
Zinc	112	Max Detect	29	29	50	**2.2**	**Retain**	100	**1.1**	**Retain**	100	**1.1**	**Retain**
On-Site Gila River - Stable Riparian Soil													
Aluminum	23400	Max Detect	17	17	A COPC only for soils with a pH less than 5.5	pH range is 7.3 to 8.5	Drop	A COPC only for soils with a pH less than 5.5	pH range is 7.3 to 8.5	Drop	A COPC only for soils with a pH less than 5.5	pH range is 7.3 to 8.5	Drop
Barium	202	Max Detect	17	17	500	0.40	Drop	330	0.61	Drop	3,000	0.07	Drop
Cobalt	11.5	Max Detect	16	17	13	0.88	Drop			Uncertainty	1,000	0.01	Drop
Iron	20700	Max Detect	17	17	Not considered toxic in soils with pH between 5 and 8	**pH range is 7.3 to 8.5**	**Retain**			Uncertainty	200	**104**	**Retain**
Manganese	794	Max Detect	17	17	220	**3.6**	**Retain**	450	**1.8**	**Retain**	100	**7.9**	**Retain**
Nickel	19.9	Max Detect	17	17	38	0.52	Drop	280	0.07	Drop	90	0.22	Drop
On-Site Gila River - Unstable Riparian Soil													
Aluminum	23400	Max Detect	12	12	A COPC only for soils with a pH less than 5.5	pH range is 7.5 to 8.7	Drop	A COPC only for soils with a pH less than 5.5	pH range is 7.5 to 8.7	Drop	A COPC only for soils with a pH less than 5.5	pH range is 7.5 to 8.7	Drop
Barium	203	Max Detect	12	12	500	0.41	Drop	330	0.62	Drop	3,000	0.07	Drop
Cobalt	17	Max Detect	12	12	13	**1.3**	**Retain**			Uncertainty	1,000	0.02	Drop
Iron	27200	Max Detect	12	12	Not considered toxic in soils with pH between 5 and 8	**pH range is 7.5 to 8.7**	**Retain**			Uncertainty	200	**136**	**Retain**
Manganese	879	Max Detect	12	12	220	**4.0**	**Retain**	450	**2.0**	**Retain**	100	**8.8**	**Retain**
Nickel	22.1	Max Detect	12	12	38	0.58	Drop	280	0.08	Drop	90	0.25	Drop

TABLE 4-3
Soil Screening for Terrestrial Organisms (Terrestrial Plants, Soil Invertebrates, and Soil Microbes)
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Plant Screening			Invertebrate Screening			Microbe Screening		
Analyte [a]	**EPC (mg/kg)**	**EPC Basis**	**Number of Detects**	**N**	**Plant Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**	**Invertebrate Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**	**Microbe Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**
On-Site San Pedro River - Combined Stable and Unstable Riparian Soil													
Antimony	0.58	Max Detect	4	4	5	0.12	Drop	78	0.007	Drop			Uncertainty
Arsenic	4.8	Max Detect	4	4	18	0.27	Drop	60	0.08	Drop	100	0.05	Drop
Beryllium	0.96	Max Detect	3	4	10	0.10	Drop	40	0.02	Drop			Uncertainty
Boron	5.7	Max Detect	4	4	0.5	**11**	**Retain**			Uncertainty	20	0.29	Drop
Cadmium	0.5	Max ND	0	4	32	0.02	Drop	140	0.004	Drop	20	0.03	Drop
Chromium	13.8	Max Detect	4	4	1	**14**	**Retain**	0.4	**35**	**Retain**	10	**1.4**	**Retain**
Copper	322	Max Detect	4	4	70	**4.6**	**Retain**	80	**4.0**	**Retain**	100	**3.2**	**Retain**
Cyanide	2.5	Max ND	1	4			Uncertainty			Uncertainty			Uncertainty
Lead	22.3	Max Detect	4	4	120	0.19	Drop	1,700	0.01	Drop	900	0.02	Drop
Mercury	0.1	Max Detect	3	4	0.3	0.33	Drop	0.1	**1**	**Retain ND**	30	0.003	Drop
Molybdenum	2	Max ND	4	4	2	**1**	**Retain**			Uncertainty	200	0.01	Drop
Selenium	3.5	Max ND	0	4	1	**3.5**	**Retain ND**	70	0.05	Drop	100	0.04	Drop
Silver	1	Max ND	1	4	560	0.002	Drop			Uncertainty	50	0.02	Drop
Thallium	2.5	Max ND	0	4	1	**2.5**	**Retain ND**			Uncertainty			Uncertainty
Vanadium	32.2	Max Detect	4	4	2	**16**	**Retain**			Uncertainty	20	**1.6**	**Retain**
Zinc	69.3	Max Detect	4	4	50	**1.4**	**Retain**	100	0.69	Drop	100	0.69	Drop
On-Site San Pedro River - Stable Riparian Soil													
Aluminum	7180	Max Detect	2	2	A COPC only for soils with a pH less than 5.5	pH range is 8.4 to 8.8	Drop	A COPC only for soils with a pH less than 5.5	pH range is 8.4 to 8.8	Drop	A COPC only for soils with a pH less than 5.5	pH range is 8.4 to 8.8	Drop
Barium	114	Max Detect	2	2	500	0.23	Drop	330	0.35	Drop	3,000	0.04	Drop
Cobalt	5	Max ND		2	13	0.38	Drop			Uncertainty	1,000	0.01	Drop
Iron	9870	Max Detect	2	2	Not considered toxic in soils with pH between 5 and 8	**pH range is 8.4 to 8.8**	**Retain**			Uncertainty	200	**49**	**Retain**
Manganese	194	Max Detect	2	2	220	0.9	Drop	450	0.43	Drop	100	**1.9**	**Retain**
Nickel	9.5	Max Detect	2	2	38	0.25	Drop	280	0.03	Drop	90	0.11	Drop
On-Site San Pedro River - Unstable Riparian Soil													
Aluminum	15100	Max Detect	2	2	A COPC only for soils with a pH less than 5.5	pH range is 7.8 to 8.8	Drop	A COPC only for soils with a pH less than 5.5	pH range is 7.8 to 8.8	Drop	A COPC only for soils with a pH less than 5.5	pH range is 7.8 to 8.8	Drop
Barium	146	Max Detect	2	2	500	0.29	Drop	330	0.44	Drop	3,000	0.05	Drop
Cobalt	8.9	Max Detect	1	2	13	0.68	Drop			Uncertainty	1,000	0.01	Drop
Iron	18000	Max Detect	2	2	Not considered toxic in soils with pH between 5 and 8	**pH range is 7.8 to 8.8**	**Retain**			Uncertainty	200	**90**	**Retain**
Manganese	591	Max Detect	2	2	220	**2.7**	**Retain**	450	**1.3**	**Retain**	100	**5.9**	**Retain**
Nickel	16	Max Detect	2	2	38	0.42	Drop	280	0.06	Drop	90	0.18	Drop

TABLE 4-3
Soil Screening for Terrestrial Organisms (Terrestrial Plants, Soil Invertebrates, and Soil Microbes)
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Plant Screening			Invertebrate Screening			Microbe Screening		
Analyte [a]	**EPC (mg/kg)**	**EPC Basis**	**Number of Detects**	**N**	**Plant Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**	**Invertebrate Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**	**Microbe Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**
Upland Soils													
Aluminum	30000	Max Detect	10	10	A COPC only for soils with a pH less than 5.5	pH range is 6.2 to 8.6	Drop	A COPC only for soils with a pH less than 5.5	pH range is 6.2 to 8.6	Drop	A COPC only for soils with a pH less than 5.5	pH range is 6.2 to 8.6	Drop
Antimony	10.4	Max Detect	10	10	5	**2.1**	**Retain**	78	0.13	Drop			Uncertainty
Arsenic	361	Max Detect	10	10	18	**20**	**Retain**	60	**6.0**	**Retain**	100	**3.6**	**Retain**
Barium	217	Max Detect	10	10	500	0.43	Drop	330	0.66	Drop	3,000	0.07	Drop
Beryllium	0.52	Max ND	2	10	10	0.05	Drop	40	0.01	Drop			Uncertainty
Boron	7.3	Max Detect	10	10	0.5	**15**	**Retain**			Uncertainty	20	0.37	Drop
Cadmium	94.7	Max Detect	9	10	32	**3.0**	**Retain**	140	0.68	Drop	20	**4.7**	**Retain**
Calcium	84300	Max Detect	10	10			Uncertainty			Uncertainty			Uncertainty
Chromium	72	Max Detect	9	10	1	**72**	**Retain**	0.4	**180**	**Retain**	10	**7.2**	**Retain**
Cobalt	84.9	Max Detect	10	10	13	**6.5**	**Retain**			Uncertainty	1,000	0.08	Drop
Copper	47200	Max Detect	10	10	70	**674**	**Retain**	80	**590**	**Retain**	100	**472**	**Retain**
Cyanide, Total	2.5	Max ND	0	10			Uncertainty			Uncertainty			Uncertainty
Iron	186999	Max Detect	10	10	Not considered toxic in soils with pH between 5 and 8	**pH range is 6.2 to 8.6**	**Retain**			Uncertainty	200	**935**	**Retain**
Lead	468	Max Detect	10	10	120	**3.9**	**Retain**	1,700	0.28	Drop	900	0.52	Drop
Manganese	797	Max Detect	10	10	220	**3.6**	**Retain**	450	**1.8**	**Retain**	100	**8.0**	**Retain**
Mercury	0.49	Max Detect	8	10	0.3	**1.6**	**Retain**	0.1	**4.9**	**Retain**	30	0.02	Drop
Molybdenum	1060	Max Detect	10	10	2	**530**	**Retain**			Uncertainty	200	**5.3**	**Retain**
Nickel	40.9	Max Detect	10	10	38	**1.1**	**Retain**	280	0.15	Drop	90	0.45	Drop
Selenium	18.8	Max Detect	9	10	1	**19**	**Retain**	70	0.27	Drop	100	0.19	Drop
Silver	24.5	Max Detect	9	10	560	0.04	Drop			Uncertainty	50	0.49	Drop
Thallium	2.4	Max ND	2	10	1	**2.4**	**Retain ND**			Uncertainty			Uncertainty
Vanadium	86.3	Max Detect	10	10	2	**43**	**Retain**			Uncertainty	20	**4.3**	**Retain**
Zinc	5920	Max Detect	10	10	50	**118**	**Retain**	100	**59**	**Retain**	100	**59**	**Retain**

TABLE 4-3
Soil Screening for Terrestrial Organisms (Terrestrial Plants, Soil Invertebrates, and Soil Microbes)
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Plant Screening			Invertebrate Screening			Microbe Screening		
Analyte [a]	**EPC (mg/kg)**	**EPC Basis**	**Number of Detects**	**N**	**Plant Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**	**Invertebrate Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**	**Microbe Screening Value (mg/kg)**	**Hazard Quotient**	**Retain/Drop**
Wash Soils													
Aluminum	18800	Max Detect	32	32	A COPC only for soils with a pH less than 5.5	pH range is 7.6 to 8.6	Drop	A COPC only for soils with a pH less than 5.5	pH range is 7.6 to 8.6	Drop	A COPC only for soils with a pH less than 5.5	pH range is 7.6 to 8.6	Drop
Antimony	20	Max Detect	21	32	5	**4.0**	**Retain**	78	0.26	Drop			Uncertainty
Arsenic	75.3	Max Detect	32	32	18	**4.2**	**Retain**	60	**1.3**	**Retain**	100	0.75	Drop
Barium	118	Max Detect	32	32	500	0.24	Drop	330	0.36	Drop	3,000	0.04	Drop
Beryllium	0.27	Max ND	1	32	10	0.03	Drop	40	0.01	Drop			Uncertainty
Boron	4	Max Detect	19	19	0.5	**8.0**	**Retain**			Uncertainty	20	0.20	Drop
Cadmium	8.3	Max Detect	30	32	32	0.26	Drop	140	0.06	Drop	20	0.42	Drop
Chromium	120	Max Detect	32	32	1	**120**	**Retain**	0.4	**300**	**Retain**	10	**12**	**Retain**
Cobalt	79	Max Detect	32	32	13	**6.1**	**Retain**			Uncertainty	1,000	0.08	Drop
Copper	12500	Max Detect	32	32	70	**179**	**Retain**	80	**156**	**Retain**	100	**125**	**Retain**
Cyanide, Total	2.5	Max ND	1	31			Uncertainty			Uncertainty			Uncertainty
Iron	320000	Max Detect	32	32	Not considered toxic in soils with pH between 5 and 8	**pH range is 7.6 to 8.6**	**Retain**			Uncertainty	200	**1600**	**Retain**
Lead	239	Max Detect	32	32	120	**2.0**	**Retain**	1,700	0.14	Drop	900	0.27	Drop
Manganese	758	Max Detect	32	32	220	**3.4**	**Retain**	450	**1.7**	**Retain**	100	**7.6**	**Retain**
Mercury	0.3	Max Detect	26	32	0.3	**1.0**	**Retain**	0.1	**3.0**	**Retain**	30	0.01	Drop
Molybdenum	86	Max Detect	20	20	2	**43**	**Retain**			Uncertainty	200	0.43	Drop
Nickel	82	Max Detect	32	32	38	**2.2**	**Retain**	280	0.29	Drop	90	0.91	Drop
Selenium	24	Max Detect	20	32	1	**24**	**Retain**	70	0.34	Drop	100	0.24	Drop
Silver	11.7	Max Detect	32	32	560	0.02	Drop			Uncertainty	50	0.23	Drop
Thallium	10	Max Detect	29	32	1	**10**	**Retain ND**			Uncertainty			Uncertainty
Vanadium	79.8	Max Detect	32	32	2	**40**	**Retain**			Uncertainty	20	**4.0**	**Retain**
Zinc	1040	Max Detect	32	32	50	**21**	**Retain**	100	**10**	**Retain**	100	**10**	**Retain**

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered macronutrients and are not expected to adversely eaffect terrestrial plants, soil invertebrates, or soil microbes, although high levels of sodium may preclude growth of some plants or invertebrate species and enable growth of some salt-tolerant (or estuarine) plant species. Additionally, there are no screening values for these analytes, so they were not evaluated.

[b] Stable and unstable riparian soils were collected along the Gila and San Pedro river. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlights represent HQ values equal to or greater than one

Detect = detected value
Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = exposure point concentration
Max = maximum
mg/kg = milligram per kilogram
ND = non-detected value
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.
Retain ND = COPEC retained solely based on non-detected data; COPEC was retained for further evaluation in the refined assessment.

TABLE 4-4

Groundwater Screening of Terrestrial Plants

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte*	Type	EPC (mg/L)	EPC Basis	Number of Detects	N	Plant Soil Solution Screening Value (mg/L)	Hazard Quotient	Retain/Drop
Aluminum	Dissolved	0.2	Max ND	0	10	0.3	0.67	Drop
Antimony	Dissolved	0.002	Max ND	0	10	--		Uncertainty
Arsenic	Dissolved	0.0067	Max Detect	10	10	0.001	**6.7**	**Retain**
Barium	Dissolved	0.191	Max Detect	10	10	--		Uncertainty
Beryllium	Dissolved	0.001	Max ND	0	10	0.5	0.002	Drop
Boron	Dissolved	0.201	Max Detect	10	10	1	0.20	Drop
Cadmium	Dissolved	0.001	Max Detect	2	10	0.1	0.01	Drop
Chromium	Dissolved	0.002	Max Detect	1	10	0.05	0.04	Drop
Cobalt	Dissolved	0.0092	Max Detect	6	10	0.06	0.15	Drop
Copper	Dissolved	0.0078	Max Detect	7	10	0.06	0.13	Drop
Cyanide, Total	Total	0.01	Max ND	0	9	--		Uncertainty
Iron	Dissolved	0.95	Max Detect	6	10	10	0.10	Drop
Lead	Dissolved	0.002	Max Detect	1	10	0.02	0.10	Drop
Manganese	Dissolved	7.3	Max Detect	9	10	4	**1.8**	**Retain**
Mercury	Dissolved	0.0002	Max Detect	2	10	0.005	0.04	Drop
Molybdenum	Dissolved	0.0257	Max Detect	10	10	0.5	0.05	Drop
Nickel	Dissolved	0.05	Max Detect	5	10	0.5	0.10	Drop
Selenium	Dissolved	0.0078	Max Detect	7	10	0.7	0.01	Drop
Silver	Dissolved	0.001	Max ND	0	10	0.1	0.01	Drop
Thallium	Dissolved	0.002	Max ND	0	10	0.05	0.04	Drop
Vanadium	Dissolved	0.0068	Max Detect	6	10	0.2	0.03	Drop
Zinc	Dissolved	0.0079	Max Detect	8	10	0.4	0.02	Drop

Notes:

* Calcium, magnesium, potassium, and sodium are considered macronutrients and are not expected to adversely eaffect terrestrial plants, although high levels of sodium may preclude growth of some plants species and enable growth of some salt-tolerant (or estuarine) plant species. Additionally, there are no screening values for these analytes, so they were not evaluated.

Highlights represent HQ values equal to or greater than one

Detect = detected value

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.

EPC = exposure point concentration

Max = maximum

mg/L = milligram per liter

ND = non-detected value

Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-5
Screening Evaluation for Swallows
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Sediment EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Aquatic Invertebrate	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River											
Aluminum	26679	62	5816.02	0	8.99	5825.01	109.7	NA	**53**	NA	**Retain**
Antimony	1.2	0.0016	0.26	0	0.0002	0.26	NA	NA	NA	NA	Uncertainty
Arsenic	5.5	0.0168	5.19	0	0.002	5.19	9.3	40.3	0.56	0.13	Drop
Barium	180	1.19	39.24	0	0.17	0.17	20.8	41.7	0.008	0.004	Drop
Beryllium	205	0.0083	52.82	0	0.001	52.82	NA	NA	NA	NA	Uncertainty
Boron	10.9	0.14	2.38	0	0.02	2.40	28.8	100	0.08	0.02	Drop
Cadmium	1.1	0.0034	0.74	0	0.0005	0.74	0.16	0.61	**4.6**	**1.2**	**Retain**
Chromium	21	0.0314	0.85	0	0.005	0.86	1	5	0.86	0.17	Drop
Cobalt	16.2	0.0392	3.53	0	0.006	3.54	3.89	7.8	0.91	0.45	Drop
Copper	392	0.172	679.97	0	0.02	680.00	47	61.7	**14**	**11**	**Retain**
Cyanide	6.9	0.01	1.50	0	0.001	1.51	NA	NA	NA	NA	Uncertainty
Iron	28500	34.5	6213.00	0	5.00	6218.00	7.03	70.3	**884**	**88**	**Retain**
Lead	30.6	0.163	2.17	0	0.02	2.20	0.19	1.78	**12**	**1.2**	**Retain**
Manganese	2410	3.54	525.38	0	0.51	525.89	98	977	**5.4**	0.54	**Retain**
Mercury	0.1	0.00042	0.09	0	0.0001	0.09	0.068	0.37	**1.3**	0.23	**Retain**
Molybdenum	2.5	0.0054	1.14	0	0.0008	1.14	3.53	35.3	0.32	0.03	Drop
Nickel	26.5	0.0501	1.24	0	0.007	1.24	77.4	106.9	0.02	0.01	Drop
Selenium	1.4	0.002	0.26	0	0.0003	0.26	0.4	0.8	0.65	0.32	Drop
Silver	1.4	0.00077	4.68	0	0.0001	4.68	0.427	4.27	**11**	**1.1**	**Retain**
Strontium	194	0	42.29	0	0	42.29	NA	NA	NA	NA	Uncertainty
Thallium	1.9	0.001	0.41	0	0.0001	0.41	0.0053	0.053	**78**	**7.8**	**Retain**
Vanadium	91.2	0.0566	19.88	0	0.008	19.89	11.4	NA	**1.7**	NA	**Retain**
Zinc	89.9	0.237	93.27	0	0.03	93.30	14.5	131	**6.4**	0.71	**Retain**
p,p'-DDE	0.01	0	0.05	0	0	0.05	0.009	0.09	**5.0**	0.50	**Retain**

TABLE 4-5
Screening Evaluation for Swallows
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Sediment EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Aquatic Invertebrate	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River											
Aluminum	26678	3.66	5815.80	0	0.53	5816.33	109.7	NA	**53**	NA	**Retain**
Antimony	0.56	0.00041	0.12	0	0.0001	0.12	NA	NA	NA	NA	Uncertainty
Arsenic	6.83	0.0085	6.45	0	0.001	6.45	9.3	40.3	0.69	0.16	Drop
Barium	177	0.373	38.59	0	0.05	0.05	20.8	41.7	0.003	0.001	Drop
Beryllium	161	0.0011	41.49	0	0.0002	41.49	NA	NA	NA	NA	Uncertainty
Boron	10.6	0.225	2.31	0	0.03	2.34	28.8	100	0.08	0.02	Drop
Cadmium	0.52	0.001	0.35	0	0.0001	0.35	0.16	0.61	**2.2**	0.57	**Retain**
Chromium	14.8	0.0081	0.60	0	0.001	0.60	1	5	0.60	0.12	Drop
Cobalt	6.6	0.0061	1.44	0	0.0009	1.44	3.89	7.8	0.37	0.18	Drop
Copper	143	0.0702	248.05	0	0.01	248.06	47	61.7	**5.3**	**4.0**	**Retain**
Cyanide	3.3	0.01	0.72	0	0.001	0.72	NA	NA	NA	NA	Uncertainty
Iron	19277	8.97	4202.39	0	1.30	4203.69	7.03	70.3	**598**	**60**	**Retain**
Lead	20.8	0.0243	1.48	0	0.004	1.48	0.19	1.78	**7.8**	0.83	**Retain**
Manganese	1031	0.538	224.76	0	0.08	224.84	98	977	**2.3**	0.23	**Retain**
Mercury	0.066	0.0002	0.06	0	0.00003	0.06	0.068	0.37	0.84	0.15	Drop
Molybdenum	2.1	0.0201	0.96	0	0.003	0.96	3.53	35.3	0.27	0.03	Drop
Nickel	16.3	0.0106	0.76	0	0.002	0.76	77.4	106.9	0.01	0.007	Drop
Selenium	0.66	0.0012	0.15	0	0.0002	0.15	0.4	0.8	0.37	0.19	Drop
Silver	0.66	0.00036	2.21	0	0.0001	2.21	0.427	4.27	**5.2**	0.52	**Retain**
Strontium	213	0	46.43	0	0	46.43	NA	NA	NA	NA	Uncertainty
Thallium	0.83	0.001	0.18	0	0.0001	0.18	0.0053	0.053	**34**	**3.4**	**Retain**
Vanadium	46.3	0.0217	10.09	0	0.003	10.10	11.4	NA	0.89	NA	Drop
Zinc	78.5	0.0497	81.44	0	0.007	81.45	14.5	131	**5.6**	0.62	**Retain**
p,p'-DDE	0.01	0	0.05	0	0	0.05	0.009	0.09	**5.0**	0.50	**Retain**

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., aquatic invertebrate portion of diet, sediment ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of sediment in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-6
Screening Evaluation for Belted Kingfisher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Sediment EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Fish	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River											
Aluminum	26679	62	1890.50	0	6.88	1897.39	109.7	NA	**17**	NA	**Retain**
Antimony	1.2	0.0016	0.0002	0	0.0002	0.0004	NA	NA	NA	NA	Uncertainty
Arsenic	5.5	0.0168	0.04	0	0.002	0.04	9.3	40.3	0.004	0.001	Drop
Barium	180	1.19	0.82	0	0.13	0.13	20.8	41.7	0.006	0.003	Drop
Beryllium	205	0.0083	0.02	0	0.0009	0.02	NA	NA	NA	NA	Uncertainty
Boron	10.9	0.14	0.02	0	0.02	0.03	28.8	100	0.001	0.0003	Drop
Cadmium	1.1	0.0034	5.57	0	0.0004	5.57	0.16	0.61	**35**	**9.1**	**Retain**
Chromium	21	0.0314	0.32	0	0.003	0.32	1	5	0.32	0.06	Drop
Cobalt	16.2	0.0392	0.01	0	0.004	0.01	3.89	7.8	0.002	0.001	Drop
Copper	392	0.172	6.58	0	0.02	6.60	47	61.7	0.14	0.11	Drop
Cyanide	6.9	0.01	0	0	0.001	0.001	NA	NA	NA	NA	Uncertainty
Iron	28500	34.5	4.55	0	3.83	8.38	7.03	70.3	**1.2**	0.12	**Retain**
Lead	30.6	0.163	0.97	0	0.02	0.99	0.19	1.78	**5.2**	0.55	**Retain**
Manganese	2410	3.54	0.47	0	0.39	0.86	98	977	0.009	0.001	Drop
Mercury	0.1	0.00042	1.55	0	0.00005	1.55	0.068	0.37	**23**	**4.2**	**Retain**
Molybdenum	2.5	0.0054	0.0007	0	0.0006	0.001	3.53	35.3	0.0004	0.00004	Drop
Nickel	26.5	0.0501	0.70	0	0.01	0.71	77.4	106.9	0.009	0.007	Drop
Selenium	1.4	0.002	0.69	0	0.0002	0.69	0.4	0.8	**1.7**	0.86	**Retain**
Silver	1.4	0.00077	0.04	0	0.00009	0.04	0.427	4.27	0.08	0.008	Drop
Strontium	194	0	0	0	0	0	NA	NA	NA	NA	Uncertainty
Thallium	1.9	0.001	0.004	0	0.0001	0.005	0.0053	0.053	0.87	0.09	Drop
Vanadium	91.2	0.0566	0.01	0	0.01	0.01	11.4	NA	0.001	NA	Drop
Zinc	89.9	0.237	30.22	0	0.03	30.25	14.5	131	**2.1**	0.23	**Retain**
p,p'-DDE	0.01	0	0	0	0	0	0.009	0.09	0	0	Drop

TABLE 4-6
Screening Evaluation for Belted Kingfisher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Sediment EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Fish	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River											
Aluminum	26678	3.66	111.60	0	0.41	112.01	109.7	NA	**1.0**	NA	**Retain**
Antimony	0.56	0.00041	0.00005	0	0.00005	0.0001	NA	NA	NA	NA	Uncertainty
Arsenic	6.83	0.0085	0.02	0	0.0009	0.02	9.3	40.3	0.002	0.0005	Drop
Barium	177	0.373	0.26	0	0.04	0.04	20.8	41.7	0.002	0.001	Drop
Beryllium	161	0.0011	0.003	0	0.0001	0.003	NA	NA	NA	NA	Uncertainty
Boron	10.6	0.225	0.03	0	0.02	0.05	28.8	100	0.002	0.001	Drop
Cadmium	0.52	0.001	1.64	0	0.0001	1.64	0.16	0.61	**10**	**2.7**	**Retain**
Chromium	14.8	0.0081	0.08	0	0.0009	0.08	1	5	0.08	0.02	Drop
Cobalt	6.6	0.0061	0.0008	0	0.0007	0.001	3.89	7.8	0.0004	0.0002	Drop
Copper	143	0.0702	2.69	0	0.01	2.70	47	61.7	0.06	0.04	Drop
Cyanide	3.3	0.01	0	0	0.001	0.001	NA	NA	NA	NA	Uncertainty
Iron	19277	8.97	1.18	0	1.00	2.18	7.03	70.3	0.31	0.03	Drop
Lead	20.8	0.0243	0.14	0	0.003	0.15	0.19	1.78	0.77	0.08	Drop
Manganese	1031	0.538	0.07	0	0.06	0.13	98	977	0.001	0.0001	Drop
Mercury	0.066	0.0002	0.74	0	0.00002	0.74	0.068	0.37	**11**	**2.0**	**Retain**
Molybdenum	2.1	0.0201	0.003	0	0.002	0.005	3.53	35.3	0.001	0.0001	Drop
Nickel	16.3	0.0106	0.15	0	0.001	0.15	77.4	106.9	0.002	0.001	Drop
Selenium	0.66	0.0012	0.41	0	0.0001	0.41	0.4	0.8	**1.0**	0.51	**Retain**
Silver	0.66	0.00036	0.02	0	0.00004	0.02	0.427	4.27	0.04	0.004	Drop
Strontium	213	0	0	0	0	0	NA	NA	NA	NA	Uncertainty
Thallium	0.83	0.001	0.004	0	0.0001	0.005	0.0053	0.053	0.87	0.09	Drop
Vanadium	46.3	0.0217	0.003	0	0.002	0.01	11.4	NA	0.0005	NA	Drop
Zinc	78.5	0.0497	6.34	0	0.01	6.34	14.5	131	0.44	0.05	Drop
p,p'-DDE	0.01	0	0	0	0	0	0.009	0.09	0	0	Drop

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., fish portion of diet, sediment ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of sediment in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-7
Screening Evaluation for Little Brown Bat
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Sediment EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Aquatic Invertebrate	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River											
Aluminum	26679	62	4962.29	0	9.98	4972.28	1.93	19.3	**2576**	**258**	**Retain**
Antimony	1.2	0.0016	0.22	0	0.0003	0.22	0.059	0.59	**3.8**	0.38	**Retain**
Arsenic	5.5	0.0168	4.43	0	0.003	4.43	0.396	1.58	**11**	**2.8**	**Retain**
Barium	180	1.19	33.48	0	0.19	0.19	45	75	0.004	0.003	Drop
Beryllium	205	0.0083	45.07	0	0.001	45.07	0.66	NA	**68**	NA	**Retain**
Boron	10.9	0.14	2.03	0	0.02	2.05	28	93.6	0.07	0.02	Drop
Cadmium	1.1	0.0034	0.63	0	0.0005	0.63	0.77	1.42	0.82	0.44	Drop
Chromium	21	0.0314	0.73	0	0.005	0.73	3.28	13.14	0.22	0.06	Drop
Cobalt	16.2	0.0392	3.01	0	0.006	3.02	5.45	10.9	0.55	0.28	Drop
Copper	392	0.172	580.16	0	0.03	580.19	11.7	15.14	**50**	**38**	**Retain**
Cyanide	6.9	0.01	1.28	0	0.002	1.29	0.15	0.5	**8.6**	**2.6**	**Retain**
Iron	28500	34.5	5301.00	0	5.55	5306.55	2.8	NA	**1895**	NA	**Retain**
Lead	30.6	0.163	1.86	0	0.03	1.88	0.92	4.7	**2.0**	0.40	**Retain**
Manganese	2410	3.54	448.26	0	0.57	448.83	88	284	**5.1**	**1.6**	**Retain**
Mercury	0.1	0.00042	0.07	0	0.0001	0.07	0.032	0.16	**2.3**	0.46	**Retain**
Molybdenum	2.5	0.0054	0.97	0	0.0009	0.97	0.26	2.6	**3.7**	0.37	**Retain**
Nickel	26.5	0.0501	1.05	0	0.008	1.06	6.8	31.63	0.16	0.03	Drop
Selenium	1.4	0.002	0.22	0	0.0003	0.22	0.2	0.33	**1.1**	0.67	**Retain**
Silver	1.4	0.00077	3.99	0	0.0001	3.99	2.38	23.8	**1.7**	0.17	**Retain**
Strontium	194	0	36.08	0	0	36.08	263	NA	0.14	NA	Drop
Thallium	1.9	0.001	0.35	0	0.0002	0.35	0.48	1.43	0.74	0.25	Drop
Vanadium	91.2	0.0566	16.96	0	0.009	16.97	0.21	2.1	**81**	**8.1**	**Retain**
Zinc	89.9	0.237	79.58	0	0.04	79.62	160	320	0.50	0.25	Drop
p,p'-DDE	0.01	0	0.04	0	0	0.04	0.8	4	0.05	0.01	Drop

TABLE 4-7
Screening Evaluation for Little Brown Bat
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Sediment EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Aquatic Invertebrate	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River											
Aluminum	26678	3.66	4962.11	0	0.59	4962.70	1.93	19.3	**2571**	**257**	**Retain**
Antimony	0.56	0.00041	0.10	0	0.0001	0.10	0.059	0.59	**1.8**	0.18	**Retain**
Arsenic	6.83	0.0085	5.50	0	0.001	5.50	0.396	1.58	**14**	**3.5**	**Retain**
Barium	177	0.373	32.92	0	0.06	0.06	45	75	0.001	0.001	Drop
Beryllium	161	0.0011	35.40	0	0.0002	35.40	0.66	NA	**54**	NA	**Retain**
Boron	10.6	0.225	1.97	0	0.04	2.01	28	93.6	0.07	0.02	Drop
Cadmium	0.52	0.001	0.30	0	0.0002	0.30	0.77	1.42	0.39	0.21	Drop
Chromium	14.8	0.0081	0.51	0	0.001	0.51	3.28	13.14	0.16	0.04	Drop
Cobalt	6.6	0.0061	1.23	0	0.001	1.23	5.45	10.9	0.23	0.11	Drop
Copper	143	0.0702	211.64	0	0.01	211.65	11.7	15.14	**18**	**14**	**Retain**
Cyanide	3.3	0.01	0.61	0	0.002	0.62	0.15	0.5	**4.1**	**1.2**	**Retain**
Iron	19277	8.97	3585.52	0	1.44	3586.97	2.8	NA	**1281**	NA	**Retain**
Lead	20.8	0.0243	1.26	0	0.004	1.27	0.92	4.7	**1.4**	0.27	**Retain**
Manganese	1031	0.538	191.77	0	0.09	191.85	88	284	**2.2**	0.68	**Retain**
Mercury	0.066	0.0002	0.05	0	0.00003	0.05	0.032	0.16	**1.5**	0.31	**Retain**
Molybdenum	2.1	0.0201	0.82	0	0.003	0.82	0.26	2.6	**3.2**	0.32	**Retain**
Nickel	16.3	0.0106	0.65	0	0.002	0.65	6.8	31.63	0.10	0.02	Drop
Selenium	0.66	0.0012	0.13	0	0.0002	0.13	0.2	0.33	0.64	0.39	Drop
Silver	0.66	0.00036	1.88	0	0.0001	1.88	2.38	23.8	0.79	0.08	Drop
Strontium	213	0	39.62	0	0	39.62	263	NA	0.15	NA	Drop
Thallium	0.83	0.001	0.15	0	0.0002	0.15	0.48	1.43	0.32	0.11	Drop
Vanadium	46.3	0.0217	8.61	0	0.003	8.62	0.21	2.1	**41**	**4.1**	**Retain**
Zinc	78.5	0.0497	69.49	0	0.008	69.49	160	320	0.43	0.22	Drop
p,p'-DDE	0.01	0	0.04	0	0	0.04	0.8	4	0.05	0.01	Drop

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., aquatic invertebrate portion of diet, sediment ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of sediment in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-8
Screening Evaluation for Mink
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Sediment EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Fish	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River											
Aluminum	26679	62	587.20	32.82	6.57	626.59	1.93	19.3	**325**	**32**	**Retain**
Antimony	1.2	0.0016	0.00007	0.001	0.0002	0.002	0.059	0.59	0.03	0.003	Drop
Arsenic	5.5	0.0168	0.01	0.007	0.002	0.02	0.396	1.58	0.05	0.01	Drop
Barium	180	1.19	0.25	0.22	0.13	0.35	45	75	0.008	0.005	Drop
Beryllium	205	0.0083	0.006	0.25	0.0009	0.26	0.66	NA	0.39	NA	Drop
Boron	10.9	0.14	0.006	0.01	0.01	0.03	28	93.6	0.001	0.0004	Drop
Cadmium	1.1	0.0034	1.73	0.001	0.0004	1.73	0.77	1.42	**2.2**	**1.2**	**Retain**
Chromium	21	0.0314	0.10	0.03	0.003	0.13	3.28	13.14	0.04	0.01	Drop
Cobalt	16.2	0.0392	0.002	0.02	0.004	0.03	5.45	10.9	0.005	0.002	Drop
Copper	392	0.172	2.05	0.48	0.02	2.55	11.7	15.14	0.22	0.17	Drop
Cyanide	6.9	0.01	0	0.008	0.001	0.01	0.15	0.5	0.06	0.02	Drop
Iron	28500	34.5	1.41	35.06	3.66	40.13	2.8	NA	**14**	NA	**Retain**
Lead	30.6	0.163	0.30	0.04	0.02	0.36	0.92	4.7	0.39	0.08	Drop
Manganese	2410	3.54	0.15	2.96	0.38	3.48	88	284	0.04	0.01	Drop
Mercury	0.1	0.00042	0.48	0.0001	0.00004	0.48	0.032	0.16	**15**	**3.0**	**Retain**
Molybdenum	2.5	0.0054	0.0002	0.003	0.0006	0.004	0.26	2.6	0.01	0.001	Drop
Nickel	26.5	0.0501	0.22	0.03	0.005	0.26	6.8	31.63	0.04	0.008	Drop
Selenium	1.4	0.002	0.21	0.002	0.0002	0.22	0.2	0.33	**1.1**	0.65	**Retain**
Silver	1.4	0.00077	0.01	0.002	0.0001	0.01	2.38	23.8	0.005	0.001	Drop
Strontium	194	0	0	0.24	0	0.24	263	NA	0.001	NA	Drop
Thallium	1.9	0.001	0.001	0.002	0.0001	0.004	0.48	1.43	0.008	0.003	Drop
Vanadium	91.2	0.0566	0.002	0.11	0.006	0.12	0.21	2.1	0.57	0.06	Drop
Zinc	89.9	0.237	9.39	0.11	0.03	9.52	160	320	0.06	0.03	Drop
p,p'-DDE	0.01	0	0	0.00001	0	0.00001	0.8	4	0.00002	0.000003	Drop

TABLE 4-8
Screening Evaluation for Mink
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Sediment EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Fish	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River											
Aluminum	26678	3.66	34.66	32.81	0.39	67.87	1.93	19.3	**35**	**3.5**	**Retain**
Antimony	0.56	0.00041	0.00002	0.0007	0.00004	0.0007	0.059	0.59	0.01	0.001	Drop
Arsenic	6.83	0.0085	0.006	0.008	0.0009	0.02	0.396	1.58	0.04	0.01	Drop
Barium	177	0.373	0.08	0.22	0.04	0.26	45	75	0.006	0.003	Drop
Beryllium	161	0.0011	0.0009	0.20	0.0001	0.20	0.66	NA	0.30	NA	Drop
Boron	10.6	0.225	0.009	0.01	0.02	0.05	28	93.6	0.002	0.0005	Drop
Cadmium	0.52	0.001	0.51	0.0006	0.0001	0.51	0.77	1.42	0.66	0.36	Drop
Chromium	14.8	0.0081	0.03	0.02	0.0009	0.04	3.28	13.14	0.01	0.003	Drop
Cobalt	6.6	0.0061	0.0003	0.008	0.0006	0.009	5.45	10.9	0.002	0.001	Drop
Copper	143	0.0702	0.83	0.18	0.007	1.02	11.7	15.14	0.09	0.07	Drop
Cyanide	3.3	0.01	0	0.004	0.001	0.005	0.15	0.5	0.03	0.01	Drop
Iron	19277	8.97	0.37	23.71	0.95	25.03	2.8	NA	**8.9**	NA	**Retain**
Lead	20.8	0.0243	0.04	0.03	0.003	0.07	0.92	4.7	0.08	0.02	Drop
Manganese	1031	0.538	0.02	1.27	0.06	1.35	88	284	0.02	0.005	Drop
Mercury	0.066	0.0002	0.23	0.0001	0.00002	0.23	0.032	0.16	**7.2**	**1.4**	**Retain**
Molybdenum	2.1	0.0201	0.0008	0.003	0.002	0.006	0.26	2.6	0.02	0.002	Drop
Nickel	16.3	0.0106	0.05	0.02	0.001	0.07	6.8	31.63	0.01	0.002	Drop
Selenium	0.66	0.0012	0.13	0.0008	0.0001	0.13	0.2	0.33	0.64	0.39	Drop
Silver	0.66	0.00036	0.005	0.0008	0.00004	0.006	2.38	23.8	0.003	0.0003	Drop
Strontium	213	0	0	0.26	0	0.26	263	NA	0.001	NA	Drop
Thallium	0.83	0.001	0.001	0.001	0.0001	0.003	0.48	1.43	0.005	0.002	Drop
Vanadium	46.3	0.0217	0.0009	0.06	0.002	0.06	0.21	2.1	0.29	0.03	Drop
Zinc	78.5	0.0497	1.97	0.10	0.005	2.07	160	320	0.01	0.006	Drop
p,p'-DDE	0.01	0	0	0.00001	0	0.00001	0.8	4	0.00002	0.000003	Drop

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., fish portion of diet, sediment ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of sediment in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-9
Screening Evaluation for Mourning Dove
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Plant	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]											
Antimony	0.92	0.0016	0.004	0.008	0.00004	0.01	NA	NA	NA	NA	Uncertainty
Arsenic	8.1	0.0168	0.87	0.07	0.0005	0.94	9.3	40.3	0.10	0.02	Drop
Beryllium	1.6	0.0083	0.08	0.01	0.0002	0.09	NA	NA	NA	NA	Uncertainty
Boron	32.5	0.14	57.09	0.29	0.004	57.39	28.8	100	**2.0**	0.57	**Retain**
Cadmium	0.95	0.0034	0.06	0.009	0.0001	0.07	0.16	0.61	0.42	0.11	Drop
Chromium	16.8	0.0314	0.14	0.15	0.0009	0.29	1	5	0.29	0.06	Drop
Copper	1150	0.172	3.04	10.37	0.005	13.42	47	61.7	0.29	0.22	Drop
Cyanide	2.5	0.01	0.24	0.02	0.0003	0.27	NA	NA	NA	NA	Uncertainty
Lead	60.8	0.163	0.26	0.55	0.005	0.81	0.19	1.78	**4.3**	0.46	**Retain**
Mercury	0.15	0.00042	0.01	0.001	0.00001	0.01	0.068	0.37	0.21	0.04	Drop
Molybdenum	7.1	0.0054	3.04	0.06	0.0002	3.11	3.53	35.3	0.88	0.09	Drop
Selenium	3.5	0.002	0.20	0.03	0.0001	0.23	0.4	0.8	0.57	0.28	Drop
Silver	1.3	0.00077	0.005	0.01	0.00002	0.02	0.427	4.27	0.04	0.004	Drop
Thallium	2.5	0.001	0.001	0.02	0.00003	0.02	0.0053	0.053	**4.4**	0.44	**Retain**
Vanadium	83.1	0.0566	0.08	0.75	0.002	0.83	11.4	NA	0.07	NA	Drop
Zinc	112	0.237	6.43	1.01	0.007	7.45	14.5	131	0.51	0.06	Drop
Middle Gila River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	23400	62	11.35	211.09	1.74	224.18	109.7	NA	**2.0**	NA	**Retain**
Barium	202	1.19	9.35	1.82	0.03	11.20	20.8	41.7	0.54	0.27	Drop
Cobalt	11.5	0.0392	0.03	0.10	0.001	0.13	3.89	7.8	0.03	0.02	Drop
Iron	20700	34.5	20.08	186.73	0.97	207.78	7.03	70.3	**30**	**3.0**	**Retain**
Manganese	794	3.54	18.02	7.16	0.10	25.28	98	977	0.26	0.03	Drop
Nickel	19.9	0.0501	0.10	0.18	0.001	0.28	77.4	106.9	0.004	0.003	Drop
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water											
Aluminum	23400	62	11.35	211.09	1.74	224.18	109.7	NA	**2.0**	NA	**Retain**
Barium	203	1.19	9.39	1.83	0.03	11.26	20.8	41.7	0.54	0.27	Drop
Cobalt	17	0.0392	0.04	0.15	0.001	0.20	3.89	7.8	0.05	0.03	Drop
Iron	27200	34.5	26.38	245.37	0.97	272.72	7.03	70.3	**39**	**3.9**	**Retain**
Manganese	879	3.54	19.95	7.93	0.10	27.98	98	977	0.29	0.03	Drop
Nickel	22.1	0.0501	0.11	0.20	0.001	0.31	77.4	106.9	0.004	0.003	Drop

TABLE 4-9
Screening Evaluation for Mourning Dove
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Plant	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water											
Antimony	0.58	0.00041	0.002	0.005	0.00001	0.01	NA	NA	NA	NA	Uncertainty
Arsenic	4.8	0.0085	0.51	0.04	0.0002	0.56	9.3	40.3	0.06	0.01	Drop
Beryllium	0.96	0.0011	0.06	0.0087	0.00003	0.06	NA	NA	NA	NA	Uncertainty
Boron	5.7	0.225	10.01	0.05	0.006	10.07	28.8	100	0.35	0.10	Drop
Cadmium	0.5	0.001	0.04	0.005	0.00003	0.05	0.16	0.61	0.29	0.08	Drop
Chromium	13.8	0.0081	0.11	0.12	0.0002	0.24	1	5	0.24	0.05	Drop
Copper	322	0.0702	1.84	2.90	0.002	4.75	47	61.7	0.10	0.08	Drop
Cyanide	2.5	0.01	0.24	0.02	0.0003	0.27	NA	NA	NA	NA	Uncertainty
Lead	22.3	0.0243	0.15	0.20	0.0007	0.35	0.19	1.78	**1.8**	0.20	**Retain**
Mercury	0.1	0.0002	0.01	0.0009	0.00001	0.01	0.068	0.37	0.16	0.03	Drop
Molybdenum	2	0.0201	0.86	0.02	0.0006	0.88	3.53	35.3	0.25	0.02	Drop
Selenium	3.5	0.0012	0.20	0.03	0.00003	0.23	0.4	0.8	0.57	0.28	Drop
Silver	1	0.00036	0.004	0.0090	0.00001	0.01	0.427	4.27	0.03	0.003	Drop
Thallium	2.5	0.001	0.001	0.02	0.00003	0.02	0.0053	0.053	**4.4**	0.44	**Retain**
Vanadium	32.2	0.0217	0.03	0.29	0.0006	0.32	11.4	NA	0.03	NA	Drop
Zinc	69.3	0.0497	4.92	0.63	0.001	5.55	14.5	131	0.38	0.04	Drop
San Pedro River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	7180	3.66	3.48	64.77	0.10	68.36	109.7	NA	0.62	NA	Drop
Barium	114	0.373	5.27	1.03	0.01	6.31	20.8	41.7	0.30	0.15	Drop
Cobalt	5	0.0061	0.01	0.05	0.0002	0.06	3.89	7.8	0.01	0.007	Drop
Iron	9870	8.97	9.57	89.04	0.25	98.86	7.03	70.3	**14**	**1.4**	**Retain**
Manganese	194	0.538	4.40	1.75	0.02	6.17	98	977	0.06	0.006	Drop
Nickel	9.5	0.0106	0.06	0.09	0.0003	0.14	77.4	106.9	0.002	0.001	Drop
San Pedro River - On-Site Untable Riparian Soil and Surface Water											
Aluminum	15100	3.66	7.32	136.22	0.10	143.64	109.7	NA	**1.3**	NA	**Retain**
Barium	146	0.373	6.76	1.32	0.01	8.08	20.8	41.7	0.39	0.19	Drop
Cobalt	8.9	0.0061	0.02	0.08	0.0002	0.10	3.89	7.8	0.03	0.01	Drop
Iron	18000	8.97	17.46	162.38	0.25	180.09	7.03	70.3	**26**	**2.6**	**Retain**
Manganese	591	0.538	13.41	5.33	0.02	18.76	98	977	0.19	0.02	Drop
Nickel	16	0.0106	0.08	0.14	0.0003	0.23	77.4	106.9	0.003	0.002	Drop

TABLE 4-9
Screening Evaluation for Mourning Dove
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Plant	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Upland Soils and Gila River Surface Water											
Aluminum	30000	62	14.55	270.63	1.74	286.92	109.7	NA	**2.6**	NA	**Retain**
Antimony	10.4	0.0016	0.03	0.09	0.00004	0.13	NA	NA	NA	NA	Uncertainty
Arsenic	361	0.0168	38.62	3.26	0.0005	41.88	9.3	40.3	**4.5**	**1.0**	**Retain**
Barium	217	1.19	10.04	1.96	0.03	12.03	20.8	41.7	0.58	0.29	Drop
Beryllium	0.52	0.0083	0.04	0.005	0.0002	0.04	NA	NA	NA	NA	Uncertainty
Boron	7.3	0.14	12.82	0.07	0.004	12.89	28.8	100	0.45	0.13	Drop
Cadmium	94.7	0.0034	0.72	0.85	0.0001	1.58	0.16	0.61	**9.9**	**2.6**	**Retain**
Chromium	72	0.0314	0.59	0.65	0.0009	1.24	1	5	**1.2**	0.25	**Retain**
Cobalt	84.9	0.0392	0.20	0.77	0.001	0.97	3.89	7.8	0.25	0.12	Drop
Copper	47200	0.172	13.15	425.79	0.005	438.94	47	61.7	**9.3**	**7.1**	**Retain**
Cyanide, Total	2.5	0.01	0.24	0.02	0.0003	0.27	NA	NA	NA	NA	Uncertainty
Iron	186999	34.5	181.39	1686.92	0.97	1869.27	7.03	70.3	**266**	**27**	**Retain**
Lead	468	0.163	0.81	4.22	0.005	5.04	0.19	1.78	**27**	**2.8**	**Retain**
Manganese	797	3.54	18.09	7.19	0.10	25.38	98	977	0.26	0.03	Drop
Mercury	0.49	0.00042	0.02	0.004	0.00001	0.03	0.068	0.37	0.42	0.08	Drop
Molybdenum	1060	0.0054	454.23	9.56	0.0002	463.79	3.53	35.3	**131**	**13**	**Retain**
Nickel	40.9	0.0501	0.17	0.37	0.001	0.54	77.4	106.9	0.007	0.005	Drop
Selenium	18.8	0.002	1.26	0.17	0.0001	1.43	0.4	0.8	**3.6**	**1.8**	**Retain**
Silver	24.5	0.00077	0.09	0.22	0.00002	0.31	0.427	4.27	0.72	0.07	Drop
Thallium	2.4	0.001	0.0009	0.02	0.00003	0.02	0.0053	0.053	**4.3**	0.43	**Retain**
Vanadium	86.3	0.0566	0.08	0.78	0.002	0.86	11.4	NA	0.08	NA	Drop
Zinc	5920	0.237	58.13	53.40	0.007	111.54	14.5	131	**7.7**	0.85	**Retain**

TABLE 4-9
Screening Evaluation for Mourning Dove
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Plant	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Wash Soils and Gila River Surface Water											
Aluminum	18800	62	9.12	169.59	1.74	180.45	109.7	NA	**1.6**	NA	**Retain**
Antimony	20	0.0016	0.06	0.18	0.00004	0.24	NA	NA	NA	NA	Uncertainty
Arsenic	75.3	0.0168	8.06	0.68	0.0005	8.74	9.3	40.3	0.94	0.22	Drop
Barium	118	1.19	5.46	1.06	0.03	6.56	20.8	41.7	0.32	0.16	Drop
Beryllium	0.27	0.0083	0.02	0.002	0.0002	0.02	NA	NA	NA	NA	Uncertainty
Boron	4	0.14	7.03	0.04	0.004	7.07	28.8	100	0.25	0.07	Drop
Cadmium	8.3	0.0034	0.19	0.07	0.0001	0.27	0.16	0.61	**1.7**	0.44	**Retain**
Chromium	120	0.0314	0.98	1.08	0.0009	2.06	1	5	**2.1**	0.41	**Retain**
Cobalt	79	0.0392	0.19	0.71	0.001	0.90	3.89	7.8	0.23	0.12	Drop
Copper	12500	0.172	7.79	112.76	0.005	120.56	47	61.7	**2.6**	**2.0**	**Retain**
Cyanide, Total	2.5	0.01	0.24	0.02	0.0003	0.27	NA	NA	NA	NA	Uncertainty
Iron	320000	34.5	310.40	2886.72	0.97	3198.09	7.03	70.3	**455**	**45**	**Retain**
Lead	239	0.163	0.56	2.16	0.005	2.72	0.19	1.78	**14**	**1.5**	**Retain**
Manganese	758	3.54	17.21	6.84	0.10	24.14	98	977	0.25	0.02	Drop
Mercury	0.3	0.00042	0.02	0.003	0.00001	0.02	0.068	0.37	0.31	0.06	Drop
Molybdenum	86	0.0054	36.85	0.78	0.0002	37.63	3.53	35.3	**11**	**1.1**	**Retain**
Nickel	82	0.0501	0.28	0.74	0.001	1.02	77.4	106.9	0.01	0.01	Drop
Selenium	24	0.002	1.64	0.22	0.0001	1.86	0.4	0.8	**4.7**	**2.3**	**Retain**
Silver	11.7	0.00077	0.04	0.11	0.00002	0.15	0.427	4.27	0.34	0.03	Drop
Thallium	10	0.001	0.004	0.09	0.00003	0.09	0.0053	0.053	**18**	**1.8**	**Retain**
Vanadium	79.8	0.0566	0.08	0.72	0.002	0.80	11.4	NA	0.07	NA	Drop
Zinc	1040	0.237	22.14	9.38	0.007	31.53	14.5	131	**2.2**	0.24	**Retain**

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., terrestrial plant portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of soil in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from ea pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro river. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-10
Screening Evaluation for Curve-billed Thrasher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]											
Antimony	0.92	0.0016	0.14	0.01	0.0002	0.16	NA	NA	NA	NA	Uncertainty
Arsenic	8.1	0.0168	0.17	0.12	0.002	0.29	9.3	40.3	0.03	0.007	Drop
Beryllium	1.6	0.0083	0.30	0.02	0.001	0.32	NA	NA	NA	NA	Uncertainty
Boron	32.5	0.14	5.10	0.47	0.02	5.60	28.8	100	0.19	0.06	Drop
Cadmium	0.95	0.0034	1.25	0.01	0.0005	1.26	0.16	0.61	**7.9**	**2.1**	**Retain**
Chromium	16.8	0.0314	8.34	0.25	0.004	8.59	1	5	**8.6**	**1.7**	**Retain**
Copper	1150	0.172	276.42	16.79	0.02	293.24	47	61.7	**6.2**	**4.8**	**Retain**
Cyanide	2.5	0.01	0.39	0.04	0.001	0.43	NA	NA	NA	NA	Uncertainty
Lead	60.8	0.163	3.47	0.89	0.02	4.38	0.19	1.78	**23**	**2.5**	**Retain**
Mercury	0.15	0.00042	0.09	0.002	0.0001	0.09	0.068	0.37	**1.4**	0.25	**Retain**
Molybdenum	7.1	0.0054	2.33	0.10	0.0007	2.44	3.53	35.3	0.69	0.07	Drop
Selenium	3.5	0.002	0.36	0.05	0.0003	0.42	0.4	0.8	**1.0**	0.52	**Retain**
Silver	1.3	0.00077	3.13	0.02	0.0001	3.15	0.427	4.27	**7.4**	0.74	**Retain**
Thallium	2.5	0.001	0.10	0.04	0.0001	0.14	0.0053	0.053	**26**	**2.6**	**Retain**
Vanadium	83.1	0.0566	1.15	1.21	0.008	2.37	11.4	NA	0.21	NA	Drop
Zinc	112	0.237	63.13	1.64	0.03	64.80	14.5	131	**4.5**	0.49	**Retain**
Middle Gila River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	23400	62	433.51	341.66	8.43	783.60	109.7	NA	**7.1**	NA	**Retain**
Barium	202	1.19	5.07	2.95	0.16	8.19	20.8	41.7	0.39	0.20	Drop
Cobalt	11.5	0.0392	0.53	0.17	0.005	0.70	3.89	7.8	0.18	0.09	Drop
Iron	20700	34.5	253.49	302.24	4.69	560.42	7.03	70.3	**80**	**8.0**	**Retain**
Manganese	794	3.54	6.64	11.59	0.48	18.72	98	977	0.19	0.02	Drop
Nickel	19.9	0.0501	14.78	0.29	0.007	15.08	77.4	106.9	0.19	0.14	Drop
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water											
Aluminum	23400	62	433.51	341.66	8.43	783.60	109.7	NA	**7.1**	NA	**Retain**
Barium	203	1.19	5.10	2.96	0.16	8.23	20.8	41.7	0.40	0.20	Drop
Cobalt	17	0.0392	0.78	0.25	0.005	1.03	3.89	7.8	0.26	0.13	Drop
Iron	27200	34.5	333.09	397.15	4.69	734.93	7.03	70.3	**105**	**10**	**Retain**
Manganese	879	3.54	7.12	12.83	0.48	20.43	98	977	0.21	0.02	Drop
Nickel	22.1	0.0501	16.41	0.32	0.007	16.74	77.4	106.9	0.22	0.16	Drop

TABLE 4-10
Screening Evaluation for Curve-billed Thrasher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water											
Antimony	0.58	0.00041	0.09	0.008	0.0001	0.10	NA	NA	NA	NA	Uncertainty
Arsenic	4.8	0.0085	0.11	0.07	0.001	0.19	9.3	40.3	0.02	0.005	Drop
Beryllium	0.96	0.0011	0.18	0.01	0.0001	0.19	NA	NA	NA	NA	Uncertainty
Boron	5.7	0.225	0.89	0.08	0.03	1.01	28.8	100	0.04	0.01	Drop
Cadmium	0.5	0.001	0.75	0.007	0.0001	0.76	0.16	0.61	**4.7**	**1.2**	**Retain**
Chromium	13.8	0.0081	6.85	0.20	0.001	7.05	1	5	**7.1**	**1.4**	**Retain**
Copper	322	0.0702	77.40	4.70	0.01	82.11	47	61.7	**1.7**	**1.3**	**Retain**
Cyanide	2.5	0.01	0.39	0.04	0.001	0.43	NA	NA	NA	NA	Uncertainty
Lead	22.3	0.0243	1.55	0.33	0.003	1.88	0.19	1.78	**9.9**	**1.1**	**Retain**
Mercury	0.1	0.0002	0.08	0.001	0.00003	0.08	0.068	0.37	**1.2**	0.22	**Retain**
Molybdenum	2	0.0201	0.66	0.03	0.003	0.69	3.53	35.3	0.20	0.02	Drop
Selenium	3.5	0.0012	0.36	0.05	0.0002	0.42	0.4	0.8	**1.0**	0.52	**Retain**
Silver	1	0.00036	2.41	0.01	0.00005	2.42	0.427	4.27	**5.7**	0.57	**Retain**
Thallium	2.5	0.001	0.10	0.04	0.0001	0.14	0.0053	0.053	**26**	**2.6**	**Retain**
Vanadium	32.2	0.0217	0.44	0.47	0.003	0.92	11.4	NA	0.08	NA	Drop
Zinc	69.3	0.0497	53.93	1.01	0.007	54.95	14.5	131	**3.8**	0.42	**Retain**
San Pedro River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	7180	3.66	133.02	104.84	0.50	238.35	109.7	NA	**2.2**	NA	**Retain**
Barium	114	0.373	2.86	1.66	0.05	4.58	20.8	41.7	0.22	0.11	Drop
Cobalt	5	0.0061	0.23	0.07	0.0008	0.30	3.89	7.8	0.08	0.04	Drop
Iron	9870	8.97	120.87	144.11	1.22	266.20	7.03	70.3	**38**	**3.8**	**Retain**
Manganese	194	0.538	2.54	2.83	0.07	5.45	98	977	0.06	0.006	Drop
Nickel	9.5	0.0106	7.05	0.14	0.001	7.19	77.4	106.9	0.09	0.07	Drop
San Pedro River - On-Site Untable Riparian Soil and Surface Water											
Aluminum	15100	3.66	279.74	220.48	0.50	500.72	109.7	NA	**4.6**	NA	**Retain**
Barium	146	0.373	3.67	2.13	0.05	5.85	20.8	41.7	0.28	0.14	Drop
Cobalt	8.9	0.0061	0.41	0.13	0.0008	0.54	3.89	7.8	0.14	0.07	Drop
Iron	18000	8.97	220.43	262.82	1.22	484.47	7.03	70.3	**69**	**6.9**	**Retain**
Manganese	591	0.538	5.43	8.63	0.07	14.13	98	977	0.14	0.01	Drop
Nickel	16	0.0106	11.88	0.23	0.001	12.12	77.4	106.9	0.16	0.11	Drop

TABLE 4-10
Screening Evaluation for Curve-billed Thrasher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Upland Soils and Gila River Surface Water											
Aluminum	30000	62	555.78	438.03	8.43	1002.24	109.7	NA	**9.1**	NA	**Retain**
Antimony	10.4	0.0016	1.63	0.15	0.0002	1.78	NA	NA	NA	NA	Uncertainty
Arsenic	361	0.0168	2.42	5.27	0.002	7.70	9.3	40.3	0.83	0.19	Drop
Barium	217	1.19	5.45	3.17	0.16	8.78	20.8	41.7	0.42	0.21	Drop
Beryllium	0.52	0.0083	0.10	0.008	0.001	0.11	NA	NA	NA	NA	Uncertainty
Boron	7.3	0.14	1.15	0.11	0.02	1.27	28.8	100	0.04	0.01	Drop
Cadmium	94.7	0.0034	48.44	1.38	0.0005	49.82	0.16	0.61	**311**	**82**	**Retain**
Chromium	72	0.0314	35.74	1.05	0.004	36.80	1	5	**37**	**7.4**	**Retain**
Cobalt	84.9	0.0392	3.88	1.24	0.005	5.12	3.89	7.8	**1.3**	0.66	**Retain**
Copper	47200	0.172	11345.32	689.17	0.02	12034.51	47	61.7	**256**	**195**	**Retain**
Cyanide, Total	2.5	0.01	0.39	0.04	0.001	0.43	NA	NA	NA	NA	Uncertainty
Iron	186999	34.5	2289.99	2730.37	4.69	5025.05	7.03	70.3	**715**	**71**	**Retain**
Lead	468	0.163	18.03	6.83	0.02	24.89	0.19	1.78	**131**	**14**	**Retain**
Manganese	797	3.54	6.66	11.64	0.48	18.78	98	977	0.19	0.02	Drop
Mercury	0.49	0.00042	0.13	0.007	0.0001	0.14	0.068	0.37	**2.1**	0.38	**Retain**
Molybdenum	1060	0.0054	347.98	15.48	0.0007	363.46	3.53	35.3	**103**	**10**	**Retain**
Nickel	40.9	0.0501	30.37	0.60	0.007	30.98	77.4	106.9	0.40	0.29	Drop
Selenium	18.8	0.002	1.25	0.27	0.0003	1.53	0.4	0.8	**3.8**	**1.9**	**Retain**
Silver	24.5	0.00077	59.00	0.36	0.0001	59.36	0.427	4.27	**139**	**14**	**Retain**
Thallium	2.4	0.001	0.10	0.04	0.0001	0.13	0.0053	0.053	**25**	**2.5**	**Retain**
Vanadium	86.3	0.0566	1.19	1.26	0.008	2.46	11.4	NA	0.22	NA	Drop
Zinc	5920	0.237	231.95	86.44	0.03	318.42	14.5	131	**22**	**2.4**	**Retain**

TABLE 4-10
Screening Evaluation for Curve-billed Thrasher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Wash Soils and Gila River Surface Water											
Aluminum	18800	62	348.29	274.50	8.43	631.22	109.7	NA	**5.8**	NA	**Retain**
Antimony	20	0.0016	3.14	0.29	0.0002	3.43	NA	NA	NA	NA	Uncertainty
Arsenic	75.3	0.0168	0.80	1.10	0.002	1.90	9.3	40.3	0.20	0.05	Drop
Barium	118	1.19	2.96	1.72	0.16	4.85	20.8	41.7	0.23	0.12	Drop
Beryllium	0.27	0.0083	0.05	0.004	0.001	0.06	NA	NA	NA	NA	Uncertainty
Boron	4	0.14	0.63	0.06	0.02	0.71	28.8	100	0.02	0.007	Drop
Cadmium	8.3	0.0034	6.99	0.12	0.0005	7.11	0.16	0.61	**44**	**12**	**Retain**
Chromium	120	0.0314	59.57	1.75	0.004	61.33	1	5	**61**	**12**	**Retain**
Cobalt	79	0.0392	3.61	1.15	0.005	4.77	3.89	7.8	**1.2**	0.61	**Retain**
Copper	12500	0.172	3004.59	182.51	0.02	3187.12	47	61.7	**68**	**52**	**Retain**
Cyanide, Total	2.5	0.01	0.39	0.04	0.001	0.43	NA	NA	NA	NA	Uncertainty
Iron	320000	34.5	3918.72	4672.32	4.69	8595.73	7.03	70.3	**1223**	**122**	**Retain**
Lead	239	0.163	10.49	3.49	0.02	14.00	0.19	1.78	**74**	**7.9**	**Retain**
Manganese	758	3.54	6.43	11.07	0.48	17.98	98	977	0.18	0.02	Drop
Mercury	0.3	0.00042	0.11	0.004	0.0001	0.12	0.068	0.37	**1.7**	0.32	**Retain**
Molybdenum	86	0.0054	28.23	1.26	0.0007	29.49	3.53	35.3	**8.4**	0.84	**Retain**
Nickel	82	0.0501	60.89	1.20	0.007	62.10	77.4	106.9	0.80	0.58	Drop
Selenium	24	0.002	1.50	0.35	0.0003	1.85	0.4	0.8	**4.6**	**2.3**	**Retain**
Silver	11.7	0.00077	28.17	0.17	0.0001	28.35	0.427	4.27	**66**	**6.6**	**Retain**
Thallium	10	0.001	0.40	0.15	0.0001	0.55	0.0053	0.053	**103**	**10**	**Retain**
Vanadium	79.8	0.0566	1.10	1.17	0.008	2.28	11.4	NA	0.20	NA	Drop
Zinc	1040	0.237	131.12	15.19	0.03	146.34	14.5	131	**10**	**1.1**	**Retain**

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., terrestrial invertebrate portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of soil in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro river. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-11
Screening Evaluation for Red-tailed Hawk
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]											
Antimony	0.92	0.0016	0.004	0	0.0001	0.004	NA	NA	NA	NA	Uncertainty
Arsenic	8.1	0.0168	0.008	0	0.001	0.009	9.3	40.3	0.001	0.0002	Drop
Beryllium	1.6	0.0083	0.01	0	0.0005	0.01	NA	NA	NA	NA	Uncertainty
Boron	32.5	0.14	5.75	0	0.008	5.76	28.8	100	0.20	0.06	Drop
Cadmium	0.95	0.0034	0.05	0	0.0002	0.05	0.16	0.61	0.31	0.08	Drop
Chromium	16.8	0.0314	0.33	0	0.002	0.33	1	5	0.33	0.07	Drop
Copper	1150	0.172	3.77	0	0.01	3.78	47	61.7	0.08	0.06	Drop
Cyanide	2.5	0.01	0.44	0	0.0006	0.44	NA	NA	NA	NA	Uncertainty
Lead	60.8	0.163	1.17	0	0.009	1.18	0.19	1.78	**6.2**	0.67	**Retain**
Mercury	0.15	0.00042	0.005	0	0.00002	0.005	0.068	0.37	0.08	0.01	Drop
Molybdenum	7.1	0.0054	1.26	0	0.0003	1.26	3.53	35.3	0.36	0.04	Drop
Selenium	3.5	0.002	0.19	0	0.0001	0.19	0.4	0.8	0.47	0.23	Drop
Silver	1.3	0.00077	0.12	0	0.00004	0.12	0.427	4.27	0.27	0.03	Drop
Thallium	2.5	0.001	0.05	0	0.0001	0.05	0.0053	0.053	**10**	**1.0**	**Retain**
Vanadium	83.1	0.0566	0.26	0	0.003	0.27	11.4	NA	0.02	NA	Drop
Zinc	112	0.237	19.39	0	0.01	19.40	14.5	131	**1.3**	0.15	**Retain**
Middle Gila River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	23400	62	303.18	0	3.60	306.78	109.7	NA	**2.8**	NA	**Retain**
Barium	202	1.19	4.01	0	0.07	4.08	20.8	41.7	0.20	0.10	Drop
Cobalt	11.5	0.0392	0.05	0	0.002	0.05	3.89	7.8	0.01	0.007	Drop
Iron	20700	34.5	50.02	0	2.00	52.02	7.03	70.3	**7.4**	0.74	**Retain**
Manganese	794	3.54	8.25	0	0.21	8.45	98	977	0.09	0.009	Drop
Nickel	19.9	0.0501	0.56	0	0.003	0.56	77.4	106.9	0.007	0.005	Drop
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water											
Aluminum	23400	62	303.18	0	3.60	306.78	109.7	NA	**2.8**	NA	**Retain**
Barium	203	1.19	4.03	0	0.07	4.10	20.8	41.7	0.20	0.10	Drop
Cobalt	17	0.0392	0.08	0	0.002	0.08	3.89	7.8	0.02	0.01	Drop
Iron	27200	34.5	58.88	0	2.00	60.88	7.03	70.3	**8.7**	0.87	**Retain**
Manganese	879	3.54	9.13	0	0.21	9.34	98	977	0.10	0.01	Drop
Nickel	22.1	0.0501	0.59	0	0.003	0.59	77.4	106.9	0.008	0.006	Drop

TABLE 4-11
Screening Evaluation for Red-tailed Hawk
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water											
Antimony	0.58	0.00041	0.003	0	0.00002	0.003	NA	NA	NA	NA	Uncertainty
Arsenic	4.8	0.0085	0.005	0	0.0005	0.006	9.3	40.3	0.001	0.0001	Drop
Beryllium	0.96	0.0011	0.008	0	0.0001	0.008	NA	NA	NA	NA	Uncertainty
Boron	5.7	0.225	1.01	0	0.01	1.02	28.8	100	0.04	0.01	Drop
Cadmium	0.5	0.001	0.04	0	0.0001	0.04	0.16	0.61	0.23	0.06	Drop
Chromium	13.8	0.0081	0.28	0	0.0005	0.28	1	5	0.28	0.06	Drop
Copper	322	0.0702	3.14	0	0.004	3.14	47	61.7	0.07	0.05	Drop
Cyanide	2.5	0.01	0.44	0	0.0006	0.44	NA	NA	NA	NA	Uncertainty
Lead	22.3	0.0243	0.75	0	0.001	0.76	0.19	1.78	**4.0**	0.42	**Retain**
Mercury	0.1	0.0002	0.003	0	0.00001	0.003	0.068	0.37	0.05	0.009	Drop
Molybdenum	2	0.0201	0.35	0	0.001	0.36	3.53	35.3	0.10	0.01	Drop
Selenium	3.5	0.0012	0.19	0	0.0001	0.19	0.4	0.8	0.47	0.23	Drop
Silver	1	0.00036	0.09	0	0.00002	0.09	0.427	4.27	0.21	0.02	Drop
Thallium	2.5	0.001	0.05	0	0.0001	0.05	0.0053	0.053	**10**	**1.0**	**Retain**
Vanadium	32.2	0.0217	0.10	0	0.001	0.10	11.4	NA	0.009	NA	Drop
Zinc	69.3	0.0497	18.74	0	0.003	18.75	14.5	131	**1.3**	0.14	**Retain**
San Pedro River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	7180	3.66	93.03	0	0.21	93.24	109.7	NA	0.85	NA	Drop
Barium	114	0.373	2.26	0	0.02	2.28	20.8	41.7	0.11	0.05	Drop
Cobalt	5	0.0061	0.02	0	0.0004	0.02	3.89	7.8	0.004	0.002	Drop
Iron	9870	8.97	32.15	0	0.52	32.67	7.03	70.3	**4.6**	0.46	**Retain**
Manganese	194	0.538	2.02	0	0.03	2.05	98	977	0.02	0.002	Drop
Nickel	9.5	0.0106	0.39	0	0.0006	0.40	77.4	106.9	0.005	0.004	Drop
San Pedro River - On-Site Untable Riparian Soil and Surface Water											
Aluminum	15100	3.66	195.64	0	0.21	195.85	109.7	NA	**1.8**	NA	**Retain**
Barium	146	0.373	2.90	0	0.02	2.92	20.8	41.7	0.14	0.07	Drop
Cobalt	8.9	0.0061	0.04	0	0.0004	0.04	3.89	7.8	0.009	0.005	Drop
Iron	18000	8.97	46.02	0	0.52	46.54	7.03	70.3	**6.6**	0.66	**Retain**
Manganese	591	0.538	6.14	0	0.03	6.17	98	977	0.06	0.006	Drop
Nickel	16	0.0106	0.50	0	0.0006	0.50	77.4	106.9	0.007	0.005	Drop

TABLE 4-11
Screening Evaluation for Red-tailed Hawk
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Upland Soils and Gila River Surface Water											
Aluminum	30000	62	388.69	0	3.60	392.29	109.7	NA	**3.6**	NA	**Retain**
Antimony	10.4	0.0016	0.05	0	0.0001	0.05	NA	NA	NA	NA	Uncertainty
Arsenic	361	0.0168	0.17	0	0.001	0.17	9.3	40.3	0.02	0.004	Drop
Barium	217	1.19	4.31	0	0.07	4.37	20.8	41.7	0.21	0.10	Drop
Beryllium	0.52	0.0083	0.004	0	0.0005	0.005	NA	NA	NA	NA	Uncertainty
Boron	7.3	0.14	1.29	0	0.008	1.30	28.8	100	0.05	0.01	Drop
Cadmium	94.7	0.0034	0.43	0	0.0002	0.43	0.16	0.61	**2.7**	0.71	**Retain**
Chromium	72	0.0314	0.95	0	0.002	0.95	1	5	0.95	0.19	Drop
Cobalt	84.9	0.0392	0.67	0	0.002	0.68	3.89	7.8	0.17	0.09	Drop
Copper	47200	0.172	6.45	0	0.01	6.46	47	61.7	0.14	0.10	Drop
Cyanide, Total	2.5	0.01	0.44	0	0.0006	0.44	NA	NA	NA	NA	Uncertainty
Iron	186999	34.5	186.08	0	2.00	188.08	7.03	70.3	**27**	**2.7**	**Retain**
Lead	468	0.163	2.90	0	0.009	2.91	0.19	1.78	**15**	**1.6**	**Retain**
Manganese	797	3.54	8.28	0	0.21	8.49	98	977	0.09	0.009	Drop
Mercury	0.49	0.00042	0.02	0	0.00002	0.02	0.068	0.37	0.25	0.05	Drop
Molybdenum	1060	0.0054	187.62	0	0.0003	187.62	3.53	35.3	**53**	**5.3**	**Retain**
Nickel	40.9	0.0501	0.78	0	0.003	0.78	77.4	106.9	0.01	0.007	Drop
Selenium	18.8	0.002	0.35	0	0.0001	0.35	0.4	0.8	0.88	0.44	Drop
Silver	24.5	0.00077	2.17	0	0.00004	2.17	0.427	4.27	**5.1**	0.51	**Retain**
Thallium	2.4	0.001	0.05	0	0.0001	0.05	0.0053	0.053	**9.8**	0.98	**Retain**
Vanadium	86.3	0.0566	0.27	0	0.003	0.28	11.4	NA	0.02	NA	Drop
Zinc	5920	0.237	25.66	0	0.01	25.67	14.5	131	**1.8**	0.20	**Retain**

TABLE 4-11
Screening Evaluation for Red-tailed Hawk
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Wash Soils and Gila River Surface Water											
Aluminum	18800	62	243.58	0	3.60	247.18	109.7	NA	**2.3**	NA	**Retain**
Antimony	20	0.0016	0.09	0	0.0001	0.09	NA	NA	NA	NA	Uncertainty
Arsenic	75.3	0.0168	0.05	0	0.001	0.05	9.3	40.3	0.005	0.001	Drop
Barium	118	1.19	2.34	0	0.07	2.41	20.8	41.7	0.12	0.06	Drop
Beryllium	0.27	0.0083	0.002	0	0.0005	0.003	NA	NA	NA	NA	Uncertainty
Boron	4	0.14	0.71	0	0.008	0.72	28.8	100	0.02	0.007	Drop
Cadmium	8.3	0.0034	0.14	0	0.0002	0.14	0.16	0.61	0.86	0.22	Drop
Chromium	120	0.0314	1.38	0	0.002	1.38	1	5	**1.4**	0.28	**Retain**
Cobalt	79	0.0392	0.61	0	0.002	0.62	3.89	7.8	0.16	0.08	Drop
Copper	12500	0.172	5.33	0	0.01	5.34	47	61.7	0.11	0.09	Drop
Cyanide, Total	2.5	0.01	0.44	0	0.0006	0.44	NA	NA	NA	NA	Uncertainty
Iron	320000	34.5	256.43	0	2.00	258.43	7.03	70.3	**37**	**3.7**	**Retain**
Lead	239	0.163	2.15	0	0.009	2.16	0.19	1.78	**11**	**1.2**	**Retain**
Manganese	758	3.54	7.88	0	0.21	8.08	98	977	0.08	0.008	Drop
Mercury	0.3	0.00042	0.01	0	0.00002	0.01	0.068	0.37	0.15	0.03	Drop
Molybdenum	86	0.0054	15.22	0	0.0003	15.22	3.53	35.3	**4.3**	0.43	**Retain**
Nickel	82	0.0501	1.08	0	0.003	1.08	77.4	106.9	0.01	0.01	Drop
Selenium	24	0.002	0.39	0	0.0001	0.39	0.4	0.8	0.97	0.48	Drop
Silver	11.7	0.00077	1.04	0	0.00004	1.04	0.427	4.27	**2.4**	0.24	**Retain**
Thallium	10	0.001	0.22	0	0.0001	0.22	0.0053	0.053	**41**	**4.1**	**Retain**
Vanadium	79.8	0.0566	0.25	0	0.003	0.26	11.4	NA	0.02	NA	Drop
Zinc	1040	0.237	22.69	0	0.01	22.71	14.5	131	**1.6**	0.17	**Retain**

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., small mammal portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of soil in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro river. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-12
Screening Evaluation for Southwestern Willow Flycatcher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]											
Antimony	0.92	0.0016	0.26	0	0	0.26	NA	NA	NA	NA	Uncertainty
Arsenic	8.1	0.0168	0.30	0	0	0.30	9.3	40.3	0.03	0.007	Drop
Beryllium	1.6	0.0083	0.53	0	0	0.53	NA	NA	NA	NA	Uncertainty
Boron	32.5	0.14	9.17	0	0	9.17	28.8	100	0.32	0.09	Drop
Cadmium	0.95	0.0034	2.24	0	0	2.24	0.16	0.61	**14**	**3.7**	**Retain**
Chromium	16.8	0.0314	14.98	0	0	14.98	1	5	**15**	**3.0**	**Retain**
Copper	1150	0.172	496.50	0	0	496.50	47	61.7	**11**	**8.0**	**Retain**
Cyanide	2.5	0.01	0.71	0	0	0.71	NA	NA	NA	NA	Uncertainty
Lead	60.8	0.163	6.24	0	0	6.24	0.19	1.78	**33**	**3.5**	**Retain**
Mercury	0.15	0.00042	0.16	0	0	0.16	0.068	0.37	**2.4**	0.43	**Retain**
Molybdenum	7.1	0.0054	4.19	0	0	4.19	3.53	35.3	**1.2**	0.12	**Retain**
Selenium	3.5	0.002	0.66	0	0	0.66	0.4	0.8	**1.6**	0.82	**Retain**
Silver	1.3	0.00077	5.62	0	0	5.62	0.427	4.27	**13**	**1.3**	**Retain**
Thallium	2.5	0.001	0.18	0	0	0.18	0.0053	0.053	**34**	**3.4**	**Retain**
Vanadium	83.1	0.0566	2.06	0	0	2.06	11.4	NA	0.18	NA	Drop
Zinc	112	0.237	113.39	0	0	113.39	14.5	131	**7.8**	0.87	**Retain**
Middle Gila River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	23400	62	778.66	0	0	778.66	109.7	NA	**7.1**	NA	**Retain**
Barium	202	1.19	9.11	0	0	9.11	20.8	41.7	0.44	0.22	Drop
Cobalt	11.5	0.0392	0.94	0	0	0.94	3.89	7.8	0.24	0.12	Drop
Iron	20700	34.5	455.32	0	0	455.32	7.03	70.3	**65**	**6.5**	**Retain**
Manganese	794	3.54	11.93	0	0	11.93	98	977	0.12	0.01	Drop
Nickel	19.9	0.0501	26.54	0	0	26.54	77.4	106.9	0.34	0.25	Drop
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water											
Aluminum	23400	62	778.66	0	0	778.66	109.7	NA	**7.1**	NA	**Retain**
Barium	203	1.19	9.16	0	0	9.16	20.8	41.7	0.44	0.22	Drop
Cobalt	17	0.0392	1.40	0	0	1.40	3.89	7.8	0.36	0.18	Drop
Iron	27200	34.5	598.29	0	0	598.29	7.03	70.3	**85**	**8.5**	**Retain**
Manganese	879	3.54	12.79	0	0	12.79	98	977	0.13	0.01	Drop
Nickel	22.1	0.0501	29.48	0	0	29.48	77.4	106.9	0.38	0.28	Drop

TABLE 4-12
Screening Evaluation for Southwestern Willow Flycatcher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water											
Antimony	0.58	0.00041	0.16	0	0	0.16	NA	NA	NA	NA	Uncertainty
Arsenic	4.8	0.0085	0.21	0	0	0.21	9.3	40.3	0.02	0.005	Drop
Beryllium	0.96	0.0011	0.32	0	0	0.32	NA	NA	NA	NA	Uncertainty
Boron	5.7	0.225	1.61	0	0	1.61	28.8	100	0.06	0.02	Drop
Cadmium	0.5	0.001	1.35	0	0	1.35	0.16	0.61	**8.4**	**2.2**	**Retain**
Chromium	13.8	0.0081	12.31	0	0	12.31	1	5	**12**	**2.5**	**Retain**
Copper	322	0.0702	139.02	0	0	139.02	47	61.7	**3.0**	**2.3**	**Retain**
Cyanide	2.5	0.01	0.71	0	0	0.71	NA	NA	NA	NA	Uncertainty
Lead	22.3	0.0243	2.78	0	0	2.78	0.19	1.78	**15**	**1.6**	**Retain**
Mercury	0.1	0.0002	0.14	0	0	0.14	0.068	0.37	**2.1**	0.38	**Retain**
Molybdenum	2	0.0201	1.18	0	0	1.18	3.53	35.3	0.33	0.03	Drop
Selenium	3.5	0.0012	0.66	0	0	0.66	0.4	0.8	**1.6**	0.82	**Retain**
Silver	1	0.00036	4.33	0	0	4.33	0.427	4.27	**10**	**1.0**	**Retain**
Thallium	2.5	0.001	0.18	0	0	0.18	0.0053	0.053	**34**	**3.4**	**Retain**
Vanadium	32.2	0.0217	0.80	0	0	0.80	11.4	NA	0.07	NA	Drop
Zinc	69.3	0.0497	96.87	0	0	96.87	14.5	131	**6.7**	0.74	**Retain**
San Pedro River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	7180	3.66	238.92	0	0	238.92	109.7	NA	**2.2**	NA	**Retain**
Barium	114	0.373	5.14	0	0	5.14	20.8	41.7	0.25	0.12	Drop
Cobalt	5	0.0061	0.41	0	0	0.41	3.89	7.8	0.11	0.05	Drop
Iron	9870	8.97	217.10	0	0	217.10	7.03	70.3	**31**	**3.1**	**Retain**
Manganese	194	0.538	4.56	0	0	4.56	98	977	0.05	0.005	Drop
Nickel	9.5	0.0106	12.67	0	0	12.67	77.4	106.9	0.16	0.12	Drop
San Pedro River - On-Site Untable Riparian Soil and Surface Water											
Aluminum	15100	3.66	502.47	0	0	502.47	109.7	NA	**4.6**	NA	**Retain**
Barium	146	0.373	6.59	0	0	6.59	20.8	41.7	0.32	0.16	Drop
Cobalt	8.9	0.0061	0.73	0	0	0.73	3.89	7.8	0.19	0.09	Drop
Iron	18000	8.97	395.93	0	0	395.93	7.03	70.3	**56**	**5.6**	**Retain**
Manganese	591	0.538	9.75	0	0	9.75	98	977	0.10	0.01	Drop
Nickel	16	0.0106	21.34	0	0	21.34	77.4	106.9	0.28	0.20	Drop

TABLE 4-12
Screening Evaluation for Southwestern Willow Flycatcher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Upland Soils and Gila River Surface Water											
Aluminum	30000	62	998.28	0	0	998.28	109.7	NA	**9.1**	NA	**Retain**
Antimony	10.4	0.0016	2.93	0	0	2.93	NA	NA	NA	NA	Uncertainty
Arsenic	361	0.0168	4.35	0	0	4.35	9.3	40.3	0.47	0.11	Drop
Barium	217	1.19	9.79	0	0	9.79	20.8	41.7	0.47	0.23	Drop
Beryllium	0.52	0.0083	0.17	0	0	0.17	NA	NA	NA	NA	Uncertainty
Boron	7.3	0.14	2.06	0	0	2.06	28.8	100	0.07	0.02	Drop
Cadmium	94.7	0.0034	87.01	0	0	87.01	0.16	0.61	**544**	**143**	**Retain**
Chromium	72	0.0314	64.20	0	0	64.20	1	5	**64**	**13**	**Retain**
Cobalt	84.9	0.0392	6.97	0	0	6.97	3.89	7.8	**1.8**	0.89	**Retain**
Copper	47200	0.172	20378.22	0	0	20378.22	47	61.7	**434**	**330**	**Retain**
Cyanide, Total	2.5	0.01	0.71	0	0	0.71	NA	NA	NA	NA	Uncertainty
Iron	186999	34.5	4113.23	0	0	4113.23	7.03	70.3	**585**	**59**	**Retain**
Lead	468	0.163	32.39	0	0	32.39	0.19	1.78	**170**	**18**	**Retain**
Manganese	797	3.54	11.96	0	0	11.96	98	977	0.12	0.01	Drop
Mercury	0.49	0.00042	0.24	0	0	0.24	0.068	0.37	**3.5**	0.65	**Retain**
Molybdenum	1060	0.0054	625.04	0	0	625.04	3.53	35.3	**177**	**18**	**Retain**
Nickel	40.9	0.0501	54.55	0	0	54.55	77.4	106.9	0.70	0.51	Drop
Selenium	18.8	0.002	2.25	0	0	2.25	0.4	0.8	**5.6**	**2.8**	**Retain**
Silver	24.5	0.00077	105.97	0	0	105.97	0.427	4.27	**248**	**25**	**Retain**
Thallium	2.4	0.001	0.17	0	0	0.17	0.0053	0.053	**33**	**3.3**	**Retain**
Vanadium	86.3	0.0566	2.14	0	0	2.14	11.4	NA	0.19	NA	Drop
Zinc	5920	0.237	416.63	0	0	416.63	14.5	131	**29**	**3.2**	**Retain**

TABLE 4-12
Screening Evaluation for Southwestern Willow Flycatcher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Wash Soils and Gila River Surface Water											
Aluminum	18800	62	625.59	0	0	625.59	109.7	NA	**5.7**	NA	**Retain**
Antimony	20	0.0016	5.64	0	0	5.64	NA	NA	NA	NA	Uncertainty
Arsenic	75.3	0.0168	1.44	0	0	1.44	9.3	40.3	0.15	0.04	Drop
Barium	118	1.19	5.32	0	0	5.32	20.8	41.7	0.26	0.13	Drop
Beryllium	0.27	0.0083	0.09	0	0	0.09	NA	NA	NA	NA	Uncertainty
Boron	4	0.14	1.13	0	0	1.13	28.8	100	0.04	0.01	Drop
Cadmium	8.3	0.0034	12.56	0	0	12.56	0.16	0.61	**79**	**21**	**Retain**
Chromium	120	0.0314	107.00	0	0	107.00	1	5	**107**	**21**	**Retain**
Cobalt	79	0.0392	6.48	0	0	6.48	3.89	7.8	**1.7**	0.83	**Retain**
Copper	12500	0.172	5396.78	0	0	5396.78	47	61.7	**115**	**87**	**Retain**
Cyanide, Total	2.5	0.01	0.71	0	0	0.71	NA	NA	NA	NA	Uncertainty
Iron	320000	34.5	7038.72	0	0	7038.72	7.03	70.3	**1001**	**100**	**Retain**
Lead	239	0.163	18.83	0	0	18.83	0.19	1.78	**99**	**11**	**Retain**
Manganese	758	3.54	11.56	0	0	11.56	98	977	0.12	0.01	Drop
Mercury	0.3	0.00042	0.20	0	0	0.20	0.068	0.37	**3.0**	0.55	**Retain**
Molybdenum	86	0.0054	50.71	0	0	50.71	3.53	35.3	**14**	**1.4**	**Retain**
Nickel	82	0.0501	109.38	0	0	109.38	77.4	106.9	**1.4**	**1.0**	**Retain**
Selenium	24	0.002	2.69	0	0	2.69	0.4	0.8	**6.7**	**3.4**	**Retain**
Silver	11.7	0.00077	50.61	0	0	50.61	0.427	4.27	**119**	**12**	**Retain**
Thallium	10	0.001	0.72	0	0	0.72	0.0053	0.053	**136**	**14**	**Retain**
Vanadium	79.8	0.0566	1.98	0	0	1.98	11.4	NA	0.17	NA	Drop
Zinc	1040	0.237	235.51	0	0	235.51	14.5	131	**16**	**1.8**	**Retain**

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., terrestrial invertebrate portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of soil in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro river. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-13
Screening Evaluation for Desert Cottontail
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Plant	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]											
Antimony	0.92	0.0016	0.002	0.003	0.0002	0.005	0.059	0.59	0.09	0.009	Drop
Arsenic	8.1	0.0168	0.47	0.03	0.002	0.50	0.396	1.58	**1.3**	0.318	**Retain**
Beryllium	1.6	0.0083	0.04	0.005	0.0008	0.05	0.66	NA	0.08	NA	Drop
Boron	32.5	0.14	31.19	0.11	0.01	31.32	28	93.6	**1.1**	0.335	**Retain**
Cadmium	0.95	0.0034	0.03	0.003	0.0003	0.04	0.77	1.42	0.05	0.025	Drop
Chromium	16.8	0.0314	0.07	0.06	0.003	0.13	3.28	13.14	0.04	0.010	Drop
Copper	1150	0.172	1.66	3.84	0.02	5.52	11.7	15.14	0.47	0.365	Drop
Cyanide	2.5	0.01	0.13	0.008	0.001	0.14	0.15	0.5	0.95	0.284	Drop
Lead	60.8	0.163	0.14	0.20	0.02	0.36	0.92	4.7	0.39	0.077	Drop
Mercury	0.15	0.00042	0.007	0.0005	0.00004	0.008	0.032	0.16	0.23	0.047	Drop
Molybdenum	7.1	0.0054	1.66	0.02	0.0005	1.69	0.26	2.6	**6.5**	0.649	**Retain**
Selenium	3.5	0.002	0.11	0.01	0.0002	0.12	0.2	0.33	0.60	0.361	Drop
Silver	1.3	0.00077	0.003	0.004	0.0001	0.007	2.38	23.8	0.003	0.000	Drop
Thallium	2.5	0.001	0.0005	0.008	0.0001	0.009	0.48	1.43	0.02	0.006	Drop
Vanadium	83.1	0.0566	0.04	0.28	0.006	0.33	0.21	2.1	**1.6**	0.155	**Retain**
Zinc	112	0.237	3.51	0.37	0.02	3.91	160	320	0.02	0.012	Drop
Middle Gila River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	23400	62	6.20	78.13	6.26	90.60	1.93	19.3	**47**	**4.69**	**Retain**
Barium	202	1.19	5.11	0.67	0.12	5.90	45	75	0.13	0.079	Drop
Cobalt	11.5	0.0392	0.02	0.04	0.004	0.06	5.45	10.9	0.01	0.005	Drop
Iron	20700	34.5	10.97	69.12	3.48	83.57	2.8	NA	**30**	NA	**Retain**
Manganese	794	3.54	9.85	2.65	0.36	12.86	88	284	0.15	0.045	Drop
Nickel	19.9	0.0501	0.05	0.07	0.005	0.13	6.8	31.63	0.02	0.004	Drop
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water											
Aluminum	23400	62	6.20	78.13	6.26	90.60	1.93	19.3	**47**	**4.69**	**Retain**
Barium	203	1.19	5.13	0.68	0.12	5.93	45	75	0.13	0.079	Drop
Cobalt	17	0.0392	0.02	0.06	0.004	0.08	5.45	10.9	0.02	0.008	Drop
Iron	27200	34.5	14.42	90.82	3.48	108.72	2.8	NA	**39**	NA	**Retain**
Manganese	879	3.54	10.90	2.93	0.36	14.19	88	284	0.16	0.050	Drop
Nickel	22.1	0.0501	0.06	0.07	0.005	0.14	6.8	31.63	0.02	0.004	Drop

TABLE 4-13
Screening Evaluation for Desert Cottontail
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Plant	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water											
Antimony	0.58	0.00041	0.001	0.002	0.00004	0.003	0.059	0.59	0.05	0.005	Drop
Arsenic	4.8	0.0085	0.28	0.02	0.0009	0.30	0.396	1.58	0.75	0.188	Drop
Beryllium	0.96	0.0011	0.03	0.003	0.0001	0.03	0.66	NA	0.05	NA	Drop
Boron	5.7	0.225	5.47	0.02	0.02	5.51	28	93.6	0.20	0.059	Drop
Cadmium	0.5	0.001	0.02	0.002	0.0001	0.02	0.77	1.42	0.03	0.017	Drop
Chromium	13.8	0.0081	0.06	0.05	0.0008	0.11	3.28	13.14	0.03	0.008	Drop
Copper	322	0.0702	1.01	1.08	0.007	2.09	11.7	15.14	0.18	0.138	Drop
Cyanide	2.5	0.01	0.13	0.008	0.001	0.14	0.15	0.5	0.95	0.284	Drop
Lead	22.3	0.0243	0.08	0.07	0.002	0.16	0.92	4.7	0.17	0.033	Drop
Mercury	0.1	0.0002	0.006	0.0003	0.00002	0.006	0.032	0.16	0.19	0.037	Drop
Molybdenum	2	0.0201	0.47	0.007	0.002	0.48	0.26	2.6	**1.8**	0.183	**Retain**
Selenium	3.5	0.0012	0.11	0.01	0.0001	0.12	0.2	0.33	0.60	0.361	Drop
Silver	1	0.00036	0.002	0.003	0.00004	0.005	2.38	23.8	0.002	0.000	Drop
Thallium	2.5	0.001	0.0005	0.008	0.0001	0.009	0.48	1.43	0.02	0.006	Drop
Vanadium	32.2	0.0217	0.02	0.11	0.002	0.13	0.21	2.1	0.60	0.060	Drop
Zinc	69.3	0.0497	2.69	0.23	0.005	2.93	160	320	0.02	0.009	Drop
San Pedro River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	7180	3.66	1.90	23.97	0.37	26.25	1.93	19.3	**14**	**1.36**	**Retain**
Barium	114	0.373	2.88	0.38	0.04	3.30	45	75	0.07	0.044	Drop
Cobalt	5	0.0061	0.007	0.02	0.0006	0.02	5.45	10.9	0.004	0.002	Drop
Iron	9870	8.97	5.23	32.96	0.91	39.09	2.8	NA	**14**	NA	**Retain**
Manganese	194	0.538	2.41	0.65	0.05	3.11	88	284	0.04	0.011	Drop
Nickel	9.5	0.0106	0.03	0.03	0.001	0.06	6.8	31.63	0.009	0.002	Drop
San Pedro River - On-Site Untable Riparian Soil and Surface Water											
Aluminum	15100	3.66	4.00	50.42	0.37	54.79	1.93	19.3	**28**	**2.84**	**Retain**
Barium	146	0.373	3.69	0.49	0.04	4.22	45	75	0.09	0.056	Drop
Cobalt	8.9	0.0061	0.01	0.03	0.0006	0.04	5.45	10.9	0.008	0.004	Drop
Iron	18000	8.97	9.54	60.10	0.91	70.55	2.8	NA	**25**	NA	**Retain**
Manganese	591	0.538	7.33	1.97	0.05	9.36	88	284	0.11	0.033	Drop
Nickel	16	0.0106	0.05	0.05	0.001	0.10	6.8	31.63	0.01	0.003	Drop

TABLE 4-13
Screening Evaluation for Desert Cottontail
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Plant	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Upland Soils and Gila River Surface Water											
Aluminum	30000	62	7.95	100.17	6.26	114.38	1.93	19.3	**59**	**5.93**	**Retain**
Antimony	10.4	0.0016	0.02	0.03	0.0002	0.05	0.059	0.59	0.91	0.091	Drop
Arsenic	361	0.0168	21.10	1.21	0.002	22.31	0.396	1.58	**56**	**14.1**	**Retain**
Barium	217	1.19	5.49	0.72	0.12	6.33	45	75	0.14	0.084	Drop
Beryllium	0.52	0.0083	0.02	0.002	0.0008	0.02	0.66	NA	0.03	NA	Drop
Boron	7.3	0.14	7.01	0.02	0.01	7.05	28	93.6	0.25	0.075	Drop
Cadmium	94.7	0.0034	0.40	0.32	0.0003	0.71	0.77	1.42	0.92	0.501	Drop
Chromium	72	0.0314	0.32	0.24	0.003	0.56	3.28	13.14	0.17	0.043	Drop
Cobalt	84.9	0.0392	0.11	0.28	0.004	0.40	5.45	10.9	0.07	0.037	Drop
Copper	47200	0.172	7.18	157.60	0.02	164.80	11.7	15.14	**14**	**10.9**	**Retain**
Cyanide	2.5	0.01	0.13	0.008	0.001	0.14	0.15	0.5	0.95	0.28	Drop
Iron	186999	34.5	99.11	624.39	3.48	726.98	2.8	NA	**260**	NA	**Retain**
Lead	468	0.163	0.44	1.56	0.02	2.02	0.92	4.7	**2.2**	0.430	**Retain**
Manganese	797	3.54	9.88	2.66	0.36	12.90	88	284	0.15	0.045	Drop
Mercury	0.49	0.00042	0.01	0.002	0.00004	0.01	0.032	0.16	0.47	0.093	Drop
Molybdenum	1060	0.0054	248.19	3.54	0.0005	251.73	0.26	2.6	**968**	**96.8**	**Retain**
Nickel	40.9	0.0501	0.09	0.14	0.005	0.23	6.8	31.63	0.03	0.007	Drop
Selenium	18.8	0.002	0.69	0.06	0.0002	0.75	0.2	0.33	**3.7**	**2.27**	**Retain**
Silver	24.5	0.00077	0.05	0.08	0.0001	0.13	2.38	23.8	0.05	0.005	Drop
Thallium	2.4	0.001	0.0005	0.008	0.0001	0.009	0.48	1.43	0.02	0.006	Drop
Vanadium	86.3	0.0566	0.04	0.29	0.006	0.34	0.21	2.1	**1.6**	0.161	**Retain**
Zinc	5920	0.237	31.76	19.77	0.02	51.55	160	320	0.32	0.161	Drop

TABLE 4-13
Screening Evaluation for Desert Cottontail
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Plant	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Wash Soils and Gila River Surface Water											
Aluminum	18800	62	4.98	62.77	6.26	74.02	1.93	19.3	**38**	**3.84**	**Retain**
Antimony	20	0.0016	0.03	0.07	0.0002	0.10	0.059	0.59	**1.7**	0.172	**Retain**
Arsenic	75.3	0.0168	4.40	0.25	0.002	4.66	0.396	1.58	**12**	**2.95**	**Retain**
Barium	118	1.19	2.98	0.39	0.12	3.50	45	75	0.08	0.047	Drop
Beryllium	0.27	0.0083	0.01	0.0009	0.0008	0.01	0.66	NA	0.02	NA	Drop
Boron	4	0.14	3.84	0.01	0.01	3.87	28	93.6	0.14	0.041	Drop
Cadmium	8.3	0.0034	0.10	0.03	0.0003	0.13	0.77	1.42	0.17	0.093	Drop
Chromium	120	0.0314	0.53	0.40	0.003	0.94	3.28	13.14	0.29	0.071	Drop
Cobalt	79	0.0392	0.10	0.26	0.004	0.37	5.45	10.9	0.07	0.034	Drop
Copper	12500	0.172	4.26	41.74	0.02	46.01	11.7	15.14	**3.9**	**3.04**	**Retain**
Cyanide	2.5	0.01	0.13	0.008	0.001	0.14	0.15	0.5	0.95	0.28	Drop
Iron	320000	34.5	169.60	1068.48	3.48	1241.56	2.8	NA	**443**	NA	**Retain**
Lead	239	0.163	0.30	0.80	0.02	1.12	0.92	4.7	**1.2**	0.238	**Retain**
Manganese	758	3.54	9.40	2.53	0.36	12.29	88	284	0.14	0.043	Drop
Mercury	0.3	0.00042	0.01	0.001	0.00004	0.01	0.032	0.16	0.35	0.070	Drop
Molybdenum	86	0.0054	20.14	0.29	0.0005	20.42	0.26	2.6	**79**	**7.86**	**Retain**
Nickel	82	0.0501	0.15	0.27	0.005	0.43	6.8	31.63	0.06	0.014	Drop
Selenium	24	0.002	0.90	0.08	0.0002	0.98	0.2	0.33	**4.9**	**2.97**	**Retain**
Silver	11.7	0.00077	0.02	0.04	0.0001	0.06	2.38	23.8	0.03	0.003	Drop
Thallium	10	0.001	0.002	0.03	0.0001	0.04	0.48	1.43	0.07	0.025	Drop
Vanadium	79.8	0.0566	0.04	0.27	0.006	0.31	0.21	2.1	**1.5**	0.149	**Retain**
Zinc	1040	0.237	12.10	3.47	0.02	15.60	160	320	0.10	0.049	Drop

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., terrestrial plant portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of soil in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEl

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro river. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-14
Screening Evaluation for Desert Shrew
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]											
Antimony	0.92	0.0016	0.18	0.02	0.0003	0.21	0.059	0.59	**3.5**	0.35	**Retain**
Arsenic	8.1	0.0168	0.21	0.21	0.003	0.42	0.396	1.58	**1.1**	0.27	**Retain**
Beryllium	1.6	0.0083	0.38	0.04	0.001	0.42	0.66	NA	0.64	NA	Drop
Boron	32.5	0.14	6.50	0.85	0.02	7.37	28	93.6	0.26	0.08	Drop
Cadmium	0.95	0.0034	1.59	0.02	0.0006	1.62	0.77	1.42	**2.1**	**1.1**	**Retain**
Chromium	16.8	0.0314	10.62	0.44	0.005	11.07	3.28	13.14	**3.4**	0.84	**Retain**
Copper	1150	0.172	352.13	29.90	0.03	382.06	11.7	15.14	**33**	**25**	**Retain**
Cyanide	2.5	0.01	0.50	0.07	0.002	0.57	0.15	0.5	**3.8**	**1.1**	**Retain**
Lead	60.8	0.163	4.43	1.58	0.03	6.03	0.92	4.7	**6.6**	**1.3**	**Retain**
Mercury	0.15	0.00042	0.11	0.004	0.0001	0.12	0.032	0.16	**3.7**	0.74	**Retain**
Molybdenum	7.1	0.0054	2.97	0.18	0.0009	3.15	0.26	2.6	**12**	**1.2**	**Retain**
Selenium	3.5	0.002	0.46	0.09	0.0003	0.56	0.2	0.33	**2.8**	**1.7**	**Retain**
Silver	1.3	0.00077	3.99	0.03	0.0001	4.02	2.38	23.8	**1.7**	0.17	**Retain**
Thallium	2.5	0.001	0.13	0.07	0.0002	0.19	0.48	1.43	0.40	0.14	Drop
Vanadium	83.1	0.0566	1.46	2.16	0.01	3.63	0.21	2.1	**17**	**1.7**	**Retain**
Zinc	112	0.237	80.42	2.91	0.04	83.37	160	320	0.52	0.26	Drop
Middle Gila River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	23400	62	552.24	608.40	10.42	1171.06	1.93	19.3	**607**	**61**	**Retain**
Barium	202	1.19	6.46	5.25	0.20	11.92	45	75	0.26	0.16	Drop
Cobalt	11.5	0.0392	0.67	0.30	0.007	0.97	5.45	10.9	0.18	0.09	Drop
Iron	20700	34.5	322.92	538.20	5.80	866.92	2.8	NA	**310**	NA	**Retain**
Manganese	794	3.54	8.46	20.64	0.59	29.70	88	284	0.34	0.10	Drop
Nickel	19.9	0.0501	18.83	0.52	0.008	19.35	6.8	31.63	**2.8**	0.61	**Retain**
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water											
Aluminum	23400	62	552.24	608.40	10.42	1171.06	1.93	19.3	**607**	**61**	**Retain**
Barium	203	1.19	6.50	5.28	0.20	11.97	45	75	0.27	0.16	Drop
Cobalt	17	0.0392	0.99	0.44	0.007	1.44	5.45	10.9	0.26	0.13	Drop
Iron	27200	34.5	424.32	707.20	5.80	1137.32	2.8	NA	**406**	NA	**Retain**
Manganese	879	3.54	9.07	22.85	0.59	32.52	88	284	0.37	0.11	Drop
Nickel	22.1	0.0501	20.91	0.57	0.008	21.49	6.8	31.63	**3.2**	0.68	**Retain**

TABLE 4-14
Screening Evaluation for Desert Shrew
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water											
Antimony	0.58	0.00041	0.12	0.02	0.0001	0.13	0.059	0.59	**2.2**	0.22	**Retain**
Arsenic	4.8	0.0085	0.15	0.12	0.001	0.27	0.396	1.58	0.69	0.17	Drop
Beryllium	0.96	0.0011	0.23	0.02	0.0002	0.25	0.66	NA	0.38	NA	Drop
Boron	5.7	0.225	1.14	0.15	0.04	1.33	28	93.6	0.05	0.01	Drop
Cadmium	0.5	0.001	0.95	0.01	0.0002	0.97	0.77	1.42	**1.3**	0.68	**Retain**
Chromium	13.8	0.0081	8.73	0.36	0.001	9.09	3.28	13.14	**2.8**	0.69	**Retain**
Copper	322	0.0702	98.60	8.37	0.01	106.98	11.7	15.14	**9.1**	**7.1**	**Retain**
Cyanide	2.5	0.01	0.50	0.07	0.002	0.57	0.15	0.5	**3.8**	**1.1**	**Retain**
Lead	22.3	0.0243	1.97	0.58	0.004	2.55	0.92	4.7	**2.8**	0.54	**Retain**
Mercury	0.1	0.0002	0.10	0.003	0.00003	0.10	0.032	0.16	**3.2**	0.64	**Retain**
Molybdenum	2	0.0201	0.84	0.05	0.003	0.89	0.26	2.6	**3.4**	0.34	**Retain**
Selenium	3.5	0.0012	0.46	0.09	0.0002	0.56	0.2	0.33	**2.8**	**1.7**	**Retain**
Silver	1	0.00036	3.07	0.03	0.0001	3.09	2.38	23.8	**1.3**	0.13	**Retain**
Thallium	2.5	0.001	0.13	0.07	0.0002	0.19	0.48	1.43	0.40	0.14	Drop
Vanadium	32.2	0.0217	0.57	0.84	0.004	1.41	0.21	2.1	**6.7**	0.67	**Retain**
Zinc	69.3	0.0497	68.70	1.80	0.008	70.51	160	320	0.44	0.22	Drop
San Pedro River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	7180	3.66	169.45	186.68	0.61	356.74	1.93	19.3	**185**	**18**	**Retain**
Barium	114	0.373	3.65	2.96	0.06	6.67	45	75	0.15	0.09	Drop
Cobalt	5	0.0061	0.29	0.13	0.001	0.42	5.45	10.9	0.08	0.04	Drop
Iron	9870	8.97	153.97	256.62	1.51	412.10	2.8	NA	**147**	NA	**Retain**
Manganese	194	0.538	3.24	5.04	0.09	8.37	88	284	0.10	0.03	Drop
Nickel	9.5	0.0106	8.99	0.25	0.002	9.24	6.8	31.63	**1.4**	0.29	**Retain**
San Pedro River - On-Site Untable Riparian Soil and Surface Water											
Aluminum	15100	3.66	356.36	392.60	0.61	749.57	1.93	19.3	**388**	**39**	**Retain**
Barium	146	0.373	4.67	3.80	0.06	8.53	45	75	0.19	0.11	Drop
Cobalt	8.9	0.0061	0.52	0.23	0.001	0.75	5.45	10.9	0.14	0.07	Drop
Iron	18000	8.97	280.80	468.00	1.51	750.31	2.8	NA	**268**	NA	**Retain**
Manganese	591	0.538	6.92	15.37	0.09	22.37	88	284	0.25	0.08	Drop
Nickel	16	0.0106	15.14	0.42	0.002	15.55	6.8	31.63	**2.3**	0.49	**Retain**

TABLE 4-14
Screening Evaluation for Desert Shrew
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Upland Soils and Gila River Surface Water											
Aluminum	30000	62	708.00	780.00	10.42	1498.42	1.93	19.3	**776**	**78**	**Retain**
Antimony	10.4	0.0016	2.08	0.27	0.0003	2.35	0.059	0.59	**40**	**4.0**	**Retain**
Arsenic	361	0.0168	3.09	9.39	0.003	12.48	0.396	1.58	**32**	**7.9**	**Retain**
Barium	217	1.19	6.94	5.64	0.20	12.79	45	75	0.28	0.17	Drop
Beryllium	0.52	0.0083	0.12	0.01	0.001	0.14	0.66	NA	0.21	NA	Drop
Boron	7.3	0.14	1.46	0.19	0.02	1.67	28	93.6	0.06	0.02	Drop
Cadmium	94.7	0.0034	61.71	2.46	0.0006	64.17	0.77	1.42	**83**	**45**	**Retain**
Chromium	72	0.0314	45.53	1.87	0.005	47.41	3.28	13.14	**14**	**3.6**	**Retain**
Cobalt	84.9	0.0392	4.94	2.21	0.007	7.16	5.45	10.9	**1.3**	0.66	**Retain**
Copper	47200	0.172	14452.64	1227.20	0.03	15679.87	11.7	15.14	**1340**	**1036**	**Retain**
Cyanide	2.5	0.01	0.50	0.07	0.002	0.57	0.15	0.5	**3.8**	**1.1**	**Retain**
Iron	186999	34.5	2917.18	4861.97	5.80	7784.95	2.8	NA	**2780**	NA	**Retain**
Lead	468	0.163	22.97	12.17	0.03	35.17	0.92	4.7	**38**	**7.5**	**Retain**
Manganese	797	3.54	8.48	20.72	0.59	29.80	88	284	0.34	0.10	Drop
Mercury	0.49	0.00042	0.17	0.01	0.0001	0.18	0.032	0.16	**5.7**	**1.1**	**Retain**
Molybdenum	1060	0.0054	443.29	27.56	0.0009	470.85	0.26	2.6	**1811**	**181**	**Retain**
Nickel	40.9	0.0501	38.69	1.06	0.008	39.76	6.8	31.63	**5.8**	**1.3**	**Retain**
Selenium	18.8	0.002	1.59	0.49	0.0003	2.08	0.2	0.33	**10**	**6.3**	**Retain**
Silver	24.5	0.00077	75.16	0.64	0.0001	75.79	2.38	23.8	**32**	**3.2**	**Retain**
Thallium	2.4	0.001	0.12	0.06	0.0002	0.19	0.48	1.43	0.39	0.13	Drop
Vanadium	86.3	0.0566	1.52	2.24	0.01	3.77	0.21	2.1	**18**	**1.8**	**Retain**
Zinc	5920	0.237	295.48	153.92	0.04	449.44	160	320	**2.8**	**1.4**	**Retain**

TABLE 4-14
Screening Evaluation for Desert Shrew
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Wash Soils and Gila River Surface Water											
Aluminum	18800	62	443.68	488.80	10.42	942.90	1.93	19.3	**489**	**49**	**Retain**
Antimony	20	0.0016	4.00	0.52	0.0003	4.52	0.059	0.59	**77**	**7.7**	**Retain**
Arsenic	75.3	0.0168	1.02	1.96	0.003	2.98	0.396	1.58	**7.5**	**1.9**	**Retain**
Barium	118	1.19	3.78	3.07	0.20	7.04	45	75	0.16	0.09	Drop
Beryllium	0.27	0.0083	0.06	0.007	0.001	0.07	0.66	NA	0.11	NA	Drop
Boron	4	0.14	0.80	0.10	0.02	0.93	28	93.6	0.03	0.01	Drop
Cadmium	8.3	0.0034	8.91	0.22	0.0006	9.12	0.77	1.42	**12**	**6.4**	**Retain**
Chromium	120	0.0314	75.89	3.12	0.005	79.01	3.28	13.14	**24**	**6.0**	**Retain**
Cobalt	79	0.0392	4.60	2.05	0.007	6.66	5.45	10.9	**1.2**	0.61	**Retain**
Copper	12500	0.172	3827.50	325.00	0.03	4152.53	11.7	15.14	**355**	**274**	**Retain**
Cyanide	2.5	0.01	0.50	0.07	0.002	0.57	0.15	0.5	**3.8**	**1.1**	**Retain**
Iron	320000	34.5	4992.00	8320.00	5.80	13317.80	2.8	NA	**4756**	NA	**Retain**
Lead	239	0.163	13.36	6.21	0.03	19.60	0.92	4.7	**21**	**4.2**	**Retain**
Manganese	758	3.54	8.20	19.71	0.59	28.50	88	284	0.32	0.10	Drop
Mercury	0.3	0.00042	0.14	0.008	0.0001	0.15	0.032	0.16	**4.8**	0.95	**Retain**
Molybdenum	86	0.0054	35.97	2.24	0.0009	38.20	0.26	2.6	**147**	**15**	**Retain**
Nickel	82	0.0501	77.57	2.13	0.008	79.71	6.8	31.63	**12**	**2.5**	**Retain**
Selenium	24	0.002	1.91	0.62	0.0003	2.53	0.2	0.33	**13**	**7.7**	**Retain**
Silver	11.7	0.00077	35.89	0.30	0.0001	36.20	2.38	23.8	**15**	**1.5**	**Retain**
Thallium	10	0.001	0.51	0.26	0.0002	0.77	0.48	1.43	**1.6**	0.54	**Retain**
Vanadium	79.8	0.0566	1.40	2.07	0.01	3.49	0.21	2.1	**17**	**1.7**	**Retain**
Zinc	1040	0.237	167.03	27.04	0.04	194.11	160	320	**1.2**	0.61	**Retain**

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were

[b] Exposure estimates by each pathway (e.g., soil invertebrate portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of soil in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro river. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were

Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-15
Screening Evaluation for Coyote
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]											
Antimony	0.92	0.0016	0.001	0.001	0.0001	0.002	0.059	0.59	0.04	0.004	Drop
Arsenic	8.1	0.0168	0.002	0.01	0.001	0.01	0.396	1.58	0.03	0.008	Drop
Beryllium	1.6	0.0083	0.003	0.002	0.0006	0.006	0.66	NA	0.008	NA	Drop
Boron	32.5	0.14	1.43	0.04	0.01	1.48	28	93.6	0.05	0.02	Drop
Cadmium	0.95	0.0034	0.01	0.001	0.0003	0.01	0.77	1.42	0.02	0.01	Drop
Chromium	16.8	0.0314	0.08	0.02	0.002	0.10	3.28	13.14	0.03	0.008	Drop
Copper	1150	0.172	0.94	1.42	0.01	2.37	11.7	15.14	0.20	0.16	Drop
Cyanide	2.5	0.01	0.11	0.003	0.0008	0.11	0.15	0.5	0.76	0.23	Drop
Lead	60.8	0.163	0.29	0.07	0.01	0.38	0.92	4.7	0.41	0.08	Drop
Mercury	0.15	0.00042	0.001	0.0002	0.00003	0.001	0.032	0.16	0.05	0.009	Drop
Molybdenum	7.1	0.0054	0.31	0.009	0.0004	0.32	0.26	2.6	**1.2**	0.12	**Retain**
Selenium	3.5	0.002	0.05	0.004	0.0002	0.05	0.2	0.33	0.25	0.15	Drop
Silver	1.3	0.00077	0.03	0.002	0.0001	0.03	2.38	23.8	0.01	0.001	Drop
Thallium	2.5	0.001	0.01	0.003	0.0001	0.02	0.48	1.43	0.03	0.01	Drop
Vanadium	83.1	0.0566	0.07	0.10	0.004	0.17	0.21	2.1	0.82	0.08	Drop
Zinc	112	0.237	4.82	0.14	0.02	4.98	160	320	0.03	0.02	Drop
Middle Gila River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	23400	62	75.37	28.83	4.84	109.03	1.93	19.3	**56**	**5.6**	**Retain**
Barium	202	1.19	1.00	0.25	0.09	1.34	45	75	0.03	0.02	Drop
Cobalt	11.5	0.0392	0.01	0.01	0.003	0.03	5.45	10.9	0.005	0.003	Drop
Iron	20700	34.5	12.43	25.50	2.69	40.63	2.8	NA	**15**	NA	**Retain**
Manganese	794	3.54	2.05	0.98	0.28	3.31	88	284	0.04	0.01	Drop
Nickel	19.9	0.0501	0.14	0.02	0.004	0.17	6.8	31.63	0.02	0.005	Drop
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water											
Aluminum	23400	62	75.37	28.83	4.84	109.03	1.93	19.3	**56**	**5.6**	**Retain**
Barium	203	1.19	1.00	0.25	0.09	1.34	45	75	0.03	0.02	Drop
Cobalt	17	0.0392	0.02	0.02	0.003	0.04	5.45	10.9	0.008	0.004	Drop
Iron	27200	34.5	14.64	33.51	2.69	50.84	2.8	NA	**18**	NA	**Retain**
Manganese	879	3.54	2.27	1.08	0.28	3.63	88	284	0.04	0.01	Drop
Nickel	22.1	0.0501	0.15	0.03	0.004	0.18	6.8	31.63	0.03	0.006	Drop

TABLE 4-15
Screening Evaluation for Coyote
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water											
Antimony	0.58	0.00041	0.0007	0.0007	0.00003	0.001	0.059	0.59	0.02	0.002	Drop
Arsenic	4.8	0.0085	0.001	0.006	0.0007	0.008	0.396	1.58	0.02	0.005	Drop
Beryllium	0.96	0.0011	0.002	0.001	0.0001	0.003	0.66	NA	0.005	NA	Drop
Boron	5.7	0.225	0.25	0.007	0.02	0.28	28	93.6	0.01	0.003	Drop
Cadmium	0.5	0.001	0.009	0.0006	0.0001	0.01	0.77	1.42	0.01	0.007	Drop
Chromium	13.8	0.0081	0.07	0.02	0.0006	0.09	3.28	13.14	0.03	0.007	Drop
Copper	322	0.0702	0.78	0.40	0.005	1.18	11.7	15.14	0.10	0.08	Drop
Cyanide	2.5	0.01	0.11	0.003	0.0008	0.11	0.15	0.5	0.76	0.23	Drop
Lead	22.3	0.0243	0.19	0.03	0.002	0.22	0.92	4.7	0.24	0.05	Drop
Mercury	0.1	0.0002	0.0008	0.0001	0.00002	0.001	0.032	0.16	0.03	0.006	Drop
Molybdenum	2	0.0201	0.09	0.002	0.002	0.09	0.26	2.6	0.35	0.04	Drop
Selenium	3.5	0.0012	0.05	0.004	0.0001	0.05	0.2	0.33	0.25	0.15	Drop
Silver	1	0.00036	0.02	0.001	0.00003	0.02	2.38	23.8	0.01	0.001	Drop
Thallium	2.5	0.001	0.01	0.003	0.0001	0.02	0.48	1.43	0.03	0.01	Drop
Vanadium	32.2	0.0217	0.03	0.04	0.002	0.07	0.21	2.1	0.32	0.03	Drop
Zinc	69.3	0.0497	4.66	0.09	0.004	4.75	160	320	0.03	0.01	Drop
San Pedro River - On-Site Stable Riparian Soil and Surface Water											
Aluminum	7180	3.66	23.13	8.85	0.29	32.26	1.93	19.3	**17**	**1.7**	**Retain**
Barium	114	0.373	0.56	0.14	0.03	0.73	45	75	0.02	0.01	Drop
Cobalt	5	0.0061	0.004	0.006	0.0005	0.01	5.45	10.9	0.002	0.001	Drop
Iron	9870	8.97	7.99	12.16	0.70	20.85	2.8	NA	**7.4**	NA	**Retain**
Manganese	194	0.538	0.50	0.24	0.04	0.78	88	284	0.009	0.003	Drop
Nickel	9.5	0.0106	0.10	0.01	0.0008	0.11	6.8	31.63	0.02	0.003	Drop
San Pedro River - On-Site Untable Riparian Soil and Surface Water											
Aluminum	15100	3.66	48.63	18.60	0.29	67.52	1.93	19.3	**35**	**3.5**	**Retain**
Barium	146	0.373	0.72	0.18	0.03	0.93	45	75	0.02	0.01	Drop
Cobalt	8.9	0.0061	0.009	0.01	0.0005	0.02	5.45	10.9	0.004	0.002	Drop
Iron	18000	8.97	11.44	22.18	0.70	34.31	2.8	NA	**12**	NA	**Retain**
Manganese	591	0.538	1.53	0.73	0.04	2.30	88	284	0.03	0.008	Drop
Nickel	16	0.0106	0.13	0.02	0.0008	0.15	6.8	31.63	0.02	0.005	Drop

TABLE 4-15
Screening Evaluation for Coyote
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Upland Soils and Gila River Surface Water											
Aluminum	30000	62	96.62	36.96	4.84	138.42	1.93	19.3	**72**	**7.2**	**Retain**
Antimony	10.4	0.0016	0.01	0.01	0.0001	0.02	0.059	0.59	0.42	0.04	Drop
Arsenic	361	0.0168	0.04	0.44	0.001	0.49	0.396	1.58	**1.2**	0.31	**Retain**
Barium	217	1.19	1.07	0.27	0.09	1.43	45	75	0.03	0.02	Drop
Beryllium	0.52	0.0083	0.001	0.0006	0.0006	0.002	0.66	NA	0.004	NA	Drop
Boron	7.3	0.14	0.32	0.009	0.01	0.34	28	93.6	0.01	0.004	Drop
Cadmium	94.7	0.0034	0.11	0.12	0.0003	0.22	0.77	1.42	0.29	0.16	Drop
Chromium	72	0.0314	0.24	0.09	0.002	0.33	3.28	13.14	0.10	0.02	Drop
Cobalt	84.9	0.0392	0.17	0.10	0.003	0.28	5.45	10.9	0.05	0.03	Drop
Copper	47200	0.172	1.60	58.15	0.01	59.77	11.7	15.14	**5.1**	**3.9**	**Retain**
Cyanide	2.5	0.01	0.11	0.003	0.0008	0.11	0.15	0.5	0.76	0.23	Drop
Iron	186999	34.5	46.26	230.38	2.69	279.33	2.8	NA	**100**	NA	**Retain**
Lead	468	0.163	0.72	0.58	0.01	1.31	0.92	4.7	**1.4**	0.28	**Retain**
Manganese	797	3.54	2.06	0.98	0.28	3.32	88	284	0.04	0.01	Drop
Mercury	0.49	0.00042	0.004	0.0006	0.00003	0.005	0.032	0.16	0.15	0.03	Drop
Molybdenum	1060	0.0054	46.64	1.31	0.0004	47.95	0.26	2.6	**184**	**18**	**Retain**
Nickel	40.9	0.0501	0.19	0.05	0.004	0.25	6.8	31.63	0.04	0.008	Drop
Selenium	18.8	0.002	0.09	0.02	0.0002	0.11	0.2	0.33	0.55	0.34	Drop
Silver	24.5	0.00077	0.54	0.03	0.0001	0.57	2.38	23.8	0.24	0.02	Drop
Thallium	2.4	0.001	0.01	0.003	0.0001	0.02	0.48	1.43	0.03	0.01	Drop
Vanadium	86.3	0.0566	0.07	0.11	0.004	0.18	0.21	2.1	0.85	0.09	Drop
Zinc	5920	0.237	6.38	7.29	0.02	13.69	160	320	0.09	0.04	Drop

TABLE 4-15
Screening Evaluation for Coyote
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Maximum Soil EPC (mg/kg)	Maximum Water EPC (mg/L)	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
			Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Wash Soils and Gila River Surface Water											
Aluminum	18800	62	60.55	23.16	4.84	88.55	1.93	19.3	**46**	**4.6**	**Retain**
Antimony	20	0.0016	0.02	0.02	0.0001	0.05	0.059	0.59	0.80	0.08	Drop
Arsenic	75.3	0.0168	0.01	0.09	0.001	0.11	0.396	1.58	0.27	0.07	Drop
Barium	118	1.19	0.58	0.15	0.09	0.82	45	75	0.02	0.01	Drop
Beryllium	0.27	0.0083	0.0006	0.0003	0.0006	0.002	0.66	NA	0.002	NA	Drop
Boron	4	0.14	0.18	0.005	0.01	0.19	28	93.6	0.007	0.002	Drop
Cadmium	8.3	0.0034	0.03	0.01	0.0003	0.04	0.77	1.42	0.06	0.03	Drop
Chromium	120	0.0314	0.34	0.15	0.002	0.49	3.28	13.14	0.15	0.04	Drop
Cobalt	79	0.0392	0.15	0.10	0.003	0.25	5.45	10.9	0.05	0.02	Drop
Copper	12500	0.172	1.32	15.40	0.01	16.74	11.7	15.14	**1.4**	**1.1**	**Retain**
Cyanide	2.5	0.01	0.11	0.003	0.0008	0.11	0.15	0.5	0.76	0.23	Drop
Iron	320000	34.5	63.74	394.24	2.69	460.68	2.8	NA	**165**	NA	**Retain**
Lead	239	0.163	0.53	0.29	0.01	0.84	0.92	4.7	0.92	0.18	Drop
Manganese	758	3.54	1.96	0.93	0.28	3.17	88	284	0.04	0.01	Drop
Mercury	0.3	0.00042	0.003	0.0004	0.00003	0.003	0.032	0.16	0.09	0.02	Drop
Molybdenum	86	0.0054	3.78	0.11	0.0004	3.89	0.26	2.6	**15**	**1.5**	**Retain**
Nickel	82	0.0501	0.27	0.10	0.004	0.37	6.8	31.63	0.05	0.01	Drop
Selenium	24	0.002	0.10	0.03	0.0002	0.13	0.2	0.33	0.63	0.38	Drop
Silver	11.7	0.00077	0.26	0.01	0.0001	0.27	2.38	23.8	0.11	0.01	Drop
Thallium	10	0.001	0.05	0.01	0.0001	0.07	0.48	1.43	0.14	0.05	Drop
Vanadium	79.8	0.0566	0.06	0.10	0.004	0.17	0.21	2.1	0.79	0.08	Drop
Zinc	1040	0.237	5.64	1.28	0.02	6.94	160	320	0.04	0.02	Drop

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they

[b] Exposure estimates by each pathway (e.g., small mammal portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation values and models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, and receptor-specific life history parameters (body weight, food ingestion rate, and proportion of soil in diet) presented in Table 3-1. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro river. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were

Highlight and bold represent HQ values equal to or greater than one

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.
EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

TABLE 4-16

Comparison of Southwester Willow Flycatcher Egg Concentrations to Literature-based NOEC and LOEC Benchmarks

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Parameter	Sample ID*	Egg Concentration (mg/kg dw)	NOEC (mg/kg dw)	LOEC (mg/kg dw)	NOEC HQ	LOEC HQ
Aluminum	CB14a	13.8	--	--	--	--
Barium	CB14a	<0.59	--	--	--	--
Boron	CB14a	4.29	44.8	--	0.096	--
Cadmium	CB14a	0.28	--	--	--	--
Copper	CB14a	4.83	5.5	--	0.88	--
Iron	CB14a	108	--	--	--	--
Magnesium	CB14a	548	--	--	--	--
Manganese	CB14a	1.47	--	--	--	--
Mercury	CB14a	0.18	0.34	1.7	0.53	0.11
Selenium	CB14a	1.95	--	16.5	--	0.12
Strontium	CB14a	58.1	--	--	--	--
Zinc	CB14a	65.0	50	--	**1.3**	--
Alumnium	CBC25a2	<8.59	--	--	--	--
Barium	CBC25a2	0.71	--	--	--	--
Boron	CBC25a2	4.59	44.8	--	0.10	--
Copper	CBC25a2	2.78	5.5	--	0.51	--
Iron	CBC25a2	90.4	--	--	--	--
Magnesium	CBC25a2	321	--	--	--	--
Manganese	CBC25a2	0.91	--	--	--	--
Mercury	CBC25a2	0.31	0.34	1.7	0.91	0.18
Selenium	CBC25a2	2.22	--	16.5	--	0.13
Strontium	CBC25a2	15.5	--	--	--	--
Zinc	CBC25a2	48.3	50	--	0.97	--

Notes:

* These eggs were collected along the San Pedro River at CB Crossing, approximately 1.2 miles south of the San Pedro River and Gila River confluence (King et al. 2002). This area is within the ASARCO Hayden LLC Plant Site study area.

Highlight and bold indicate HQs that are equal to or greater than one.

Arsenic, beryllium, chromium, molybdenum, and vanadium were not detected in any samples

Source: King et al. 2002

TABLE 4-17

Comparison of Estimated Maximum Concentrations of Chemicals of Potential Ecological Concern in Small Mammal Tissue (Kidney and Liver) to Literature-based Benchmarks

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Model Type	N	Maximum Concentration in Soil (mg/kg)	Estimated Concentration in Tissue (mg/kg DW)	Threshold	Units	Hazard Quotient	Screen Results
Riparian* - soil-to-kidney								
Cadmium	insectivore	27	0.95	8.82	350	mg/kg DW	0.025	No risk; drop
Cadmium	herbivore	25	0.95	0.75	350	mg/kg DW	0.002	No risk; drop
Copper	insectivore	27	1150	29.91	NA		NA	Uncertainty
Copper	herbivore	18	1150	16.48	NA		NA	Uncertainty
Lead	insectivore	26	60.8	4.20	10	mg/kg DW	0.420	No risk; drop
Lead	herbivore	31	60.8	6.17	10	mg/kg DW	0.617	No risk; drop
Mercury	general	8	0.15	0.65	NA			
Zinc	herbivore	16	112	86.46	463	mg/kg DW	0.187	No risk; drop
Riparian* - soil-to-liver								
Cadmium	herbivore	25	0.95	0.21	NA		NA	Uncertainty
Cadmium	insectivore	27	0.95	10.90	NA		NA	Uncertainty
Copper	herbivore	18	1150	16.80	68	mg/kg WW	0.247	No risk; drop
Copper	insectivore	27	1150	46.25	68	mg/kg WW	0.680	No risk; drop
Lead	herbivore	34	60.8	2.57	5	mg/kg DW	0.514	No risk; drop
Lead	insectivore	26	60.8	2.14	5	mg/kg DW	0.428	No risk; drop
Upland - soil-to-kidney								
Cadmium	insectivore	27	94.7	211.98	350	mg/kg DW	0.606	No risk; drop
Cadmium	herbivore	25	94.7	36.21	350	mg/kg DW	0.103	No risk; drop
Copper	insectivore	27	47200	83.05	NA		NA	Uncertainty
Copper	herbivore	18	47200	20.93	NA		NA	Uncertainty
Lead	insectivore	26	468	22.35	10	mg/kg DW	**2.23**	**Risk; retain**
Lead	herbivore	31	468	13.67	10	mg/kg DW	**1.37**	**Risk; retain**
Mercury	general	8	0.49	1.08	NA		NA	Uncertainty
Zinc	herbivore	16	5920	112.05	463	mg/kg DW	0.242	No risk; drop
Upland - soil-to-liver								
Cadmium	herbivore	25	94.7	10.27	NA		NA	Uncertainty
Cadmium	insectivore	27	94.7	407.84	NA		NA	Uncertainty
Copper	herbivore	18	47200	21.55	68	mg/kg WW	0.317	No risk; drop
Copper	insectivore	27	47200	112.59	68	mg/kg WW	**1.66**	**Likely risk; retain**
Lead	herbivore	34	468	4.55	5	mg/kg DW	0.910	No risk; drop
Lead	insectivore	26	468	6.17	5	mg/kg DW	**1.23**	**Risk; retain**
Wash - soil-to-kidney								
Cadmium	insectivore	27	8.3	39.44	350	mg/kg DW	0.113	No risk; drop
Cadmium	herbivore	25	8.3	4.66	350	mg/kg DW	0.013	No risk; drop
Copper	insectivore	27	12500	57.64	NA		NA	Uncertainty
Copper	herbivore	18	12500	19.21	NA		NA	Uncertainty
Lead	insectivore	26	239	12.88	10	mg/kg DW	**1.29**	**Risk; retain**
Lead	herbivore	31	239	10.52	10	mg/kg DW	**1.05**	**Risk; retain**
Mercury	general	8	0.3	0.87	NA		NA	Uncertainty
Zinc	herbivore	16	1040	100.01	463	mg/kg DW	0.216	No risk; drop
Wash - soil-to-liver								
Cadmium	herbivore	25	8.3	1.33	NA		NA	Uncertainty
Cadmium	insectivore	27	8.3	60.03	NA		NA	Uncertainty
Copper	herbivore	18	12500	19.71	68	mg/kg WW	0.290	No risk; drop
Copper	insectivore	27	12500	81.90	68	mg/kg WW	**1.20**	**Likely risk; retain**
Lead	herbivore	34	239	3.77	5	mg/kg DW	0.754	No risk; drop
Lead	insectivore	26	239	4.35	5	mg/kg DW	0.871	No risk; drop

Notes:

* The maximum riparian soil concentration across all groups (Gila River, San Pedro River, stable, and unstable) was used to estimate the small mammal tissue concentration.

DW = dry weight

Highlight and bold represent HQ values equal to or greater than one

mg/kg = milligram per kilogram

NA = not available

WW =- wet weight

TABLE 4-18

Summary of Initial Screening Evaluation for Aquatic Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Aquatic Organisms	Benthic Invertebrates	Swallows	Belted Kingfisher	Little Brown Bat	Mink
On-Site Gila River						
Aluminum	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
[1] Antimony	Drop	Drop	Uncertainty	Uncertainty	**Retain**	Drop
[1] Arsenic	Drop	Drop	Drop	Drop	**Retain**	Drop
Barium	**Retain**	Drop	Drop	Drop	Drop	Drop
Beryllium	**Retain**	Uncertainty	Uncertainty	Uncertainty	**Retain**	Drop
Boron	**Retain**	Uncertainty	Drop	Drop	Drop	Drop
[1] Cadmium	**Retain ND/Det**	**Retain ND**	**Retain**	**Retain**	Drop	**Retain**
Calcium	**Retain**	-	-	-	-	-
[1] Chromium	Drop	Drop	Drop	Drop	Drop	Drop
Cobalt	**Retain**	Uncertainty	Drop	Drop	Drop	Drop
[1] Copper	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Cyanide	**Retain ND/Det**	**Retain ND**	Uncertainty	Uncertainty	**Retain**	Drop
Iron	**Retain**	Drop	**Retain**	**Retain**	**Retain**	**Retain**
[1] Lead	**Retain**	Drop	**Retain**	**Retain**	**Retain**	Drop
Manganese	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
[1] Mercury	**Retain/ND Det**	Drop	**Retain**	**Retain**	**Retain**	**Retain**
Molybdenum	Drop	Uncertainty	Drop	Drop	**Retain**	Drop
[1] Nickel	Drop	**Retain**	Drop	Drop	Drop	Drop
Selenium	**Retain**	Drop	Drop	**Retain**	**Retain**	**Retain**
Silver	**Retain ND**	**Retain ND**	**Retain**	Drop	**Retain**	Drop
Strontium	-	Uncertainty	Uncertainty	Uncertainty	Drop	Drop
[1] Thallium	Drop	Uncertainty	**Retain**	Drop	Drop	Drop
Vanadium	**Retain**	Uncertainty	**Retain**	Drop	**Retain**	Drop
[1] Zinc	Drop	Drop	**Retain**	**Retain**	Drop	Drop
Total Dissolved Solids	**Retain**	-	-	-	-	-
Ammonia as N	Drop	-	-	-	-	-
p,p'-DDE	-	**Retain ND**	**Retain**	Drop	Drop	Drop

TABLE 4-18

Summary of Initial Screening Evaluation for Aquatic Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Aquatic Organisms	Benthic Invertebrates	Swallows	Belted Kingfisher	Little Brown Bat	Mink
On-Site San Pedro River						
Aluminum	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Antimony	Drop	Drop	Uncertainty	Uncertainty	**Retain**	Drop
Arsenic	Drop	Drop	Drop	Drop	**Retain**	Drop
Barium	**Retain**	Drop	Drop	Drop	Drop	Drop
Beryllium	**Retain**	Uncertainty	Uncertainty	Uncertainty	**Retain**	Drop
Boron	**Retain**	Uncertainty	Drop	Drop	Drop	Drop
Cadmium	Drop	Drop	**Retain**	**Retain**	Drop	Drop
Calcium	**Retain**	-	-	-	-	-
[2] Chromium	Drop	Drop	Drop	Drop	Drop	Drop
Cobalt	Drop	Uncertainty	Drop	Drop	Drop	Drop
Copper	Drop	**Retain**	**Retain**	Drop	**Retain**	Drop
Cyanide	**Retain ND**	**Retain ND**	Uncertainty	Uncertainty	**Retain**	Drop
Iron	**Retain**	Drop	**Retain**	Drop	**Retain**	**Retain**
Lead	Drop	Drop	**Retain**	Drop	**Retain**	Drop
Manganese	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Mercury	**Retain ND**	Drop	Drop	**Retain**	**Retain**	**Retain**
Molybdenum	Drop	Uncertainty	Drop	Drop	**Retain**	Drop
Nickel	Drop	Drop	Drop	Drop	Drop	Drop
Selenium	Drop	Drop	Drop	**Retain**	Drop	Drop
Silver	Drop	Drop	**Retain**	Drop	Drop	Drop
Strontium	-	Uncertainty	Uncertainty	Uncertainty	Drop	Drop
Thallium	Drop	Uncertainty	**Retain**	Drop	Drop	Drop
Vanadium	**Retain**	Uncertainty	Drop	Drop	**Retain**	Drop
Zinc	Drop	Drop	**Retain**	Drop	Drop	Drop
Total Solids	**Retain**	-	-	-	-	-
Ammonia as N	Drop	-	-	-	-	-
p,p'-DDE	-	**Retain ND**	**Retain**	Drop	Drop	Drop

Notes:

[1] Dissolved fraction of some metals used for aquatic organism evaluation

[2] Chromium (VI) benchmark used for the Aquatic Organism Effects Assessment

"'-" = not evaluated

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.

Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

Retain ND = COPEC retained solely based on non-detected data; COPEC was retained for further evaluation in the refined assessment.

Retain ND/Det = The maximum non-detected value exceeded the maximum detected value and both exceeded the screening benchmark; COPEC was retained for further evaluation in the refined assessment.

TABLE 4-19

Summary of Initial Screening Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants*	Terrestrial Invertebrates*	Terrestrial Microbes*	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher	Desert Cottontail	Desert Shrew	Coyote
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water										
Antimony	Drop	Drop	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	**Retain**	Drop
Arsenic	Drop	Drop	Drop	Drop	Drop	Drop	Drop	**Retain**	**Retain**	Drop
Beryllium	Drop	Drop	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	Drop	Drop
Boron	**Retain**	Uncertainty	**Retain**	**Retain**	Drop	Drop	Drop	**Retain**	Drop	Drop
Cadmium	Drop	Drop	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Chromium	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Copper	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Cyanide	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	**Retain**	Drop
Lead	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Mercury	Drop	**Retain**	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Molybdenum	**Retain**	Uncertainty	Drop	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**
Selenium	**Retain ND**	Drop	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Silver	Drop	Uncertainty	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Thallium	**Retain ND**	Uncertainty	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop
Vanadium	**Retain**	Uncertainty	**Retain**	Drop	Drop	Drop	Drop	**Retain**	**Retain**	Drop
Zinc	**Retain**	**Retain**	**Retain**	Drop	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop
Middle Gila River - On-Site Stable Riparian Soil and Surface Water										
Aluminum	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Barium	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Cobalt	Drop	Uncertainty	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Iron	**Retain**	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Manganese	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Nickel	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	**Retain**	Drop
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water										
Aluminum	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Barium	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Cobalt	**Retain**	Uncertainty	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Iron	**Retain**	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Manganese	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Nickel	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	**Retain**	Drop

TABLE 4-19

Summary of Initial Screening Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants*	Terrestrial Invertebrates*	Terrestrial Microbes*	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher	Desert Cottontail	Desert Shrew	Coyote
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water										
Antimony	Drop	Drop	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	**Retain**	Drop
Arsenic	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Beryllium	Drop	Drop	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	Drop	Drop
Boron	**Retain**	Uncertainty	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Cadmium	Drop	Drop	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Chromium	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Copper	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Cyanide	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	**Retain**	Drop
Lead	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Mercury	Drop	**Retain ND**	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Molybdenum	**Retain**	Uncertainty	Drop	Drop	Drop	Drop	Drop	**Retain**	**Retain**	Drop
Selenium	**Retain ND**	Drop	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Silver	Drop	Uncertainty	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Thallium	**Retain ND**	Uncertainty	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop
Vanadium	**Retain**	Uncertainty	**Retain**	Drop	Drop	Drop	Drop	Drop	**Retain**	Drop
Zinc	**Retain**	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop
San Pedro River - On-Site Stable Riparian Soil and Surface Water										
Aluminum	Drop	Drop	Drop	Drop	**Retain**	Drop	**Retain**	**Retain**	**Retain**	**Retain**
Barium	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Cobalt	Drop	Uncertainty	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Iron	**Retain**	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Manganese	Drop	Drop	**Retain**	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Nickel	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	**Retain**	Drop
San Pedro River - On-Site Untable Riparian Soil and Surface Water										
Aluminum	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Barium	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Cobalt	Drop	Uncertainty	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Iron	**Retain**	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Manganese	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Nickel	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	**Retain**	Drop

TABLE 4-19

Summary of Initial Screening Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants*	Terrestrial Invertebrates*	Terrestrial Microbes*	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher	Desert Cottontail	Desert Shrew	Coyote
Upland Soils and Gila River Surface Water										
Aluminum	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Antimony	**Retain**	Drop	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	**Retain**	Drop
Arsenic	**Retain**	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**
Barium	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Beryllium	Drop	Drop	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	Drop	Drop
Boron	**Retain**	Uncertainty	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Cadmium	**Retain**	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Chromium	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Cobalt	**Retain**	Uncertainty	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Copper	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	**Retain**	**Retain**	**Retain**
Cyanide	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	**Retain**	Drop
Iron	**Retain**	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Lead	**Retain**	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Manganese	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Mercury	**Retain**	**Retain**	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Molybdenum	**Retain**	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Nickel	**Retain**	Drop	Drop	Drop	Drop	Drop	Drop	Drop	**Retain**	Drop
Selenium	**Retain**	Drop	Drop	**Retain**	**Retain**	Drop	**Retain**	**Retain**	**Retain**	Drop
Silver	Drop	Uncertainty	Drop	Drop	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Thallium	**Retain ND**	Uncertainty	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop
Vanadium	**Retain**	Uncertainty	**Retain**	Drop	Drop	Drop	Drop	**Retain**	**Retain**	Drop
Zinc	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop

TABLE 4-19

Summary of Initial Screening Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants*	Terrestrial Invertebrates*	Terrestrial Microbes*	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher	Desert Cottontail	Desert Shrew	Coyote
Wash Soils and Gila River Surface Water										
Aluminum	Drop	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Antimony	**Retain**	Drop	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	**Retain**	**Retain**	Drop
Arsenic	**Retain**	**Retain**	Drop	Drop	Drop	Drop	Drop	**Retain**	**Retain**	Drop
Barium	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Beryllium	Drop	Drop	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	Drop	Drop
Boron	**Retain**	Uncertainty	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Cadmium	Drop	Drop	Drop	**Retain**	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Chromium	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Cobalt	**Retain**	Uncertainty	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Copper	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	**Retain**	**Retain**	**Retain**
Cyanide	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Uncertainty	Drop	**Retain**	Drop
Iron	**Retain**	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Lead	**Retain**	Drop	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	Drop
Manganese	**Retain**	**Retain**	**Retain**	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Mercury	**Retain**	**Retain**	Drop	Drop	**Retain**	Drop	**Retain**	Drop	**Retain**	Drop
Molybdenum	**Retain**	Uncertainty	Drop	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**
Nickel	**Retain**	Drop	Drop	Drop	Drop	Drop	**Retain**	Drop	**Retain**	Drop
Selenium	**Retain**	Drop	Drop	**Retain**	**Retain**	Drop	**Retain**	**Retain**	**Retain**	Drop
Silver	Drop	Uncertainty	Drop	Drop	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Thallium	**Retain ND**	Uncertainty	Uncertainty	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop
Vanadium	**Retain**	Uncertainty	**Retain**	Drop	Drop	Drop	Drop	**Retain**	**Retain**	Drop
Zinc	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	**Retain**	Drop	**Retain**	Drop

Notes:

* Potential effects only from direct contact with Site soils were evaluated for non-wildlife receptors.

Drop = Screening criteria were not exceeded; analyte dropped from further evaluation.

Retain = COPEC failed initial screening and was retained for further evaluation in the refined assessment.

Retain ND = COPEC retained solely based on non-detected data; retained as an uncertainty

TABLE 5-1

Summary Statistics and Results of Rank ANOVA of Metals Concentrations (mg/kg dw) in Onsite and Offsite Sediments at the Hayden Asarco Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Parameter [a]	Number of Detects	N	Mean	Standard Deviation	Minimum	Median	Maximum	Results of Statistical Comparisons [b]
1-offsite-up	Aluminum	8	8	18530	7785	5437	20315.5	25695	A
2-onsite	Aluminum	24	24	15812	4936	4240	16750	26679	AB
3-offsite-do	Aluminum	11	11	20161	8431	7393	17995	34963	A
4-offsite-SP	Aluminum	9	9	4238	2525	1250	3610	8540	C
5-onsite-SP	Aluminum	5	5	10180	9655	4250	4540	26678	B
2-onsite	Antimony	21	22	0.78	0.28	0.4	0.705	1.2	A
5-onsite-SP	Antimony	4	4	0.43	0.15	0.21	0.47	0.56	B
1-offsite-up	Arsenic	8	8	5.9	2.7	1.9	5.61	10.4	A
2-onsite	Arsenic	24	24	3.6	1.4	1.1	3.9	5.5	A
3-offsite-do	Arsenic	11	11	6.7	4.4	2.37	6.67	17.97	A
4-offsite-SP	Arsenic	9	9	4.1	1.9	1.6	3.5	6.6	A
5-onsite-SP	Arsenic	5	5	3.4	2.2	1.4	2.6	6.83	A
1-offsite-up	Barium	7	7	186.3	51.6	106	199	244	A
2-onsite	Barium	22	22	129.0	41.3	51.8	140.5	180	A
3-offsite-do	Barium	4	4	134.0	42.2	82	134.5	185	A
4-offsite-SP	Barium	9	9	107.1	83.7	26	86	288	A
5-onsite-SP	Barium	4	4	102.3	52.7	61.4	85.3	177	A
1-offsite-up	Beryllium	9	9	15.57	43.66	0.6	1	132	AB
2-onsite	Beryllium	25	26	13.58	46.99	0.09	0.57	205	BC
3-offsite-do	Beryllium	18	18	55.90	73.31	0.43	1.49	200	A
4-offsite-SP	Beryllium	9	9	0.36	0.24	0.1	0.25	0.78	C
5-onsite-SP	Beryllium	6	6	27.29	65.50	0.15	0.545	161	BC
1-offsite-up	Boron	7	8	8.18	4.71	3.1	7.45	18.4	A
2-onsite	Boron	24	24	5.65	3.16	0.81	5.45	10.9	A
3-offsite-do	Boron	11	11	6.18	3.37	1.6	8	11.37	A
4-offsite-SP	Boron	1	9	4.02	4.48	1	1	10	A
5-onsite-SP	Boron	5	5	3.78	4.00	0.9	1.9	10.6	A
1-offsite-up	Cadmium	7	8	4.38	3.01	0.4	4.75	8.6	A
2-onsite	Cadmium	6	24	0.48	0.25	0.03	0.5	1.1	B
3-offsite-do	Cadmium	10	11	0.78	1.05	0.23	0.46	3.91	B
5-onsite-SP	Cadmium	2	5	0.39	0.16	0.12	0.43	0.52	B

TABLE 5-1

Summary Statistics and Results of Rank ANOVA of Metals Concentrations (mg/kg dw) in Onsite and Offsite Sediments at the Hayden Asarco Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Parameter [a]	Number of Detects	N	Mean	Standard Deviation	Minimum	Median	Maximum	Results of Statistical Comparisons [b]
1-offsite-up	Chromium	8	8	17.38	6.82	9	16.5	31	A
2-onsite	Chromium	24	24	12.95	4.34	4.3	13	21	A
3-offsite-do	Chromium	11	11	15.47	5.95	5.85	14.6	29.34	A
4-offsite-SP	Chromium	9	9	3.27	1.99	1.4	2.3	6.9	B
5-onsite-SP	Chromium	5	5	7.58	5.36	2.9	4.3	14.8	B
2-onsite	Cobalt	22	22	10.5	3.2	3.2	10.3	16.2	A
5-onsite-SP	Cobalt	4	4	4.5	1.6	3.2	4.15	6.6	B
1-offsite-up	Copper	8	8	73.3	47.9	12	79.5	137	B
2-onsite	Copper	24	24	111.8	75.7	11.6	94.5	392	AB
3-offsite-do	Copper	11	11	468.8	801.1	44	137	2660	A
4-offsite-SP	Copper	9	9	16.2	12.0	3.4	13	40	C
5-onsite-SP	Copper	5	5	53.7	54.2	9.1	35.4	143	BC
2-onsite	Cyanide		22	3.99090909	1.067221176	2.6	3.8	6.9	A
5-onsite-SP	Cyanide		4	2.975	0.25	2.7	2.95	3.3	B
1-offsite-up	Iron	8	8	19063	6865	8930	17639.5	30573	A
2-onsite	Iron	24	24	19220	5145	6890	19300	28500	A
3-offsite-do	Iron	11	11	19920	5399	9344	18696	28043	A
4-offsite-SP	Iron	9	9	5100	2507	1920	4790	8720	B
5-onsite-SP	Iron	5	5	10757	5710	5480	8710	19277	B
1-offsite-up	Lead	8	8	15.9	6.2	7	17.5	22.4	AB
2-onsite	Lead	24	24	14.3	6.2	3.4	14.45	30.6	AB
3-offsite-do	Lead	11	11	25.0	16.8	8.32	21.3	72.37	A
4-offsite-SP	Lead	7	9	11.7	10.7	5	6.1	36	B
5-onsite-SP	Lead	5	5	12.2	6.1	6.7	10.5	20.8	B
1-offsite-up	Manganese	8	8	675	277	197	644	1072	A
2-onsite	Manganese	24	24	789	592	113	547	2410	A
3-offsite-do	Manganese	11	11	611	188	414	597	1073	A
4-offsite-SP	Manganese	9	9	306	224	128	219	825	B
5-onsite-SP	Manganese	5	5	388	373	155	183	1031	B
1-offsite-up	Mercury	2	8	0.053	0.019	0.03	0.05	0.09	A
2-onsite	Mercury	12	24	0.056	0.024	0.021	0.057	0.1	A
3-offsite-do	Mercury	10	11	0.041	0.024	0.015	0.042	0.09	A
5-onsite-SP	Mercury	1	5	0.046	0.021	0.023	0.058	0.066	A

TABLE 5-1

Summary Statistics and Results of Rank ANOVA of Metals Concentrations (mg/kg dw) in Onsite and Offsite Sediments at the Hayden Asarco Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Parameter [a]	Number of Detects	N	Mean	Standard Deviation	Minimum	Median	Maximum	Results of Statistical Comparisons [b]
1-offsite-up	Molybdenum		1	2.1		2.1	2.1	2.1	A
2-onsite	Molybdenum	10	24	1.4	0.8	0.09	1.5	2.5	A
3-offsite-do	Molybdenum	6	11	5.8	11.9	1.5	1.99	41.6	A
5-onsite-SP	Molybdenum	2	5	1.5	0.7	0.34	1.7	2.1	A
1-offsite-up	Nickel	8	8	25.1	8.8	11	26.9	34	A
2-onsite	Nickel	24	24	15.7	4.5	6.1	15.35	26.5	B
3-offsite-do	Nickel	11	11	20.3	7.6	10.63	17	36.19	AB
4-offsite-SP	Nickel	9	9	5.0	2.4	2.3	4.3	8.8	C
5-onsite-SP	Nickel	5	5	9.7	4.6	5.2	7.3	16.3	C
1-offsite-up	Selenium		1	0.22		0.22	0.22	0.22	A
2-onsite	Selenium	14	24	0.79	0.29	0.17	0.8	1.4	A
3-offsite-do	Selenium	6	11	0.45	0.58	0.15	0.26	2.16	A
5-onsite-SP	Selenium		5	0.51	0.19	0.17	0.58	0.66	A
2-onsite	Silver	1	22	0.77	0.25	0.15	0.73	1.4	A
5-onsite-SP	Silver		4	0.59	0.05	0.53	0.585	0.66	B
1-offsite-up	Strontium	8	8	197.6	67.4	88	197.5	289	A
2-onsite	Strontium	2	2	183.0	15.6	172	183	194	A
3-offsite-do	Strontium	11	11	117.9	36.1	46	119	165	A
4-offsite-SP	Strontium	9	9	3004.1	5786.8	28	101	13310	A
5-onsite-SP	Strontium	1	1	213.0		213	213	213	A
1-offsite-up	Thallium	4	7	111.14	85.58	14	159	189	A
2-onsite	Thallium	6	22	1.11	0.32	0.57	1.1	1.9	B
5-onsite-SP	Thallium	1	4	0.75	0.10	0.6	0.78	0.83	C
2-onsite	Total Organic Carbon	21	22	1.36	0.97	0.12	1.45	3.1	A
5-onsite-SP	Total Organic Carbon	4	4	0.19	0.12	0.07	0.165	0.35	B
1-offsite-up	Vanadium	8	8	40.59	20.72	5	39.5	72	A
2-onsite	Vanadium	24	24	46.98	17.25	14.6	44.8	91.2	A
3-offsite-do	Vanadium	11	11	50.29	19.33	17.84	51.4	91.7	A
4-offsite-SP	Vanadium	9	9	6.92	2.62	3	7.2	10	B
5-onsite-SP	Vanadium	5	5	21.36	15.53	8.7	14.2	46.3	B

TABLE 5-1

Summary Statistics and Results of Rank ANOVA of Metals Concentrations (mg/kg dw) in Onsite and Offsite Sediments at the Hayden Asarco Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Parameter [a]	Number of Detects	N	Mean	Standard Deviation	Minimum	Median	Maximum	Results of Statistical Comparisons [b]
1-offsite-up	Zinc	8	8	69.7	24.9	31	74.65	102	AB
2-onsite	Zinc	24	24	53.2	17.5	14.5	50.9	89.9	BC
3-offsite-do	Zinc	11	11	105.5	71.6	35.06	82.3	281.17	A
4-offsite-SP	Zinc	9	9	23.9	12.9	8	20	46	D
5-onsite-SP	Zinc	5	5	36.3	26.9	17	20	78.5	CD
2-onsite	pH	22	22	8.0	0.3	7.6	7.9	8.7	B
5-onsite-SP	pH	4	4	8.5	0.3	8.1	8.5	8.9	A

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered macronutrients. These analytes were excluded from further evaluation in the initial screening analysis and are not presented in the background screen.

[b] Rows with same letter within analyte are not significantly different as determined by ANOVA on rank-transformed concentrations.

1 Upper Gila River - locations upstream of Site
2 Middile Gila River - locations within study area at Site
3 Middile Gila River - locations downstream of study area at Site
4 San Pedro River - locations upstream of Site
5 San Pedro River - locations within study area at Site

TABLE 5-2

Summary Statistics and Comparison of Maximum Onsite Metals Concentrations (mg/kg dw) to Upper Tolerance Limits (UTLs) Developed for Background Soils at the Hayden ASARCO Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

							Background UTLs			Background Comparison to Maximum		
Watershed	**Area**	**MatrixType**	**Parameter**	**Detected**	**N**	**Maximum**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**
Middle Gila	onsite	stable	Aluminum	17	17	23400						
San Pedro	onsite-SP	stable	Aluminum	2	2	7180						
Middle Gila	onsite	unstable	Aluminum	12	12	23400						
San Pedro	onsite-SP	unstable	Aluminum	2	2	15100						
Middle Gila	onsite	stable	Antimony	17	17	0.87	3.243	2.492			0.35	
San Pedro	onsite-SP	stable	Antimony	2	2	0.34	3.243	2.492			0.14	
Middle Gila	onsite	unstable	Antimony	12	12	0.92	3.243	2.492			0.37	
San Pedro	onsite-SP	unstable	Antimony	2	2	0.58	3.243	2.492			0.23	
Middle Gila	onsite	stable	Arsenic	17	17	8.1	9.1	8.778	12.5		0.92	
San Pedro	onsite-SP	stable	Arsenic	2	2	2.3	9.1	8.778	12.5		0.26	
Middle Gila	onsite	unstable	Arsenic	12	12	6.7	9.1	8.778	12.5		0.76	
San Pedro	onsite-SP	unstable	Arsenic	2	2	4.8	9.1	8.778	12.5		0.55	
Middle Gila	onsite	stable	Barium	17	17	202	275	159			1.27	
San Pedro	onsite-SP	stable	Barium	2	2	114	275	159			0.72	
Middle Gila	onsite	unstable	Barium	12	12	203	275	159			1.28	
San Pedro	onsite-SP	unstable	Barium	2	2	146	275	159			0.92	
Middle Gila	onsite	stable	Beryllium	11	17	1.6	0.904	1.78			0.90	
San Pedro	onsite-SP	stable	Beryllium	2	2	0.53	0.904	1.78			0.30	
Middle Gila	onsite	unstable	Beryllium	9	12	1.3	0.904	1.78			0.73	
San Pedro	onsite-SP	unstable	Beryllium	1	2	0.96	0.904	1.78			0.54	
Middle Gila	onsite	stable	Boron	17	17	32.5						
San Pedro	onsite-SP	stable	Boron	2	2	1.4						
Middle Gila	onsite	unstable	Boron	12	12	8.8						
San Pedro	onsite-SP	unstable	Boron	2	2	5.7						
Middle Gila	onsite	stable	Cadmium	5	17	0.7	0.92	1.085	6.36		0.65	
San Pedro	onsite-SP	stable	Cadmium		2	0.5	0.92	1.085	6.36		0.46	
Middle Gila	onsite	unstable	Cadmium	3	12	0.95	0.92	1.085	6.36		0.88	
San Pedro	onsite-SP	unstable	Cadmium		2	0.5	0.92	1.085	6.36		0.46	
Middle Gila	onsite	stable	Calcium	17	17	48600						
San Pedro	onsite-SP	stable	Calcium	2	2	15800						
Middle Gila	onsite	unstable	Calcium	12	12	50400						
San Pedro	onsite-SP	unstable	Calcium	2	2	28400						
Middle Gila	onsite	stable	Chromium	17	17	16.6	23.2	33.88	71.88		0.49	
San Pedro	onsite-SP	stable	Chromium	2	2	8.2	23.2	33.88	71.88		0.24	
Middle Gila	onsite	unstable	Chromium	12	12	16.8	23.2	33.88	71.88		0.50	
San Pedro	onsite-SP	unstable	Chromium	2	2	13.8	23.2	33.88	71.88		0.41	
Middle Gila	onsite	stable	Cobalt	16	17	11.5	11.9	12.73			0.90	

TABLE 5-2

Summary Statistics and Comparison of Maximum Onsite Metals Concentrations (mg/kg dw) to Upper Tolerance Limits (UTLs) Developed for Background Soils at the Hayden ASARCO Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

							Background UTLs			Background Comparison to Maximum		
Watershed	**Area**	**MatrixType**	**Parameter**	**Detected**	**N**	**Maximum**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**
San Pedro	onsite-SP	stable	Cobalt		2	5	11.9	12.73			0.39	
Middle Gila	onsite	unstable	Cobalt	12	12	17	11.9	12.73			1.34	
San Pedro	onsite-SP	unstable	Cobalt	1	2	8.9	11.9	12.73			0.70	
Middle Gila	onsite	stable	Copper	17	17	1150	882	428.9	1270		2.68	
San Pedro	onsite-SP	stable	Copper	2	2	36.6	882	428.9	1270		0.09	
Middle Gila	onsite	unstable	Copper	12	12	696	882	428.9	1270		1.62	
San Pedro	onsite-SP	unstable	Copper	2	2	322	882	428.9	1270		0.75	
Middle Gila	onsite	stable	Cyanide	1	17	2.5						
San Pedro	onsite-SP	stable	Cyanide		2	2.5						
Middle Gila	onsite	unstable	Cyanide	1	12	2.5						
San Pedro	onsite-SP	unstable	Cyanide	1	2	2.5						
Middle Gila	onsite	stable	Iron	17	17	20700						
San Pedro	onsite-SP	stable	Iron	2	2	9870						
Middle Gila	onsite	unstable	Iron	12	12	27200						
San Pedro	onsite-SP	unstable	Iron	2	2	18000						
Middle Gila	onsite	stable	Lead	17	17	60.8	45.8	65.4	47.9		0.93	
San Pedro	onsite-SP	stable	Lead	2	2	10.2	45.8	65.4	47.9		0.16	
Middle Gila	onsite	unstable	Lead	12	12	32.8	45.8	65.4	47.9		0.50	
San Pedro	onsite-SP	unstable	Lead	2	2	22.3	45.8	65.4	47.9		0.34	
Middle Gila	onsite	stable	Magnesium	17	17	12100						
San Pedro	onsite-SP	stable	Magnesium	2	2	3690						
Middle Gila	onsite	unstable	Magnesium	12	12	15600						
San Pedro	onsite-SP	unstable	Magnesium	2	2	6920						
Middle Gila	onsite	stable	Manganese	17	17	794						
San Pedro	onsite-SP	stable	Manganese	2	2	194						
Middle Gila	onsite	unstable	Manganese	12	12	879						
San Pedro	onsite-SP	unstable	Manganese	2	2	591						
Middle Gila	onsite	stable	Mercury	6	17	0.15	0.052	0.0496	0.265		3.02	
San Pedro	onsite-SP	stable	Mercury	2	2	0.051	0.052	0.0496	0.265		1.03	
Middle Gila	onsite	unstable	Mercury	7	12	0.12	0.052	0.0496	0.265		2.42	
San Pedro	onsite-SP	unstable	Mercury	1	2	0.1	0.052	0.0496	0.265		2.02	
Middle Gila	onsite	stable	Molybdenum	17	17	7.1	15.9	3.39			2.09	
San Pedro	onsite-SP	stable	Molybdenum	2	2	2	15.9	3.39			0.59	
Middle Gila	onsite	unstable	Molybdenum	12	12	2.8	15.9	3.39			0.83	
San Pedro	onsite-SP	unstable	Molybdenum	2	2	1.7	15.9	3.39			0.50	
Middle Gila	onsite	stable	Nickel	17	17	19.9	25.5	26.71			0.75	
San Pedro	onsite-SP	stable	Nickel	2	2	9.5	25.5	26.71			0.36	

TABLE 5-2

Summary Statistics and Comparison of Maximum Onsite Metals Concentrations (mg/kg dw) to Upper Tolerance Limits (UTLs) Developed for Background Soils at the Hayden ASARCO Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

							Background UTLs			Background Comparison to Maximum		
Watershed	**Area**	**MatrixType**	**Parameter**	**Detected**	**N**	**Maximum**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**
Middle Gila	onsite	unstable	Nickel	12	12	22.1	25.5	26.71			0.83	
San Pedro	onsite-SP	unstable	Nickel	2	2	16	25.5	26.71			0.60	
Middle Gila	onsite	stable	Potassium	17	17	5570						
San Pedro	onsite-SP	stable	Potassium	2	2	1750						
Middle Gila	onsite	unstable	Potassium	12	12	4690						
San Pedro	onsite-SP	unstable	Potassium	2	2	4070						
Middle Gila	onsite	stable	Selenium	1	17	3.5	0.853	2.456			1.43	
San Pedro	onsite-SP	stable	Selenium		2	3.5	0.853	2.456			1.43	
Middle Gila	onsite	unstable	Selenium		12	3.5	0.853	2.456			1.43	
San Pedro	onsite-SP	unstable	Selenium		2	3.5	0.853	2.456			1.43	
Middle Gila	onsite	stable	Silver	2	17	1.3	0.51	0.709			1.83	
San Pedro	onsite-SP	stable	Silver		2	1	0.51	0.709			1.41	
Middle Gila	onsite	unstable	Silver	2	12	1	0.51	0.709			1.41	
San Pedro	onsite-SP	unstable	Silver	1	2	1	0.51	0.709			1.41	
Middle Gila	onsite	stable	Sodium	17	17	10700						
San Pedro	onsite-SP	stable	Sodium	2	2	436						
Middle Gila	onsite	unstable	Sodium	12	12	3900						
San Pedro	onsite-SP	unstable	Sodium	2	2	929						
Middle Gila	onsite	stable	Thallium		17	2.5	0.87	5.443			0.46	
San Pedro	onsite-SP	stable	Thallium		2	2.5	0.87	5.443			0.46	
Middle Gila	onsite	unstable	Thallium		12	2.5	0.87	5.443			0.46	
San Pedro	onsite-SP	unstable	Thallium		2	2.5	0.87	5.443			0.46	
Middle Gila	onsite	stable	Vanadium	17	17	57.6	61.9	89.4			0.64	
San Pedro	onsite-SP	stable	Vanadium	2	2	20.6	61.9	89.4			0.23	
Middle Gila	onsite	unstable	Vanadium	12	12	83.1	61.9	89.4			0.93	
San Pedro	onsite-SP	unstable	Vanadium	2	2	32.2	61.9	89.4			0.36	
Middle Gila	onsite	stable	Zinc	17	17	112	169.8	217	590		0.52	
San Pedro	onsite-SP	stable	Zinc	2	2	35.3	169.8	217	590		0.16	
Middle Gila	onsite	unstable	Zinc	12	12	93.3	169.8	217	590		0.43	
San Pedro	onsite-SP	unstable	Zinc	2	2	69.3	169.8	217	590		0.32	
Upland soil	onsite	--	Aluminum	10	10	30000						
Upland soil	onsite	--	Antimony	10	10	10.4	3.243	2.492		3.21	4.17	
Upland soil	onsite	--	Arsenic	10	10	361	9.1	8.778	12.5	39.67	41.13	28.88
Upland soil	onsite	--	Barium	10	10	217	275	159		0.79	1.36	
Upland soil	onsite	--	Beryllium	2	10	0.52	0.904	1.78		0.58	0.29	
Upland soil	onsite	--	Boron	10	10	7.3						
Upland soil	onsite	--	Cadmium	9	10	94.7	0.92	1.085	6.36	102.93	87.28	14.89

TABLE 5-2

Summary Statistics and Comparison of Maximum Onsite Metals Concentrations (mg/kg dw) to Upper Tolerance Limits (UTLs) Developed for Background Soils at the Hayden ASARCO Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

							Background UTLs			Background Comparison to Maximum		
Watershed	**Area**	**MatrixType**	**Parameter**	**Detected**	**N**	**Maximum**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**
Upland soil	onsite	--	Calcium	10	10	84300						
Upland soil	onsite	--	Chromium	9	10	72	23.2	33.88	71.88	3.10	2.13	1.002
Upland soil	onsite	--	Cobalt	10	10	84.9	11.9	12.73		7.13	6.67	
Upland soil	onsite	--	Copper	10	10	47200	882	428.9	1270	53.51	110.05	37.17
Upland soil	onsite	--	Iron	10	10	186999						
Upland soil	onsite	--	Lead	10	10	468	45.8	65.4	47.9	10.22	7.16	9.77
Upland soil	onsite	--	Magnesium	10	10	22000						
Upland soil	onsite	--	Manganese	10	10	797						
Upland soil	onsite	--	Mercury	8	10	0.49	0.052	0.0496	0.265	9.42	9.88	1.85
Upland soil	onsite	--	Molybdenum	10	10	1060	15.9	3.39		66.67	312.68	
Upland soil	onsite	--	Nickel	10	10	40.9	25.5	26.71		1.60	1.53	
Upland soil	onsite	--	Potassium	10	10	6430						
Upland soil	onsite	--	Selenium	9	10	18.8	0.853	2.456		22.04	7.65	
Upland soil	onsite	--	Silver	9	10	24.5	0.51	0.709		48.04	34.56	
Upland soil	onsite	--	Sodium	8	10	1010						
Upland soil	onsite	--	Thallium	2	10	2.4	0.87	5.443		2.76	0.44	
Upland soil	onsite	--	Vanadium	10	10	86.3	61.9	89.4		1.39	0.97	
Upland soil	onsite	--	Zinc	10	10	5920	169.8	217	590	34.86	27.28	10.03
Wash soil	onsite	--	Aluminum	32	32	18800						
Wash soil	onsite	--	Antimony	21	32	20	3.243	2.492		6.17	8.03	
Wash soil	onsite	--	Arsenic	32	32	75.3	9.1	8.778	12.5	8.27	8.58	6.02
Wash soil	onsite	--	Barium	32	32	118	275	159		0.43	0.74	
Wash soil	onsite	--	Beryllium	1	32	0.27	0.904	1.78		0.30	0.15	
Wash soil	onsite	--	Boron	19	19	4						
Wash soil	onsite	--	Cadmium	30	32	8.3	0.92	1.085	6.36	9.02	7.65	1.31
Wash soil	onsite	--	Calcium	32	32	79500						
Wash soil	onsite	--	Chromium	32	32	120	23.2	33.88	71.88	5.17	3.54	1.67
Wash soil	onsite	--	Cobalt	32	32	79	11.9	12.73		6.64	6.21	
Wash soil	onsite	--	Copper	32	32	12500	882	428.9	1270	14.17	29.14	9.84
Wash soil	onsite	--	Iron	32	32	320000						
Wash soil	onsite	--	Lead	32	32	239	45.8	65.4	47.9	5.22	3.65	4.99
Wash soil	onsite	--	Magnesium	32	32	17900						
Wash soil	onsite	--	Manganese	32	32	758						
Wash soil	onsite	--	Mercury	26	32	0.3	0.052	0.0496	0.265	5.77	6.05	1.13
Wash soil	onsite	--	Molybdenum	20	20	86	15.9	3.39		5.41	25.37	
Wash soil	onsite	--	Nickel	32	32	82	25.5	26.71		3.22	3.07	
Wash soil	onsite	--	Potassium	32	32	8270						

TABLE 5-2

Summary Statistics and Comparison of Maximum Onsite Metals Concentrations (mg/kg dw) to Upper Tolerance Limits (UTLs) Developed for Background Soils at the Hayden ASARCO Smelte

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

							Background UTLs			Background Comparison to Maximum		
Watershed	**Area**	**MatrixType**	**Parameter**	**Detected**	**N**	**Maximum**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**	**Qo Formation Soils**	**Qal Formation Soils**	**Ts Formation Soils**
Wash soil	onsite	--	Selenium	20	32	24	0.853	2.456		28.14	9.77	
Wash soil	onsite	--	Silver	32	32	11.7	0.51	0.709		22.94	16.50	
Wash soil	onsite	--	Sodium	19	32	1130						
Wash soil	onsite	--	Thallium	29	32	10	0.87	5.443		11.49	1.84	
Wash soil	onsite	--	Vanadium	32	32	79.8	61.9	89.4		1.29	0.89	
Wash soil	onsite	--	Zinc	32	32	1040	169.8	217	590	6.12	4.79	1.76

Notes:

Highlighted cells indicate cases where the maximum site concentration exceeded the appropriate Background UTL.

Onsite riparian soils (Middle Gila River and San Pedro River) were located in the Qal geologic formations soils and were therefore only compared to the UTLs for Qal formation soils.

Upland and wash soils spanned the three geologic formations (Qo, Qal, and Ts) and were therefore compared to all three soil types.

dw = dry weight

mg/kg = miligram per kilogram

onsite = onsite in the Gila River

onsite-SP = onsite in the San Pedro River

Ts formation = tertiary sediments/soils

UTL = upper tolerance limit

Qal formation = quaternary alluvium sediments/soils

Qo formation = older quaternary sediment/soil deposits

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-01	Primary Sample	Aluminum	5010		µg/L	87	58	1		
Middle Gila	GR-SW-02	Primary Sample	Aluminum	4790		µg/L	87	55	1		
Middle Gila	GR-SW-03	Primary Sample	Aluminum	4250		µg/L	87	49	1		
Middle Gila	GR-SW-04	Primary Sample	Aluminum	4100		µg/L	87	47	1		
Middle Gila	GR-SW-05	Primary Sample	Aluminum	5000		µg/L	87	57	1		
Middle Gila	GR-SW-06	Primary Sample	Aluminum	62000		µg/L	87	713	1		
Middle Gila	GR-SW-07	Primary Sample	Aluminum	51900		µg/L	87	597	1		
Middle Gila	GR-SW-08	Primary Sample	Aluminum	12000		µg/L	87	138	1		
Middle Gila	GR-SW-09	Primary Sample	Aluminum	4370		µg/L	87	50	1		
Middle Gila	GR-SW-10	Primary Sample	Aluminum	6630		µg/L	87	76	1		
Middle Gila	GR-SW-11	Primary Sample	Aluminum	7010		µg/L	87	81	1		
Middle Gila	GR-SW-01	Primary Sample	Aluminum	738		µg/L	87	8.5	1		
Middle Gila	GR-SW-02	Primary Sample	Aluminum	904		µg/L	87	10	1		
Middle Gila	GR-SW-03	Primary Sample	Aluminum	816		µg/L	87	9.4	1		
Middle Gila	GR-SW-04	Primary Sample	Aluminum	944		µg/L	87	11	1		
Middle Gila	GR-SW-05	Primary Sample	Aluminum	1030		µg/L	87	12	1		
Middle Gila	GR-SW-06	Primary Sample	Aluminum	821		µg/L	87	9.4	1		
Middle Gila	GR-SW-07	Primary Sample	Aluminum	754		µg/L	87	8.7	1		
Middle Gila	GR-SW-08	Primary Sample	Aluminum	1090		µg/L	87	13	1		
Middle Gila	GR-SW-09	Primary Sample	Aluminum	1040		µg/L	87	12	1		
Middle Gila	GR-SW-10	Primary Sample	Aluminum	981		µg/L	87	11	1		
Middle Gila	GR-SW-11	Primary Sample	Aluminum	1090		µg/L	87	13	1		
Middle Gila	GR-SW-01	Primary Sample	Barium	115		µg/L	4	29	1		
Middle Gila	GR-SW-02	Primary Sample	Barium	112		µg/L	4	28	1		
Middle Gila	GR-SW-03	Primary Sample	Barium	109		µg/L	4	27	1		
Middle Gila	GR-SW-04	Primary Sample	Barium	105		µg/L	4	26	1		
Middle Gila	GR-SW-05	Primary Sample	Barium	118		µg/L	4	30	1		
Middle Gila	GR-SW-06	Primary Sample	Barium	1190		µg/L	4	298	1		
Middle Gila	GR-SW-07	Primary Sample	Barium	893		µg/L	4	223	1		
Middle Gila	GR-SW-08	Primary Sample	Barium	230		µg/L	4	58	1		
Middle Gila	GR-SW-09	Primary Sample	Barium	138		µg/L	4	35	1		
Middle Gila	GR-SW-10	Primary Sample	Barium	171		µg/L	4	43	1		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-11	Primary Sample	Barium	168		µg/L	4	42	1		
Middle Gila	GR-SW-01	Primary Sample	Barium	63.6		µg/L	4	16	1		
Middle Gila	GR-SW-02	Primary Sample	Barium	63		µg/L	4	16	1		
Middle Gila	GR-SW-03	Primary Sample	Barium	61.5		µg/L	4	15	1		
Middle Gila	GR-SW-04	Primary Sample	Barium	64.5		µg/L	4	16	1		
Middle Gila	GR-SW-05	Primary Sample	Barium	62.5		µg/L	4	16	1		
Middle Gila	GR-SW-06	Primary Sample	Barium	62		µg/L	4	16	1		
Middle Gila	GR-SW-07	Primary Sample	Barium	64.5		µg/L	4	16	1		
Middle Gila	GR-SW-08	Primary Sample	Barium	65.7		µg/L	4	16	1		
Middle Gila	GR-SW-09	Primary Sample	Barium	68.7		µg/L	4	17	1		
Middle Gila	GR-SW-10	Primary Sample	Barium	63		µg/L	4	16	1		
Middle Gila	GR-SW-11	Primary Sample	Barium	68.1		µg/L	4	17	1		
Middle Gila	GR-SW-01	Primary Sample	Beryllium	0.18		µg/L	0.66	0.3	0		
Middle Gila	GR-SW-02	Primary Sample	Beryllium	0.25		µg/L	0.66	0.4	0		
Middle Gila	GR-SW-03	Primary Sample	Beryllium	0.22		µg/L	0.66	0.3	0		
Middle Gila	GR-SW-04	Primary Sample	Beryllium	0.22		µg/L	0.66	0.3	0		
Middle Gila	GR-SW-05	Primary Sample	Beryllium	0.31		µg/L	0.66	0.5	0		
Middle Gila	GR-SW-06	Primary Sample	Beryllium	8.3		µg/L	0.66	13	1		
Middle Gila	GR-SW-07	Primary Sample	Beryllium	5.3		µg/L	0.66	8.0	1		
Middle Gila	GR-SW-08	Primary Sample	Beryllium	0.81		µg/L	0.66	1.2	1		
Middle Gila	GR-SW-09	Primary Sample	Beryllium	0.22		µg/L	0.66	0.3	0		
Middle Gila	GR-SW-10	Primary Sample	Beryllium	0.41		µg/L	0.66	0.6	0		
Middle Gila	GR-SW-11	Primary Sample	Beryllium	0.37		µg/L	0.66	0.6	0		
Middle Gila	GR-SW-01	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
Middle Gila	GR-SW-02	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
Middle Gila	GR-SW-03	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
Middle Gila	GR-SW-04	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
Middle Gila	GR-SW-05	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
Middle Gila	GR-SW-06	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
Middle Gila	GR-SW-07	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
Middle Gila	GR-SW-08	Primary Sample	Beryllium	0.09		µg/L	0.66	0.1	0		
Middle Gila	GR-SW-09	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-10	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
Middle Gila	GR-SW-11	Primary Sample	Beryllium	0.07		µg/L	0.66	0.1	0		
Middle Gila	GR-SW-01	Primary Sample	Boron	114		µg/L	1.6	71	1		
Middle Gila	GR-SW-02	Primary Sample	Boron	119		µg/L	1.6	74	1		
Middle Gila	GR-SW-03	Primary Sample	Boron	116		µg/L	1.6	73	1		
Middle Gila	GR-SW-04	Primary Sample	Boron	113		µg/L	1.6	71	1		
Middle Gila	GR-SW-05	Primary Sample	Boron	113		µg/L	1.6	71	1		
Middle Gila	GR-SW-06	Primary Sample	Boron	140		µg/L	1.6	88	1		
Middle Gila	GR-SW-07	Primary Sample	Boron	132		µg/L	1.6	83	1		
Middle Gila	GR-SW-08	Primary Sample	Boron	127		µg/L	1.6	79	1		
Middle Gila	GR-SW-09	Primary Sample	Boron	126		µg/L	1.6	79	1		
Middle Gila	GR-SW-10	Primary Sample	Boron	128		µg/L	1.6	80	1		
Middle Gila	GR-SW-11	Primary Sample	Boron	126		µg/L	1.6	79	1		
Middle Gila	GR-SW-01	Primary Sample	Boron	129		µg/L	1.6	81	1		
Middle Gila	GR-SW-02	Primary Sample	Boron	128		µg/L	1.6	80	1		
Middle Gila	GR-SW-03	Primary Sample	Boron	125		µg/L	1.6	78	1		
Middle Gila	GR-SW-04	Primary Sample	Boron	131		µg/L	1.6	82	1		
Middle Gila	GR-SW-05	Primary Sample	Boron	124		µg/L	1.6	78	1		
Middle Gila	GR-SW-06	Primary Sample	Boron	124		µg/L	1.6	78	1		
Middle Gila	GR-SW-07	Primary Sample	Boron	130		µg/L	1.6	81	1		
Middle Gila	GR-SW-08	Primary Sample	Boron	130		µg/L	1.6	81	1		
Middle Gila	GR-SW-09	Primary Sample	Boron	139		µg/L	1.6	87	1		
Middle Gila	GR-SW-10	Primary Sample	Boron	125		µg/L	1.6	78	1		
Middle Gila	GR-SW-11	Primary Sample	Boron	136		µg/L	1.6	85	1		
Middle Gila	GR-SW-01	Primary Sample	Calcium	48600		µg/L	116000	0.4	0		
Middle Gila	GR-SW-02	Primary Sample	Calcium	48700		µg/L	116000	0.4	0		
Middle Gila	GR-SW-03	Primary Sample	Calcium	47600		µg/L	116000	0.4	0		
Middle Gila	GR-SW-04	Primary Sample	Calcium	46400		µg/L	116000	0.4	0		
Middle Gila	GR-SW-05	Primary Sample	Calcium	48500		µg/L	116000	0.4	0		
Middle Gila	GR-SW-06	Primary Sample	Calcium	381999		µg/L	116000	3.3	1		
Middle Gila	GR-SW-07	Primary Sample	Calcium	263001		µg/L	116000	2.3	1		
Middle Gila	GR-SW-08	Primary Sample	Calcium	90100		µg/L	116000	0.8	0		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-09	Primary Sample	Calcium	65000		µg/L	116000	0.6	0		
Middle Gila	GR-SW-10	Primary Sample	Calcium	73000		µg/L	116000	0.6	0		
Middle Gila	GR-SW-11	Primary Sample	Calcium	72500		µg/L	116000	0.6	0		
Middle Gila	GR-SW-01	Primary Sample	Calcium	58800		µg/L	116000	0.5	0		
Middle Gila	GR-SW-02	Primary Sample	Calcium	58400		µg/L	116000	0.5	0		
Middle Gila	GR-SW-03	Primary Sample	Calcium	58200		µg/L	116000	0.5	0		
Middle Gila	GR-SW-04	Primary Sample	Calcium	58400		µg/L	116000	0.5	0		
Middle Gila	GR-SW-05	Primary Sample	Calcium	58800		µg/L	116000	0.5	0		
Middle Gila	GR-SW-06	Primary Sample	Calcium	56500		µg/L	116000	0.5	0		
Middle Gila	GR-SW-07	Primary Sample	Calcium	59200		µg/L	116000	0.5	0		
Middle Gila	GR-SW-08	Primary Sample	Calcium	63400		µg/L	116000	0.5	0		
Middle Gila	GR-SW-09	Primary Sample	Calcium	66400		µg/L	116000	0.6	0		
Middle Gila	GR-SW-10	Primary Sample	Calcium	68500		µg/L	116000	0.6	0		
Middle Gila	GR-SW-11	Primary Sample	Calcium	68700		µg/L	116000	0.6	0		
Middle Gila	GR-SW-01	Primary Sample	Cobalt	2.7		µg/L	23	0.1	0		
Middle Gila	GR-SW-02	Primary Sample	Cobalt	2.6		µg/L	23	0.1	0		
Middle Gila	GR-SW-03	Primary Sample	Cobalt	2.5		µg/L	23	0.1	0		
Middle Gila	GR-SW-04	Primary Sample	Cobalt	2.4		µg/L	23	0.1	0		
Middle Gila	GR-SW-05	Primary Sample	Cobalt	2.8		µg/L	23	0.1	0		
Middle Gila	GR-SW-06	Primary Sample	Cobalt	39.2		µg/L	23	1.7	1		
Middle Gila	GR-SW-07	Primary Sample	Cobalt	27.7		µg/L	23	1.2	1		
Middle Gila	GR-SW-08	Primary Sample	Cobalt	5.6		µg/L	23	0.2	0		
Middle Gila	GR-SW-09	Primary Sample	Cobalt	2.6		µg/L	23	0.1	0		
Middle Gila	GR-SW-10	Primary Sample	Cobalt	3.9		µg/L	23	0.2	0		
Middle Gila	GR-SW-11	Primary Sample	Cobalt	3.3		µg/L	23	0.1	0		
Middle Gila	GR-SW-01	Primary Sample	Cobalt	0.5		µg/L	23	0.02	0		
Middle Gila	GR-SW-02	Primary Sample	Cobalt	0.46		µg/L	23	0.02	0		
Middle Gila	GR-SW-03	Primary Sample	Cobalt	0.49		µg/L	23	0.02	0		
Middle Gila	GR-SW-04	Primary Sample	Cobalt	0.44		µg/L	23	0.02	0		
Middle Gila	GR-SW-05	Primary Sample	Cobalt	0.45		µg/L	23	0.02	0		
Middle Gila	GR-SW-06	Primary Sample	Cobalt	0.43		µg/L	23	0.02	0		
Middle Gila	GR-SW-07	Primary Sample	Cobalt	0.45		µg/L	23	0.02	0		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-08	Primary Sample	Cobalt	0.53		µg/L	23	0.02	0		
Middle Gila	GR-SW-09	Primary Sample	Cobalt	0.56		µg/L	23	0.02	0		
Middle Gila	GR-SW-10	Primary Sample	Cobalt	0.49		µg/L	23	0.02	0		
Middle Gila	GR-SW-11	Primary Sample	Cobalt	0.63		µg/L	23	0.03	0		
Middle Gila	GR-SW-01	Primary Sample	Cyanide	6.1		µg/L	5.2	1.2	1		
Middle Gila	GR-SW-02	Primary Sample	Cyanide		4.8	µg/L	5.2			0.9	0
Middle Gila	GR-SW-03	Primary Sample	Cyanide		4.6	µg/L	5.2			0.9	0
Middle Gila	GR-SW-04	Primary Sample	Cyanide		3.8	µg/L	5.2			0.7	0
Middle Gila	GR-SW-05	Primary Sample	Cyanide		4.6	µg/L	5.2			0.9	0
Middle Gila	GR-SW-06	Primary Sample	Cyanide		4.4	µg/L	5.2			0.8	0
Middle Gila	GR-SW-07	Primary Sample	Cyanide		4.9	µg/L	5.2			0.9	0
Middle Gila	GR-SW-08	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-09	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-10	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-11	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-01	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-02	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-03	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-04	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-05	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-06	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-07	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-08	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-09	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-10	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-11	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
Middle Gila	GR-SW-01	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-02	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-03	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-04	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-05	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-06	Primary Sample	Dissolved Cadmium	0.42		µg/L	0.29	1.4	1		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-07	Primary Sample	Dissolved Cadmium	0.32		µg/L	0.29	1.1	1		
Middle Gila	GR-SW-08	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-09	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-10	Primary Sample	Dissolved Cadmium	0.02		µg/L	0.29	0.07	0		
Middle Gila	GR-SW-11	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-01	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-02	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-03	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-04	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-05	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-06	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-07	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-08	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-09	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-10	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-11	Primary Sample	Dissolved Cadmium		0.25	µg/L	0.29			0.9	0
Middle Gila	GR-SW-01	Primary Sample	Dissolved Copper	0.61		µg/L	11	0.06	0		
Middle Gila	GR-SW-02	Primary Sample	Dissolved Copper	2.6		µg/L	11	0.2	0		
Middle Gila	GR-SW-03	Primary Sample	Dissolved Copper	1.1		µg/L	11	0.1	0		
Middle Gila	GR-SW-04	Primary Sample	Dissolved Copper	0.82		µg/L	11	0.07	0		
Middle Gila	GR-SW-05	Primary Sample	Dissolved Copper	2.4		µg/L	11	0.2	0		
Middle Gila	GR-SW-06	Primary Sample	Dissolved Copper	43.5		µg/L	11	4.0	1		
Middle Gila	GR-SW-07	Primary Sample	Dissolved Copper	29.9		µg/L	11	2.7	1		
Middle Gila	GR-SW-08	Primary Sample	Dissolved Copper	2.5		µg/L	11	0.2	0		
Middle Gila	GR-SW-09	Primary Sample	Dissolved Copper	3.9		µg/L	11	0.4	0		
Middle Gila	GR-SW-10	Primary Sample	Dissolved Copper	4.2		µg/L	11	0.4	0		
Middle Gila	GR-SW-11	Primary Sample	Dissolved Copper	7.9		µg/L	11	0.7	0		
Middle Gila	GR-SW-01	Primary Sample	Dissolved Copper	2.2		µg/L	11	0.2	0		
Middle Gila	GR-SW-02	Primary Sample	Dissolved Copper	2.1		µg/L	11	0.2	0		
Middle Gila	GR-SW-03	Primary Sample	Dissolved Copper	7.3		µg/L	11	0.7	0		
Middle Gila	GR-SW-04	Primary Sample	Dissolved Copper	2.8		µg/L	11	0.3	0		
Middle Gila	GR-SW-05	Primary Sample	Dissolved Copper	3.7		µg/L	11	0.3	0		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-06	Primary Sample	Dissolved Copper	2.5		µg/L	11	0.2	0		
Middle Gila	GR-SW-07	Primary Sample	Dissolved Copper	2.4		µg/L	11	0.2	0		
Middle Gila	GR-SW-08	Primary Sample	Dissolved Copper	2.8		µg/L	11	0.3	0		
Middle Gila	GR-SW-09	Primary Sample	Dissolved Copper	2.9		µg/L	11	0.3	0		
Middle Gila	GR-SW-10	Primary Sample	Dissolved Copper	2.7		µg/L	11	0.2	0		
Middle Gila	GR-SW-11	Primary Sample	Dissolved Copper	2.6		µg/L	11	0.2	0		
Middle Gila	GR-SW-01	Primary Sample	Dissolved Lead	0.16		µg/L	3.3	0.05	0		
Middle Gila	GR-SW-02	Primary Sample	Dissolved Lead	0.07		µg/L	3.3	0.02	0		
Middle Gila	GR-SW-03	Primary Sample	Dissolved Lead	0.21		µg/L	3.3	0.06	0		
Middle Gila	GR-SW-04	Primary Sample	Dissolved Lead	0.06		µg/L	3.3	0.02	0		
Middle Gila	GR-SW-05	Primary Sample	Dissolved Lead	0.06		µg/L	3.3	0.02	0		
Middle Gila	GR-SW-06	Primary Sample	Dissolved Lead	27.7		µg/L	3.3	8.4	1		
Middle Gila	GR-SW-07	Primary Sample	Dissolved Lead	20.6		µg/L	3.3	6.2	1		
Middle Gila	GR-SW-08	Primary Sample	Dissolved Lead	0.2		µg/L	3.3	0.06	0		
Middle Gila	GR-SW-09	Primary Sample	Dissolved Lead	0.24		µg/L	3.3	0.07	0		
Middle Gila	GR-SW-10	Primary Sample	Dissolved Lead	1.1		µg/L	3.3	0.3	0		
Middle Gila	GR-SW-11	Primary Sample	Dissolved Lead	0.08		µg/L	3.3	0.02	0		
Middle Gila	GR-SW-01	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-02	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-03	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-04	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-05	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-06	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-07	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-08	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-09	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-10	Primary Sample	Dissolved Lead		0.06	µg/L	3.3			0.02	0
Middle Gila	GR-SW-11	Primary Sample	Dissolved Lead		1	µg/L	3.3			0.3	0
Middle Gila	GR-SW-01	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-02	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-03	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-04	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1

TABLE 5-3
Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-05	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-06	Primary Sample	Dissolved Mercury	0.076		µg/L	0.01	7.6	1		
Middle Gila	GR-SW-07	Primary Sample	Dissolved Mercury	0.068		µg/L	0.01	6.8	1		
Middle Gila	GR-SW-08	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-09	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-10	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-11	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-01	Primary Sample	Dissolved Mercury		0.043	µg/L	0.01			4.3	1
Middle Gila	GR-SW-02	Primary Sample	Dissolved Mercury		0.048	µg/L	0.01			4.8	1
Middle Gila	GR-SW-03	Primary Sample	Dissolved Mercury		0.042	µg/L	0.01			4.2	1
Middle Gila	GR-SW-04	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-05	Primary Sample	Dissolved Mercury		0.044	µg/L	0.01			4.4	1
Middle Gila	GR-SW-06	Primary Sample	Dissolved Mercury		0.042	µg/L	0.01			4.2	1
Middle Gila	GR-SW-07	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
Middle Gila	GR-SW-08	Primary Sample	Dissolved Mercury		0.038	µg/L	0.01			3.8	1
Middle Gila	GR-SW-09	Primary Sample	Dissolved Mercury		0.037	µg/L	0.01			3.7	1
Middle Gila	GR-SW-10	Primary Sample	Dissolved Mercury		0.043	µg/L	0.01			4.3	1
Middle Gila	GR-SW-11	Primary Sample	Dissolved Mercury		0.039	µg/L	0.01			3.9	1
Middle Gila	GR-SW-01	Primary Sample	Iron	3010		µg/L	1000	3.0	1		
Middle Gila	GR-SW-02	Primary Sample	Iron	2940		µg/L	1000	2.9	1		
Middle Gila	GR-SW-03	Primary Sample	Iron	2760		µg/L	1000	2.8	1		
Middle Gila	GR-SW-04	Primary Sample	Iron	2670		µg/L	1000	2.7	1		
Middle Gila	GR-SW-05	Primary Sample	Iron	3280		µg/L	1000	3.3	1		
Middle Gila	GR-SW-06	Primary Sample	Iron	34500		µg/L	1000	35	1		
Middle Gila	GR-SW-07	Primary Sample	Iron	29800		µg/L	1000	30	1		
Middle Gila	GR-SW-08	Primary Sample	Iron	7110		µg/L	1000	7.1	1		
Middle Gila	GR-SW-09	Primary Sample	Iron	3010		µg/L	1000	3.0	1		
Middle Gila	GR-SW-10	Primary Sample	Iron	4690		µg/L	1000	4.7	1		
Middle Gila	GR-SW-11	Primary Sample	Iron	4420		µg/L	1000	4.4	1		
Middle Gila	GR-SW-01	Primary Sample	Iron	505		µg/L	1000	0.5	0		
Middle Gila	GR-SW-02	Primary Sample	Iron	581		µg/L	1000	0.6	0		
Middle Gila	GR-SW-03	Primary Sample	Iron	527		µg/L	1000	0.5	0		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-04	Primary Sample	Iron	580		µg/L	1000	0.6	0		
Middle Gila	GR-SW-05	Primary Sample	Iron	628		µg/L	1000	0.6	0		
Middle Gila	GR-SW-06	Primary Sample	Iron	545		µg/L	1000	0.5	0		
Middle Gila	GR-SW-07	Primary Sample	Iron	507		µg/L	1000	0.5	0		
Middle Gila	GR-SW-08	Primary Sample	Iron	718		µg/L	1000	0.7	0		
Middle Gila	GR-SW-09	Primary Sample	Iron	687		µg/L	1000	0.7	0		
Middle Gila	GR-SW-10	Primary Sample	Iron	640		µg/L	1000	0.6	0		
Middle Gila	GR-SW-11	Primary Sample	Iron	738		µg/L	1000	0.7	0		
Middle Gila	GR-SW-01	Primary Sample	Manganese	301		µg/L	120	2.5	1		
Middle Gila	GR-SW-02	Primary Sample	Manganese	293		µg/L	120	2.4	1		
Middle Gila	GR-SW-03	Primary Sample	Manganese	291		µg/L	120	2.4	1		
Middle Gila	GR-SW-04	Primary Sample	Manganese	284		µg/L	120	2.4	1		
Middle Gila	GR-SW-05	Primary Sample	Manganese	314		µg/L	120	2.6	1		
Middle Gila	GR-SW-06	Primary Sample	Manganese	3540		µg/L	120	30	1		
Middle Gila	GR-SW-07	Primary Sample	Manganese	2510		µg/L	120	21	1		
Middle Gila	GR-SW-08	Primary Sample	Manganese	561		µg/L	120	4.7	1		
Middle Gila	GR-SW-09	Primary Sample	Manganese	339		µg/L	120	2.8	1		
Middle Gila	GR-SW-10	Primary Sample	Manganese	414		µg/L	120	3.5	1		
Middle Gila	GR-SW-11	Primary Sample	Manganese	403		µg/L	120	3.4	1		
Middle Gila	GR-SW-01	Primary Sample	Manganese	105		µg/L	120	0.9	0		
Middle Gila	GR-SW-02	Primary Sample	Manganese	97.9		µg/L	120	0.8	0		
Middle Gila	GR-SW-03	Primary Sample	Manganese	97.4		µg/L	120	0.8	0		
Middle Gila	GR-SW-04	Primary Sample	Manganese	89.8		µg/L	120	0.7	0		
Middle Gila	GR-SW-05	Primary Sample	Manganese	81.3		µg/L	120	0.7	0		
Middle Gila	GR-SW-06	Primary Sample	Manganese	80.5		µg/L	120	0.7	0		
Middle Gila	GR-SW-07	Primary Sample	Manganese	94.1		µg/L	120	0.8	0		
Middle Gila	GR-SW-08	Primary Sample	Manganese	139		µg/L	120	1.2	1		
Middle Gila	GR-SW-09	Primary Sample	Manganese	145		µg/L	120	1.2	1		
Middle Gila	GR-SW-10	Primary Sample	Manganese	134		µg/L	120	1.1	1		
Middle Gila	GR-SW-11	Primary Sample	Manganese	146		µg/L	120	1.2	1		
Middle Gila	GR-SW-01	Primary Sample	Selenium	0.63		µg/L	2	0.3	0		
Middle Gila	GR-SW-02	Primary Sample	Selenium	0.61		µg/L	2	0.3	0		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-03	Primary Sample	Selenium	0.53		µg/L	2	0.3	0		
Middle Gila	GR-SW-04	Primary Sample	Selenium	0.54		µg/L	2	0.3	0		
Middle Gila	GR-SW-05	Primary Sample	Selenium	0.52		µg/L	2	0.3	0		
Middle Gila	GR-SW-06	Primary Sample	Selenium	2		µg/L	2	1.0	1		
Middle Gila	GR-SW-07	Primary Sample	Selenium	1.4		µg/L	2	0.7	0		
Middle Gila	GR-SW-08	Primary Sample	Selenium	0.8		µg/L	2	0.4	0		
Middle Gila	GR-SW-09	Primary Sample	Selenium	0.88		µg/L	2	0.4	0		
Middle Gila	GR-SW-10	Primary Sample	Selenium	0.83		µg/L	2	0.4	0		
Middle Gila	GR-SW-11	Primary Sample	Selenium	0.67		µg/L	2	0.3	0		
Middle Gila	GR-SW-01	Primary Sample	Selenium	0.53		µg/L	2	0.3	0		
Middle Gila	GR-SW-02	Primary Sample	Selenium	0.45		µg/L	2	0.2	0		
Middle Gila	GR-SW-03	Primary Sample	Selenium	0.38		µg/L	2	0.2	0		
Middle Gila	GR-SW-04	Primary Sample	Selenium	0.54		µg/L	2	0.3	0		
Middle Gila	GR-SW-05	Primary Sample	Selenium	0.49		µg/L	2	0.2	0		
Middle Gila	GR-SW-06	Primary Sample	Selenium	0.38		µg/L	2	0.2	0		
Middle Gila	GR-SW-07	Primary Sample	Selenium	0.39		µg/L	2	0.2	0		
Middle Gila	GR-SW-08	Primary Sample	Selenium	0.9		µg/L	2	0.5	0		
Middle Gila	GR-SW-09	Primary Sample	Selenium	0.97		µg/L	2	0.5	0		
Middle Gila	GR-SW-10	Primary Sample	Selenium	0.49		µg/L	2	0.2	0		
Middle Gila	GR-SW-11	Primary Sample	Selenium	0.44		µg/L	2	0.2	0		
Middle Gila	GR-SW-01	Primary Sample	Silver		0.04	µg/L	0.5			0.08	0
Middle Gila	GR-SW-02	Primary Sample	Silver		0.03	µg/L	0.5			0.06	0
Middle Gila	GR-SW-03	Primary Sample	Silver		0.02	µg/L	0.5			0.04	0
Middle Gila	GR-SW-04	Primary Sample	Silver		0.03	µg/L	0.5			0.06	0
Middle Gila	GR-SW-05	Primary Sample	Silver		0.03	µg/L	0.5			0.06	0
Middle Gila	GR-SW-06	Primary Sample	Silver		0.77	µg/L	0.5			1.5	1
Middle Gila	GR-SW-07	Primary Sample	Silver		0.61	µg/L	0.5			1.2	1
Middle Gila	GR-SW-08	Primary Sample	Silver		0.1	µg/L	0.5			0.2	0
Middle Gila	GR-SW-09	Primary Sample	Silver		0.03	µg/L	0.5			0.06	0
Middle Gila	GR-SW-10	Primary Sample	Silver		0.05	µg/L	0.5			0.1	0
Middle Gila	GR-SW-11	Primary Sample	Silver		0.05	µg/L	0.5			0.1	0
Middle Gila	GR-SW-01	Primary Sample	Silver		0.36	µg/L	0.5			0.7	0

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-02	Primary Sample	Silver		0.36	µg/L	0.5			0.7	0
Middle Gila	GR-SW-03	Primary Sample	Silver	0.08		µg/L	0.5	0.2	0		
Middle Gila	GR-SW-04	Primary Sample	Silver		0.36	µg/L	0.5			0.7	0
Middle Gila	GR-SW-05	Primary Sample	Silver		0.36	µg/L	0.5			0.7	0
Middle Gila	GR-SW-06	Primary Sample	Silver	0.06		µg/L	0.5	0.1	0		
Middle Gila	GR-SW-07	Primary Sample	Silver		0.36	µg/L	0.5			0.7	0
Middle Gila	GR-SW-08	Primary Sample	Silver		0.36	µg/L	0.5			0.7	0
Middle Gila	GR-SW-09	Primary Sample	Silver		0.36	µg/L	0.5			0.7	0
Middle Gila	GR-SW-10	Primary Sample	Silver		0.36	µg/L	0.5			0.7	0
Middle Gila	GR-SW-11	Primary Sample	Silver	0.04		µg/L	0.5	0.08	0		
Middle Gila	GR-SW-01	Primary Sample	Total Dissolved Solids	430000		µg/L	723000	0.6	0		
Middle Gila	GR-SW-02	Primary Sample	Total Dissolved Solids	430000		µg/L	723000	0.6	0		
Middle Gila	GR-SW-03	Primary Sample	Total Dissolved Solids	440000		µg/L	723000	0.6	0		
Middle Gila	GR-SW-04	Primary Sample	Total Dissolved Solids	440000		µg/L	723000	0.6	0		
Middle Gila	GR-SW-05	Primary Sample	Total Dissolved Solids	440000		µg/L	723000	0.6	0		
Middle Gila	GR-SW-06	Primary Sample	Total Dissolved Solids	480000		µg/L	723000	0.7	0		
Middle Gila	GR-SW-07	Primary Sample	Total Dissolved Solids	780000		µg/L	723000	1.1	1		
Middle Gila	GR-SW-08	Primary Sample	Total Dissolved Solids	560000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-09	Primary Sample	Total Dissolved Solids	540000		µg/L	723000	0.7	0		
Middle Gila	GR-SW-10	Primary Sample	Total Dissolved Solids	560000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-11	Primary Sample	Total Dissolved Solids	560000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-01	Primary Sample	Total Dissolved Solids	570000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-02	Primary Sample	Total Dissolved Solids	560000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-03	Primary Sample	Total Dissolved Solids	560000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-04	Primary Sample	Total Dissolved Solids	570000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-05	Primary Sample	Total Dissolved Solids	560000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-06	Primary Sample	Total Dissolved Solids	570000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-07	Primary Sample	Total Dissolved Solids	570000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-08	Primary Sample	Total Dissolved Solids	610000		µg/L	723000	0.8	0		
Middle Gila	GR-SW-09	Primary Sample	Total Dissolved Solids	620000		µg/L	723000	0.9	0		
Middle Gila	GR-SW-10	Primary Sample	Total Dissolved Solids	620000		µg/L	723000	0.9	0		
Middle Gila	GR-SW-11	Primary Sample	Total Dissolved Solids	620000		µg/L	723000	0.9	0		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila	GR-SW-01	Primary Sample	Vanadium	15.1		µg/L	20	0.8	0		
Middle Gila	GR-SW-02	Primary Sample	Vanadium	14.8		µg/L	20	0.7	0		
Middle Gila	GR-SW-03	Primary Sample	Vanadium	14.6		µg/L	20	0.7	0		
Middle Gila	GR-SW-04	Primary Sample	Vanadium	14.5		µg/L	20	0.7	0		
Middle Gila	GR-SW-05	Primary Sample	Vanadium	15.5		µg/L	20	0.8	0		
Middle Gila	GR-SW-06	Primary Sample	Vanadium	56.6		µg/L	20	2.8	1		
Middle Gila	GR-SW-07	Primary Sample	Vanadium	49.2		µg/L	20	2.5	1		
Middle Gila	GR-SW-08	Primary Sample	Vanadium	20.9		µg/L	20	1.0	1		
Middle Gila	GR-SW-09	Primary Sample	Vanadium	15		µg/L	20	0.8	0		
Middle Gila	GR-SW-10	Primary Sample	Vanadium	17.8		µg/L	20	0.9	0		
Middle Gila	GR-SW-11	Primary Sample	Vanadium	16.8		µg/L	20	0.8	0		
Middle Gila	GR-SW-01	Primary Sample	Vanadium	6.2		µg/L	20	0.3	0		
Middle Gila	GR-SW-02	Primary Sample	Vanadium	6.2		µg/L	20	0.3	0		
Middle Gila	GR-SW-03	Primary Sample	Vanadium	6.1		µg/L	20	0.3	0		
Middle Gila	GR-SW-04	Primary Sample	Vanadium	5.9		µg/L	20	0.3	0		
Middle Gila	GR-SW-05	Primary Sample	Vanadium	5.6		µg/L	20	0.3	0		
Middle Gila	GR-SW-06	Primary Sample	Vanadium	5.7		µg/L	20	0.3	0		
Middle Gila	GR-SW-07	Primary Sample	Vanadium	5.9		µg/L	20	0.3	0		
Middle Gila	GR-SW-08	Primary Sample	Vanadium	6		µg/L	20	0.3	0		
Middle Gila	GR-SW-09	Primary Sample	Vanadium	6.4		µg/L	20	0.3	0		
Middle Gila	GR-SW-10	Primary Sample	Vanadium	5.9		µg/L	20	0.3	0		
Middle Gila	GR-SW-11	Primary Sample	Vanadium	6.4		µg/L	20	0.3	0		
San Pedro	SPR-SW-01	Primary Sample	Aluminum	3130		µg/L	87	36	1		
San Pedro	SPR-SW-02	Primary Sample	Aluminum	3660		µg/L	87	42	1		
San Pedro	SPR-SW-01	Primary Sample	Aluminum	765		µg/L	87	8.8	1		
San Pedro	SPR-SW-02	Primary Sample	Aluminum	64.5		µg/L	87	0.7	0		
San Pedro	SPR-SW-01	Primary Sample	Barium	345		µg/L	4	86	1		
San Pedro	SPR-SW-02	Primary Sample	Barium	373		µg/L	4	93	1		
San Pedro	SPR-SW-01	Primary Sample	Barium	81.2		µg/L	4	20	1		
San Pedro	SPR-SW-02	Primary Sample	Barium	68.1		µg/L	4	17	1		
San Pedro	SPR-SW-01	Primary Sample	Beryllium	0.82		µg/L	0.66	1.2	1		
San Pedro	SPR-SW-02	Primary Sample	Beryllium	1.1		µg/L	0.66	1.7	1		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
San Pedro	SPR-SW-01	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
San Pedro	SPR-SW-02	Primary Sample	Beryllium		0.66	µg/L	0.66			1.0	1
San Pedro	SPR-SW-01	Primary Sample	Boron	159		µg/L	1.6	99	1		
San Pedro	SPR-SW-02	Primary Sample	Boron	172		µg/L	1.6	108	1		
San Pedro	SPR-SW-01	Primary Sample	Boron	188		µg/L	1.6	118	1		
San Pedro	SPR-SW-02	Primary Sample	Boron	225		µg/L	1.6	141	1		
San Pedro	SPR-SW-01	Primary Sample	Calcium	159999		µg/L	116000	1.4	1		
San Pedro	SPR-SW-02	Primary Sample	Calcium	171999		µg/L	116000	1.5	1		
San Pedro	SPR-SW-01	Primary Sample	Calcium	135000		µg/L	116000	1.2	1		
San Pedro	SPR-SW-02	Primary Sample	Calcium	123000		µg/L	116000	1.1	1		
San Pedro	SPR-SW-01	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
San Pedro	SPR-SW-02	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
San Pedro	SPR-SW-01	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
San Pedro	SPR-SW-02	Primary Sample	Cyanide		10	µg/L	5.2			1.9	1
San Pedro	SPR-SW-01	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
San Pedro	SPR-SW-02	Primary Sample	Dissolved Mercury		0.2	µg/L	0.01			20	1
San Pedro	SPR-SW-01	Primary Sample	Dissolved Mercury		0.053	µg/L	0.01			5.3	1
San Pedro	SPR-SW-02	Primary Sample	Dissolved Mercury		0.048	µg/L	0.01			4.8	1
San Pedro	SPR-SW-01	Primary Sample	Iron	7180		µg/L	1000	7.2	1		
San Pedro	SPR-SW-02	Primary Sample	Iron	8970		µg/L	1000	9.0	1		
San Pedro	SPR-SW-01	Primary Sample	Iron	552		µg/L	1000	0.6	0		
San Pedro	SPR-SW-02	Primary Sample	Iron		47.3	µg/L	1000			0.05	0
San Pedro	SPR-SW-01	Primary Sample	Manganese	471		µg/L	120	3.9	1		
San Pedro	SPR-SW-02	Primary Sample	Manganese	538		µg/L	120	4.5	1		
San Pedro	SPR-SW-01	Primary Sample	Manganese	31.6		µg/L	120	0.3	0		
San Pedro	SPR-SW-02	Primary Sample	Manganese	92		µg/L	120	0.8	0		
San Pedro	SPR-SW-01	Primary Sample	Total Dissolved Solids	920000		µg/L	723000	1.3	1		
San Pedro	SPR-SW-02	Primary Sample	Total Dissolved Solids	940000		µg/L	723000	1.3	1		
San Pedro	SPR-SW-01	Primary Sample	Total Dissolved Solids	980000		µg/L	723000	1.4	1		
San Pedro	SPR-SW-02	Primary Sample	Total Dissolved Solids	980000		µg/L	723000	1.4	1		
San Pedro	SPR-SW-01	Primary Sample	Vanadium	18.9		µg/L	20	0.9	0		
San Pedro	SPR-SW-02	Primary Sample	Vanadium	21.7		µg/L	20	1.1	1		

TABLE 5-3

Detailed Point-by-Point Risk Evaluation of Onsite Surface Water Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	LocID	SampType	Parameter	Conc	DL	Units	Water Chronic Benchmark (ug/L)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
San Pedro	SPR-SW-01	Primary Sample	Vanadium	4.9		µg/L	20	0.2	0		
San Pedro	SPR-SW-02	Primary Sample	Vanadium	4.4		µg/L	20	0.2	0		

Notes:

Conc = concentration

Det = indicates whether the chemical is detected. A "1" is used to indicate detected, a "0" is used to indicate non-detect.

DL = detection limit

HQ = hazard quotient

HQ G1 = Indicates whether HQ is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.

HQ_{DL} = hazard quotient based on detection limit

HQ_{DL} G1 = Indicates whether HQ based on the detection limit (for non-detects) is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.

LocID = sample location identifier

µg/L = micrograms per liter

TABLE 5-4
Summary of the Point-by-Point Analysis for Freshwater Aquatic Organisms
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

		Evaluation on Detected Concentration						Evaluation on Detection Limit			
Parameter	**Chronic Benchmark (µg/L)**	**DF**	**Percent Detects**	**Water Concentration Range (ug/L)**	**HQ Range**	**EF**	**Percent Exceedance**	**DL Range**	**HQ_{DL} Range**	**EF**	**Percent Exceedance**
On-Site Middle Gila River Surface Water											
Aluminum	87	22/22	100	738 - 62000	8.5 - 713	22/22	100			0/22	0
Barium	4	22/22	100	61.5 - 1190	15.4 - 298	22/22	100			0/22	0
Beryllium	0.66	13/22	59	0.07 - 8.3	0.11 - 12.6	3/22	14	0.66	1	9/22	41
Boron	1.6	22/22	100	113 - 140	70.6 - 87.5	22/22	100			0/22	0
Calcium	116000	22/22	100	46400 - 381999	0.4 - 3.3	2/22	9			0/22	0
Cobalt	23	22/22	100	0.43 - 39.2	0.02 - 1.7	2/22	9			0/22	0
Cyanide	5.2	1/22	5	6.1	1.2	1/22	5	3.8 - 10	0.73 - 1.9	15/22	68
Dissolved Cadmium	0.29	3/22	14	0.02 - 0.42	0.07 - 1.4	2/22	9	0.25	0.86	0/22	0
Dissolved Copper	11	22/22	100	0.61 - 43.5	0.06 - 4	2/22	9			0/22	0
Dissolved Lead	3.3	11/22	50	0.06 - 27.7	0.02 - 8.4	2/22	9	0.06 - 1	0.02 - 0.3	0/22	0
Dissolved Mercury	0.01	2/22	9	0.068 - 0.076	6.8 - 7.6	2/22	9	0.037 - 0.2	3.7 - 20	20/22	91
Iron	1000	22/22	100	505 - 34500	0.51 - 34.5	11/22	50			0/22	0
Manganese	120	22/22	100	80.5 - 3540	0.67 - 29.5	15/22	68			0/22	0
Selenium	2	22/22	100	0.38 - 2	0.19 - 1	1/22	5			0/22	0
Silver	0.5	3/22	14	0.04 - 0.08	0.08 - 0.16	0/22	0	0.02 - 0.77	0.04 - 1.5	2/22	9
Total Dissolved Solids	723000	22/22	100	430000 - 780000	0.59 - 1.1	1/22	5			0/22	0
Vanadium	20	22/22	100	5.6 - 56.6	0.28 - 2.8	3/22	14			0/22	0
On-Site San Pedro River Surface Water											
Aluminum	87	4/4	100	64.5 - 3660	0.74 - 42.1	3/4	75			0/4	0
Barium	4	4/4	100	68.1 - 373	17 - 93.3	4/4	100			0/4	0
Beryllium	0.66	2/4	50	0.82 - 1.1	1.2 - 1.7	2/4	50	0.66	1	2/4	50
Boron	1.6	4/4	100	159 - 225	99.4 - 140.6	4/4	100			0/4	0
Calcium	116000	4/4	100	123000 - 171999	1.1 - 1.5	4/4	100			0/4	0
Cyanide	5.2	0/4	0			0/4	0	10	1.9	4/4	100
Dissolved Mercury	0.01	0/4	0			0/4	0	0.048 - 0.2	4.8 - 20	4/4	100
Iron	1000	3/4	75	552 - 8970	0.55 - 9	2/4	50	47.3	0.05	0/4	0
Manganese	120	4/4	100	31.6 - 538	0.26 - 4.5	2/4	50			0/4	0
Total Dissolved Solids	723000	4/4	100	920000 - 980000	1.3 - 1.4	4/4	100			0/4	0
Vanadium	20	4/4	100	4.4 - 21.7	0.22 - 1.1	1/4	25			0/4	0

Notes:
DF = detection frequency (i.e. 22/22 = 22 detections out of 22 samples)
DL = detection limit
DW = dry weight
EF = exceedance frequency (i.e. 1/22 = 1 exceedance of the benchmark out of 22 samples)
HQ = hazard quotient
HQ_{DL} = hazard quotient based on detection limit
TRV = toxicity reference value (i.e. benchmark)
µg/L = micrograms per liter

TABLE 5-5

Summary of Fish Monitoring Data for the San Pedro (SPR) and Gila (GR) Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Year	Upstream SPR (Swingle Wash)	Onsite SPR (Mouth)	Upstream GR (O'Carroll Canyon)	Onsite GR (San Pedro River)	Downstream GR (Kearny)	Source
1995	604 fish, 3 species, 1 native species	2511 fish, 3 species, 1 native species	62 fish, 4 species, 3 native species	Not sampled - right of access issues	Not sampled - right of access issues	Clarkson 1998
1996	258 fish, 8 species, 3 native species	1580 fish, 6 species, 3 native species	No fish collected	Not sampled - right of access issues	Not sampled - right of access issues	Clarkson 1998
1997	48 fish, 6 species, 2 native species	76 fish, 7 species, 3 native species	235 fish, 9 species, 3 native species	155 fish, 11 species, 2 native species	103 fish, 9 species, 1 native species	Clarkson 1999
1998	76 fish, 9 species, 3 native species	67 fish, 8 species, 3 native species	174 fish, 8 species, 2 native species	371 fish, 11 species, 3 native species	98 fish, 8 species, 2 native species	Marsh 1999
1999	49 fish, 8 species, 3 native species	42 fish, 4 species, 1 native species	796 fish, 9 species, 1 native species	214 fish, 7 species, 1 native species	62 fish, 2 species, no native	Clarkson 2002
2001	48 fish, 5 species, 1 native species	25 fish, 4 species, 1 native species	58 fish, 6 species, 1 native species	58 fish, 8 species, 2 native species	45 fish, 6 species, 1 native species	Marsh 2004a
2002	7 fish, 1 species, no native	Not sampled - dry streambed	138 fish, 8 species, no native	45 fish, 3 species, no native	Not sampled - dry streambed	Marsh 2004b
2003	Not sampled - dry streambed	Not sampled - dry streambed	12 fish, 4species, no native	No fish collected	No fish collected	Marsh and Kesner 2007a
2004	Not sampled - dry streambed	Not sampled - dry streambed	Not sampled - access issues	Not sampled - dry streambed	Not sampled - dry streambed	Marsh and Kesner 2005
2005	190 fish, 4 species, 1 native species	4 fish, 1 species, no native	16 fish, 4 species, no native	Not sampled due to weather	49 fish, 3 species, no native	Marsh 2006
2006	14 fish, 5 species, no native	8 fish, 3 species, no native	50 fish, 6 species, no native	18 fish, 4 species, no native	19 fish, 4 species, no native	Marsh and Kesner 2007b

Note:

The data presented provide a general summary of the available fish monitoring data. The specific species and the number of individuals collected for each species are provided in the referenced reports.

TABLE 5-6

Detailed Point-by-Point Risk Evaluation of Onsite Sediment (mg/kg dw) Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	Matrix	Type	SampType	LocID	Parameter	Conc	DL	Low Sediment TRV (mg/kg dw)	Low TRV HQ	Low TRV HQ G1	Low TRV HQ_{DL}	Low TRV HQ_{DL} G1	High Sediment TRV (mg/kg dw)	High TRV HQ	High TRV HQ G1	High TRV HQ_{DL}	High TRV HQ_{DL} G1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Aluminum	16200		14000	1.2	1			58000	0.28	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Aluminum	18400		14000	1.3	1			58000	0.32	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Aluminum	20400		14000	1.5	1			58000	0.35	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Aluminum	8850		14000	0.63	0			58000	0.15	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Aluminum	4240		14000	0.30	0			58000	0.073	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Aluminum	11400		14000	0.81	0			58000	0.20	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Aluminum	17200		14000	1.2	1			58000	0.30	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Aluminum	18400		14000	1.3	1			58000	0.32	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Aluminum	14900		14000	1.1	1			58000	0.26	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Aluminum	13100		14000	0.94	0			58000	0.23	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Aluminum	13700		14000	0.98	0			58000	0.24	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Aluminum	17500		14000	1.3	1			58000	0.30	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Aluminum	17800		14000	1.3	1			58000	0.31	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Aluminum	19400		14000	1.4	1			58000	0.33	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Aluminum	6750		14000	0.48	0			58000	0.12	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Aluminum	13200		14000	0.94	0			58000	0.23	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Aluminum	12800		14000	0.91	0			58000	0.22	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Aluminum	20300		14000	1.5	1			58000	0.35	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Aluminum	18900		14000	1.4	1			58000	0.33	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Aluminum	13000		14000	0.93	0			58000	0.22	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Aluminum	16300		14000	1.2	1			58000	0.28	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Aluminum	20000		14000	1.4	1			58000	0.34	0		
Middle Gila	Sediment	onsite	Primary Sample	GRaboveW	Aluminum	20069		14000	1.4	1			58000	0.35	0		
Middle Gila	Sediment	onsite	Primary Sample	GRatSPR	Aluminum	26679		14000	1.9	1			58000	0.46	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Cadmium		0.47	0.99			0.47	0	4.98			0.09	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Cadmium		0.46	0.99			0.46	0	4.98			0.09	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Cadmium		0.5	0.99			0.51	0	4.98			0.10	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Cadmium		0.46	0.99			0.46	0	4.98			0.09	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Cadmium		0.5	0.99			0.51	0	4.98			0.10	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Cadmium		0.48	0.99			0.48	0	4.98			0.10	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Cadmium		0.59	0.99			0.60	0	4.98			0.12	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Cadmium		0.68	0.99			0.69	0	4.98			0.14	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Cadmium		0.59	0.99			0.60	0	4.98			0.12	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Cadmium		0.56	0.99			0.57	0	4.98			0.11	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Cadmium		0.58	0.99			0.59	0	4.98			0.12	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Cadmium		0.42	0.99			0.42	0	4.98			0.08	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Cadmium		0.82	0.99			0.83	0	4.98			0.16	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Cadmium	0.06		0.99	0.06	0			4.98	0.01	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Cadmium		0.52	0.99			0.53	0	4.98			0.10	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Cadmium		0.52	0.99			0.53	0	4.98			0.10	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Cadmium		0.69	0.99			0.70	0	4.98			0.14	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Cadmium	0.04		0.99	0.04	0			4.98	0.01	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Cadmium		1.1	0.99			1.1	1	4.98			0.22	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Cadmium	1.1		0.99	1.1	1			4.98	0.22	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Cadmium	0.03		0.99	0.03	0			4.98	0.01	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Cadmium	0.11		0.99	0.11	0			4.98	0.02	0		
Middle Gila	Sediment	onsite	Primary Sample	GRaboveW	Cadmium	0.35		0.99	0.35	0			4.98	0.07	0		
Middle Gila	Sediment	onsite	Primary Sample	GRatSPR	Cadmium	0.37		0.99	0.37	0			4.98	0.07	0		

TABLE 5-6
Detailed Point-by-Point Risk Evaluation of Onsite Sediment (mg/kg dw) Collected from the Middle Gila and San Pedro Rivers
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	Matrix	Type	SampType	LocID	Parameter	Conc	DL	Low Sediment TRV (mg/kg dw)	Low TRV HQ	Low TRV HQ G1	Low TRV HQ_{DL}	Low TRV HQ_{DL} G1	High Sediment TRV (mg/kg dw)	High TRV HQ	High TRV HQ G1	High TRV HQ_{DL}	High TRV HQ_{DL} G1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Copper	57.5		31.6	1.8	1			149	0.39	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Copper	74.8		31.6	2.4	1			149	0.50	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Copper	71.9		31.6	2.3	1			149	0.48	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Copper	49.9		31.6	1.6	1			149	0.33	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Copper	11.6		31.6	0.37	0			149	0.078	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Copper	68.1		31.6	2.2	1			149	0.46	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Copper	134		31.6	4.2	1			149	0.90	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Copper	142		31.6	4.5	1			149	0.95	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Copper	93		31.6	2.9	1			149	0.62	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Copper	91.7		31.6	2.9	1			149	0.62	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Copper	107		31.6	3.4	1			149	0.72	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Copper	45		31.6	1.4	1			149	0.30	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Copper	191		31.6	6.0	1			149	1.3	1		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Copper	392		31.6	12.4	1			149	2.6	1		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Copper	29.3		31.6	0.93	0			149	0.20	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Copper	88.2		31.6	2.8	1			149	0.59	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Copper	96		31.6	3.0	1			149	0.64	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Copper	158		31.6	5.0	1			149	1.1	1		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Copper	177		31.6	5.6	1			149	1.2	1		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Copper	109		31.6	3.4	1			149	0.73	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Copper	147		31.6	4.7	1			149	0.99	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Copper	144		31.6	4.6	1			149	0.97	0		
Middle Gila	Sediment	onsite	Primary Sample	GRaboveW	Copper	70		31.6	2.2	1			149	0.47	0		
Middle Gila	Sediment	onsite	Primary Sample	GRatSPR	Copper	135		31.6	4.3	1			149	0.91	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Cyanide		3.1	0.1			31.0	1	0.25			12	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Cyanide		2.9	0.1			29.0	1	0.25			12	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Cyanide		3.3	0.1			33.0	1	0.25			13	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Cyanide		3.1	0.1			31.0	1	0.25			12	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Cyanide		3.1	0.1			31.0	1	0.25			12	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Cyanide		3.3	0.1			33.0	1	0.25			13	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Cyanide		3.8	0.1			38.0	1	0.25			15	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Cyanide		4.2	0.1			42.0	1	0.25			17	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Cyanide		3.9	0.1			39.0	1	0.25			16	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Cyanide		3.8	0.1			38.0	1	0.25			15	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Cyanide		3.7	0.1			37.0	1	0.25			15	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Cyanide		2.6	0.1			26.0	1	0.25			10	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Cyanide		5.1	0.1			51.0	1	0.25			20	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Cyanide		6.1	0.1			61.0	1	0.25			24	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Cyanide		3.2	0.1			32.0	1	0.25			13	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Cyanide		3.3	0.1			33.0	1	0.25			13	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Cyanide		4.3	0.1			43.0	1	0.25			17	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Cyanide		5.1	0.1			51.0	1	0.25			20	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Cyanide		4.1	0.1			41.0	1	0.25			16	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Cyanide		6.9	0.1			69.0	1	0.25			28	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Cyanide		4.8	0.1			48.0	1	0.25			19	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Cyanide		4.1	0.1			41.0	1	0.25			16	1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Manganese	508		730	0.70	0			1700	0.30	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Manganese	440		730	0.60	0			1700	0.26	0		

TABLE 5-6
Detailed Point-by-Point Risk Evaluation of Onsite Sediment (mg/kg dw) Collected from the Middle Gila and San Pedro Rivers
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	Matrix	Type	SampType	LocID	Parameter	Conc	DL	Low Sediment TRV (mg/kg dw)	Low TRV HQ	Low TRV HQ G1	Low TRV HQ_{DL}	Low TRV HQ_{DL} G1	High Sediment TRV (mg/kg dw)	High TRV HQ	High TRV HQ G1	High TRV HQ_{DL}	High TRV HQ_{DL} G1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Manganese	461		730	0.63	0			1700	0.27	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Manganese	286		730	0.39	0			1700	0.17	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Manganese	113		730	0.15	0			1700	0.07	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Manganese	467		730	0.64	0			1700	0.27	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Manganese	574		730	0.79	0			1700	0.34	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Manganese	665		730	0.91	0			1700	0.39	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Manganese	573		730	0.78	0			1700	0.34	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Manganese	473		730	0.65	0			1700	0.28	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Manganese	576		730	0.79	0			1700	0.34	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Manganese	515		730	0.71	0			1700	0.30	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Manganese	2270		730	3.1	1			1700	1.3	1		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Manganese	2410		730	3.3	1			1700	1.4	1		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Manganese	201		730	0.28	0			1700	0.12	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Manganese	437		730	0.60	0			1700	0.26	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Manganese	458		730	0.63	0			1700	0.27	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Manganese	1080		730	1.5	1			1700	0.64	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Manganese	1010		730	1.4	1			1700	0.59	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Manganese	1410		730	1.9	1			1700	0.83	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Manganese	1470		730	2.0	1			1700	0.86	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Manganese	1170		730	1.6	1			1700	0.69	0		
Middle Gila	Sediment	onsite	Primary Sample	GRaboveW	Manganese	521		730	0.71	0			1700	0.31	0		
Middle Gila	Sediment	onsite	Primary Sample	GRatSPR	Manganese	838		730	1.1	1			1700	0.49	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Nickel	15.1		22.7	0.67	0			48.6	0.31	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Nickel	13.7		22.7	0.60	0			48.6	0.28	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Nickel	14		22.7	0.62	0			48.6	0.29	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Nickel	10		22.7	0.44	0			48.6	0.21	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Nickel	6.1		22.7	0.27	0			48.6	0.13	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Nickel	14		22.7	0.62	0			48.6	0.29	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Nickel	18		22.7	0.79	0			48.6	0.37	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Nickel	19		22.7	0.84	0			48.6	0.39	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Nickel	15.6		22.7	0.69	0			48.6	0.32	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Nickel	16.5		22.7	0.73	0			48.6	0.34	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Nickel	16.7		22.7	0.74	0			48.6	0.34	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Nickel	14		22.7	0.62	0			48.6	0.29	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Nickel	18.3		22.7	0.81	0			48.6	0.38	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Nickel	21.8		22.7	0.96	0			48.6	0.45	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Nickel	7.8		22.7	0.34	0			48.6	0.16	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Nickel	12.6		22.7	0.56	0			48.6	0.26	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Nickel	12.5		22.7	0.55	0			48.6	0.26	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Nickel	20.6		22.7	0.91	0			48.6	0.42	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Nickel	19.3		22.7	0.85	0			48.6	0.40	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Nickel	14.3		22.7	0.63	0			48.6	0.29	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Nickel	17.8		22.7	0.78	0			48.6	0.37	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Nickel	20.1		22.7	0.89	0			48.6	0.41	0		
Middle Gila	Sediment	onsite	Primary Sample	GRaboveW	Nickel	13		22.7	0.57	0			48.6	0.27	0		
Middle Gila	Sediment	onsite	Primary Sample	GRatSPR	Nickel	26.5		22.7	1.2	1			48.6	0.55	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Silver		0.59	1			0.59	0	3.7			0.16	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Silver		0.58	1			0.58	0	3.7			0.16	0

TABLE 5-6
Detailed Point-by-Point Risk Evaluation of Onsite Sediment (mg/kg dw) Collected from the Middle Gila and San Pedro Rivers
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	Matrix	Type	SampType	LocID	Parameter	Conc	DL	Low Sediment TRV (mg/kg dw)	Low TRV HQ	Low TRV HQ G1	Low TRV HQ_{DL}	Low TRV HQ_{DL} G1	High Sediment TRV (mg/kg dw)	High TRV HQ	High TRV HQ G1	High TRV HQ_{DL}	High TRV HQ_{DL} G1
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Silver		0.63	1			0.63	0	3.7			0.17	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Silver		0.57	1			0.57	0	3.7			0.15	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Silver		0.63	1			0.63	0	3.7			0.17	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Silver		0.61	1			0.61	0	3.7			0.16	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Silver		0.74	1			0.74	0	3.7			0.20	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Silver		0.84	1			0.84	0	3.7			0.23	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Silver		0.73	1			0.73	0	3.7			0.20	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Silver		0.7	1			0.70	0	3.7			0.19	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Silver		0.73	1			0.73	0	3.7			0.20	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-01	Silver	0.15		1	0.15	0			3.7	0.041	0		
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-02	Silver		1	1			1.0	1	3.7			0.27	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-03	Silver		1.2	1			1.2	1	3.7			0.32	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-04	Silver		0.65	1			0.65	0	3.7			0.18	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-06	Silver		0.66	1			0.66	0	3.7			0.18	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-05	Silver		0.86	1			0.86	0	3.7			0.23	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-07	Silver		1	1			1.0	1	3.7			0.27	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-08	Silver		0.82	1			0.82	0	3.7			0.22	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-09	Silver		1.4	1			1.4	1	3.7			0.38	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-10	Silver		0.97	1			0.97	0	3.7			0.26	0
Middle Gila	Sediment	onsite	Primary Sample	GR-SED-11	Silver		0.82	1			0.82	0	3.7			0.22	0
Middle Gila	Sediment	onsite	Primary Sample	GRaboveW	p,p'-DDE		0.01	0.00316			3.2	1	0.0313			0.32	0
Middle Gila	Sediment	onsite	Primary Sample	GRatSPR	p,p'-DDE		0.01	0.00316			3.2	1	0.0313			0.32	0
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-01	Aluminum	4430		14000	0.32	0			58000	0.076	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-02	Aluminum	11000		14000	0.79	0			58000	0.19	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-01	Aluminum	4250		14000	0.30	0			58000	0.073	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-02	Aluminum	4540		14000	0.32	0			58000	0.078	0		
San Pedro	Sediment	onsite	Primary Sample	SPRatGR	Aluminum	26678		14000	1.9	1			58000	0.46	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-01	Copper	9.1		31.6	0.29	0			149	0.061	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-02	Copper	35.4		31.6	1.1	1			149	0.24	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-01	Copper	143		31.6	4.5	1			149	0.96	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-02	Copper	16.8		31.6	0.53	0			149	0.11	0		
San Pedro	Sediment	onsite	Primary Sample	SPRatGR	Copper	64		31.6	2.0	1			149	0.43	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-01	Cyanide		2.7	0.1			27	1	0.25			11	1
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-02	Cyanide		3.3	0.1			33	1	0.25			13	1
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-01	Cyanide		2.9	0.1			29	1	0.25			12	1
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-02	Cyanide		3	0.1			30	1	0.25			12	1
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-01	Manganese	155		730	0.21	0			1700	0.091	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-02	Manganese	399		730	0.55	0			1700	0.23	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-01	Manganese	183		730	0.25	0			1700	0.11	0		
San Pedro	Sediment	onsite	Primary Sample	SPR-SED-02	Manganese	173		730	0.24	0			1700	0.10	0		
San Pedro	Sediment	onsite	Primary Sample	SPRatGR	Manganese	1031		730	1.4	1			1700	0.61	0		

TABLE 5-6

Detailed Point-by-Point Risk Evaluation of Onsite Sediment (mg/kg dw) Collected from the Middle Gila and San Pedro Rivers

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Watershed	Matrix	Type	SampType	LocID	Parameter	Conc	DL	Low Sediment TRV (mg/kg dw)	Low TRV HQ	Low TRV HQ G1	Low TRV HQ_{DL}	Low TRV HQ_{DL} G1	High Sediment TRV (mg/kg dw)	High TRV HQ	High TRV HQ G1	High TRV HQ_{DL}	High TRV HQ_{DL} G1
San Pedro	Sediment	onsite	Primary Sample	SPRatGR	p,p'-DDE		0.01	0.00316			3.2	1	0.0313			0.32	0

Notes:

Conc = concentration

Det = indicates whether the chemical is detected. A "1" is used to indicate detected, a "0" is used to indicate non-detect.

DL = detection limit

DW = dry weight

HQ = hazard quotient

HQ G1 = Indicates whether HQ is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.

HQ_{DL} = hazard quotient based on detection limit

HQ_{DL} G1 = Indicates whether HQ based on the detection limit (for non-detects) is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.

LocID = sample location identifier

TRV = toxicity reference value (i.e. benchmark)

TABLE 5-7
Summary of the Point-by-Point Analysis for Benthic Invertebrates
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

			Summary Statistics on Analyte				Evauation Based on Low TRV						Evauation Based on High TRV					
			Detected Concentration and Detection Limit				Evaluation of Detected Concentration			Evaluation of Detection Limit			Evaluation of Detected Concentration			Evaluation of Detection Limit		
Chemical	Low TRV	High TRV	DF	Percent Detects	Sediment Concentration Range (mg/kg dw*)	DL Range	Low HQ Range	EF	Percent Exceedance	Low HQDL Range	EF	Percent Exceedance	High HQ Range	EF	Percent Exceedance	High HQDL Range	EF	Percent Exceedance
On-Site Gila River Sediment																		
Aluminum	14000	58000	24/24	100	4240 - 26679	--	0.3 - 1.9	15/24	63	0	0/24	0	0.07 - 0.46	0/24	0	0	0/24	0
Cadmium	0.99	4.98	6/24	25	0.03 - 1.1	0.42 - 1.1	0.03 - 1.1	1/24	4	0.42 - 1.1	1/24	4	0.01 - 0.22	0/24	0	0.08 - 0.22	0/24	0
Copper	31.6	149	24/24	100	11.6 - 392	--	0.37 - 12.4	22/24	92	0	0/24	0	0.08 - 2.6	4/24	17	0	0/24	0
Cyanide	0.1	0.25	0/22	0	--	2.6 - 6.9	0	0/22	0	26 - 69	22/22	100	0	0/22	0	10.4 - 27.6	22/22	100
Manganese	730	1700	24/24	100	113 - 2410	--	0.15 - 3.3	8/24	33	0	0/24	0	0.07 - 1.4	2/24	8	0	0/24	0
Nickel	22.7	48.6	24/24	100	6.1 - 26.5	--	0.27 - 1.2	1/24	4	0	0/24	0	0.13 - 0.55	0/24	0	0	0/24	0
p,p'-DDE	0.00316	0.0313	0/2	0	--	0.01	0	0/2	0	3.2	2/2	100	0	0/2	0	0.32	0/2	0
Silver	1	3.7	1/22	5	0.15	0.57 - 1.4	0.15	0/22	0	0.57 - 1.4	4/22	18	0.04	0/22	0	0.15 - 0.38	0/22	0
On-Site San Pedro River Sediment																		
Aluminum	14000	58000	5/5	100	4250 - 26678	--	0.3 - 1.9	1/5	20	0	0/5	0	0.07 - 0.46	0/5	0	0	0/5	0
Copper	31.6	149	5/5	100	9.1 - 143	--	0.29 - 4.5	3/5	60	0	0/5	0	0.06 - 0.96	0/5	0	0	0/5	0
Cyanide	0.1	0.25	0/4	0	--	2.7 - 3.3	0	0/4	0	27 - 33	4/4	100	0	0/4	0	10.8 - 13.2	4/4	100
Manganese	730	1700	5/5	100	155 - 1031	--	0.21 - 1.4	1/5	20	0	0/5	0	0.09 - 0.61	0/5	0	0	0/5	0
p,p'-DDE	0.00316	0.0313	0/1	0	--	0.01	0	0/1	0	3.2	1/1	100	0	0/1	0	0.32	0/1	0

Notes:
* Concentration basis for p,p'-DDE is in mg/kg wet weight (ww)

DF = detection frequency (i.e. 24/24 = 24 detections out of 24 samples)
DL = detection limit
dw = dry weight
EF = exceedance frequency (i.e. 2/29 = 2 exceedance of the benchmark out of 29 samples)
HQ = hazard quotient
HQ_{DL} = hazard quotient based on detection limit
TRV = toxicity reference value (i.e. benchmark)

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River *	Soil	stable	2006	GR-REF-01S	Boron	1.1		0.5	2.2	1	--	--
Middle Gila River *	Soil	stable	2006	GR1-01S	Boron	0.68		0.5	1.4	1	--	--
Middle Gila River *	Soil	stable	2006	GR10-01S	Boron	2.7		0.5	5.4	1	--	--
Middle Gila River *	Soil	stable	2006	GR11-01S	Boron	3.1		0.5	6.2	1	--	--
Middle Gila River *	Soil	stable	2006	GR12-01S	Boron	0.48		0.5	0.96	0	--	--
Middle Gila River *	Soil	stable	2006	GR13-01S	Boron	4.6		0.5	9.2	1	--	--
Middle Gila River *	Soil	stable	2006	GR14-01S	Boron	3.5		0.5	7.0	1	--	--
Middle Gila River *	Soil	stable	2006	GR15-01S	Boron	2.9		0.5	5.8	1	--	--
Middle Gila River *	Soil	stable	2006	GR16-01S	Boron	10		0.5	20	1	--	--
Middle Gila River *	Soil	stable	2006	GR2-01S	Boron	1.5		0.5	3.0	1	--	--
Middle Gila River *	Soil	stable	2006	GR3-01S	Boron	2.9		0.5	5.8	1	--	--
Middle Gila River *	Soil	stable	2006	GR4-01S	Boron	4.9		0.5	9.8	1	--	--
Middle Gila River *	Soil	stable	2006	GR5-01S	Boron	4.4		0.5	8.8	1	--	--
Middle Gila River *	Soil	stable	2006	GR6-01S	Boron	16		0.5	32	1	--	--
Middle Gila River *	Soil	stable	2006	GR7-01S	Boron	32.5		0.5	65	1	--	--
Middle Gila River *	Soil	stable	2006	GR8-01S	Boron	5.4		0.5	11	1	--	--
Middle Gila River *	Soil	stable	2006	GR9-01S	Boron	2.6		0.5	5.2	1	--	--
Middle Gila River *	Soil	unstable	2006	GR-REF-01U	Boron	7.5		0.5	15	1	--	--
Middle Gila River *	Soil	unstable	2006	GR1-01U	Boron	0.62		0.5	1.2	1	--	--
Middle Gila River *	Soil	unstable	2006	GR10-01U	Boron	2.4		0.5	4.8	1	--	--
Middle Gila River *	Soil	unstable	2006	GR11-01U	Boron	5.6		0.5	11	1	--	--
Middle Gila River *	Soil	unstable	2006	GR2-01U	Boron	4.8		0.5	9.6	1	--	--
Middle Gila River *	Soil	unstable	2006	GR3-01U	Boron	3.6		0.5	7.2	1	--	--
Middle Gila River *	Soil	unstable	2006	GR4-01U	Boron	6.2		0.5	12	1	--	--
Middle Gila River *	Soil	unstable	2006	GR5-01U	Boron	5.3		0.5	11	1	--	--
Middle Gila River *	Soil	unstable	2006	GR6-01U	Boron	7.3		0.5	15	1	--	--
Middle Gila River *	Soil	unstable	2006	GR7-01U	Boron	8.8		0.5	18	1	--	--
Middle Gila River *	Soil	unstable	2006	GR8-01U	Boron	5.8		0.5	12	1	--	--
Middle Gila River *	Soil	unstable	2006	GR9-01U	Boron	1.5		0.5	3.0	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR10-01U	Cobalt	9.2		13	0.71	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR1-01U	Cobalt	17		13	1.3	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR11-01U	Cobalt	10.3		13	0.79	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR2-01U	Cobalt	12.2		13	0.94	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR3-01U	Cobalt	12.8		13	0.98	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR4-01U	Cobalt	11.8		13	0.91	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR5-01U	Cobalt	10.7		13	0.82	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR6-01U	Cobalt	8.9		13	0.68	0	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River - u	Soil	unstable	2006	GR7-01U	Cobalt	9.1		13	0.70	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR8-01U	Cobalt	9.8		13	0.75	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR9-01U	Cobalt	7.4		13	0.57	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR-REF-01U	Cobalt	11.7		13	0.90	0	--	--
Middle Gila River *	Soil	stable	2006	GR-REF-01S	Copper	85.8		70	1.2	1	--	--
Middle Gila River *	Soil	stable	2006	GR1-01S	Copper	87.6		70	1.3	1	--	--
Middle Gila River *	Soil	stable	2006	GR10-01S	Copper	90.2		70	1.3	1	--	--
Middle Gila River *	Soil	stable	2006	GR11-01S	Copper	69.9		70	0.999	0	--	--
Middle Gila River *	Soil	stable	2006	GR12-01S	Copper	245		70	3.5	1	--	--
Middle Gila River *	Soil	stable	2006	GR13-01S	Copper	226		70	3.2	1	--	--
Middle Gila River *	Soil	stable	2006	GR14-01S	Copper	55.1		70	0.79	0	--	--
Middle Gila River *	Soil	stable	2006	GR15-01S	Copper	73.4		70	1.05	1	--	--
Middle Gila River *	Soil	stable	2006	GR16-01S	Copper	102		70	1.5	1	--	--
Middle Gila River *	Soil	stable	2006	GR2-01S	Copper	437		70	6.2	1	--	--
Middle Gila River *	Soil	stable	2006	GR3-01S	Copper	1150		70	16	1	--	--
Middle Gila River *	Soil	stable	2006	GR4-01S	Copper	57.3		70	0.82	0	--	--
Middle Gila River *	Soil	stable	2006	GR5-01S	Copper	106		70	1.5	1	--	--
Middle Gila River *	Soil	stable	2006	GR6-01S	Copper	198		70	2.8	1	--	--
Middle Gila River *	Soil	stable	2006	GR7-01S	Copper	239		70	3.4	1	--	--
Middle Gila River *	Soil	stable	2006	GR8-01S	Copper	117		70	1.7	1	--	--
Middle Gila River *	Soil	stable	2006	GR9-01S	Copper	51.8		70	0.74	0	--	--
Middle Gila River *	Soil	unstable	2006	GR-REF-01U	Copper	83.3		70	1.2	1	--	--
Middle Gila River *	Soil	unstable	2006	GR1-01U	Copper	95.4		70	1.4	1	--	--
Middle Gila River *	Soil	unstable	2006	GR10-01U	Copper	91.6		70	1.3	1	--	--
Middle Gila River *	Soil	unstable	2006	GR11-01U	Copper	103		70	1.5	1	--	--
Middle Gila River *	Soil	unstable	2006	GR2-01U	Copper	696		70	9.9	1	--	--
Middle Gila River *	Soil	unstable	2006	GR3-01U	Copper	572		70	8.2	1	--	--
Middle Gila River *	Soil	unstable	2006	GR4-01U	Copper	164		70	2.3	1	--	--
Middle Gila River *	Soil	unstable	2006	GR5-01U	Copper	145		70	2.1	1	--	--
Middle Gila River *	Soil	unstable	2006	GR6-01U	Copper	93.8		70	1.3	1	--	--
Middle Gila River *	Soil	unstable	2006	GR7-01U	Copper	74		70	1.1	1	--	--
Middle Gila River *	Soil	unstable	2006	GR8-01U	Copper	87.8		70	1.3	1	--	--
Middle Gila River *	Soil	unstable	2006	GR9-01U	Copper	40.2		70	0.57	0	--	--
Middle Gila River - s	Soil	stable	2006	GR-REF-01S	Iron	20000		not toxic between	*7.8*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR1-01S	Iron	20300		pH of 5 to 8	*7.9*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR10-01S	Iron	17100			*7.6*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR11-01S	Iron	14100			*8.5*	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River - s	Soil	stable	2006	GR12-01S	Iron	14900			*8.4*	1	--	--
Middle Gila River - s	Soil	stable	2006	GR13-01S	Iron	12300			*7.4*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR14-01S	Iron	13200			*7.7*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR15-01S	Iron	11100			*8.1*	1	--	--
Middle Gila River - s	Soil	stable	2006	GR16-01S	Iron	20700			*7.9*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR2-01S	Iron	17700			*7.7*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR3-01S	Iron	18100			*7.3*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR4-01S	Iron	16600			*8.3*	1	--	--
Middle Gila River - s	Soil	stable	2006	GR5-01S	Iron	12400			*7.4*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR6-01S	Iron	15800			*7.9*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR7-01S	Iron	19600			*8.1*	1	--	--
Middle Gila River - s	Soil	stable	2006	GR8-01S	Iron	17600			*7.6*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR9-01S	Iron	8480			*7.6*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR-REF-01U	Iron	19800		not toxic between	*8.6*	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR1-01U	Iron	27200		pH of 5 to 8	*8.7*	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR10-01U	Iron	16300			*7.5*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR11-01U	Iron	18000			*7.7*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR2-01U	Iron	22800			*8*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR3-01U	Iron	21500			*8*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR4-01U	Iron	18700			*7.6*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR5-01U	Iron	20000			*8.2*	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR6-01U	Iron	16800			*7.6*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR7-01U	Iron	18400			*7.8*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR8-01U	Iron	17600			*7.6*	0	--	--
Middle Gila River - u	Soil	unstable	2006	GR9-01U	Iron	13200			*7.8*	0	--	--
Middle Gila River - s	Soil	stable	2006	GR-REF-01S	Manganese	381		220	1.7	1	--	--
Middle Gila River - s	Soil	stable	2006	GR1-01S	Manganese	427		220	1.9	1	--	--
Middle Gila River - s	Soil	stable	2006	GR10-01S	Manganese	532		220	2.4	1	--	--
Middle Gila River - s	Soil	stable	2006	GR11-01S	Manganese	361		220	1.6	1	--	--
Middle Gila River - s	Soil	stable	2006	GR12-01S	Manganese	210		220	1.0	0	--	--
Middle Gila River - s	Soil	stable	2006	GR13-01S	Manganese	310		220	1.4	1	--	--
Middle Gila River - s	Soil	stable	2006	GR14-01S	Manganese	287		220	1.3	1	--	--
Middle Gila River - s	Soil	stable	2006	GR15-01S	Manganese	259		220	1.2	1	--	--
Middle Gila River - s	Soil	stable	2006	GR16-01S	Manganese	794		220	3.6	1	--	--
Middle Gila River - s	Soil	stable	2006	GR2-01S	Manganese	364		220	1.7	1	--	--
Middle Gila River - s	Soil	stable	2006	GR3-01S	Manganese	407		220	1.9	1	--	--
Middle Gila River - s	Soil	stable	2006	GR4-01S	Manganese	437		220	2.0	1	--	--
Middle Gila River - s	Soil	stable	2006	GR5-01S	Manganese	265		220	1.2	1	--	--
Middle Gila River - s	Soil	stable	2006	GR6-01S	Manganese	443		220	2.0	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River - s	Soil	stable	2006	GR7-01S	Manganese	596		220	2.7	1	--	--
Middle Gila River - s	Soil	stable	2006	GR8-01S	Manganese	536		220	2.4	1	--	--
Middle Gila River - s	Soil	stable	2006	GR9-01S	Manganese	364		220	1.7	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR-REF-01U	Manganese	879		220	4.0	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR1-01U	Manganese	695		220	3.2	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR10-01U	Manganese	417		220	1.9	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR11-01U	Manganese	619		220	2.8	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR2-01U	Manganese	584		220	2.7	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR3-01U	Manganese	611		220	2.8	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR4-01U	Manganese	538		220	2.4	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR5-01U	Manganese	614		220	2.8	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR6-01U	Manganese	498		220	2.3	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR7-01U	Manganese	638		220	2.9	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR8-01U	Manganese	545		220	2.5	1	--	--
Middle Gila River - u	Soil	unstable	2006	GR9-01U	Manganese	339		220	1.5	1	--	--
Middle Gila River *	Soil	stable	2006	GR-REF-01S	Molybdenum	2		2	1.0	1	--	--
Middle Gila River *	Soil	stable	2006	GR1-01S	Molybdenum	2		2	1.0	1	--	--
Middle Gila River *	Soil	stable	2006	GR10-01S	Molybdenum	2.1		2	1.1	1	--	--
Middle Gila River *	Soil	stable	2006	GR11-01S	Molybdenum	0.16		2	0.08	0	--	--
Middle Gila River *	Soil	stable	2006	GR12-01S	Molybdenum	3.1		2	1.6	1	--	--
Middle Gila River *	Soil	stable	2006	GR13-01S	Molybdenum	2.8		2	1.4	1	--	--
Middle Gila River *	Soil	stable	2006	GR14-01S	Molybdenum	0.84		2	0.42	0	--	--
Middle Gila River *	Soil	stable	2006	GR15-01S	Molybdenum	0.53		2	0.27	0	--	--
Middle Gila River *	Soil	stable	2006	GR16-01S	Molybdenum	1.1		2	0.55	0	--	--
Middle Gila River *	Soil	stable	2006	GR2-01S	Molybdenum	1.4		2	0.70	0	--	--
Middle Gila River *	Soil	stable	2006	GR3-01S	Molybdenum	7.1		2	3.6	1	--	--
Middle Gila River *	Soil	stable	2006	GR4-01S	Molybdenum	2		2	1.0	1	--	--
Middle Gila River *	Soil	stable	2006	GR5-01S	Molybdenum	0.83		2	0.42	0	--	--
Middle Gila River *	Soil	stable	2006	GR6-01S	Molybdenum	4		2	2.0	1	--	--
Middle Gila River *	Soil	stable	2006	GR7-01S	Molybdenum	4.4		2	2.2	1	--	--
Middle Gila River *	Soil	stable	2006	GR8-01S	Molybdenum	0.62		2	0.31	0	--	--
Middle Gila River *	Soil	stable	2006	GR9-01S	Molybdenum	0.31		2	0.16	0	--	--
Middle Gila River *	Soil	unstable	2006	GR-REF-01U	Molybdenum	2.8		2	1.4	1	--	--
Middle Gila River *	Soil	unstable	2006	GR1-01U	Molybdenum	2.5		2	1.3	1	--	--
Middle Gila River *	Soil	unstable	2006	GR10-01U	Molybdenum	0.1		2	0.05	0	--	--
Middle Gila River *	Soil	unstable	2006	GR11-01U	Molybdenum	0.51		2	0.26	0	--	--
Middle Gila River *	Soil	unstable	2006	GR2-01U	Molybdenum	2.1		2	1.1	1	--	--

TABLE 5-8
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Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River *	Soil	unstable	2006	GR3-01U	Molybdenum	2		2	1.0	1	--	--
Middle Gila River *	Soil	unstable	2006	GR4-01U	Molybdenum	0.43		2	0.2	0	--	--
Middle Gila River *	Soil	unstable	2006	GR5-01U	Molybdenum	0.18		2	0.09	0	--	--
Middle Gila River *	Soil	unstable	2006	GR6-01U	Molybdenum	0.38		2	0.19	0	--	--
Middle Gila River *	Soil	unstable	2006	GR7-01U	Molybdenum	0.49		2	0.25	0	--	--
Middle Gila River *	Soil	unstable	2006	GR8-01U	Molybdenum	0.34		2	0.17	0	--	--
Middle Gila River *	Soil	unstable	2006	GR9-01U	Molybdenum	2		2	1.0	1	--	--
Middle Gila River *	Soil	stable	2006	GR10-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR1-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR11-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR12-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR13-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR14-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR15-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR16-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR2-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR3-01S	Selenium	0.67		1	0.67	0	--	--
Middle Gila River *	Soil	stable	2006	GR4-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR5-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR6-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR7-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR8-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR9-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	stable	2006	GR-REF-01S	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR10-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR1-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR11-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR2-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR3-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR4-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR5-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR6-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR7-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR8-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR9-01U	Selenium		3.5	1	--	--	3.5	1
Middle Gila River *	Soil	unstable	2006	GR-REF-01U	Selenium		3.5	1	--	--	3.5	1
San Pedro River *	Soil	stable	2006	SPR1-01S	Boron	1.4		0.5	2.8	1	--	--
San Pedro River *	Soil	stable	2006	SPR2-01S	Boron	1.4		0.5	2.8	1	--	--
San Pedro River *	Soil	unstable	2006	SPR1-01U	Boron	0.88		0.5	1.8	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
San Pedro River *	Soil	unstable	2006	SPR2-01U	Boron	5.7		0.5	11	1	--	--
San Pedro River - s	Soil	stable	2006	SPR1-01S	Iron	9870		not toxic between	*8.4*	1	--	--
San Pedro River - s	Soil	stable	2006	SPR2-01S	Iron	9490		pH of 5 to 8	*8.8*	1	--	--
San Pedro River - u	Soil	unstable	2006	SPR1-01U	Iron	6570		not toxic between	*8.8*	1	--	--
San Pedro River - u	Soil	unstable	2006	SPR2-01U	Iron	18000		pH of 5 to 8	*7.8*	0	--	--
San Pedro River - u	Soil	unstable	2006	SPR1-01U	Manganese	158		220	0.72	0	--	--
San Pedro River - u	Soil	unstable	2006	SPR2-01U	Manganese	591		220	2.7	1	--	--
San Pedro River *	Soil	stable	2006	SPR1-01S	Selenium		3.5	1	--	--	3.5	1
San Pedro River *	Soil	stable	2006	SPR2-01S	Selenium		3.5	1	--	--	3.5	1
San Pedro River *	Soil	unstable	2006	SPR1-01U	Selenium		3.5	1	--	--	3.5	1
San Pedro River *	Soil	unstable	2006	SPR2-01U	Selenium		3.5	1	--	--	3.5	1
San Pedro River *	Soil	stable	2006	SPR1-01S	Thallium		2.5	1	--	--	2.5	1
San Pedro River *	Soil	stable	2006	SPR2-01S	Thallium		2.5	1	--	--	2.5	1
San Pedro River *	Soil	unstable	2006	SPR1-01U	Thallium		2.5	1	--	--	2.5	1
San Pedro River *	Soil	unstable	2006	SPR2-01U	Thallium		2.5	1	--	--	2.5	1
Upland Soil	Soil	--	2006	SD-01-SED-0	Antimony	10.4		5	2.1	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Antimony	7.5		5	1.5	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Antimony	3.7		5	0.74	0	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Antimony	2.6		5	0.52	0	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Antimony	2.6		5	0.52	0	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Antimony	2.4		5	0.48	0	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Antimony	0.94		5	0.19	0	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Antimony	1.3		5	0.26	0	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Antimony	0.39		5	0.08	0	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Antimony	1.2		5	0.24	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Arsenic	24.7		18	1.4	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Arsenic	361		18	20	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Arsenic	232		18	13	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Arsenic	74		18	4.1	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Arsenic	39.1		18	2.2	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Arsenic	13.7		18	0.76	0	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Arsenic	10.9		18	0.61	0	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Arsenic	6.7		18	0.37	0	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Arsenic	1.8		18	0.10	0	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Arsenic	9.1		18	0.51	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Boron	7.3		0.5	15	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Boron	4.8		0.5	9.6	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Boron	3.9		0.5	7.8	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Upland Soil	Soil	--	2006	SDD-03-SED-0	Boron	2.6		0.5	5.2	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Boron	3.3		0.5	6.6	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Boron	2		0.5	4.0	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Boron	3.2		0.5	6.4	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Boron	1.9		0.5	3.8	1	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Boron	2.5		0.5	5.0	1	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Boron	1.5		0.5	3.0	1	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Cadmium	9.6		32	0.30	0	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Cadmium	94.7		32	3.0	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Cadmium	82.4		32	2.6	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Cadmium	18.8		32	0.59	0	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Cadmium	8.3		32	0.26	0	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Cadmium	1.1		32	0.03	0	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Cadmium	1.7		32	0.05	0	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Cadmium	1.6		32	0.05	0	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Cadmium		0.08	32	--	--	0.003	0
Upland Soil	Soil	--	2006	UPA-07-SED-0	Cadmium	0.92		32	0.03	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Chromium		0.4	1	--	--	0.40	0
Upland Soil	Soil	--	2006	SDD-01-SED-0	Chromium	72		1	72	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Chromium	16.4		1	16	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Chromium	3.8		1	3.8	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Chromium	25.5		1	26	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Chromium	15.7		1	16	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Chromium	21.9		1	22	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Chromium	7.3		1	7.3	1	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Chromium	5.9		1	5.9	1	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Chromium	11.8		1	12	1	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Cobalt	84.9		13	6.5	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Cobalt	46.8		13	3.6	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Cobalt	32.8		13	2.5	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Cobalt	29.2		13	2.2	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Cobalt	15.8		13	1.2	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Cobalt	34.4		13	2.6	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Cobalt	22.2		13	1.7	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Cobalt	29.1		13	2.2	1	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Cobalt	5.7		13	0.44	0	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Cobalt	11.8		13	0.91	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Copper	47200		70	670	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Copper	12100		70	170	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Upland Soil	Soil	--	2006	SDD-02-SED-0	Copper	10200		70	150	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Copper	27000		70	390	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Copper	8130		70	120	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Copper	1990		70	28	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Copper	1540		70	22	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Copper	854		70	12	1	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Copper	16.6		70	0.24	0	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Copper	882		70	13	1	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Iron	186999		not toxic between				
Upland Soil	Soil	--	2006	SDD-01-SED-0	Iron	64200		pH of 5 to 8				
Upland Soil	Soil	--	2006	SDD-02-SED-0	Iron	34400			*7.6*	0	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Iron	53000						
Upland Soil	Soil	--	2006	SR77-01-SED-0	Iron	27200						
Upland Soil	Soil	--	2006	TPA-07-SED-0	Iron	36100			*7.8*	0	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Iron	26100			*8.5*	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Iron	33700			*7.5*	0	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Iron	11500			*8.6*	1	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Iron	21100			*6.2*	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Lead	468		120	3.9	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Lead	308		120	2.6	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Lead	220		120	1.8	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Lead	112		120	0.93	0	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Lead	231		120	1.9	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Lead	60		120	0.50	0	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Lead	41.1		120	0.34	0	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Lead	36.3		120	0.30	0	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Lead	5.1		120	0.04	0	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Lead	41.1		120	0.34	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Manganese	232		220	1.1	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Manganese	557		220	2.5	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Manganese	647		220	2.9	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Manganese	581		220	2.6	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Manganese	382		220	1.7	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Manganese	341		220	1.6	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Manganese	797		220	3.6	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Manganese	686		220	3.1	1	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Manganese	258		220	1.2	1	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Manganese	276		220	1.3	1	--	--

TABLE 5-8
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Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Upland Soil	Soil	--	2006	SD-01-SED-0	Mercury	0.02		0.3	0.07	0	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Mercury	0.49		0.3	1.6	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Mercury	0.44		0.3	1.5	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Mercury	0.13		0.3	0.43	0	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Mercury	0.15		0.3	0.50	0	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Mercury		0.02	0.3	--	--	0.07	0
Upland Soil	Soil	--	2006	UP-01-SED-0	Mercury	0.053		0.3	0.18	0	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Mercury	0.031		0.3	0.10	0	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Mercury		0.02	0.3	--	--	0.07	0
Upland Soil	Soil	--	2006	UPA-07-SED-0	Mercury	0.052		0.3	0.17	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Molybdenum	1060		2	530	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Molybdenum	235		2	120	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Molybdenum	103		2	52	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Molybdenum	119		2	60	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Molybdenum	37.6		2	19	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Molybdenum	90.2		2	45	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Molybdenum	4.4		2	2.2	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Molybdenum	3.5		2	1.8	1	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Molybdenum	0.25		2	0.12	0	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Molybdenum	15.9		2	8.0	1	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Nickel	32.1		38	0.84	0	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Nickel	40.9		38	1.1	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Nickel	35.5		38	0.93	0	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Nickel	24.8		38	0.65	0	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Nickel	34.3		38	0.90	0	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Nickel	27.1		38	0.71	0	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Nickel	27.9		38	0.73	0	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Nickel	17.5		38	0.46	0	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Nickel	7.2		38	0.19	0	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Nickel	12.8		38	0.34	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Selenium	18.8		1	19	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Selenium	17.4		1	17	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Selenium	8.2		1	8.2	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Selenium	7.9		1	7.9	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Selenium	3.3		1	3.3	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Selenium	3		1	3.0	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Selenium	0.94		1	0.94	0	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Selenium	0.95		1	0.95	0	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Selenium		0.51	1	--	--	0.51	0

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Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Upland Soil	Soil	--	2006	UPA-07-SED-0	Selenium	0.75		1	0.75	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Thallium		2.4	1	--	--	2.4	1
Upland Soil	Soil	--	2006	SDD-01-SED-0	Thallium		0.73	1	--	--	0.73	0
Upland Soil	Soil	--	2006	SDD-02-SED-0	Thallium		0.44	1	--	--	0.44	0
Upland Soil	Soil	--	2006	SDD-03-SED-0	Thallium		0.71	1	--	--	0.71	0
Upland Soil	Soil	--	2006	SR77-01-SED-0	Thallium		0.7	1	--	--	0.70	0
Upland Soil	Soil	--	2006	TPA-07-SED-0	Thallium		0.68	1	--	--	0.68	0
Upland Soil	Soil	--	2006	UP-01-SED-0	Thallium	0.4		1	0.40	0	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Thallium		0.71	1	--	--	0.71	0
Upland Soil	Soil	--	2006	UPA-04-SED-1	Thallium		0.72	1	--	--	0.72	0
Upland Soil	Soil	--	2006	UPA-07-SED-0	Thallium	0.87		1	0.87	0	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Vanadium	24.4		2	12	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Vanadium	70.6		2	35	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Vanadium	65		2	33	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Vanadium	69		2	35	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Vanadium	42.9		2	21	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Vanadium	79.4		2	40	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Vanadium	71.8		2	36	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Vanadium	86.3		2	43	1	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Vanadium	22.4		2	11	1	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Vanadium	41.6		2	21	1	--	--
Upland Soil	Soil	--	2006	SD-01-SED-0	Zinc	5920		50	120	1	--	--
Upland Soil	Soil	--	2006	SDD-01-SED-0	Zinc	5300		50	110	1	--	--
Upland Soil	Soil	--	2006	SDD-02-SED-0	Zinc	3340		50	67	1	--	--
Upland Soil	Soil	--	2006	SDD-03-SED-0	Zinc	1380		50	28	1	--	--
Upland Soil	Soil	--	2006	SR77-01-SED-0	Zinc	400		50	8.0	1	--	--
Upland Soil	Soil	--	2006	TPA-07-SED-0	Zinc	597		50	12	1	--	--
Upland Soil	Soil	--	2006	UP-01-SED-0	Zinc	113		50	2.3	1	--	--
Upland Soil	Soil	--	2006	UPA-01-SED-0	Zinc	99.3		50	2.0	1	--	--
Upland Soil	Soil	--	2006	UPA-04-SED-1	Zinc	30.3		50	0.61	0	--	--
Upland Soil	Soil	--	2006	UPA-07-SED-0	Zinc	106		50	2.1	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Antimony	0.84		5	0.17	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Antimony	3.3		5	0.66	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Antimony		2.2	5	--	--	0.44	0
Wash Soil	Soil	--	2005	PHW-SED-03AS	Antimony	2.1		5	0.42	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Antimony	2.2		5	0.44	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Antimony		2.7	5	--	--	0.54	0
Wash Soil	Soil	--	2005	PHW-SED-06AS	Antimony	3.1		5	0.62	0	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-07AS	Antimony	3.6		5	0.72	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Antimony		2.6	5	--	--	0.52	0
Wash Soil	Soil	--	2005	PHW-SED-09AS	Antimony		2.1	5	--	--	0.42	0
Wash Soil	Soil	--	2005	PHW-SED-10AS	Antimony		0.93	5	--	--	0.19	0
Wash Soil	Soil	--	2005	PHW-SED-11AS	Antimony		0.49	5	--	--	0.10	0
Wash Soil	Soil	--	2005	PHW-SED-12AS	Antimony		0.62	5	--	--	0.12	0
Wash Soil	Soil	--	2005	PHW-SED-13AS	Antimony		0.61	5	--	--	0.12	0
Wash Soil	Soil	--	2005	PHW-SED-14AS	Antimony		0.97	5	--	--	0.19	0
Wash Soil	Soil	--	2005	PHW-SED-15AS	Antimony		1	5	--	--	0.20	0
Wash Soil	Soil	--	2005	SPW-SED-01AS	Antimony	1.2		5	0.24	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Antimony	2		5	0.40	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Antimony	1.5		5	0.30	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Antimony	1		5	0.20	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Antimony	0.99		5	0.20	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Antimony	1.5		5	0.30	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Antimony	1		5	0.20	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Antimony	1.3		5	0.26	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Antimony	0.96		5	0.19	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Antimony	0.85		5	0.17	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Antimony	0.97		5	0.19	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Antimony	1		5	0.20	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Antimony	1.4		5	0.28	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Antimony	1.2		5	0.24	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Antimony	1.5		5	0.30	0	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Antimony		20	5	--	--	4.0	1
Wash Soil	Soil	--	2006	KAW-02-SED-0	Arsenic	1.6		18	0.09	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Arsenic	35.7		18	2.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Arsenic	43.3		18	2.4	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Arsenic	36.4		18	2.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Arsenic	25.4		18	1.4	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Arsenic	75.3		18	4.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Arsenic	36.1		18	2.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Arsenic	43.5		18	2.4	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Arsenic	16.5		18	0.92	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Arsenic	21.5		18	1.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Arsenic	8.9		18	0.49	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Arsenic	10.4		18	0.58	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Arsenic	4.6		18	0.26	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Arsenic	6.1		18	0.34	0	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-14AS	Arsenic	7.9		18	0.44	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Arsenic	22		18	1.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Arsenic	23.1		18	1.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Arsenic	29.7		18	1.6	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Arsenic	23.2		18	1.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Arsenic	15.1		18	0.84	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Arsenic	24.7		18	1.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Arsenic	28.9		18	1.6	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Arsenic	5.5		18	0.31	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Arsenic	18.3		18	1.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Arsenic	13		18	0.72	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Arsenic	9		18	0.50	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Arsenic	17.7		18	0.98	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Arsenic	14.3		18	0.79	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Arsenic	13.5		18	0.75	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Arsenic	9.5		18	0.53	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Arsenic	16.4		18	0.91	0	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Arsenic	28		18	1.6	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Boron	0.85		0.5	1.7	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Boron	2.9		0.5	5.8	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Boron	3.1		0.5	6.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Boron	2.9		0.5	5.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Boron	3.1		0.5	6.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Boron	3.5		0.5	7.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Boron	4		0.5	8.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Boron	2.7		0.5	5.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Boron	3.2		0.5	6.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Boron	2.6		0.5	5.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Boron	2.4		0.5	4.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Boron	3.2		0.5	6.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Boron	3.3		0.5	6.6	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Boron	2.6		0.5	5.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Boron	1.1		0.5	2.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Boron	2.4		0.5	4.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Boron	3.1		0.5	6.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Boron	1.7		0.5	3.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Boron	3.5		0.5	7.0	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Chromium	3.8		1	3.8	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Chromium	19.1		1	19	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-02AS	Chromium	22		1	22	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Chromium	20.3		1	20	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Chromium	19.9		1	20	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Chromium	18.1		1	18	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Chromium	18		1	18	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Chromium	15.7		1	16	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Chromium	11.1		1	11	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Chromium	16.3		1	16	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Chromium	12.5		1	13	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Chromium	22		1	22	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Chromium	14.1		1	14	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Chromium	4.8		1	4.8	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Chromium	14.8		1	15	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Chromium	16		1	16	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Chromium	18.2		1	18	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Chromium	18.3		1	18	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Chromium	16.6		1	17	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Chromium	17.2		1	17	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Chromium	13.1		1	13	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Chromium	15		1	15	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Chromium	9.8		1	9.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Chromium	11.6		1	12	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Chromium	9.8		1	9.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Chromium	10.1		1	10	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Chromium	10.9		1	11	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Chromium	17.3		1	17	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Chromium	16		1	16	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Chromium	9		1	9.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Chromium	13.9		1	14	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Chromium	120		1	120	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Cobalt	7.5		13	0.58	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Cobalt	33.2		13	2.6	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Cobalt	29.2		13	2.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Cobalt	27.9		13	2.1	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Cobalt	29.8		13	2.3	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Cobalt	28.8		13	2.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Cobalt	36.9		13	2.8	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Cobalt	47.8		13	3.7	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Cobalt	29.9		13	2.3	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-09AS	Cobalt	32.3		13	2.5	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Cobalt	17.3		13	1.3	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Cobalt	29.1		13	2.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Cobalt	16		13	1.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Cobalt	7.2		13	0.55	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Cobalt	21.5		13	1.7	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Cobalt	21		13	1.6	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Cobalt	30.2		13	2.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Cobalt	29.7		13	2.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Cobalt	22.9		13	1.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Cobalt	26.7		13	2.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Cobalt	14.6		13	1.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Cobalt	20.1		13	1.5	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Cobalt	15.8		13	1.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Cobalt	16.6		13	1.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Cobalt	13.6		13	1.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Cobalt	13.7		13	1.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Cobalt	7.1		13	0.55	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Cobalt	26.1		13	2.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Cobalt	17.4		13	1.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Cobalt	9.8		13	0.75	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Cobalt	16.4		13	1.3	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Cobalt	79		13	6.1	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Copper	2900		70	41	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Copper	6030		70	86	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Copper	7700		70	110	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Copper	8270		70	120	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Copper	6070		70	87	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Copper	12200		70	170	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Copper	8810		70	130	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Copper	9030		70	130	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Copper	4650		70	66	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Copper	8510		70	120	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Copper	2380		70	34	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Copper	6670		70	95	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Copper	1230		70	18	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Copper	2270		70	32	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Copper	1770		70	25	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Copper	5650		70	81	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-01AS	Copper	10500		70	150	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Copper	12500		70	180	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Copper	7230		70	100	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Copper	5970		70	85	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Copper	6260		70	89	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Copper	7050		70	100	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Copper	926		70	13	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Copper	4950		70	71	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Copper	3150		70	45	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Copper	2440		70	35	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Copper	2860		70	41	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Copper	6060		70	87	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Copper	5170		70	74	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Copper	2230		70	32	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Copper	4920		70	70	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Copper	4700		70	67	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Iron	11200		not toxic between	*7.6*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Iron	43300		pH of 5 to 8	*7.8*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Iron	38100			*7.7*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Iron	33700			*7.8*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Iron	35000			*8*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Iron	37000			*8*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Iron	54800			*7.8*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Iron	63300			*8.3*	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Iron	37600			*8.1*	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Iron	40200			*8.6*	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Iron	19500			*8.1*	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Iron	35000			*7.7*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Iron	18300			*8*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Iron	9590			*7.8*	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Iron	24700			*8.3*	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Iron	26500			*8.2*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Iron	35200			*8*	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Iron	36200			*8.1*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Iron	29300			*8.1*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Iron	27900			*8.1*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Iron	17700			*8.5*	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-06AS	Iron	24700			*8.4*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Iron	17500			*8.4*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Iron	19900			*8.1*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Iron	17700			*8.1*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Iron	16300			*8.4*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Iron	11400			*8.6*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Iron	26900			*7.8*	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Iron	26900			*8.4*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Iron	12900			*8.3*	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Iron	22200			*8.5*	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Iron	320000						
Wash Soil	Soil	--	2006	KAW-02-SED-0	Lead	9.6		120	0.08	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Lead	130		120	1.1	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Lead	145		120	1.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Lead	110		120	0.92	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Lead	104		120	0.87	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Lead	239		120	2.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Lead	125		120	1.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Lead	146		120	1.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Lead	54		120	0.45	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Lead	63.4		120	0.53	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Lead	31.9		120	0.27	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Lead	14.3		120	0.12	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Lead	13.3		120	0.11	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Lead	15		120	0.12	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Lead	55.1		120	0.46	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Lead	86.9		120	0.72	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Lead	51.5		120	0.43	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Lead	67		120	0.56	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Lead	118		120	0.98	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Lead	30.9		120	0.26	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Lead	89.7		120	0.75	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Lead	129		120	1.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Lead	24.1		120	0.20	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Lead	90.4		120	0.75	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Lead	57.8		120	0.48	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Lead	45.4		120	0.38	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Lead	62.6		120	0.52	0	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-12AS	Lead	35.6		120	0.30	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Lead	65.3		120	0.54	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Lead	38.6		120	0.32	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Lead	60.8		120	0.51	0	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Lead	17		120	0.14	0	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Manganese	61.1		220	0.28	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Manganese	502		220	2.3	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Manganese	510		220	2.3	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Manganese	563		220	2.6	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Manganese	576		220	2.6	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Manganese	424		220	1.9	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Manganese	213		220	0.97	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Manganese	355		220	1.6	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Manganese	302		220	1.4	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Manganese	304		220	1.4	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Manganese	391		220	1.8	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Manganese	758		220	3.4	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Manganese	434		220	2.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Manganese	126		220	0.57	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Manganese	602		220	2.7	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Manganese	437		220	2.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Manganese	676		220	3.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Manganese	622		220	2.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Manganese	482		220	2.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Manganese	599		220	2.7	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Manganese	291		220	1.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Manganese	406		220	1.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Manganese	451		220	2.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Manganese	358		220	1.6	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Manganese	333		220	1.5	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Manganese	332		220	1.5	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Manganese	98.3		220	0.45	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Manganese	481		220	2.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Manganese	355		220	1.6	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Manganese	196		220	0.89	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Manganese	369		220	1.7	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Manganese	100		220	0.45	0	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Mercury	0.025		0.3	0.08	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Mercury	0.065		0.3	0.22	0	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-02AS	Mercury	0.15		0.3	0.50	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Mercury	0.11		0.3	0.37	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Mercury	0.03		0.3	0.10	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Mercury	0.3		0.3	1.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Mercury	0.025		0.3	0.08	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Mercury	0.039		0.3	0.13	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Mercury	0.038		0.3	0.13	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Mercury	0.092		0.3	0.31	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Mercury		0.051	0.3	--	--	0.33	0
Wash Soil	Soil	--	2005	PHW-SED-11AS	Mercury		0.05	0.3	--	--	0.33	0
Wash Soil	Soil	--	2005	PHW-SED-12AS	Mercury		0.051	0.3	--	--	0.33	0
Wash Soil	Soil	--	2005	PHW-SED-13AS	Mercury	0.032		0.3	0.11	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Mercury	0.025		0.3	0.08	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Mercury	0.061		0.3	0.20	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Mercury	0.05		0.3	0.17	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Mercury	0.093		0.3	0.31	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Mercury	0.12		0.3	0.40	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Mercury	0.02		0.3	0.07	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Mercury	0.076		0.3	0.25	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Mercury	0.14		0.3	0.47	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Mercury		0.051	0.3	--	--	0.33	0
Wash Soil	Soil	--	2005	SPW-SED-08AS	Mercury	0.082		0.3	0.27	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Mercury	0.05		0.3	0.17	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Mercury		0.05	0.3	--	--	0.33	0
Wash Soil	Soil	--	2005	SPW-SED-11AS	Mercury	0.061		0.3	0.20	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Mercury		0.051	0.3	--	--	0.33	0
Wash Soil	Soil	--	2005	SPW-SED-13AS	Mercury	0.058		0.3	0.19	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Mercury	0.021		0.3	0.07	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Mercury	0.047		0.3	0.16	0	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Mercury	0.15		0.3	0.50	0	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Molybdenum	55		2	28	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Molybdenum	40.2		2	20	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Molybdenum	65.8		2	33	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Molybdenum	45.2		2	23	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Molybdenum	64.2		2	32	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Molybdenum	86		2	43	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Molybdenum	31.4		2	16	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Molybdenum	35.4		2	18	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Molybdenum	38.5		2	19	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-06AS	Molybdenum	32.7		2	16	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Molybdenum	3.8		2	1.9	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Molybdenum	32.7		2	16	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Molybdenum	22.4		2	11	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Molybdenum	13.3		2	6.6	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Molybdenum	28.6		2	14	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Molybdenum	35.1		2	18	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Molybdenum	39		2	20	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Molybdenum	41.2		2	21	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Molybdenum	41.8		2	21	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Molybdenum	72		2	36	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Nickel	7		38	0.18	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Nickel	32.6		38	0.86	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Nickel	31.8		38	0.84	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Nickel	32.5		38	0.86	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Nickel	33.9		38	0.89	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Nickel	34.9		38	0.92	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Nickel	25.7		38	0.68	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Nickel	34.2		38	0.90	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Nickel	23.9		38	0.63	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Nickel	25		38	0.66	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Nickel	22.1		38	0.58	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Nickel	34.2		38	0.90	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Nickel	21.3		38	0.56	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Nickel	7.5		38	0.20	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Nickel	28.2		38	0.74	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Nickel	24.3		38	0.64	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Nickel	32.5		38	0.86	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Nickel	32.2		38	0.85	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Nickel	29.4		38	0.77	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Nickel	31.1		38	0.82	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Nickel	19.8		38	0.52	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Nickel	25.3		38	0.67	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Nickel	14.4		38	0.38	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Nickel	18.2		38	0.48	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Nickel	14.3		38	0.38	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Nickel	15.3		38	0.40	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Nickel	8.2		38	0.22	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Nickel	31.3		38	0.82	0	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-13AS	Nickel	24.4		38	0.64	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Nickel	11.5		38	0.30	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Nickel	18.5		38	0.49	0	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Nickel	82		38	2.2	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Selenium	2.3		1	2.3	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Selenium	0.55		1	0.55	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Selenium	0.74		1	0.74	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Selenium	0.67		1	0.67	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	PHW-SED-05AS	Selenium	4.3		1	4.3	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Selenium	1.4		1	1.4	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Selenium	2.8		1	2.8	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Selenium	1.5		1	1.5	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Selenium	1.6		1	1.6	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	PHW-SED-11AS	Selenium	1.2		1	1.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	PHW-SED-13AS	Selenium	0.92		1	0.92	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	PHW-SED-15AS	Selenium	0.57		1	0.57	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Selenium	0.16	0.16	1	0.16	0	0.16	0
Wash Soil	Soil	--	2005	SPW-SED-02AS	Selenium	1.2		1	1.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	SPW-SED-04AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	SPW-SED-05AS	Selenium	0.32		1	0.32	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	SPW-SED-07AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	SPW-SED-08AS	Selenium	0.97		1	0.97	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Selenium	0.18		1	0.18	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	SPW-SED-11AS	Selenium	0.76		1	0.76	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	SPW-SED-13AS	Selenium		0.15	1	--	--	0.15	0
Wash Soil	Soil	--	2005	SPW-SED-14AS	Selenium	0.65		1	0.65	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Selenium	0.22		1	0.22	0	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Selenium	24		1	24	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Thallium		0.7	1	--	--	0.70	0
Wash Soil	Soil	--	2005	PHW-SED-01AS	Thallium	2		1	2.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Thallium	1.2		1	1.2	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-03AS	Thallium	1.4		1	1.4	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Thallium	2.1		1	2.1	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Thallium	0.82		1	0.82	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Thallium		0.35	1	--	--	0.35	0
Wash Soil	Soil	--	2005	PHW-SED-07AS	Thallium	0.21		1	0.21	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Thallium	1		1	1.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Thallium	0.91		1	0.91	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Thallium	1.6		1	1.6	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Thallium	1.5		1	1.5	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Thallium	1.6		1	1.6	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Thallium	0.2		1	0.20	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Thallium	1.8		1	1.8	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Thallium	1.1		1	1.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Thallium	1.1		1	1.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Thallium	0.62		1	0.62	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Thallium	2		1	2.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Thallium	1.6		1	1.6	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Thallium	0.85		1	0.85	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Thallium	1.4		1	1.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Thallium	2.1		1	2.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Thallium	1.3		1	1.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Thallium	0.93		1	0.93	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Thallium	1.3		1	1.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Thallium	0.39		1	0.39	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Thallium	1.7		1	1.7	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Thallium	1.3		1	1.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Thallium	0.81		1	0.81	0	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Thallium	1.4		1	1.4	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Thallium		10	1	--	--	10	1
Wash Soil	Soil	--	2006	KAW-02-SED-0	Vanadium	14.1		2	7.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Vanadium	68.9		2	34	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Vanadium	63.5		2	32	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Vanadium	67		2	34	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Vanadium	72.7		2	36	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Vanadium	58.1		2	29	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Vanadium	43.6		2	22	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Vanadium	49.9		2	25	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Vanadium	41.7		2	21	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Vanadium	45		2	23	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-10AS	Vanadium	51		2	26	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Vanadium	79.8		2	40	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Vanadium	56.5		2	28	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Vanadium	16.5		2	8.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Vanadium	63.9		2	32	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Vanadium	52.8		2	26	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Vanadium	65.4		2	33	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-02AS	Vanadium	63.3		2	32	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Vanadium	65.9		2	33	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Vanadium	69.6		2	35	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Vanadium	38.1		2	19	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Vanadium	51		2	26	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Vanadium	53.5		2	27	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Vanadium	43.7		2	22	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Vanadium	40.8		2	20	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Vanadium	42.6		2	21	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Vanadium	18.8		2	9.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Vanadium	64.7		2	32	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Vanadium	49.9		2	25	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Vanadium	30.4		2	15	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Vanadium	50.3		2	25	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Vanadium	32		2	16	1	--	--
Wash Soil	Soil	--	2006	KAW-02-SED-0	Zinc	34.7		50	0.69	0	--	--
Wash Soil	Soil	--	2005	PHW-SED-01AS	Zinc	510		50	10	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-02AS	Zinc	554		50	11	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-03AS	Zinc	478		50	9.6	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-04AS	Zinc	525		50	11	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-05AS	Zinc	566		50	11	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-06AS	Zinc	1040		50	21	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-07AS	Zinc	830		50	17	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-08AS	Zinc	349		50	7.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-09AS	Zinc	383		50	7.7	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-10AS	Zinc	292		50	5.8	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-11AS	Zinc	109		50	2.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-12AS	Zinc	54.9		50	1.1	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-13AS	Zinc	57.7		50	1.2	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-14AS	Zinc	150		50	3.0	1	--	--
Wash Soil	Soil	--	2005	PHW-SED-15AS	Zinc	267		50	5.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-01AS	Zinc	270		50	5.4	1	--	--

TABLE 5-8
Detailed Point-by-Point Evaluation of Soil (mg/kg dw) for Terrestrial Plants by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-02AS	Zinc	283		50	5.7	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-03AS	Zinc	264		50	5.3	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-04AS	Zinc	192		50	3.8	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-05AS	Zinc	207		50	4.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-06AS	Zinc	256		50	5.1	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-07AS	Zinc	71.9		50	1.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-08AS	Zinc	250		50	5.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-09AS	Zinc	170		50	3.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-10AS	Zinc	121		50	2.4	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-11AS	Zinc	93.9		50	1.9	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-12AS	Zinc	211		50	4.2	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-13AS	Zinc	200		50	4.0	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-14AS	Zinc	95.1		50	1.9	1	--	--
Wash Soil	Soil	--	2005	SPW-SED-15AS	Zinc	176		50	3.5	1	--	--
Wash Soil	Soil	--	2006	SPW-SED-16AS	Zinc	71		50	1.4	1	--	--

Notes:
* Because concentrations of this analyte in stable and unstable riparian soils did not differ, the data were combined for the point-by-point analysis
Values in the HQ column that are italics and underline are the pH values for the sample, toxicity of iron is based on these pH values, with toxicity occuring at pH values greater than 8

HQ = hazard quotient
DW = dry weight
HQ_{DL} = hazard quotient based on detection limit
HQ_{DL} G1 = Indicates whether HQ based on the detection limit (for non-detects) is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.
HQ G1 = Indicates whether HQ is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.
Det = indicates whether the chemical is detected. A "1" is used to indicate detected, a "0" is used to indicate non-detect
DL = detection limit
LocID = sample location identifier
Conc = concentration

TABLE 5-9

Summary of Point-by-Point Evaluation for Terrestrial Plant

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

		Summary Statistics of Analyte				Evauation Based on Plant Benchmark					
		Detected Concentration and Detection Limit				Evaluation of Detected Concentration			Evaluation of Detection Limit		
Analyte	Plant Benchmark (mg/kg dw)	DF	Percent Detects	Soil Concentration Range (mg/kg dw)	DL Range	HQ Range	EF	Percent Exceedance	HQDL Range	EF	Percent Exceedance
On-Site Gila River - Combined Stable and Unstable Riparian Soil											
Boron	0.5	29/29	100	0.48 - 32.5	--	0.96 - 65	28/29	97	0	0/29	0
Copper	70	29/29	100	40.2 - 1150	--	0.57 - 16.4	24/29	83	0	0/29	0
Molybdenum	2	29/29	100	0.1 - 7.1	--	0.05 - 3.6	14/29	48	0	0/29	0
Selenium	1	1/29	3	0.67	3.5	0.67	0/29	0	3.5	28/29	97
On-Site Gila River - Stable Riparian Soil											
Iron	not toxic at pH 5-8	17/17	100	8480 - 20700	--	7.3 - 8.5	5/17	29	0	0/17	0
Manganese	220	17/17	100	210 - 794	--	0.95 - 3.6	16/17	94	0	0/17	0
On-Site Gila River - Unstable Riparian Soil											
Cobalt	13	12/12	100	7.4 - 17	--	0.57 - 1.3	1/12	8	0	0/12	0
Iron	not toxic at pH 5-8	12/12	100	13200 - 27200	--	7.5 - 8.7	3/12	25	0	0/12	0
Manganese	220	12/12	100	339 - 879	--	1.5 - 4	12/12	100	0	0/12	0
On-Site San Pedro River - Combined Stable and Unstable Riparian Soil											
Boron	0.5	4/4	100	0.88 - 5.7	--	1.8 - 11.4	4/4	100	0	0/4	0
Selenium	1	0/4	0	--	3.5	0	0/4	0	3.5	4/4	100
On-Site San Pedro River - Stable Riparian Soil											
Iron	not toxic at pH 5-8	2/2	100	9490 - 9870	--	8.4 - 8.8	2/2	100	0	0/2	0
On-Site San Pedro River - Unstable Riparian Soil											
Iron	not toxic at pH 5-8	2/2	100	6570 - 18000	--	7.8 - 8.8	1/2	50	0	0/2	0
Manganese	220	2/2	100	158 - 591	--	0.72 - 2.7	1/2	50	0	0/2	0
Upland Soils											
Antimony	5	10/10	100	0.39 - 10.4	--	0.08 - 2.08	2/10	20	0	0/10	0
Arsenic	18	10/10	100	1.8 - 361	--	0.1 - 20.1	5/10	50	0	0/10	0
Boron	0.5	10/10	100	1.5 - 7.3	--	3 - 14.6	10/10	100	0	0/10	0
Cadmium	32	9/10	90	0.92 - 94.7	0.08	0.03 - 3	2/10	20	0.003	0/10	0
Chromium	1	9/10	90	3.8 - 72	0.4	3.8 - 72	9/10	90	0.4	0/10	0
Cobalt	13	10/10	100	5.7 - 84.9	--	0.44 - 6.5	8/10	80	0	0/10	0
Copper	70	10/10	100	16.6 - 47200	--	0.24 - 670	9/10	90	0	0/10	0
Iron	not toxic at pH 5-8	10/10	100	11500 - 186999	--	6.2 - 8.6	2/10	20	0	0/10	0
Lead	120	10/10	100	5.1 - 468	--	0.04 - 3.9	4/10	40	0	0/10	0
Manganese	220	10/10	100	232 - 797	--	1.1 - 3.6	10/10	100	0	0/10	0
Mercury	0.3	8/10	80	0.02 - 0.49	0.02	0.07 - 1.6	2/10	20	0.07	0/10	0
Molybdenum	2	10/10	100	0.25 - 1060	--	0.12 - 530	9/10	90	0	0/10	0
Nickel	38	10/10	100	7.2 - 40.9	--	0.19 - 1.1	1/10	10	0	0/10	0
Selenium	1	9/10	90	0.75 - 18.8	0.51	0.75 - 18.8	6/10	60	0.51	0/10	0
Thallium	1	2/10	20	0.4 - 0.87	0.44 - 2.4	0.4 - 0.87	0/10	0	0.44 - 2.4	1/10	10
Vanadium	2	10/10	100	22.4 - 86.3	--	11.2 - 43.2	10/10	100	0	0/10	0
Zinc	50	10/10	100	30.3 - 5920	--	0.61 - 120	9/10	90	0	0/10	0

TABLE 5-9

Summary of Point-by-Point Evaluation for Terrestrial Plant

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

		Summary Statistics of Analyte Detected Concentration and Detection Limit				Evauation Based on Plant Benchmark					
						Evaluation of Detected Concentration			Evaluation of Detection Limit		
Analyte	**Plant Benchmark (mg/kg dw)**	**DF**	**Percent Detects**	**Soil Concentration Range (mg/kg dw)**	**DL Range**	**HQ Range**	**EF**	**Percent Exceedance**	**HQDL Range**	**EF**	**Percent Exceedance**
Wash Soils											
Antimony	5	21/32	66	0.84 - 3.6	0.49 - 20	0.17 - 0.72	0/32	0	0.098 - 4	1/32	3
Arsenic	18	32/32	100	1.6 - 75.3	--	0.09 - 4.2	16/32	50	0	0/32	0
Boron	0.5	19/19	100	0.85 - 4	--	1.7 - 8	19/19	100	0	0/19	0
Chromium	1	32/32	100	3.8 - 120	--	3.8 - 120	32/32	100	0	0/32	0
Cobalt	13	32/32	100	7.1 - 79	--	0.55 - 6.1	28/32	88	0	0/32	0
Copper	70	32/32	100	926 - 12500	--	13 - 180	32/32	100	0	0/32	0
Iron	not toxic at pH 5-8	32/32	100	9590 - 320000	--	7.6 - 8.6	19/32	59	0	0/32	0
Lead	120	32/32	100	9.6 - 239	--	0.08 - 2	6/32	19	0	0/32	0
Manganese	220	32/32	100	61.1 - 758	--	0.28 - 3.4	26/32	81	0	0/32	0
Mercury	0.3	26/32	81	0.02 - 0.3	0.05 - 0.051	0.07 - 1	1/32	3	0.33	0/32	0
Molybdenum	2	20/20	100	3.8 - 86	--	1.9 - 43	20/20	100	0	0/20	0
Nickel	38	32/32	100	7 - 82	--	0.18 - 2.2	1/32	3	0	0/32	0
Selenium	1	20/32	63	0.16 - 24	0.15 - 0.16	0.16 - 24	9/32	28	0.15 - 0.16	0/32	0
Thallium	1	29/32	91	0.2 - 2.1	0.35 - 10	0.2 - 2.1	20/32	63	0.35 - 10	1/32	3
Vanadium	2	32/32	100	14.1 - 79.8	--	7 - 40	32/32	100	0	0/32	0
Zinc	50	32/32	100	34.7 - 1040	--	0.69 - 21	31/32	97	0	0/32	0

Notes:

HQ = hazard quotient

DF = detection frequency (i.e. 29/29 = 29 detections out of 29 samples)

DW = dry weight

DL = detection limit

EF = exceedance frequency (i.e. 2/29 = 2 exceedance of the benchmark out of 29 samples)

HQ_{DL} = hazard quotient based on detection limit

TABLE 5-10

Detailed Point-by-Point Evaluation of Groundwater for Potential Plant Exposure

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Martix	Sampling Event	LocID	Date	Sample Type	Parameter	Conc	DL	Units	Plant Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Groundwater	GW_Summer	H-1	9/13/06	Primary Sample	Arsenic	4.7		µg/L	1.0	4.7	1		
Groundwater	GW_Summer	H-10	8/29/06	Primary Sample	Arsenic	5.8		µg/L	1.0	5.8	1		
Groundwater	GW_Summer	H-2A	9/13/06	Primary Sample	Arsenic	3.8		µg/L	1.0	3.8	1		
Groundwater	GW_Summer	H-5	9/13/06	Primary Sample	Arsenic	4.9		µg/L	1.0	4.9	1		
Groundwater	GW_Summer	GW-03	9/1/06	Primary Sample	Arsenic	3.6		µg/L	1.0	3.6	1		
Groundwater	GW_Winter	H-1	2/28/06	Primary Sample	Arsenic	6.5		µg/L	1.0	6.5	1		
Groundwater	GW_Winter	H-10	2/27/06	Primary Sample	Arsenic	5.2		µg/L	1.0	5.2	1		
Groundwater	GW_Winter	H-2A	2/28/06	Primary Sample	Arsenic	4.9		µg/L	1.0	4.9	1		
Groundwater	GW_Winter	H-5	2/28/06	Primary Sample	Arsenic	7.4		µg/L	1.0	7.4	1		
Groundwater	GW_Winter	GW-03	3/3/06	Primary Sample	Arsenic	5.7		µg/L	1.0	5.7	1		
Groundwater	GW_Summer	H-1	9/13/06	Primary Sample	Manganese	7330		µg/L	4000	1.8	1		
Groundwater	GW_Summer	H-10	8/29/06	Primary Sample	Manganese	767		µg/L	4000	0.2	0		
Groundwater	GW_Summer	H-2A	9/13/06	Primary Sample	Manganese	5250		µg/L	4000	1.3	1		
Groundwater	GW_Summer	H-5	9/13/06	Primary Sample	Manganese	2190		µg/L	4000	0.6	0		
Groundwater	GW_Summer	GW-03	9/1/06	Primary Sample	Manganese		1	µg/L	4000			0.0003	0
Groundwater	GW_Winter	H-1	2/28/06	Primary Sample	Manganese	6500		µg/L	4000	1.6	1		
Groundwater	GW_Winter	H-10	2/27/06	Primary Sample	Manganese	320		µg/L	4000	0.08	0		
Groundwater	GW_Winter	H-2A	2/28/06	Primary Sample	Manganese	7200		µg/L	4000	1.8	1		
Groundwater	GW_Winter	H-5	2/28/06	Primary Sample	Manganese	850		µg/L	4000	0.2	0		
Groundwater	GW_Winter	GW-03	3/3/06	Primary Sample	Manganese		2	µg/L	4000			0.0005	0

Notes:

Conc = concentration

Det = indicates whether the chemical is detected. A "1" is used to indicate detected, a "0" is used to indicate non-detect

DL = detection limit

DW = dry weight

HQ = hazard quotient

HQ G1 = Indicates whether HQ is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.

HQ_{DL} = hazard quotient based on detection limit

HQ_{DL} G1 = Indicates whether HQ based on the detection limit (for non-detects) is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.

LocID = sample location identifier

µg/L = micrograms per liter

TABLE 5-11

Summary of Point-by-Point Evaluation for Terrestrial Plant Potentially Exposed to Groundwater

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

		Summary Statistics of Analyte Detected Concentration and Detection Limit				Evauation Based on Solution-Based Plant TRV					
						Evaluation of Detected Concentration			Evaluation of Detection Limit		
Analyte	**Solution-Based Plant TRV (µg/L)**	**DF**	**Percent Detects**	**Groundwater Concentration Range (µg/L)**	**DL Range**	**HQ Range**	**EF**	**Percent Exceedance**	**HQ_{DL} Range**	**EF**	**Percent Exceedance**
Arsenic	1.0	10/10	100	3.6 - 7.4	--	3.6 - 7.4	10/10	100	--	0/10	0
Manganese	4000	8/10	80	320 - 7330	1 - 2	0.08 - 1.8	4/10	40	0.00025 - 0.0005	0/10	0

Notes:

DF = detection frequency (i.e. 29/29 = 29 detections out of 29 samples)

DL = detection limit

DW = dry weight

EF = exceedance frequency (i.e. 2/29 = 2 exceedance of the benchmark out of 29 samples)

HQ = hazard quotient

HQ_{DL} = hazard quotient based on detection limit

µg/L = micrograms per liter

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River *	Soil	stable	2006	GR-REF-01S	Copper	85.8		80	1.1	1		
Middle Gila River *	Soil	stable	2006	GR1-01S	Copper	87.6		80	1.1	1		
Middle Gila River *	Soil	stable	2006	GR10-01S	Copper	90.2		80	1.1	1		
Middle Gila River *	Soil	stable	2006	GR11-01S	Copper	69.9		80	0.87	0		
Middle Gila River *	Soil	stable	2006	GR12-01S	Copper	245		80	3.1	1		
Middle Gila River *	Soil	stable	2006	GR13-01S	Copper	226		80	2.8	1		
Middle Gila River *	Soil	stable	2006	GR14-01S	Copper	55.1		80	0.69	0		
Middle Gila River *	Soil	stable	2006	GR15-01S	Copper	73.4		80	0.92	0		
Middle Gila River *	Soil	stable	2006	GR16-01S	Copper	102		80	1.3	1		
Middle Gila River *	Soil	stable	2006	GR2-01S	Copper	437		80	5.5	1		
Middle Gila River *	Soil	stable	2006	GR3-01S	Copper	1150		80	14	1		
Middle Gila River *	Soil	stable	2006	GR4-01S	Copper	57.3		80	0.72	0		
Middle Gila River *	Soil	stable	2006	GR5-01S	Copper	106		80	1.3	1		
Middle Gila River *	Soil	stable	2006	GR6-01S	Copper	198		80	2.5	1		
Middle Gila River *	Soil	stable	2006	GR7-01S	Copper	239		80	3.0	1		
Middle Gila River *	Soil	stable	2006	GR8-01S	Copper	117		80	1.5	1		
Middle Gila River *	Soil	stable	2006	GR9-01S	Copper	51.8		80	0.65	0		
Middle Gila River *	Soil	unstable	2006	GR-REF-01U	Copper	83.3		80	1.0	1		
Middle Gila River *	Soil	unstable	2006	GR1-01U	Copper	95.4		80	1.2	1		
Middle Gila River *	Soil	unstable	2006	GR10-01U	Copper	91.6		80	1.1	1		
Middle Gila River *	Soil	unstable	2006	GR11-01U	Copper	103		80	1.3	1		
Middle Gila River *	Soil	unstable	2006	GR2-01U	Copper	696		80	8.7	1		
Middle Gila River *	Soil	unstable	2006	GR3-01U	Copper	572		80	7.2	1		
Middle Gila River *	Soil	unstable	2006	GR4-01U	Copper	164		80	2.1	1		
Middle Gila River *	Soil	unstable	2006	GR5-01U	Copper	145		80	1.8	1		
Middle Gila River *	Soil	unstable	2006	GR6-01U	Copper	93.8		80	1.2	1		
Middle Gila River *	Soil	unstable	2006	GR7-01U	Copper	74		80	0.93	0		
Middle Gila River *	Soil	unstable	2006	GR8-01U	Copper	87.8		80	1.1	1		
Middle Gila River *	Soil	unstable	2006	GR9-01U	Copper	40.2		80	0.50	0		
Middle Gila River - s		stable	2006	GR-REF-01S	Manganese	381		450	0.85	0		
Middle Gila River - s		stable	2006	GR1-01S	Manganese	427		450	0.95	0		
Middle Gila River - s		stable	2006	GR10-01S	Manganese	532		450	1.2	1		
Middle Gila River - s		stable	2006	GR11-01S	Manganese	361		450	0.80	0		
Middle Gila River - s		stable	2006	GR12-01S	Manganese	210		450	0.47	0		
Middle Gila River - s		stable	2006	GR13-01S	Manganese	310		450	0.69	0		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River - s		stable	2006	GR14-01S	Manganese	287		450	0.64	0		
Middle Gila River - s		stable	2006	GR15-01S	Manganese	259		450	0.58	0		
Middle Gila River - s		stable	2006	GR16-01S	Manganese	794		450	1.8	1		
Middle Gila River - s		stable	2006	GR2-01S	Manganese	364		450	0.81	0		
Middle Gila River - s		stable	2006	GR3-01S	Manganese	407		450	0.90	0		
Middle Gila River - s		stable	2006	GR4-01S	Manganese	437		450	1.0	1		
Middle Gila River - s		stable	2006	GR5-01S	Manganese	265		450	0.59	0		
Middle Gila River - s		stable	2006	GR6-01S	Manganese	443		450	0.98	0		
Middle Gila River - s		stable	2006	GR7-01S	Manganese	596		450	1.3	1		
Middle Gila River - s		stable	2006	GR8-01S	Manganese	536		450	1.2	1		
Middle Gila River - s		stable	2006	GR9-01S	Manganese	364		450	0.81	0		
Middle Gila River - u	Soil	unstable	2006	GR-REF-01U	Manganese	879		450	2.0	1		
Middle Gila River - u	Soil	unstable	2006	GR1-01U	Manganese	695		450	1.5	1		
Middle Gila River - u	Soil	unstable	2006	GR10-01U	Manganese	417		450	0.93	0		
Middle Gila River - u	Soil	unstable	2006	GR11-01U	Manganese	619		450	1.4	1		
Middle Gila River - u	Soil	unstable	2006	GR2-01U	Manganese	584		450	1.3	1		
Middle Gila River - u	Soil	unstable	2006	GR3-01U	Manganese	611		450	1.4	1		
Middle Gila River - u	Soil	unstable	2006	GR4-01U	Manganese	538		450	1.2	1		
Middle Gila River - u	Soil	unstable	2006	GR5-01U	Manganese	614		450	1.4	1		
Middle Gila River - u	Soil	unstable	2006	GR6-01U	Manganese	498		450	1.1	1		
Middle Gila River - u	Soil	unstable	2006	GR7-01U	Manganese	638		450	1.4	1		
Middle Gila River - u	Soil	unstable	2006	GR8-01U	Manganese	545		450	1.2	1		
Middle Gila River - u	Soil	unstable	2006	GR9-01U	Manganese	339		450	0.75	0		
Middle Gila River *	Soil	stable	2006	GR10-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR1-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR11-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR12-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR13-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR14-01S	Mercury	0.033		0.1	0.33	0		
Middle Gila River *	Soil	stable	2006	GR15-01S	Mercury	0.073		0.1	0.73	0		
Middle Gila River *	Soil	stable	2006	GR16-01S	Mercury	0.15		0.1	1.5	1		
Middle Gila River *	Soil	stable	2006	GR2-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR3-01S	Mercury	0.05		0.1	0.50	0		
Middle Gila River *	Soil	stable	2006	GR4-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR5-01S	Mercury		0.1	0.1			1.0	1

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River *	Soil	stable	2006	GR6-01S	Mercury	0.057		0.1	0.57	0		
Middle Gila River *	Soil	stable	2006	GR7-01S	Mercury	0.11		0.1	1.1	1		
Middle Gila River *	Soil	stable	2006	GR8-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR9-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	stable	2006	GR-REF-01S	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	unstable	2006	GR10-01U	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	unstable	2006	GR1-01U	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	unstable	2006	GR11-01U	Mercury	0.078		0.1	0.78	0		
Middle Gila River *	Soil	unstable	2006	GR2-01U	Mercury	0.035		0.1	0.35	0		
Middle Gila River *	Soil	unstable	2006	GR3-01U	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	unstable	2006	GR4-01U	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	unstable	2006	GR5-01U	Mercury	0.045		0.1	0.45	0		
Middle Gila River *	Soil	unstable	2006	GR6-01U	Mercury	0.032		0.1	0.32	0		
Middle Gila River *	Soil	unstable	2006	GR7-01U	Mercury	0.12		0.1	1.2	1		
Middle Gila River *	Soil	unstable	2006	GR8-01U	Mercury	0.12		0.1	1.2	1		
Middle Gila River *	Soil	unstable	2006	GR9-01U	Mercury		0.1	0.1			1.0	1
Middle Gila River *	Soil	unstable	2006	GR-REF-01U	Mercury	0.061		0.1	0.61	0		
San Pedro River - u	Soil	unstable	2006	SPR1-01U	Manganese	158		450	0.35	0		
San Pedro River - u	Soil	unstable	2006	SPR2-01U	Manganese	591		450	1.3	1		
San Pedro River *	Soil	stable	2006	SPR1-01S	Mercury	0.023		0.1	0.23	0		
San Pedro River *	Soil	stable	2006	SPR2-01S	Mercury	0.051		0.1	0.51	0		
San Pedro River *	Soil	unstable	2006	SPR1-01U	Mercury		0.1	0.1			1.0	1
San Pedro River *	Soil	unstable	2006	SPR2-01U	Mercury	0.043		0.1	0.43	0		
Upland Soil	Soil	--	2006	SD-01-SED-0	Arsenic	24.7		60	0.41	0		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Arsenic	361		60	6.0	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Arsenic	232		60	3.9	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Arsenic	74		60	1.2	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Arsenic	39.1		60	0.65	0		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Arsenic	13.7		60	0.23	0		
Upland Soil	Soil	--	2006	UP-01-SED-0	Arsenic	10.9		60	0.18	0		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Arsenic	6.7		60	0.11	0		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Arsenic	1.8		60	0.03	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Arsenic	9.1		60	0.15	0		
Upland Soil	Soil	--	2006	SD-01-SED-0	Chromium		0.4	0.4			1.0	1
Upland Soil	Soil	--	2006	SDD-01-SED-0	Chromium	72		0.4	180	1		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Upland Soil	Soil	--	2006	SDD-02-SED-0	Chromium	16.4		0.4	41	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Chromium	3.8		0.4	9.5	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Chromium	25.5		0.4	64	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Chromium	15.7		0.4	39	1		
Upland Soil	Soil	--	2006	UP-01-SED-0	Chromium	21.9		0.4	55	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Chromium	7.3		0.4	18	1		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Chromium	5.9		0.4	15	1		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Chromium	11.8		0.4	30	1		
Upland Soil	Soil	--	2006	SD-01-SED-0	Copper	47200		80	590	1		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Copper	12100		80	151	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Copper	10200		80	128	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Copper	27000		80	338	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Copper	8130		80	102	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Copper	1990		80	25	1		
Upland Soil	Soil	--	2006	UP-01-SED-0	Copper	1540		80	19	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Copper	854		80	11	1		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Copper	16.6		80	0.21	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Copper	882		80	11	1		
Upland Soil	Soil	--	2006	SD-01-SED-0	Manganese	232		450	0.52	0		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Manganese	557		450	1.2	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Manganese	647		450	1.4	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Manganese	581		450	1.3	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Manganese	382		450	0.85	0		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Manganese	341		450	0.76	0		
Upland Soil	Soil	--	2006	UP-01-SED-0	Manganese	797		450	1.8	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Manganese	686		450	1.5	1		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Manganese	258		450	0.57	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Manganese	276		450	0.61	0		
Upland Soil	Soil	--	2006	SD-01-SED-0	Mercury	0.02		0.1	0.20	0		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Mercury	0.49		0.1	4.9	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Mercury	0.44		0.1	4.4	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Mercury	0.13		0.1	1.3	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Mercury	0.15		0.1	1.5	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Mercury		0.02	0.1			0.20	0
Upland Soil	Soil	--	2006	UP-01-SED-0	Mercury	0.053		0.1	0.53	0		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Upland Soil	Soil	--	2006	UPA-01-SED-0	Mercury	0.031		0.1	0.31	0		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Mercury		0.02	0.1			0.20	0
Upland Soil	Soil	--	2006	UPA-07-SED-0	Mercury	0.052		0.1	0.52	0		
Upland Soil	Soil	--	2006	SD-01-SED-0	Zinc	5920		100	59	1		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Zinc	5300		100	53	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Zinc	3340		100	33	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Zinc	1380		100	14	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Zinc	400		100	4.0	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Zinc	597		100	6.0	1		
Upland Soil	Soil	--	2006	UP-01-SED-0	Zinc	113		100	1.1	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Zinc	99.3		100	0.99	0		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Zinc	30.3		100	0.30	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Zinc	106		100	1.1	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Arsenic	1.6		60	0.03	0		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Arsenic	35.7		60	0.60	0		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Arsenic	43.3		60	0.72	0		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Arsenic	36.4		60	0.61	0		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Arsenic	25.4		60	0.42	0		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Arsenic	75.3		60	1.3	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Arsenic	36.1		60	0.60	0		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Arsenic	43.5		60	0.73	0		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Arsenic	16.5		60	0.28	0		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Arsenic	21.5		60	0.36	0		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Arsenic	8.9		60	0.15	0		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Arsenic	10.4		60	0.17	0		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Arsenic	4.6		60	0.08	0		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Arsenic	6.1		60	0.10	0		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Arsenic	7.9		60	0.13	0		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Arsenic	22		60	0.37	0		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Arsenic	23.1		60	0.39	0		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Arsenic	29.7		60	0.50	0		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Arsenic	23.2		60	0.39	0		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Arsenic	15.1		60	0.25	0		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Arsenic	24.7		60	0.41	0		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Arsenic	28.9		60	0.48	0		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Arsenic	5.5		60	0.09	0		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-08AS	Arsenic	18.3		60	0.31	0		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Arsenic	13		60	0.22	0		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Arsenic	9		60	0.15	0		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Arsenic	17.7		60	0.30	0		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Arsenic	14.3		60	0.24	0		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Arsenic	13.5		60	0.23	0		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Arsenic	9.5		60	0.16	0		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Arsenic	16.4		60	0.27	0		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Arsenic	28		60	0.47	0		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Chromium	3.8		0.4	9.5	1		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Chromium	19.1		0.4	48	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Chromium	22		0.4	55	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Chromium	20.3		0.4	51	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Chromium	19.9		0.4	50	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Chromium	18.1		0.4	45	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Chromium	18		0.4	45	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Chromium	15.7		0.4	39	1		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Chromium	11.1		0.4	28	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Chromium	16.3		0.4	41	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Chromium	12.5		0.4	31	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Chromium	22		0.4	55	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Chromium	14.1		0.4	35	1		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Chromium	4.8		0.4	12	1		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Chromium	14.8		0.4	37	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Chromium	16		0.4	40	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Chromium	18.2		0.4	46	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Chromium	18.3		0.4	46	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Chromium	16.6		0.4	42	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Chromium	17.2		0.4	43	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Chromium	13.1		0.4	33	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Chromium	15		0.4	38	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Chromium	9.8		0.4	25	1		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Chromium	11.6		0.4	29	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Chromium	9.8		0.4	25	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Chromium	10.1		0.4	25	1		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-11AS	Chromium	10.9		0.4	27	1		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Chromium	17.3		0.4	43	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Chromium	16		0.4	40	1		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Chromium	9		0.4	23	1		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Chromium	13.9		0.4	35	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Chromium	120		0.4	300	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Copper	2900		80	36	1		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Copper	6030		80	75	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Copper	7700		80	96	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Copper	8270		80	103	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Copper	6070		80	76	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Copper	12200		80	153	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Copper	8810		80	110	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Copper	9030		80	113	1		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Copper	4650		80	58	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Copper	8510		80	106	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Copper	2380		80	30	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Copper	6670		80	83	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Copper	1230		80	15	1		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Copper	2270		80	28	1		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Copper	1770		80	22	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Copper	5650		80	71	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Copper	10500		80	131	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Copper	12500		80	156	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Copper	7230		80	90	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Copper	5970		80	75	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Copper	6260		80	78	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Copper	7050		80	88	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Copper	926		80	12	1		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Copper	4950		80	62	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Copper	3150		80	39	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Copper	2440		80	31	1		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Copper	2860		80	36	1		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Copper	6060		80	76	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Copper	5170		80	65	1		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-14AS	Copper	2230		80	28	1		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Copper	4920		80	62	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Copper	4700		80	59	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Manganese	61.1		450	0.14	0		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Manganese	502		450	1.1	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Manganese	510		450	1.1	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Manganese	563		450	1.3	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Manganese	576		450	1.3	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Manganese	424		450	0.94	0		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Manganese	213		450	0.47	0		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Manganese	355		450	0.79	0		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Manganese	302		450	0.67	0		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Manganese	304		450	0.68	0		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Manganese	391		450	0.87	0		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Manganese	758		450	1.7	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Manganese	434		450	0.96	0		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Manganese	126		450	0.28	0		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Manganese	602		450	1.3	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Manganese	437		450	0.97	0		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Manganese	676		450	1.5	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Manganese	622		450	1.4	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Manganese	482		450	1.1	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Manganese	599		450	1.3	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Manganese	291		450	0.65	0		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Manganese	406		450	0.90	0		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Manganese	451		450	1.0	1		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Manganese	358		450	0.80	0		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Manganese	333		450	0.74	0		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Manganese	332		450	0.74	0		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Manganese	98.3		450	0.22	0		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Manganese	481		450	1.1	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Manganese	355		450	0.79	0		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Manganese	196		450	0.44	0		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Manganese	369		450	0.82	0		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Manganese	100		450	0.22	0		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2006	KAW-02-SED-0	Mercury	0.025		0.1	0.25	0		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Mercury	0.065		0.1	0.65	0		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Mercury	0.15		0.1	1.5	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Mercury	0.11		0.1	1.1	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Mercury	0.03		0.1	0.30	0		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Mercury	0.3		0.1	3.0	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Mercury	0.025		0.1	0.25	0		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Mercury	0.039		0.1	0.39	0		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Mercury	0.038		0.1	0.38	0		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Mercury	0.092		0.1	0.92	0		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Mercury		0.051	0.1			0.51	0
Wash Soil	Soil	--	2005	PHW-SED-11AS	Mercury		0.05	0.1			0.50	0
Wash Soil	Soil	--	2005	PHW-SED-12AS	Mercury		0.051	0.1			0.51	0
Wash Soil	Soil	--	2005	PHW-SED-13AS	Mercury	0.032		0.1	0.32	0		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Mercury	0.025		0.1	0.25	0		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Mercury	0.061		0.1	0.61	0		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Mercury	0.05		0.1	0.50	0		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Mercury	0.093		0.1	0.93	0		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Mercury	0.12		0.1	1.2	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Mercury	0.02		0.1	0.20	0		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Mercury	0.076		0.1	0.76	0		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Mercury	0.14		0.1	1.4	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Mercury		0.051	0.1			0.51	0
Wash Soil	Soil	--	2005	SPW-SED-08AS	Mercury	0.082		0.1	0.82	0		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Mercury	0.05		0.1	0.50	0		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Mercury		0.05	0.1			0.50	0
Wash Soil	Soil	--	2005	SPW-SED-11AS	Mercury	0.061		0.1	0.61	0		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Mercury		0.051	0.1			0.51	0
Wash Soil	Soil	--	2005	SPW-SED-13AS	Mercury	0.058		0.1	0.58	0		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Mercury	0.021		0.1	0.21	0		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Mercury	0.047		0.1	0.47	0		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Mercury	0.15		0.1	1.5	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Zinc	34.7		100	0.35	0		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Zinc	510		100	5.1	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Zinc	554		100	5.5	1		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-03AS	Zinc	478		100	4.8	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Zinc	525		100	5.3	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Zinc	566		100	5.7	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Zinc	1040		100	10	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Zinc	830		100	8.3	1		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Zinc	349		100	3.5	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Zinc	383		100	3.8	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Zinc	292		100	2.9	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Zinc	109		100	1.1	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Zinc	54.9		100	0.55	0		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Zinc	57.7		100	0.58	0		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Zinc	150		100	1.5	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Zinc	267		100	2.7	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Zinc	270		100	2.7	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Zinc	283		100	2.8	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Zinc	264		100	2.6	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Zinc	192		100	1.9	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Zinc	207		100	2.1	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Zinc	256		100	2.6	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Zinc	71.9		100	0.72	0		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Zinc	250		100	2.5	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Zinc	170		100	1.7	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Zinc	121		100	1.2	1		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Zinc	93.9		100	0.94	0		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Zinc	211		100	2.1	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Zinc	200		100	2.0	1		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Zinc	95.1		100	0.95	0		

TABLE 5-12
Detailed Point-by-Point Evaluation of Soil for Soil Invertebrates by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc (mg/kg dw)	DL	Soil Invertebrate Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-15AS	Zinc	176		100	1.8	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Zinc	71		100	0.71	0		

Notes:
* Because concentrations of this analyte in stable and unstable riparian soils did not differ, the data were combined for the point-by-point analysis.
Conc = concentration
Det = indicates whether the chemical is detected. A "1" is used to indicate detected, a "0" is used to indicate non-detect.
DL = detection limit
DW = dry weight
HQ = hazard quotient
HQ G1 = Indicates whether HQ is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.
HQ_{DL} = hazard quotient based on detection limit
HQ_{DL} G1 = Indicates whether HQ based on the detection limit (for non-detects) is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.
LocID = sample location identifier

TABLE 5-13
Summary of Point-by-Point Evaluation for Soil Invertebrates
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Parameter	Soil Invertebrate TRV (mg/kg dw)	DF	Percent Detects	Soil Concentration Range (mg/kg dw)	DL Range	HQ Range	EF	Percent Exceedance	HQ_{DL} Range	EF	Percent Exceedance
On-Site Gila River - Combined Stable and Unstable Riparian Soil											
Copper	80	29/29	100	40.2 - 1150	--	0.5 - 14.4	22/29	76	--	0/29	0
Mercury	0.1	13/29	45	0.032 - 0.15	0.1	0.32 - 1.5	4/29	14	1	16/29	55
On-Site Gila River - Stable Riparian Soil											
Manganese	450	17/17	100	210 - 794	--	0.47 - 1.8	5/17	29	--	0/17	0
On-Site Gila River - Unstable Riparian Soil											
Manganese	450	12/12	100	339 - 879	--	0.75 - 1.95	10/12	83	--	0/12	0
On-Site San Pedro River - Combined Stable and Unstable Riparian Soil											
Mercury	0.1	3/4	75	0.023 - 0.051	0.1	0.23 - 0.51	0/4	0	1	1/4	25
On-Site San Pedro River - Unstable Riparian Soil											
Manganese	450	2/2	100	158 - 591	--	0.35 - 1.3	1/2	50	--	0/2	0
Upland Soils											
Arsenic	60	10/10	100	1.8 - 361	--	0.03 - 6	3/10	30	--	0/10	0
Chromium	0.4	9/10	90	3.8 - 72	0.4	9.5 - 180	9/10	90	1	1/10	10
Copper	80	10/10	100	16.6 - 47200	--	0.21 - 590	9/10	90	--	0/10	0
Manganese	450	10/10	100	232 - 797	--	0.52 - 1.8	5/10	50	--	0/10	0
Mercury	0.1	8/10	80	0.02 - 0.49	0.02	0.2 - 4.9	4/10	40	0.2	0/10	0
Zinc	100	10/10	100	30.3 - 5920	--	0.3 - 59	8/10	80	--	0/10	0
Wash Soils											
Arsenic	60	32/32	100	1.6 - 75.3	--	0.03 - 1.3	1/32	3	--	0/32	0
Chromium	0.4	32/32	100	3.8 - 120	--	9.5 - 300	32/32	100	--	0/32	0
Copper	80	32/32	100	926 - 12500	--	11.6 - 156	32/32	100	--	0/32	0
Manganese	450	32/32	100	61.1 - 758	--	0.14 - 1.7	12/32	38	--	0/32	0
Mercury	0.1	26/32	81	0.02 - 0.3	0.05 - 0.051	0.2 - 3	6/32	19	0.5 - 0.51	0/32	0
Zinc	100	32/32	100	34.7 - 1040	--	0.35 - 10.4	25/32	78	--	0/32	0

Notes:
DF = detection frequency (i.e. 29/29 = 29 detections out of 29 samples)
DL = detection limit
DW = dry weight
EF = exceedance frequency (i.e. 2/29 = 2 exceedance of the benchmark out of 29 samples)
HQ = hazard quotient
HQ_{DL} = hazard quotient based on detection limit

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River *	Soil	stable	2006	GR-REF-01S	Boron	1.1		MG/KG	20	0.06	0		
Middle Gila River *	Soil	stable	2006	GR1-01S	Boron	0.68		MG/KG	20	0.03	0		
Middle Gila River *	Soil	stable	2006	GR10-01S	Boron	2.7		MG/KG	20	0.14	0		
Middle Gila River *	Soil	stable	2006	GR11-01S	Boron	3.1		MG/KG	20	0.16	0		
Middle Gila River *	Soil	stable	2006	GR12-01S	Boron	0.48		MG/KG	20	0.02	0		
Middle Gila River *	Soil	stable	2006	GR13-01S	Boron	4.6		MG/KG	20	0.23	0		
Middle Gila River *	Soil	stable	2006	GR14-01S	Boron	3.5		MG/KG	20	0.18	0		
Middle Gila River *	Soil	stable	2006	GR15-01S	Boron	2.9		MG/KG	20	0.15	0		
Middle Gila River *	Soil	stable	2006	GR16-01S	Boron	10		MG/KG	20	0.50	0		
Middle Gila River *	Soil	stable	2006	GR2-01S	Boron	1.5		MG/KG	20	0.08	0		
Middle Gila River *	Soil	stable	2006	GR3-01S	Boron	2.9		MG/KG	20	0.15	0		
Middle Gila River *	Soil	stable	2006	GR4-01S	Boron	4.9		MG/KG	20	0.25	0		
Middle Gila River *	Soil	stable	2006	GR5-01S	Boron	4.4		MG/KG	20	0.22	0		
Middle Gila River *	Soil	stable	2006	GR6-01S	Boron	16		MG/KG	20	0.80	0		
Middle Gila River *	Soil	stable	2006	GR7-01S	Boron	32.5		MG/KG	20	1.6	1		
Middle Gila River *	Soil	stable	2006	GR8-01S	Boron	5.4		MG/KG	20	0.27	0		
Middle Gila River *	Soil	stable	2006	GR9-01S	Boron	2.6		MG/KG	20	0.13	0		
Middle Gila River *	Soil	unstable	2006	GR-REF-01U	Boron	7.5		MG/KG	20	0.38	0		
Middle Gila River *	Soil	unstable	2006	GR1-01U	Boron	0.62		MG/KG	20	0.03	0		
Middle Gila River *	Soil	unstable	2006	GR10-01U	Boron	2.4		MG/KG	20	0.12	0		
Middle Gila River *	Soil	unstable	2006	GR11-01U	Boron	5.6		MG/KG	20	0.28	0		
Middle Gila River *	Soil	unstable	2006	GR2-01U	Boron	4.8		MG/KG	20	0.24	0		
Middle Gila River *	Soil	unstable	2006	GR3-01U	Boron	3.6		MG/KG	20	0.18	0		
Middle Gila River *	Soil	unstable	2006	GR4-01U	Boron	6.2		MG/KG	20	0.31	0		
Middle Gila River *	Soil	unstable	2006	GR5-01U	Boron	5.3		MG/KG	20	0.27	0		
Middle Gila River *	Soil	unstable	2006	GR6-01U	Boron	7.3		MG/KG	20	0.37	0		
Middle Gila River *	Soil	unstable	2006	GR7-01U	Boron	8.8		MG/KG	20	0.44	0		
Middle Gila River *	Soil	unstable	2006	GR8-01U	Boron	5.8		MG/KG	20	0.29	0		
Middle Gila River *	Soil	unstable	2006	GR9-01U	Boron	1.5		MG/KG	20	0.08	0		
Middle Gila River *	Soil	stable	2006	GR-REF-01S	Copper	85.8		MG/KG	100	0.86	0		
Middle Gila River *	Soil	stable	2006	GR1-01S	Copper	87.6		MG/KG	100	0.88	0		
Middle Gila River *	Soil	stable	2006	GR10-01S	Copper	90.2		MG/KG	100	0.90	0		
Middle Gila River *	Soil	stable	2006	GR11-01S	Copper	69.9		MG/KG	100	0.70	0		
Middle Gila River *	Soil	stable	2006	GR12-01S	Copper	245		MG/KG	100	2.5	1		
Middle Gila River *	Soil	stable	2006	GR13-01S	Copper	226		MG/KG	100	2.3	1		
Middle Gila River *	Soil	stable	2006	GR14-01S	Copper	55.1		MG/KG	100	0.55	0		
Middle Gila River *	Soil	stable	2006	GR15-01S	Copper	73.4		MG/KG	100	0.73	0		
Middle Gila River *	Soil	stable	2006	GR16-01S	Copper	102		MG/KG	100	1.0	1		
Middle Gila River *	Soil	stable	2006	GR2-01S	Copper	437		MG/KG	100	4.4	1		
Middle Gila River *	Soil	stable	2006	GR3-01S	Copper	1150		MG/KG	100	12	1		
Middle Gila River *	Soil	stable	2006	GR4-01S	Copper	57.3		MG/KG	100	0.57	0		
Middle Gila River *	Soil	stable	2006	GR5-01S	Copper	106		MG/KG	100	1.1	1		
Middle Gila River *	Soil	stable	2006	GR6-01S	Copper	198		MG/KG	100	2.0	1		
Middle Gila River *	Soil	stable	2006	GR7-01S	Copper	239		MG/KG	100	2.4	1		
Middle Gila River *	Soil	stable	2006	GR8-01S	Copper	117		MG/KG	100	1.2	1		
Middle Gila River *	Soil	stable	2006	GR9-01S	Copper	51.8		MG/KG	100	0.52	0		
Middle Gila River *	Soil	unstable	2006	GR-REF-01U	Copper	83.3		MG/KG	100	0.83	0		
Middle Gila River *	Soil	unstable	2006	GR1-01U	Copper	95.4		MG/KG	100	0.95	0		
Middle Gila River *	Soil	unstable	2006	GR10-01U	Copper	91.6		MG/KG	100	0.92	0		
Middle Gila River *	Soil	unstable	2006	GR11-01U	Copper	103		MG/KG	100	1.0	1		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River *	Soil	unstable	2006	GR2-01U	Copper	696		MG/KG	100	7.0	1		
Middle Gila River *	Soil	unstable	2006	GR3-01U	Copper	572		MG/KG	100	5.7	1		
Middle Gila River *	Soil	unstable	2006	GR4-01U	Copper	164		MG/KG	100	1.6	1		
Middle Gila River *	Soil	unstable	2006	GR5-01U	Copper	145		MG/KG	100	1.5	1		
Middle Gila River *	Soil	unstable	2006	GR6-01U	Copper	93.8		MG/KG	100	0.94	0		
Middle Gila River *	Soil	unstable	2006	GR7-01U	Copper	74		MG/KG	100	0.74	0		
Middle Gila River *	Soil	unstable	2006	GR8-01U	Copper	87.8		MG/KG	100	0.88	0		
Middle Gila River *	Soil	unstable	2006	GR9-01U	Copper	40.2		MG/KG	100	0.40	0		
Middle Gila River - s	Soil	stable	2006	GR-REF-01S	Iron	20000		MG/KG	200	100	1		
Middle Gila River - s	Soil	stable	2006	GR1-01S	Iron	20300		MG/KG	200	102	1		
Middle Gila River - s	Soil	stable	2006	GR10-01S	Iron	17100		MG/KG	200	86	1		
Middle Gila River - s	Soil	stable	2006	GR11-01S	Iron	14100		MG/KG	200	71	1		
Middle Gila River - s	Soil	stable	2006	GR12-01S	Iron	14900		MG/KG	200	75	1		
Middle Gila River - s	Soil	stable	2006	GR13-01S	Iron	12300		MG/KG	200	62	1		
Middle Gila River - s	Soil	stable	2006	GR14-01S	Iron	13200		MG/KG	200	66	1		
Middle Gila River - s	Soil	stable	2006	GR15-01S	Iron	11100		MG/KG	200	56	1		
Middle Gila River - s	Soil	stable	2006	GR16-01S	Iron	20700		MG/KG	200	104	1		
Middle Gila River - s	Soil	stable	2006	GR2-01S	Iron	17700		MG/KG	200	89	1		
Middle Gila River - s	Soil	stable	2006	GR3-01S	Iron	18100		MG/KG	200	91	1		
Middle Gila River - s	Soil	stable	2006	GR4-01S	Iron	16600		MG/KG	200	83	1		
Middle Gila River - s	Soil	stable	2006	GR5-01S	Iron	12400		MG/KG	200	62	1		
Middle Gila River - s	Soil	stable	2006	GR6-01S	Iron	15800		MG/KG	200	79	1		
Middle Gila River - s	Soil	stable	2006	GR7-01S	Iron	19600		MG/KG	200	98	1		
Middle Gila River - s	Soil	stable	2006	GR8-01S	Iron	17600		MG/KG	200	88	1		
Middle Gila River - s	Soil	stable	2006	GR9-01S	Iron	8480		MG/KG	200	42	1		
Middle Gila River - u	Soil	unstable	2006	GR-REF-01U	Iron	19800		MG/KG	200	99	1		
Middle Gila River - u	Soil	unstable	2006	GR1-01U	Iron	27200		MG/KG	200	136	1		
Middle Gila River - u	Soil	unstable	2006	GR10-01U	Iron	16300		MG/KG	200	82	1		
Middle Gila River - u	Soil	unstable	2006	GR11-01U	Iron	18000		MG/KG	200	90	1		
Middle Gila River - u	Soil	unstable	2006	GR2-01U	Iron	22800		MG/KG	200	114	1		
Middle Gila River - u	Soil	unstable	2006	GR3-01U	Iron	21500		MG/KG	200	108	1		
Middle Gila River - u	Soil	unstable	2006	GR4-01U	Iron	18700		MG/KG	200	94	1		
Middle Gila River - u	Soil	unstable	2006	GR5-01U	Iron	20000		MG/KG	200	100	1		
Middle Gila River - u	Soil	unstable	2006	GR6-01U	Iron	16800		MG/KG	200	84	1		
Middle Gila River - u	Soil	unstable	2006	GR7-01U	Iron	18400		MG/KG	200	92	1		
Middle Gila River - u	Soil	unstable	2006	GR8-01U	Iron	17600		MG/KG	200	88	1		
Middle Gila River - u	Soil	unstable	2006	GR9-01U	Iron	13200		MG/KG	200	66	1		
Middle Gila River - s	Soil	stable	2006	GR-REF-01S	Manganese	381		MG/KG	100	3.8	1		
Middle Gila River - s	Soil	stable	2006	GR1-01S	Manganese	427		MG/KG	100	4.3	1		
Middle Gila River - s	Soil	stable	2006	GR10-01S	Manganese	532		MG/KG	100	5.3	1		
Middle Gila River - s	Soil	stable	2006	GR11-01S	Manganese	361		MG/KG	100	3.6	1		
Middle Gila River - s	Soil	stable	2006	GR12-01S	Manganese	210		MG/KG	100	2.1	1		
Middle Gila River - s	Soil	stable	2006	GR13-01S	Manganese	310		MG/KG	100	3.1	1		
Middle Gila River - s	Soil	stable	2006	GR14-01S	Manganese	287		MG/KG	100	2.9	1		
Middle Gila River - s	Soil	stable	2006	GR15-01S	Manganese	259		MG/KG	100	2.6	1		
Middle Gila River - s	Soil	stable	2006	GR16-01S	Manganese	794		MG/KG	100	7.9	1		
Middle Gila River - s	Soil	stable	2006	GR2-01S	Manganese	364		MG/KG	100	3.6	1		
Middle Gila River - s	Soil	stable	2006	GR3-01S	Manganese	407		MG/KG	100	4.1	1		
Middle Gila River - s	Soil	stable	2006	GR4-01S	Manganese	437		MG/KG	100	4.4	1		
Middle Gila River - s	Soil	stable	2006	GR5-01S	Manganese	265		MG/KG	100	2.7	1		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Middle Gila River - s	Soil	stable	2006	GR6-01S	Manganese	443		MG/KG	100	4.4	1		
Middle Gila River - s	Soil	stable	2006	GR7-01S	Manganese	596		MG/KG	100	6.0	1		
Middle Gila River - s	Soil	stable	2006	GR8-01S	Manganese	536		MG/KG	100	5.4	1		
Middle Gila River - s	Soil	stable	2006	GR9-01S	Manganese	364		MG/KG	100	3.6	1		
Middle Gila River - u	Soil	unstable	2006	GR-REF-01U	Manganese	879		MG/KG	100	8.8	1		
Middle Gila River - u	Soil	unstable	2006	GR1-01U	Manganese	695		MG/KG	100	7.0	1		
Middle Gila River - u	Soil	unstable	2006	GR10-01U	Manganese	417		MG/KG	100	4.2	1		
Middle Gila River - u	Soil	unstable	2006	GR11-01U	Manganese	619		MG/KG	100	6.2	1		
Middle Gila River - u	Soil	unstable	2006	GR2-01U	Manganese	584		MG/KG	100	5.8	1		
Middle Gila River - u	Soil	unstable	2006	GR3-01U	Manganese	611		MG/KG	100	6.1	1		
Middle Gila River - u	Soil	unstable	2006	GR4-01U	Manganese	538		MG/KG	100	5.4	1		
Middle Gila River - u	Soil	unstable	2006	GR5-01U	Manganese	614		MG/KG	100	6.1	1		
Middle Gila River - u	Soil	unstable	2006	GR6-01U	Manganese	498		MG/KG	100	5.0	1		
Middle Gila River - u	Soil	unstable	2006	GR7-01U	Manganese	638		MG/KG	100	6.4	1		
Middle Gila River - u	Soil	unstable	2006	GR8-01U	Manganese	545		MG/KG	100	5.5	1		
Middle Gila River - u	Soil	unstable	2006	GR9-01U	Manganese	339		MG/KG	100	3.4	1		
San Pedro River - s	Soil	stable	2006	SPR1-01S	Iron	9870		MG/KG	200	49	1		
San Pedro River - s	Soil	stable	2006	SPR2-01S	Iron	9490		MG/KG	200	47	1		
San Pedro River - u	Soil	unstable	2006	SPR1-01U	Iron	6570		MG/KG	200	33	1		
San Pedro River - u	Soil	unstable	2006	SPR2-01U	Iron	18000		MG/KG	200	90	1		
San Pedro River - s	Soil	stable	2006	SPR1-01S	Manganese	194		MG/KG	100	1.9	1		
San Pedro River - s	Soil	stable	2006	SPR2-01S	Manganese	186		MG/KG	100	1.9	1		
San Pedro River - u	Soil	unstable	2006	SPR1-01U	Manganese	158		MG/KG	100	1.6	1		
San Pedro River - u	Soil	unstable	2006	SPR2-01U	Manganese	591		MG/KG	100	5.9	1		
Upland Soil	Soil	--	2006	SD-01-SED-0	Arsenic	24.7		MG/KG	100	0.25	0		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Arsenic	361		MG/KG	100	3.6	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Arsenic	232		MG/KG	100	2.3	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Arsenic	74		MG/KG	100	0.74	0		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Arsenic	39.1		MG/KG	100	0.39	0		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Arsenic	13.7		MG/KG	100	0.14	0		
Upland Soil	Soil	--	2006	UP-01-SED-0	Arsenic	10.9		MG/KG	100	0.11	0		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Arsenic	6.7		MG/KG	100	0.07	0		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Arsenic	1.8		MG/KG	100	0.02	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Arsenic	9.1		MG/KG	100	0.09	0		
Upland Soil	Soil	--	2006	SD-01-SED-0	Cadmium	9.6		MG/KG	20	0.48	0		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Cadmium	94.7		MG/KG	20	4.7	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Cadmium	82.4		MG/KG	20	4.1	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Cadmium	18.8		MG/KG	20	0.94	0		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Cadmium	8.3		MG/KG	20	0.42	0		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Cadmium	1.1		MG/KG	20	0.06	0		
Upland Soil	Soil	--	2006	UP-01-SED-0	Cadmium	1.7		MG/KG	20	0.09	0		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Cadmium	1.6		MG/KG	20	0.08	0		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Cadmium		0.08	MG/KG	20			0.004	0
Upland Soil	Soil	--	2006	UPA-07-SED-0	Cadmium	0.92		MG/KG	20	0.05	0		
Upland Soil	Soil	--	2006	SD-01-SED-0	Chromium		0.4	MG/KG	10			0.04	0
Upland Soil	Soil	--	2006	SDD-01-SED-0	Chromium	72		MG/KG	10	7.2	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Chromium	16.4		MG/KG	10	1.6	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Chromium	3.8		MG/KG	10	0.38	0		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Chromium	25.5		MG/KG	10	2.6	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Chromium	15.7		MG/KG	10	1.6	1		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Upland Soil	Soil	--	2006	UP-01-SED-0	Chromium	21.9		MG/KG	10	2.2	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Chromium	7.3		MG/KG	10	0.73	0		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Chromium	5.9		MG/KG	10	0.59	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Chromium	11.8		MG/KG	10	1.2	1		
Upland Soil	Soil	--	2006	SD-01-SED-0	Copper	47200		MG/KG	100	472	1		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Copper	12100		MG/KG	100	121	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Copper	10200		MG/KG	100	102	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Copper	27000		MG/KG	100	270	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Copper	8130		MG/KG	100	81	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Copper	1990		MG/KG	100	20	1		
Upland Soil	Soil	--	2006	UP-01-SED-0	Copper	1540		MG/KG	100	15	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Copper	854		MG/KG	100	8.5	1		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Copper	16.6		MG/KG	100	0.17	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Copper	882		MG/KG	100	8.8	1		
Upland Soil	Soil	--	2006	SD-01-SED-0	Iron	186999		MG/KG	200	935	1		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Iron	64200		MG/KG	200	321	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Iron	34400		MG/KG	200	172	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Iron	53000		MG/KG	200	265	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Iron	27200		MG/KG	200	136	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Iron	36100		MG/KG	200	181	1		
Upland Soil	Soil	--	2006	UP-01-SED-0	Iron	26100		MG/KG	200	131	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Iron	33700		MG/KG	200	169	1		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Iron	11500		MG/KG	200	58	1		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Iron	21100		MG/KG	200	106	1		
Upland Soil	Soil	--	2006	SD-01-SED-0	Manganese	232		MG/KG	100	2.3	1		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Manganese	557		MG/KG	100	5.6	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Manganese	647		MG/KG	100	6.5	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Manganese	581		MG/KG	100	5.8	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Manganese	382		MG/KG	100	3.8	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Manganese	341		MG/KG	100	3.4	1		
Upland Soil	Soil	--	2006	UP-01-SED-0	Manganese	797		MG/KG	100	8.0	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Manganese	686		MG/KG	100	6.9	1		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Manganese	258		MG/KG	100	2.6	1		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Manganese	276		MG/KG	100	2.8	1		
Upland Soil	Soil	--	2006	SD-01-SED-0	Molybdenum	1060		MG/KG	200	5.3	1		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Molybdenum	235		MG/KG	200	1.2	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Molybdenum	103		MG/KG	200	0.52	0		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Molybdenum	119		MG/KG	200	0.60	0		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Molybdenum	37.6		MG/KG	200	0.19	0		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Molybdenum	90.2		MG/KG	200	0.45	0		
Upland Soil	Soil	--	2006	UP-01-SED-0	Molybdenum	4.4		MG/KG	200	0.02	0		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Molybdenum	3.5		MG/KG	200	0.02	0		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Molybdenum	0.25		MG/KG	200	0.001	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Molybdenum	15.9		MG/KG	200	0.08	0		
Upland Soil	Soil	--	2006	SD-01-SED-0	Vanadium	24.4		MG/KG	20	1.2	1		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Vanadium	70.6		MG/KG	20	3.5	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Vanadium	65		MG/KG	20	3.3	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Vanadium	69		MG/KG	20	3.5	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Vanadium	42.9		MG/KG	20	2.1	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Vanadium	79.4		MG/KG	20	4.0	1		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Upland Soil	Soil	--	2006	UP-01-SED-0	Vanadium	71.8		MG/KG	20	3.6	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Vanadium	86.3		MG/KG	20	4.3	1		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Vanadium	22.4		MG/KG	20	1.1	1		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Vanadium	41.6		MG/KG	20	2.1	1		
Upland Soil	Soil	--	2006	SD-01-SED-0	Zinc	5920		MG/KG	100	59	1		
Upland Soil	Soil	--	2006	SDD-01-SED-0	Zinc	5300		MG/KG	100	53	1		
Upland Soil	Soil	--	2006	SDD-02-SED-0	Zinc	3340		MG/KG	100	33	1		
Upland Soil	Soil	--	2006	SDD-03-SED-0	Zinc	1380		MG/KG	100	14	1		
Upland Soil	Soil	--	2006	SR77-01-SED-0	Zinc	400		MG/KG	100	4.0	1		
Upland Soil	Soil	--	2006	TPA-07-SED-0	Zinc	597		MG/KG	100	6.0	1		
Upland Soil	Soil	--	2006	UP-01-SED-0	Zinc	113		MG/KG	100	1.1	1		
Upland Soil	Soil	--	2006	UPA-01-SED-0	Zinc	99.3		MG/KG	100	0.99	0		
Upland Soil	Soil	--	2006	UPA-04-SED-1	Zinc	30.3		MG/KG	100	0.30	0		
Upland Soil	Soil	--	2006	UPA-07-SED-0	Zinc	106		MG/KG	100	1.1	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Chromium	3.8		MG/KG	0.4	9.5	1		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Chromium	19.1		MG/KG	0.4	48	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Chromium	22		MG/KG	0.4	55	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Chromium	20.3		MG/KG	0.4	51	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Chromium	19.9		MG/KG	0.4	50	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Chromium	18.1		MG/KG	0.4	45	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Chromium	18		MG/KG	0.4	45	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Chromium	15.7		MG/KG	0.4	39	1		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Chromium	11.1		MG/KG	0.4	28	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Chromium	16.3		MG/KG	0.4	41	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Chromium	12.5		MG/KG	0.4	31	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Chromium	22		MG/KG	0.4	55	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Chromium	14.1		MG/KG	0.4	35	1		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Chromium	4.8		MG/KG	0.4	12	1		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Chromium	14.8		MG/KG	0.4	37	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Chromium	16		MG/KG	0.4	40	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Chromium	18.2		MG/KG	0.4	46	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Chromium	18.3		MG/KG	0.4	46	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Chromium	16.6		MG/KG	0.4	42	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Chromium	17.2		MG/KG	0.4	43	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Chromium	13.1		MG/KG	0.4	33	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Chromium	15		MG/KG	0.4	38	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Chromium	9.8		MG/KG	0.4	25	1		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Chromium	11.6		MG/KG	0.4	29	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Chromium	9.8		MG/KG	0.4	25	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Chromium	10.1		MG/KG	0.4	25	1		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Chromium	10.9		MG/KG	0.4	27	1		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Chromium	17.3		MG/KG	0.4	43	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Chromium	16		MG/KG	0.4	40	1		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Chromium	9		MG/KG	0.4	23	1		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Chromium	13.9		MG/KG	0.4	35	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Chromium	120		MG/KG	0.4	300	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Copper	2900		MG/KG	100	29	1		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Copper	6030		MG/KG	100	60	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Copper	7700		MG/KG	100	77	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Copper	8270		MG/KG	100	83	1		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-04AS	Copper	6070		MG/KG	100	61	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Copper	12200		MG/KG	100	122	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Copper	8810		MG/KG	100	88	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Copper	9030		MG/KG	100	90	1		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Copper	4650		MG/KG	100	47	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Copper	8510		MG/KG	100	85	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Copper	2380		MG/KG	100	24	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Copper	6670		MG/KG	100	67	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Copper	1230		MG/KG	100	12	1		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Copper	2270		MG/KG	100	23	1		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Copper	1770		MG/KG	100	18	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Copper	5650		MG/KG	100	57	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Copper	10500		MG/KG	100	105	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Copper	12500		MG/KG	100	125	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Copper	7230		MG/KG	100	72	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Copper	5970		MG/KG	100	60	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Copper	6260		MG/KG	100	63	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Copper	7050		MG/KG	100	71	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Copper	926		MG/KG	100	9.3	1		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Copper	4950		MG/KG	100	50	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Copper	3150		MG/KG	100	32	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Copper	2440		MG/KG	100	24	1		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Copper	2860		MG/KG	100	29	1		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Copper	6060		MG/KG	100	61	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Copper	5170		MG/KG	100	52	1		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Copper	2230		MG/KG	100	22	1		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Copper	4920		MG/KG	100	49	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Copper	4700		MG/KG	100	47	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Iron	11200		MG/KG	200	56	1		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Iron	43300		MG/KG	200	217	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Iron	38100		MG/KG	200	191	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Iron	33700		MG/KG	200	169	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Iron	35000		MG/KG	200	175	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Iron	37000		MG/KG	200	185	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Iron	54800		MG/KG	200	274	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Iron	63300		MG/KG	200	317	1		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Iron	37600		MG/KG	200	188	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Iron	40200		MG/KG	200	201	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Iron	19500		MG/KG	200	98	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Iron	35000		MG/KG	200	175	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Iron	18300		MG/KG	200	92	1		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Iron	9590		MG/KG	200	48	1		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Iron	24700		MG/KG	200	124	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Iron	26500		MG/KG	200	133	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Iron	35200		MG/KG	200	176	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Iron	36200		MG/KG	200	181	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Iron	29300		MG/KG	200	147	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Iron	27900		MG/KG	200	140	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Iron	17700		MG/KG	200	89	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Iron	24700		MG/KG	200	124	1		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-07AS	Iron	17500		MG/KG	200	88	1		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Iron	19900		MG/KG	200	100	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Iron	17700		MG/KG	200	89	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Iron	16300		MG/KG	200	82	1		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Iron	11400		MG/KG	200	57	1		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Iron	26900		MG/KG	200	135	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Iron	26900		MG/KG	200	135	1		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Iron	12900		MG/KG	200	65	1		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Iron	22200		MG/KG	200	111	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Iron	320000		MG/KG	200	1600	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Manganese	61.1		MG/KG	100	0.61	0		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Manganese	502		MG/KG	100	5.0	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Manganese	510		MG/KG	100	5.1	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Manganese	563		MG/KG	100	5.6	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Manganese	576		MG/KG	100	5.8	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Manganese	424		MG/KG	100	4.2	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Manganese	213		MG/KG	100	2.1	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Manganese	355		MG/KG	100	3.6	1		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Manganese	302		MG/KG	100	3.0	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Manganese	304		MG/KG	100	3.0	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Manganese	391		MG/KG	100	3.9	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Manganese	758		MG/KG	100	7.6	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Manganese	434		MG/KG	100	4.3	1		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Manganese	126		MG/KG	100	1.3	1		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Manganese	602		MG/KG	100	6.0	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Manganese	437		MG/KG	100	4.4	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Manganese	676		MG/KG	100	6.8	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Manganese	622		MG/KG	100	6.2	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Manganese	482		MG/KG	100	4.8	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Manganese	599		MG/KG	100	6.0	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Manganese	291		MG/KG	100	2.9	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Manganese	406		MG/KG	100	4.1	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Manganese	451		MG/KG	100	4.5	1		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Manganese	358		MG/KG	100	3.6	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Manganese	333		MG/KG	100	3.3	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Manganese	332		MG/KG	100	3.3	1		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Manganese	98.3		MG/KG	100	0.98	0		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Manganese	481		MG/KG	100	4.8	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Manganese	355		MG/KG	100	3.6	1		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Manganese	196		MG/KG	100	2.0	1		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Manganese	369		MG/KG	100	3.7	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Manganese	100		MG/KG	100	1.0	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Vanadium	14.1		MG/KG	20	0.71	0		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Vanadium	68.9		MG/KG	20	3.4	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Vanadium	63.5		MG/KG	20	3.2	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Vanadium	67		MG/KG	20	3.4	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Vanadium	72.7		MG/KG	20	3.6	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Vanadium	58.1		MG/KG	20	2.9	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Vanadium	43.6		MG/KG	20	2.2	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Vanadium	49.9		MG/KG	20	2.5	1		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	PHW-SED-08AS	Vanadium	41.7		MG/KG	20	2.1	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Vanadium	45		MG/KG	20	2.3	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Vanadium	51		MG/KG	20	2.6	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Vanadium	79.8		MG/KG	20	4.0	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Vanadium	56.5		MG/KG	20	2.8	1		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Vanadium	16.5		MG/KG	20	0.83	0		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Vanadium	63.9		MG/KG	20	3.2	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Vanadium	52.8		MG/KG	20	2.6	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Vanadium	65.4		MG/KG	20	3.3	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Vanadium	63.3		MG/KG	20	3.2	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Vanadium	65.9		MG/KG	20	3.3	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Vanadium	69.6		MG/KG	20	3.5	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Vanadium	38.1		MG/KG	20	1.9	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Vanadium	51		MG/KG	20	2.6	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Vanadium	53.5		MG/KG	20	2.7	1		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Vanadium	43.7		MG/KG	20	2.2	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Vanadium	40.8		MG/KG	20	2.0	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Vanadium	42.6		MG/KG	20	2.1	1		
Wash Soil	Soil	--	2005	SPW-SED-11AS	Vanadium	18.8		MG/KG	20	0.94	0		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Vanadium	64.7		MG/KG	20	3.2	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Vanadium	49.9		MG/KG	20	2.5	1		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Vanadium	30.4		MG/KG	20	1.5	1		
Wash Soil	Soil	--	2005	SPW-SED-15AS	Vanadium	50.3		MG/KG	20	2.5	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Vanadium	32		MG/KG	20	1.6	1		
Wash Soil	Soil	--	2006	KAW-02-SED-0	Zinc	34.7		MG/KG	100	0.35	0		
Wash Soil	Soil	--	2005	PHW-SED-01AS	Zinc	510		MG/KG	100	5.1	1		
Wash Soil	Soil	--	2005	PHW-SED-02AS	Zinc	554		MG/KG	100	5.5	1		
Wash Soil	Soil	--	2005	PHW-SED-03AS	Zinc	478		MG/KG	100	4.8	1		
Wash Soil	Soil	--	2005	PHW-SED-04AS	Zinc	525		MG/KG	100	5.3	1		
Wash Soil	Soil	--	2005	PHW-SED-05AS	Zinc	566		MG/KG	100	5.7	1		
Wash Soil	Soil	--	2005	PHW-SED-06AS	Zinc	1040		MG/KG	100	10	1		
Wash Soil	Soil	--	2005	PHW-SED-07AS	Zinc	830		MG/KG	100	8.3	1		
Wash Soil	Soil	--	2005	PHW-SED-08AS	Zinc	349		MG/KG	100	3.5	1		
Wash Soil	Soil	--	2005	PHW-SED-09AS	Zinc	383		MG/KG	100	3.8	1		
Wash Soil	Soil	--	2005	PHW-SED-10AS	Zinc	292		MG/KG	100	2.9	1		
Wash Soil	Soil	--	2005	PHW-SED-11AS	Zinc	109		MG/KG	100	1.1	1		
Wash Soil	Soil	--	2005	PHW-SED-12AS	Zinc	54.9		MG/KG	100	0.55	0		
Wash Soil	Soil	--	2005	PHW-SED-13AS	Zinc	57.7		MG/KG	100	0.58	0		
Wash Soil	Soil	--	2005	PHW-SED-14AS	Zinc	150		MG/KG	100	1.5	1		
Wash Soil	Soil	--	2005	PHW-SED-15AS	Zinc	267		MG/KG	100	2.7	1		
Wash Soil	Soil	--	2005	SPW-SED-01AS	Zinc	270		MG/KG	100	2.7	1		
Wash Soil	Soil	--	2005	SPW-SED-02AS	Zinc	283		MG/KG	100	2.8	1		
Wash Soil	Soil	--	2005	SPW-SED-03AS	Zinc	264		MG/KG	100	2.6	1		
Wash Soil	Soil	--	2005	SPW-SED-04AS	Zinc	192		MG/KG	100	1.9	1		
Wash Soil	Soil	--	2005	SPW-SED-05AS	Zinc	207		MG/KG	100	2.1	1		
Wash Soil	Soil	--	2005	SPW-SED-06AS	Zinc	256		MG/KG	100	2.6	1		
Wash Soil	Soil	--	2005	SPW-SED-07AS	Zinc	71.9		MG/KG	100	0.72	0		
Wash Soil	Soil	--	2005	SPW-SED-08AS	Zinc	250		MG/KG	100	2.5	1		
Wash Soil	Soil	--	2005	SPW-SED-09AS	Zinc	170		MG/KG	100	1.7	1		
Wash Soil	Soil	--	2005	SPW-SED-10AS	Zinc	121		MG/KG	100	1.2	1		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-11AS	Zinc	93.9		MG/KG	100	0.94	0		
Wash Soil	Soil	--	2005	SPW-SED-12AS	Zinc	211		MG/KG	100	2.1	1		
Wash Soil	Soil	--	2005	SPW-SED-13AS	Zinc	200		MG/KG	100	2.0	1		
Wash Soil	Soil	--	2005	SPW-SED-14AS	Zinc	95.1		MG/KG	100	0.95	0		

TABLE 5-14
Detailed Point-by-Point Evaluation of Soil for Soil Microbes by Area
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Area	Matrix	Matrix Type	Year	LocID	Parameter	Conc	DL	Units	Microbial Benchmark (mg/kg dw)	HQ	HQ G1	HQ_{DL}	HQ_{DL} G1
Wash Soil	Soil	--	2005	SPW-SED-15AS	Zinc	176		MG/KG	100	1.8	1		
Wash Soil	Soil	--	2006	SPW-SED-16AS	Zinc	71		MG/KG	100	0.71	0		

Notes:
Conc = concentration
Det = indicates whether the chemical is detected. A "1" is used to indicate detected, a "0" is used to indicate non-detect.
DL = detection limit
DW = dry weight
HQ = hazard quotient
HQ G1 = Indicates whether HQ is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.
HQ_{DL} = hazard quotient based on detection limit
HQ_{DL} G1 = Indicates whether HQ based on the detection limit (for non-detects) is greater than 1. If HQ is greater than 1, "1" is used; if it is less than 1, "0" is used.
LocID = sample location identifier

TABLE 5-15
Summary of Point-by-Point Evaluation for Soil Microbes
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

		Summary Statistics of Analyte Detected Concentration and Detection Limit				Evauation Based on Soil Microbial TRV: Evaluation of Detected Concentration			Evaluation of Detection Limit		
Analyte	**Soil Microbe TRV (mg/kg dw)**	**DF**	**Percent Detects**	**Soil Concentration Range (mg/kg dw)**	**DL Range**	**HQ Range**	**EF**	**Percent Exceedance**	**HQ_{DL} Range**	**EF**	**Percent Exceedance**
On-Site Gila River - Combined Stable and Unstable Riparian Soil											
Boron	20	29/29	100	0.48 - 32.5	--	0.02 - 1.6	1/29	3	--	0/29	0
Copper	100	29/29	100	40.2 - 1150	--	0.4 - 11.5	14/29	48	--	0/29	0
On-Site Gila River - Stable Riparian Soil											
Iron	200	17/17	100	8480 - 20700	--	42.4 - 104	17/17	100	--	0/17	0
Manganese	100	17/17	100	210 - 794	--	2.1 - 7.9	17/17	100	--	0/17	0
On-Site Gila River - Unstable Riparian Soil											
Iron	200	12/12	100	13200 - 27200	--	66 - 136	12/12	100	--	0/12	0
Manganese	100	12/12	100	339 - 879	--	3.4 - 8.8	12/12	100	--	0/12	0
On-Site San Pedro River - Stable Riparian Soil											
Iron	200	2/2	100	9490 - 9870	--	47.5 - 49.3	2/2	100	--	0/2	0
Manganese	100	2/2	100	186 - 194	--	1.9	2/2	100	--	0/2	0
On-Site San Pedro River - Unstable Riparian Soil											
Iron	200	2/2	100	6570 - 18000	--	32.9 - 90	2/2	100	--	0/2	0
Manganese	100	2/2	100	158 - 591	--	1.6 - 5.9	2/2	100	--	0/2	0
Upland Soils											
Arsenic	100	10/10	100	1.8 - 361	--	0.02 - 3.6	2/10	20	--	0/10	0
Cadmium	20	9/10	90	0.92 - 94.7	0.08	0.05 - 4.7	2/10	20	0.004	0/10	0
Chromium	10	9/10	90	3.8 - 72	0.4	0.38 - 7.2	6/10	60	0.04	0/10	0
Copper	100	10/10	100	16.6 - 47200	--	0.17 - 472	9/10	90	--	0/10	0
Iron	200	10/10	100	11500 - 186999	--	57.5 - 935	10/10	100	--	0/10	0
Manganese	100	10/10	100	232 - 797	--	2.3 - 8	10/10	100	--	0/10	0
Molybdenum	200	10/10	100	0.25 - 1060	--	0.001 - 5.3	2/10	20	--	0/10	0
Vanadium	20	10/10	100	22.4 - 86.3	--	1.1 - 4.3	10/10	100	--	0/10	0
Zinc	100	10/10	100	30.3 - 5920	--	0.3 - 59	8/10	80	--	0/10	0
Wash Soils											
Chromium	0.4	32/32	100	3.8 - 120	--	9.5 - 300	32/32	100	--	0/32	0
Copper	100	32/32	100	926 - 12500	--	9.3 - 125	32/32	100	--	0/32	0
Iron	200	32/32	100	9590 - 320000	--	48 - 1600	32/32	100	--	0/32	0
Manganese	100	32/32	100	61.1 - 758	--	0.61 - 7.6	30/32	94	--	0/32	0
Vanadium	20	32/32	100	14.1 - 79.8	--	0.71 - 4	29/32	91	--	0/32	0
Zinc	100	32/32	100	34.7 - 1040	--	0.35 - 10.4	25/32	78	--	0/32	0

Notes:
DF = detection frequency (i.e. 29/29 = 29 detections out of 29 samples)
DL = detection limit
DW = dry weight
EF = exceedance frequency (i.e. 2/29 = 2 exceedance of the benchmark out of 29 samples)
HQ = hazard quotient
HQ_{DL} = hazard quotient based on detection limit

TABLE 5-16

Surface Water and Sediment Exposure Point Concentrations for Refined Screening of Birds and Mammals

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

	WATER						SEDIMENT					
	Gila River			San Pedro River			Gila River			San Pedro River		
Analyte	EPC[a] (µg/L)	Statistical Basis	Data Distribution[b]	EPC[a] (µg/L)	Statistical Basis	Data Distribution[b]	EPC[a] (mg/kg DW)	Statistical Basis	Data Distribution[b]	EPC[a] (mg/kg DW)	Statistical Basis	Data Distribution[b]
Aluminum	42335	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	3660	Maximum detected value	Calculated UCL exceeded maximum detected value	17539	95% Student's-t UCL	Normal (0.05)	26678	Maximum detected value	Calculated UCL exceeded maximum detected value
Antimony	1.6	Maximum non detected value	All non detected values	0.41	Maximum non detected value	All non detected values	0.855	95% KM (t) UCL	Normal (0.05) for detected values only	0.56	Maximum detected value	Calculated UCL exceeded maximum Detected value
Arsenic	9.159	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	8.5	Maximum detected value	Calculated UCL exceeded maximum Detected value	4.084	95% Student's-t UCL	Normal (0.05)	5.484	95% Student's-t UCL	Normal (0.05)
Barium	449	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	373	Maximum detected value	Calculated UCL exceeded maximum Detected value	144.1	95% Student's-t UCL	Normal (0.05)	164.2	95% Student's-t UCL	Normal (0.05)
Beryllium	3.547	97.5% KM (Chebyshev) UCL	No discernable distribution (0.05)	1.1	Maximum detected value	Two detected values and two non detected values	105.3	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05) for detected values only	161	Maximum detected value	Calculated UCL exceeded maximum Detected value
Boron	128.9	95% Student's-t UCL	Normal (0.05)	219.6	95% Student's-t UCL	Normal (0.05)	6.759	95% Student's-t UCL	Normal (0.05)	7.597	95% Student's-t UCL	Normal (0.05)
Cadmium	0.724	95% KM (BCA) UCL	No discernable distribution (0.05)	0.4	Maximum detected value	Three detected values and one non detected values	0.27	95% KM (t) UCL	Gamma (0.05) for detected values only	0.43	95% KM (% Bootstrap) UCL	No discernable distribution (0.05) for detected values only
Chromium	21.02	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	8.1	Maximum detected value	Calculated UCL exceeded maximum Detected value	14.46	95% Student's-t UCL	Normal (0.05)	12.69	95% Student's-t UCL	Normal (0.05)
Cobalt	24.99	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	6.1	Maximum detected value	Calculated UCL exceeded maximum Detected value	11.72	95% Student's-t UCL	Normal (0.05)	6.381	95% Student's-t UCL	Normal (0.05)
Copper	116.7	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	66.29	95% Student's-t UCL	Normal (0.05)	141.6	95% Approximate Gamma UCL	Gamma (0.05)	105.4	95% Student's-t UCL	Normal (0.05)
Cyanide	6.1	Maximum detected value	1 detected value and 21 non detected values	10	Maximum non detected value	All non detected values	6.9	Maximum non detected value	All non detected values	3.3	Maximum non detected value	All non detected values
Iron	24003	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	8970	Maximum detected value	Three detected values and one non detected values	21020	95% Student's-t UCL	Normal (0.05)	16201	95% Student's-t UCL	Normal (0.05)
Lead	105.1	Use 99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	24.3	Maximum detected value	Calculated UCL exceeded maximum detected value	16.43	95% Student's-t UCL	Normal (0.05)	17.98	95% Student's-t UCL	Normal (0.05)
Manganese	2280	Use 99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	538	Maximum detected value	Calculated UCL exceeded maximum detected value	1101	95% H-UCL	Lognormal (0.05)	1031	Maximum detected value	Calculated UCL exceeded maximum detected value

TABLE 5-16

Surface Water and Sediment Exposure Point Concentrations for Refined Screening of Birds and Mammals

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

	WATER						SEDIMENT					
	Gila River			San Pedro River			Gila River			San Pedro River		
Analyte	**EPC[a] (µg/L)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (µg/L)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg DW)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg DW)**	**Statistical Basis**	**Data Distribution[b]**
Mercury	0.42	95% KM (Percentile Bootstrap) UCL	Normal (0.05) for detected values only	0.033	Maximum detected value	1 detected value and 3 non detected values	0.0602	95% KM (% Bootstrap) UCL	Normal (0.05) for detected values only	0.06	Maximum detected value	1 detected value and 4 non detected values
Molybdenum	5.126	Use 99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	20.1	Maximum detected value	Calculated UCL exceeded maximum detected value	1.586	95% KM (% Bootstrap) UCL	Normal (0.05) for detected values only	1.871	95% KM (t) UCL	No discernable distribution (0.05) for detected values only
Nickel	19.31	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	10.6	Maximum detected value	Calculated UCL exceeded maximum detected value	17.3	95% Student's-t UCL	Normal (0.05)	14.05	95% Student's-t UCL	Normal (0.05)
Selenium	0.845	95% Modified-t UCL	No discernable distribution (0.05)	1.2	Maximum detected value	Calculated UCL exceeded maximum detected value	0.809	95% KM (% Bootstrap) UCL	Normal (0.05) for detected values only	0.66	Maximum non detected value	All non detected values
Silver	0.0533	95% KM (t) UCL	Normal (0.05) for detected values only	0.05	Maximum detected value	1 detected value and 3 non detected values	0.15	Maximum detected value	1 detected value and 21 non detected values	0.66	Maximum non detected value	All non detected values
Strontium							194	Maximum detected value	2 detected values	213	Maximum detected value	1 detected value
Thallium	0.358	95% KM (t) UCL	Approximate Gamma (0.05) for detected values only	0.18	Maximum detected value	1 detected value and 3 non detected values	0.897	95% KM (t) UCL	Gama (0.05) for detected values only	0.6	Maximum detected value	1 detected value and 3 non detected values
Vanadium	26.96	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	21.7	Maximum detected value	Calculated UCL exceeded maximum detected value	53.02	95% Student's-t UCL	Normal (0.05)	36.17	95% Student's-t UCL	Normal (0.05)
Zinc	155.2	99% Chebyshev (Mean, SD) UCL	No discernable distribution (0.05)	49.7	Maximum detected value	Calculated UCL exceeded maximum detected value	59.29	95% Student's-t UCL	Normal (0.05)	61.93	95% Student's-t UCL	Normal (0.05)

Notes:

[a] The EPC was calculated using ProUCL Version 4.0 (EPA 2007b). The EPC value, statistical basis, and data distribution are those recommended by the ProUCL software.

[b] Alpha significance level for data distribution provided in parentheses

DW = dry weight

EPC = exposure point concentration

KM = Kaplan-Meier

mg/kg = milligram per kilogram

µg/L = mcrograms per liter

NA = not applicable

SD = standard deviation

UCL = upper confidence limit

TABLE 5-17
Soil Exposure Point Concentrations for Refined Screening of Birds and Mammals
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

	RIPARIAN SOIL																		UPLAND SOIL			WASH SOIL		
	Gila River Combined Stable and Unstable			Gila River Stable Riparian Soil			Gila River Unstable Riparian Soil			San Pedro River Combined Stable and			San Pedro River Stable Riparian Soil			San Pedro River Unstable Riparian Soil								
Analyte	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**
Aluminum	NA			14314	95% Student's-t UCL	Normal (0.05)	19455	95% Student's-t UCL	Normal (0.05)	NA			7180	Maximum detected value	2 detected values	15100	Maximum detected value	2 detected values	19558	95% Student's-t UCL	Normal (0.05)	13300	95% Student's-t UCL	No discernable distribution (0.05)
Antimony	0.637	95% Student's-t UCL	Normal (0.05)	NA			NA			0.546	95% Student's-t UCL	Normal (0.05)	NA			NA			5.65	95% Approximate Gamma UCL	Gamma (0.05)	1.699	95% KM (t) UCL	No discernable distribution (0.05) for detected values only
Arsenic	4.543	95% Approximate Gamma UCL	Gamma (0.05)	NA			NA			4.401	95% Student's-t UCL	Normal (0.05)	NA			NA			185.3	95% Approximate Gamma UCL	Gamma (0.05)	28.34	95% Approximate Gamma UCL	Gamma (0.05)
Barium	NA			125.4	95% Student's-t UCL	Normal (0.05)	153.9	95% Student's-t UCL	Normal (0.05)	NA			86.8	Maximum detected value	2 detected values	146	Maximum detected value	2 detected values	130.3	95% Student's-t UCL	Normal (0.05)	71.09	95% Student's-t UCL	Normal (0.05)
Beryllium	0.787	95% KM (Percentile Bootstrap) UCL	Gamma (0.05) for detected values only	NA			NA			0.96	95% KM (Percentile Bootstrap) UCL	Normal (0.05) for detected values only	NA			NA			0.414	95% KM (t) UCL	No discernable distribution (0.05) for detected values only	0.15	Maximum detected value	1 detected value and 39 non detected value
Boron	7.358	95% Approximate Gamma UCL	Gamma (0.05)	NA			NA			5.7	Maximum detected value	Calculated UCL exceeded maximum detected value	NA			NA			4.244	95% Approximate Gamma UCL	Gamma (0.05)	3.022	95% Student's-t UCL	No discernable distribution (0.05)
Cadmium	0.28	95% KM (t) UCL	Gamma (0.05) for detected values only	NA			NA			0.5	Maximum non detected value	All non detected values	NA			NA			65.83	95% KM (Chebyshev) UCL	Gamma (0.05) for detected values only	3.161	95% KM (BCA) UCL	Gamma (0.05) for detected values only
Chromium	12.34	95% Student's-t UCL	Normal (0.05)	NA			NA			13.02	95% Student's-t UCL	Normal (0.05)	NA			NA			43.15	95% KM (Chebyshev) UCL	Gamma (0.05) for detected values only	29.48	95% Chebyshev (Mean, Sd) UCL	No discernable distribution (0.05)
Cobalt	NA			9.335	95% KM (t) UCL	Normal (0.05) for detected values only	12.2	95% Student's-t UCL	Normal (0.05)	NA			5	Maximum non detected value	2 non detected values	8.9	Maximum detected value	1 detected value and 1 non detected value	41.28	95% Student's-t UCL	Normal (0.05)	29	95% Approximate Gamma UCL	Gamma (0.05)
Copper	389.1	99% Chebyshev (Mean, Sd) UCL	No discernable distribution (0.05)	NA			NA			281.9	95% Student's-t UCL	Normal (0.05)	NA			NA			37027	95% Adjusted Gamma UCL	Gamma (0.05)	6848	95% Student's-t UCL	Normal (0.05)
Cyanide	0.26	Maximum detected value	2 detected values 27 non detected values and	NA			NA			0.34	Maximum detected value	1 detected value and 3 non detected values	NA			NA			2.5	Maximum non detected value	All non detected values	2.5	Maximum detected value	1 detected value and 38 non detected value
Iron	NA			17381	95% Student's-t UCL	Normal (0.05)	21030	95% Student's-t UCL	Normal (0.05)	NA			9870	Maximum detected value	2 detected values	18000	Maximum detected value	2 detected values	75892	95% Approximate Gamma UCL	Gamma (0.05)	70306	95% Chebyshev (Mean, Sd) UCL	No discernable distribution (0.05)
Lead	21.18	95% Approximate Gamma UCL	Gamma (0.05)	NA			NA			20.44	95% Student's-t UCL	Normal (0.05)	NA			NA			297.7	95% Approximate Gamma UCL	Gamma (0.05)	95.83	95% Approximate Gamma UCL	Gamma (0.05)
Manganese	NA			471.1	95% Student's-t UCL	Normal (0.05)	652	95% Student's-t UCL	Normal (0.05)	NA			194	Maximum detected value	2 detected values	591	Maximum detected value	2 detected values	566.5	95% Student's-t UCL	Normal (0.05)	432.1	95% Student's-t UCL	Normal (0.05)
Mercury	0.0735	95% KM (t) UCL	Normal (0.05) for detected values only	NA			NA			0.051	Maximum detected value	Calculated UCL exceeded maximum detected value	NA			NA			0.36	95% KM (Chebyshev) UCL	Gamma (0.05) for detected values only	0.0981	95% KM (BCA) UCL	Approximate Gamma (0.05) for detected values only
Molybdenum	2.33	95% Approximate Gamma UCL	Approximate Gamma (0.05)	NA			NA			2	Maximum detected value	Calculated UCL exceeded maximum detected value	NA			NA			648.7	95% Adjusted Gamma UCL	Gamma (0.05)	48.08	95% Student's-t UCL	Normal (0.05)
Nickel	NA			15.71	95% Student's-t UCL	Normal (0.05)	18.51	95% Student's-t UCL	Normal (0.05)	NA			9.5	Maximum detected value	2 detected values	16	Maximum detected value	2 detected values	30.64	95% Student's-t UCL	Normal (0.05)	34.97	95% Chebyshev (Mean, Sd) UCL	No discernable distribution (0.05)
Selenium	0.67	Maximum detected value	1 detected value 28 non detected values and	NA			NA			3.5	Maximum non detected value	All non detected values	NA			NA			14.63	95% KM (Chebyshev) UCL	Gamma (0.05) for detected values only	2.712	95% KM (BCA) UCL	Lognormal (0.05) for detected values only
Silver	0.466	95% KM (% Bootstrap) UCL	No discernable distribution (0.05) for detected values only	NA			NA			0.24	Maximum detected value	1 detected value and 3 non detected values	NA			NA			15.63	95% KM (Chebyshev) UCL	Gamma (0.05) for detected values only	3.678	95% Approximate Gamma UCL	Gamma (0.05)
Thallium	2.5	Maximum non detected value	All non detected values	NA			NA			2.5	Maximum non detected value	All non detected values	NA			NA			0.87	95% KM (% Bootstrap) UCL	No discernable distribution (0.05) for detected values only	1.305	95% KM (t) UCL	Normal (0.05) for detected values only

TABLE 5-17
Soil Exposure Point Concentrations for Refined Screening of Birds and Mammals
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

	RIPARIAN SOIL																		UPLAND SOIL			WASH SOIL		
	Gila River Combined Stable and Unstable			Gila River Stable Riparian Soil			Gila River Unstable Riparian Soil			San Pedro River Combined Stable and			San Pedro River Stable Riparian Soil			San Pedro River Unstable Riparian Soil								
Analyte	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**	**EPC[a] (mg/kg)**	**Statistical Basis**	**Data Distribution[b]**
Vanadium	42	95% Approximate Gamma UCL	Gamma (0.05)	NA			NA			30.83	95% Student's-t UCL	Normal (0.05)	NA			NA			67.31	95% Student's-t UCL	Normal (0.05)	54.86	95% Student's-t UCL	Normal (0.05)
Zinc	70.15	95% Student's-t UCL	Normal (0.05)	NA			NA			69.3	Maximum detected value	Calculated UCL exceeded maximum detected value	NA			NA			5170	95% Adjusted Gamma UCL	Gamma (0.05)	373.1	95% Approximate Gamma UCL	Gamma (0.05)

Notes:

[a] The EPC was calculated using ProUCL Version 4.0 (EPA 2007b). The EPC value, statistical basis, and data distribution are those recommended by the ProUCL software.

[b] Alpha significance level for data distribution provided in parentheses

EPC = exposure point concentration

mg/kg = milligram per kilogram

NA = not applicable

UCL = upper confidence limit

KM = Kaplan-Meier

TABLE 5-18

Median Bioaccumulation Factors for Refined Screening of Birds and Mammals

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Aquatic Invertebrate	Plant	Soil Invertebrate	Small Mammal
Aluminum	0.043	0.00287	0.043	0.0263
Antimony	*1*	regression	*1*	uptake from diet
Arsenic	0.373	0.0375	regression	regression
Beryllium	0.045	regression	0.045	uptake from diet
Cadmium	0.459	regression	regression	regression
Chromium	0.083	0.041	0.306	regression
Cobalt	*1*	0.0075	0.122	regression
Copper	0.661	regression	0.515	regression
Iron	0.036	0.00425	0.036	regression
Lead	0.08	regression	regression	regression
Manganese	0.054	0.079	regression	0.0205
Mercury	2.837	regression	regression	0.0543
Molybdenum	0.953	1.25035	0.953	*1*
Nickel	0.134	regression	1.059	regression
Selenium	regression	regression	regression	regression
Silver	2.045	0.014	2.045	0.004
Thallium	0.0541	*0.004*	0.0541	0.1124
Vanadium	0.042	0.00485	0.042	0.0123
Zinc	0.84	regression	regression	regression

Notes:

Italics indicates BAFs that do not differ from those used in the initial screening

regression = the soil-to-tissue regression model as presented in Section 4 was used in the refined screen

uptake from diet = the diet to small mammal tissue model presented in Section 4 was used in the refined screen

TABLE 5-19

Bioavailability Values for Refined Screening of Birds and Mammals

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Percent Bioavailable	Source
Arsenic	60	EPA 2000
Barium	10	Owen 1990
Cadmium	9	Hrudely et al. 1995
Copper	40	Hrudely et al. 1995
Lead	50 - Birds	Hoffman et al. 2000
	26.2 - Mammals	Maddaloni et al. 1998
Mercury	15 - Abiotic	Owen 1990
	95 - Biotic	
Selenium	60	Owen 1990
Zinc	50	Owen 1990

TABLE 5-20
Refined Screening Evaluation for Swallows
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Sediment EPC (mg/kg)	Sediment EPC Basis	Water EPC (mg/L)	Water EPC Basis	Exposure Estimate by Pathway [b] (mg/kg/d)					NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Risk Conclusion
					Aquatic Invertebrate	Plant	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River														
Aluminum	17539	95UCL	42.335	99UCL	159.48	0.33	0	6.14	165.95	109.7	NA	**1.5**	NA	Uncertainty
Cadmium	0.27	95UCL	0.000724	95UCL	0.03	0.002	0	0.0001	0.03	0.16	0.61	0.18	0.05	No Risk
Copper	141.6	95UCL	0.12	99UCL	19.79	0.09	0	0.02	19.90	47	61.7	0.42	0.32	No Risk
Iron	21020	95UCL	24.003	99UCL	160.02	0.58	0	3.48	164.08	7.03	70.3	**23**	**2.3**	**Possible Risk**
Lead	16.43	95UCL	0.1051	99UCL	0.28	0.008	0	0.02	0.30	0.19	1.78	**1.6**	0.17	No Risk
Manganese	1101	95UCL	2.28	99UCL	12.57	0.57	0	0.33	13.47	98	977	0.14	0.01	No Risk
Mercury	0.0602	95UCL	0.00042	95UCL	0.03	0.0005	0	0.0001	0.03	0.068	0.37	0.51	0.09	No Risk
Silver	0.15	95UCL	0.0000533	95UCL	0.06	0.00001	0	0.0000	0.06	0.427	4.27	0.15	0.02	No Risk
Thallium	0.897	95UCL	0.000358	95UCL	0.01	0.00002	0	0.0001	0.01	0.0053	0.053	**2.0**	0.20	No Risk
Vanadium	53.02	95UCL	0.02696	99UCL	0.47	0.002	0	0.004	0.48	11.4	NA	0.04	NA	No Risk
Zinc	59.29	95UCL	0.1552	99UCL	10.53	0.30	0	0.02	10.86	14.5	131	0.75	0.08	No Risk
p,p'-DDE	0.01	Max ND	0	Not Measured	0.04	0.00001	0	0	0.04	0.009	0.09	**4.9**	0.49	No Risk
San Pedro River														
Aluminum	26678	Max Detect	3.66	Max Detect	242.58	0.50	0	0.53	243.61	109.7	NA	**2.2**	NA	Uncertainty
Cadmium	0.43	Max Detect	0.0004	95UCL	0.04	0.003	0	0.0001	0.04	0.16	0.61	0.28	0.07	No Risk
Copper	105.4	95UCL	0.06629	95UCL	14.73	0.08	0	0.01	14.82	47	61.7	0.32	0.24	No Risk
Iron	16201	95UCL	8.970	95UCL	123.33	0.45	0	1.30	125.08	7.03	70.3	**18**	**1.8**	**Possible Risk**
Lead	19.98	95UCL	0.0243	Max Detect	0.34	0.009	0	0.004	0.35	0.19	1.78	**1.8**	0.20	No Risk
Manganese	1031	Max Detect	0.538	Max Detect	11.77	0.53	0	0.08	12.38	98	977	0.13	0.01	No Risk
Silver	0.66	Max ND	0.00005	Max Detect	0.29	0.00006	0	0.00001	0.29	0.427	4.27	0.67	0.07	No Risk
Thallium	0.6	Max Detect	0.00018	Max Detect	0.01	0.00002	0	0.00003	0.01	0.0053	0.053	**1.3**	0.13	No Risk
Zinc	61.93	95UCL	0.0497	Max Detect	11.00	0.31	0	0.007	11.32	14.5	131	0.78	0.09	No Risk
p,p'-DDE	0.01	Max ND	0	Not Measured	0.04	0.00001	0	0	0.04	0.009	0.09	**4.9**	0.49	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., aquatic invertebrate and plant portions of diet, sediment ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 97% aquatic invertebrates and 3% plants was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mean

TABLE 5-21
Refined Screening Evaluation for Belted Kingfisher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Sediment EPC (mg/kg)	Sediment EPC Basis	Water EPC (mg/L)	Water EPC Basis	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
					Fish	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River													
Aluminum	17539	95UCL	42.335	99UCL	1290.88	0	4.70	1295.58	109.7	NA	**12**	NA	Uncertainty
Cadmium	0.27	95UCL	0.000724	95UCL	1.19	0	0.0001	1.19	0.16	0.61	**7.4**	**1.9**	**Possible Risk**
Iron	21020	95UCL	24.003	99UCL	3.17	0	2.66	5.83	7.03	70.3	0.83	0.08	No Risk
Lead	16.43	95UCL	0.1051	99UCL	0.62	0	0.01	0.64	0.19	1.78	**3.3**	0.36	No Risk
Mercury	0.0602	95UCL	0.00042	95UCL	1.47	0	0.00005	1.47	0.068	0.37	**22**	**4.0**	**Possible Risk**
Selenium	0.809	95UCL	0.000845	95UCL	0.29	0	0.0001	0.29	0.4	0.8	0.73	0.36	No Risk
Zinc	59.29	95UCL	0.1552	99UCL	19.79	0	0.02	19.81	14.5	131	**1.4**	0.15	No Risk
San Pedro River													
Aluminum	26678	Max Detect	3.66	Max Detect	111.60	0	0.41	112.01	109.7	NA	**1.02**	NA	Uncertainty
Cadmium	0.43	Max Detect	0.0004	95UCL	0.65	0	0.00004	0.65	0.16	0.61	**4.1**	**1.1**	**Possible Risk**
Mercury	0.06	Max Detect	0.000033	Max Detect	0.12	0	0.000004	0.12	0.068	0.37	**1.7**	0.31	No Risk
Selenium	0.66	Max ND	0.0012	Max Detect	0.41	0	0.00013	0.41	0.4	0.8	**1.0**	0.51	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., fish portion of diet, sediment ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 100% fish was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mean

TABLE 5-22
Refined Screening Evaluation for Little Brown Bat
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Sediment EPC (mg/kg)	Sediment EPC Basis	Water EPC (mg/L)	Water EPC Basis	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
					Aquatic Invertebrate	Sediment	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River													
Aluminum	17539	95UCL	42.335	99UCL	140.28	0	6.82	147.09	1.93	19.3	**76**	**8**	**Possible Risk**
Antimony	0.855	95UCL	0.0016	Max ND	0.16	0	0.0003	0.16	0.059	0.59	**2.7**	0.27	No Risk
Arsenic	4.084	95UCL	0.009159	99UCL	0.28	0	0.001	0.28	0.396	1.58	0.72	0.18	No Risk
Beryllium	105.3	99UCL	0.003547	97.5UCL	0.88	0	0.0006	0.88	0.66	NA	**1.3**	NA	Uncertainty
Copper	141.6	95UCL	0.1167	99UCL	17.41	0	0.02	17.43	11.7	15.14	**1.5**	**1.2**	**Possible Risk**
Cyanide	6.9	Max ND	0.0061	Max Detect	1.28	0	0.001	1.28	0.15	0.5	**8.6**	**2.6**	**Possible Risk**
Iron	21020	95UCL	24.003	99UCL	140.75	0	3.86	144.61	2.8	NA	**52**	NA	Uncertainty
Lead	16.43	95UCL	0.1051	99UCL	0.24	0	0.02	0.26	0.92	4.7	0.28	0.06	No Risk
Manganese	1101	95UCL	2.28	99UCL	11.06	0	0.37	11.43	88	284	0.13	0.04	No Risk
Mercury	0.0602	95UCL	0.00042	95UCL	0.03	0	0.0001	0.03	0.032	0.16	0.95	0.19	No Risk
Molybdenum	1.586	95UCL	0.005126	99UCL	0.28	0	0.0008	0.28	0.26	2.6	**1.1**	0.11	No Risk
Selenium	0.809	95UCL	0.000845	95UCL	0.15	0	0.0001	0.15	0.2	0.33	0.74	0.45	No Risk
Silver	0.15	95UCL	0.0000533	95UCL	0.06	0	0.00001	0.06	2.38	23.8	0.02	0.00	No Risk
Vanadium	53.02	95UCL	0.02696	99UCL	0.41	0	0.004	0.42	0.21	2.1	**2.0**	0.20	No Risk
San Pedro River													
Aluminum	26678	Max Detect	3.66	Max Detect	213.37	0	0.59	213.96	1.93	19.3	**111**	**11**	**Possible Risk**
Antimony	0.56	Max Detect	0.00041	Max ND	0.10	0	0.0001	0.10	0.059	0.59	**1.8**	0.18	No Risk
Arsenic	5.484	95UCL	0.0085	Max Detect	0.38	0	0.001	0.38	0.396	1.58	0.96	0.24	No Risk
Beryllium	161	Max Detect	0.0011	95UCL	1.35	0	0.0002	1.35	0.66	NA	**2.0**	NA	Uncertainty
Copper	105.4	95UCL	0.06629	95UCL	12.96	0	0.01	12.97	11.7	15.14	**1.1**	0.86	No Risk
Cyanide	3.3	Max ND	0.01	Max ND	0.61	0	0.002	0.62	0.15	0.5	**4.1**	**1.2**	**Possible Risk**
Iron	16201	95UCL	8.970	95UCL	108.48	0	1.44	109.93	2.8	NA	**39**	NA	Uncertainty
Lead	19.98	95UCL	0.0243	Max Detect	0.30	0	0.004	0.30	0.92	4.7	0.33	0.06	No Risk
Manganese	1031	Max Detect	0.538	Max Detect	10.36	0	0.09	10.44	88	284	0.12	0.04	No Risk
Mercury	0.06	Max Detect	0.000033	Max Detect	0.03	0	0.00001	0.03	0.032	0.16	0.94	0.19	No Risk
Molybdenum	1.871	Max Detect	0.0201	Max Detect	0.33	0	0.003	0.33	0.26	2.6	**1.3**	0.13	No Risk
Vanadium	36.17	95UCL	0.0217	Max Detect	0.28	0	0.003	0.29	0.21	2.1	**1.4**	0.14	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., aquatic invertebrate portion of diet, sediment ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 100% aquatic invertebrates was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mean
99 UCL = 99 percent upper confidence limit of the arithmetic mean

TABLE 5-23
Refined Screening Evaluation for Mink
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)							Hazard Quotients [c]		
Analytes [a]	**Sediment EPC (mg/kg)**	**Sediment EPC Basis**	**Water EPC (mg/L)**	**Water EPC Basis**	**Aquatic Invert**	**Fish**	**Sediment**	**Water**	**Total**	**NOAEL (mg/kg/d)**	**LOAEL (mg/kg/d)**	**NOAEL HQ**	**LOAEL HQ**	**Retain/Drop**
Middle Gila River														
Aluminum	17539	95UCL	42.335	99UCL	4.95	336.80	21.57	4.49	367.81	1.93	19.3	**191**	**19**	**Possible Risk**
Cadmium	0.27	95UCL	0.000724	95UCL	0.001	0.31	0.00003	0.0001	0.31	0.77	1.42	0.40	0.22	No Risk
Iron	21020	95UCL	24.003	99UCL	4.96	0.83	25.85	2.54	34.19	2.8	NA	**12**	NA	Uncertainty
Mercury	0.0602	95UCL	0.00042	95UCL	0.001	0.38	0.00001	0.00004	0.38	0.032	0.16	**12**	**2.4**	**Possible Risk**
Selenium	0.809	95UCL	0.000845	95UCL	0.005	0.08	0.0006	0.0001	0.08	0.2	0.33	0.41	0.25	No Risk
San Pedro River														
Aluminum	26678	Max Detect	3.66	Max Detect	7.53	29.12	32.81	0.39	69.84	1.93	19.3	**36**	**3.6**	**Possible Risk**
Iron	16201	95UCL	8.97	95UCL	3.83	0.31	19.93	0.95	25.01	2.8	NA	**8.9**	NA	Uncertainty
Mercury	0.06	Max Detect	0.000033	Max Detect	0.001	0.03	0.00001	0.000003	0.03	0.032	0.16	0.97	0.19	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., fish portion of diet, sediment ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 100% fish was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mear
99 UCL = 99 percent upper confidence limit of the arithmetic mear

TABLE 5-24
Refined Screening Evaluation for Mourning Dove
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)							Hazard Quotients [c]		
Analytes [a]	**Soil EPC (mg/kg)**	**Soil EPC Basis**	**Water EPC (mg/L)**	**Water EPC Basis**	**Plant**	**Soil Invertebrate**	**Soil**	**Water**	**Total**	**NOAEL (mg/kg/d)**	**LOAEL (mg/kg/d)**	**NOAEL HQ**	**LOAEL HQ**	**Risk Conclusion**
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]														
Boron	7.358	95UCL	0.1289	95UCL	12.54	0.02	0.07	0.0036	12.63	28.8	100	0.44	0.13	No Risk
Middle Gila River - On-Site Stable Riparian Soil and Surface Water														
Iron	17381	95UCL	24	99UCL	6.95	1.82	156.79	0.67	166.24	7.03	70.3	**24**	**2.4**	**Possible Risk**
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water														
Iron	21030	95UCL	24	99UCL	8.41	2.20	189.71	0.67	201.00	7.03	70.3	**29**	**2.9**	**Possible Risk**
San Pedro River - On-Site Stable Riparian Soil and Surface Water														
Iron	9870	Max Detect	8.97	Max Detect	3.95	1.03	89.04	0.25	94.27	7.03	70.3	**13**	**1.3**	**Possible Risk**
San Pedro River - On-Site Untable Riparian Soil and Surface Water														
Iron	18000	Max Detect	8.97	Max Detect	7.20	1.89	162.38	0.25	171.71	7.03	70.3	**24**	**2.4**	**Possible Risk**
Upland Soils and Gila River Surface Water														
Arsenic	185.3	95UCL	0.009159	99UCL	0.65	0.03	1.00	0.0003	1.69	9.3	40.3	0.18	0.04	No Risk
Cadmium	65.83	95UCL	0.000724	95UCL	0.58	0.67	0.05	0	1.30	0.16	0.61	**8.1**	**2.1**	**Possible Risk**
Chromium	43.15	95UCL	0.021	99UCL	0.17	0.04	0.39	0.0006	0.59	1	5	0.59	0.12	No Risk
Copper	37027	95UCL	0.1167	99UCL	11.59	55.49	133.61	0.003	200.69	47	61.7	**4.3**	**3.3**	**Possible Risk**
Iron	75892	95UCL	24	99UCL	30.35	7.95	684.62	0.672	723.59	7.03	70.3	**103**	**10.3**	**Possible Risk**
Lead	297.7	95UCL	0.1051	99UCL	0.61	0.23	1.34	0.003	2.19	0.19	1.78	**12**	**1.2**	**Possible Risk**
Molybdenum	648.7	95UCL	0.005126	99UCL	76.32	1.80	5.85	0.0001	83.97	3.53	35.3	**24**	**2.4**	**Possible Risk**
Selenium	14.63	95UCL	0.000845	95UCL	0.92	0.02	0.08	0	1.02	0.4	0.8	**2.6**	**1.3**	**Possible Risk**
Thallium	0.87	95UCL	0.000358	95UCL	0.0003	0.0001	0.01	0.00001	0.01	0.0053	0.053	**1.6**	0.16	No Risk
Zinc	5170	95UCL	0.1552	99UCL	52.31	4.11	23.32	0.004	79.74	14.5	131	**5.5**	0.61	No Risk
Wash Soils and Gila River Surface Water														
Cadmium	3.161	95UCL	0.000724	95UCL	0.11	0.06	0.003	0	0.17	0.16	0.61	**1.1**	0.28	No Risk
Chromium	29.48	95UCL	0.021	99UCL	0.11	0.03	0.27	0.0006	0.41	1	5	0.41	0.08	No Risk
Copper	6848	95UCL	0.1167	99UCL	5.96	10.26	24.71	0.003	40.94	47	61.7	0.87	0.66	No Risk
Iron	70306	95UCL	24	99UCL	28.11	7.37	634.23	0.67	670.38	7.03	70.3	**95**	**10**	**Possible Risk**
Lead	95.83	95UCL	0.1051	99UCL	0.32	0.09	0.43	0.003	0.85	0.19	1.78	**4.5**	0.48	No Risk
Molybdenum	48.08	95UCL	0.005126	99UCL	5.66	0.13	0.43	0.0001	6.22	3.53	35.3	**1.8**	0.18	No Risk
Selenium	2.712	95UCL	0.000845	95UCL	0.14	0.01	0.02	0.00002	0.17	0.4	0.8	0.43	0.22	No Risk

TABLE 5-24
Refined Screening Evaluation for Mourning Dove
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)							Hazard Quotients [c]		
Analytes [a]	**Soil EPC (mg/kg)**	**Soil EPC Basis**	**Water EPC (mg/L)**	**Water EPC Basis**	**Plant**	**Soil Invertebrate**	**Soil**	**Water**	**Total**	**NOAEL (mg/kg/d)**	**LOAEL (mg/kg/d)**	**NOAEL HQ**	**LOAEL HQ**	**Risk Conclusion**
Thallium	1.305	95UCL	0.000358	95UCL	0.0005	0.000	0.01	0.00001	0.01	0.0053	0.053	**2.4**	0.24	No Risk
Zinc	373.1	95UCL	0.1552	99UCL	12.16	1.74	1.68	0.004	15.58	14.5	131	**1.1**	0.12	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., terrestrial plant and soil invertebrate portions of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 97% plants and 3% soil invertebrates was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL
[d] Stable and unstable riparian soils were collected along the Gila and San Pedro rivers. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mear
99 UCL = 99 percent upper confidence limit of the arithmetic mear

TABLE 5-25
Refined Screening Evaluation for Curve-billed Thrasher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)							Hazard Quotients [c]		
Analytes [a]	Soil EPC (mg/kg)	Soil EPC Basis	Water EPC (mg/L)	Water EPC Basis	Plant	Soil Invertebrate	Soil	Water	Total	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	NOAEL HQ	LOAEL HQ	Risk Conclusion
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]														
Copper	389.1	99UCL	0.1167	99UCL	0.19	29.57	0.23	0.02	30.01	47	61.7	0.64	0.49	No Risk
Mercury	0.0735	95UCL	0.00042	95UCL	0.0008	0.0629	0.0002	0.0001	0.06	0.068	0.37	0.94	0.17	No Risk
Selenium	0.67	Max Detect	0.000845	95UCL	0.0031	0.1021	0.0059	0.0001	0.11	0.4	0.8	0.28	0.14	No Risk
Silver	0.466	95UCL	0.0000533	95UCL	0.0001	0.1406	0.0068	0.00001	0.15	0.427	4.27	0.35	0.03	No Risk
Middle Gila River - On-Site Stable Riparian Soil and Surface Water														
Iron	17381	95UCL	24	99UCL	0.70	92.34	253.78	3.26	350.08	7.03	70.3	**50**	**5.0**	**Possible Risk**
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water														
Iron	21030	95UCL	24	99UCL	0.84	111.73	307.06	3.26	422.89	7.03	70.3	**60**	**6.0**	**Possible Risk**
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water														
Mercury	0.051	Max Detect	0.00042	95UCL	0.0007	0.06	0.0001	0.0001	0.06	0.068	0.37	0.83	0.15	No Risk
Selenium	3.5	Max ND	0.000845	95UCL	0.02	0.34	0.03	0.0001	0.39	0.4	0.8	0.98	0.49	No Risk
Silver	0.24	Max Detect	0.00005	Max Detect	0.00003	0.07	0.004	0.00001	0.08	0.427	4.27	0.18	0.02	No Risk
San Pedro River - On-Site Stable Riparian Soil and Surface Water														
Iron	9870	Max Detect	8.97	Max Detect	0.40	52.44	144.11	1.22	198.17	7.03	70.3	**28**	**2.8**	**Possible Risk**
San Pedro River - On-Site Untable Riparian Soil and Surface Water														
Iron	18000	Max Detect	8.97	Max Detect	0.72	95.63	262.82	1.22	360.39	7.03	70.3	**51**	**5.1**	**Possible Risk**
Upland Soils and Gila River Surface Water														
Cadmium	65.83	95UCL	0.000724	95UCL	0.06	34.10	0.09	0.0001	34.25	0.16	0.61	**214**	**56**	**Possible Risk**
Chromium	43.15	95UCL	0.021	99UCL	0.02	1.95	0.63	0.0029	2.60	1	5	**2.6**	0.52	No Risk
Cobalt	41.28	95UCL	0.02499	99UCL	0.003	0.74	0.60	0.003	1.35	3.89	7.8	0.35	0.17	No Risk
Copper	37027	95UCL	0.1167	99UCL	1.16	2814.19	216.25	0.02	3031.62	47	61.7	**65**	**49**	**Possible Risk**
Iron	75892	95UCL	24	99UCL	3.04	403.21	1108.10	3.26	1517.61	7.03	70.3	**216**	**22**	**Possible Risk**
Lead	297.7	95UCL	0.1051	99UCL	0.06	11.77	2.17	0.01	14.02	0.19	1.78	**74**	**7.9**	**Possible Risk**
Mercury	0.36	95UCL	0.00042	95UCL	0.002	0.11	0.001	0.0001	0.11	0.068	0.37	**1.6**	0.30	No Risk
Molybdenum	648.7	95UCL	0.005126	99UCL	7.64	91.24	9.47	0.0007	108.35	3.53	35.3	**31**	**3.1**	**Possible Risk**
Selenium	14.63	95UCL	0.000845	95UCL	0.09	0.98	0.13	0.0001	1.20	0.4	0.8	**3.0**	**1.5**	**Possible Risk**
Silver	15.63	95UCL	0.0000533	95UCL	0.002	4.72	0.23	0.00001	4.95	0.427	4.27	**12**	**1.2**	**Possible Risk**
Thallium	0.87	95UCL	0.000358	95UCL	0.00	0.01	0.01	0.00005	0.02	0.0053	0.053	**3.7**	0.37	No Risk
Zinc	5170	95UCL	0.1552	99UCL	5.24	208.56	37.74	0.02	251.56	14.5	131	**17**	**1.9**	**Possible Risk**
Wash Soils and Gila River Surface Water														
Cadmium	3.161	95UCL	0.000724	95UCL	0.01	3.05	0.004	0.0001	3.07	0.16	0.61	**19**	**5.0**	**Possible Risk**
Chromium	29.48	95UCL	0.021	99UCL	0.01	1.33	0.43	0.003	1.78	1	5	**1.8**	0.36	No Risk
Cobalt	29	95UCL	0.02499	99UCL	0.002	0.52	0.42	0.003	0.95	3.89	7.8	0.24	0.12	No Risk
Copper	6848	95UCL	0.1167	99UCL	0.60	520.47	40.00	0.02	561.08	47	61.7	**12**	**9.1**	**Possible Risk**
Iron	70306	95UCL	24	99UCL	2.81	373.53	1026.54	3.2640	1406.14	7.03	70.3	**200**	**20**	**Possible Risk**
Lead	95.83	95UCL	0.1051	99UCL	0.03	4.71	0.70	0.0143	5.46	0.19	1.78	**29**	**3.1**	**Possible Risk**
Mercury	0.0981	95UCL	0.00042	95UCL	0.001	0.07	0.0002	0.0001	0.07	0.068	0.37	**1.04**	0.19	No Risk
Molybdenum	48.08	95UCL	0.005126	99UCL	0.57	6.76	0.70	0.0007	8.03	3.53	35.3	**2.3**	0.23	No Risk
Selenium	2.712	95UCL	0.000845	95UCL	0.01	0.28	0.02	0.0001	0.32	0.4	0.8	0.81	0.40	No Risk

TABLE 5-25
Refined Screening Evaluation for Curve-billed Thrasher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)							Hazard Quotients [c]		
Analytes [a]	Soil EPC (mg/kg)	Soil EPC Basis	Water EPC (mg/L)	Water EPC Basis	Plant	Soil Invertebrate	Soil	Water	Total	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	NOAEL HQ	LOAEL HQ	Risk Conclusion
Silver	3.678	95UCL	0.0000533	95UCL	0.0005	1.11	0.05	0.00001	1.16	0.427	4.27	**2.7**	0.27	No Risk
Thallium	1.305	95UCL	0.000358	95UCL	0.00	0.01	0.02	0.00005	0.03	0.0053	0.053	**5.6**	0.56	No Risk
Zinc	373.1	95UCL	0.1552	99UCL	1.22	88.06	2.72	0.02	92.02	14.5	131	**6.3**	0.70	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., terrestrial plant and soil invertebrate portions of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 6% plants and 94% soil invertebrates was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro rivers. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mean
99 UCL = 99 percent upper confidence limit of the arithmetic mean

TABLE 5-26
Refined Screening Evaluation for Red-tailed Hawk
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Soil EPC (mg/kg)	Soil EPC Basis	Water EPC (mg/L)	Water EPC Basis	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Retain/Drop
					Mammal	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Stable Riparian Soil and Surface Water													
Iron	17381	95UCL	24	99UCL	45.07	0	1.39	46.46	7.03	70.3	**6.6**	0.66	No Risk
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water													
Iron	21030	95UCL	24	99UCL	50.49	0	1.39	51.89	7.03	70.3	**7.4**	0.74	No Risk
San Pedro River - On-Site Stable Riparian Soil and Surface Water													
Iron	9870	Max Detect	8.97	Max Detect	32.15	0	0.52	32.67	7.03	70.3	**4.6**	0.46	No Risk
San Pedro River - On-Site Untable Riparian Soil and Surface Water													
Iron	18000	Max Detect	8.97	Max Detect	46.02	0	0.52	46.54	7.03	70.3	**6.6**	0.66	No Risk
Upland Soils and Gila River Surface Water													
Cadmium	65.83	95UCL	0.000724	95UCL	0.36	0	0.00004	0.36	0.16	0.61	**2.3**	0.60	No Risk
Iron	75892	95UCL	24	99UCL	108.62	0	1.3920	110.02	7.03	70.3	**16**	**1.6**	**Possible Risk**
Lead	297.7	95UCL	0.1051	99UCL	2.37	0	0.006	2.38	0.19	1.78	**13**	**1.3**	**Possible Risk**
Molybdenum	648.7	95UCL	0.005126	99UCL	114.82	0	0.0003	114.82	3.53	35.3	**33**	**3.3**	**Possible Risk**
Silver	15.63	95UCL	0.0000533	95UCL	0.01	0	0.000003	0.01	0.427	4.27	0.03	0.003	No Risk
Thallium	0.87	95UCL	0.000358	95UCL	0.02	0	0.0000	0.02	0.0053	0.053	**3.3**	0.33	No Risk
Zinc	5170	95UCL	0.1552	99UCL	25.41	0	0.009	25.42	14.5	131	**1.8**	0.19	No Risk
Wash Soils and Gila River Surface Water													
Chromium	29.48	95UCL	0.021	99UCL	0.49	0	0.0012	0.49	1	5	0.49	0.10	No Risk
Iron	70306	95UCL	24	99UCL	103.78	0	1.3920	105.17	7.03	70.3	**15**	**1.5**	**Possible Risk**
Lead	95.83	95UCL	0.1051	99UCL	1.44	0	0.0061	1.44	0.19	1.78	**7.6**	0.81	No Risk
Molybdenum	48.08	95UCL	0.005126	99UCL	8.51	0	0.0003	8.51	3.53	35.3	**2.4**	0.24	No Risk
Silver	3.678	95UCL	0.0000533	95UCL	0.003	0	0.000003	0.003	0.427	4.27	0.01	0.001	No Risk
Thallium	1.305	95UCL	0.000358	95UCL	0.03	0	0.00002	0.03	0.0053	0.053	**4.9**	0.49	No Risk
Zinc	373.1	95UCL	0.1552	99UCL	21.11	0	0.009	21.12	14.5	131	**1.5**	0.16	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., small mammal portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 100% small mammals was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro rivers. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mean
99 UCL = 99 percent upper confidence limit of the arithmetic mean

TABLE 5-27
Refined Screening Evaluation for Southwestern Willow Flycatcher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)							Hazard Quotients [c]		
Analytes [a]	Soil EPC (mg/kg)	Soil EPC Basis	Water EPC (mg/L)	Water EPC Basis	Plant	Soil Invertebrate	Soil	Water	Total	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	NOAEL HQ	LOAEL HQ	Risk Conclusion
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]														
Copper	389.1	99UCL	0.1167	99UCL	0.23	54.25	0	0	54.48	47	61.7	**1.2**	0.88	**Possible Risk**
Mercury	0.0735	95UCL	0.00042	95UCL	0.001	0.12	0	0	0.12	0.068	0.37	**1.7**	0.31	**Possible Risk**
Molybdenum	2.33	95UCL	0.005126	99UCL	0.03	0.60	0	0	0.63	3.53	35.3	0.18	0.02	No Risk
Selenium	0.67	Max Detect	0.000845	95UCL	0.004	0.19	0	0	0.19	0.4	0.8	0.48	0.24	No Risk
Silver	0.466	95UCL	0.0000533	95UCL	0.0001	0.26	0	0	0.26	0.427	4.27	0.60	0.06	No Risk
Middle Gila River - On-Site Stable Riparian Soil and Surface Water														
Iron	17381	95UCL	24	99UCL	0.83	169.39	0	0	170.23	7.03	70.3	**24**	**2.4**	**Probable Risk**
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water														
Iron	21030	95UCL	24	99UCL	1.01	204.96	0	0	205.96	7.03	70.3	**29**	**2.9**	**Probable Risk**
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water														
Mercury	0.051	Max Detect	0.00042	95UCL	0.0008	0.10	0	0	0.10	0.068	0.37	**1.5**	0.28	**Possible Risk**
Selenium	3.5	Max ND	0.000845	95UCL	0.02	0.63	0	0	0.65	0.4	0.8	**1.6**	0.81	**Possible Risk**
Silver	0.24	Max Detect	0.00005	Max Detect	0.00004	0.13	0	0	0.13	0.427	4.27	0.31	0.03	No Risk
San Pedro River - On-Site Stable Riparian Soil and Surface Water														
Iron	9870	Max Detect	8.97	Max Detect	0.47	96.19	0	0	96.67	7.03	70.3	**14**	**1.4**	**Probable Risk**
San Pedro River - On-Site Untable Riparian Soil and Surface Water														
Iron	18000	Max Detect	8.97	Max Detect	0.86	175.43	0	0	176.29	7.03	70.3	**25**	**2.5**	**Probable Risk**
Upland Soils and Gila River Surface Water														
Cadmium	65.83	95UCL	0.00069	95UCL	0.07	62.56	0	0	62.62	0.16	0.61	**391**	**103**	**Probable Risk**
Chromium	43.15	95UCL	0.021	99UCL	0.02	3.57	0	0	3.59	1	5	**3.6**	0.72	**Possible Risk**
Cobalt	41.28	95UCL	0.02499	99UCL	0.003	1.36	0	0	1.37	3.89	7.8	0.35	0.18	No Risk
Copper	37027	95UCL	0.1167	99UCL	1.39	5162.33	0	0	5163.72	47	61.7	**110**	**84**	**Probable Risk**
Iron	75892	95UCL	24	99UCL	3.64	739.64	0	0	743.28	7.03	70.3	**106**	**11**	**Probable Risk**
Lead	297.7	95UCL	0.1051	99UCL	0.07	21.59	0	0	21.66	0.19	1.78	**114**	**12**	**Probable Risk**
Mercury	0.36	95UCL	0.00042	95UCL	0.002	0.20	0	0	0.20	0.068	0.37	**2.9**	0.54	**Possible Risk**
Molybdenum	648.7	95UCL	0.005126	99UCL	9.15	167.36	0	0	176.51	3.53	35.3	**50**	**5.0**	**Probable Risk**
Selenium	14.63	95UCL	0.000845	95UCL	0.11	1.80	0	0	1.91	0.4	0.8	**4.8**	**2.4**	**Probable Risk**
Silver	15.63	95UCL	0.0000533	95UCL	0.002	8.65	0	0	8.66	0.427	4.27	**20**	**2.0**	**Probable Risk**
Thallium	0.87	95UCL	0.000358	95UCL	0.00004	0.01	0	0	0.01	0.0053	0.053	**2.4**	0.24	**Possible Risk**
Zinc	5170	95UCL	0.1552	99UCL	6.27	382.58	0	0	388.85	14.5	131	**27**	**3.0**	**Probable Risk**
Wash Soils and Gila River Surface Water														
Cadmium	3.161	95UCL	0.00069	95UCL	0.01	5.60	0	0	5.61	0.16	0.61	**35**	**9.2**	**Probable Risk**
Chromium	29.48	95UCL	0.021	99UCL	0.01	2.44	0	0	2.46	1	5	**2.5**	0.49	**Possible Risk**
Cobalt	29	95UCL	0.02499	99UCL	0.002	0.96	0	0	0.96	3.89	7.8	0.25	0.12	No Risk
Copper	6848	95UCL	0.1167	99UCL	0.71	954.75	0	0	955.47	47	61.7	**20**	**15**	**Probable Risk**
Iron	70306	95UCL	24	99UCL	3.37	685.20	0	0	688.57	7.03	70.3	**98**	**9.8**	**Probable Risk**
Lead	95.83	95UCL	0.1051	99UCL	0.04	8.65	0	0	8.69	0.19	1.78	**46**	**4.9**	**Probable Risk**
Mercury	0.0981	95UCL	0.00042	95UCL	0.001	0.13	0	0	0.13	0.068	0.37	**1.9**	0.35	**Possible Risk**
Molybdenum	48.08	95UCL	0.005126	99UCL	0.68	12.40	0	0	13.08	3.53	35.3	**3.7**	0.37	**Possible Risk**
Nickel	34.97	95UCL	0.01931	99UCL	0.02	10.03	0	0	10.04	77.4	106.9	0.13	0.09	No Risk
Selenium	2.712	95UCL	0.000845	95UCL	0.02	0.52	0	0	0.54	0.4	0.8	**1.3**	0.67	**Possible Risk**
Silver	3.678	95UCL	0.0000533	95UCL	0.0006	2.04	0	0	2.04	0.427	4.27	**4.8**	0.48	**Possible Risk**

TABLE 5-27
Refined Screening Evaluation for Southwestern Willow Flycatcher
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)							Hazard Quotients [c]		
Analytes [a]	**Soil EPC (mg/kg)**	**Soil EPC Basis**	**Water EPC (mg/L)**	**Water EPC Basis**	**Plant**	**Soil Invertebrate**	**Soil**	**Water**	**Total**	**NOAEL (mg/kg/d)**	**LOAEL (mg/kg/d)**	**NOAEL HQ**	**LOAEL HQ**	**Risk Conclusion**
Thallium	1.305	95UCL	0.000358	95UCL	0.00006	0.02	0	0	0.02	0.0053	0.053	**3.6**	0.36	**Possible Risk**
Zinc	373.1	95UCL	0.1552	99UCL	1.46	161.53	0	0	162.99	14.5	131	**11**	**1.2**	**Probable Risk**

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., terrestrial plant and soil invertebrate portions of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 4% plants and 96% soil invertebrates was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro rivers. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level

TABLE 5-28
Refined Screening Evaluation for Desert Cottontail
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Soil EPC (mg/kg)	Soil EPC Basis	Water EPC (mg/L)	Water EPC Basis	Exposure Estimate by Pathway [b] (mg/kg/d) Plant	Soil	Water	Total	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c] NOAEL HQ	LOAEL HQ	Risk Conclusion
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]													
Boron	7.358	95UCL	0.1289	95UCL	7.06	0.02	0.01	7.10	28	93.6	0.25	0.08	No Risk
Molybdenum	2.33	95UCL	0.005126	99UCL	0.15	0.01	0.001	0.16	0.26	2.6	0.63	0.06	No Risk
Middle Gila River - On-Site Stable Riparian Soil and Surface Water													
Iron	17381	95UCL	24	99UCL	3.92	58.04	2.42	64.37	2.8	NA	**23**	NA	Uncertainty
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water													
Iron	21030	95UCL	24	99UCL	4.74	70.22	2.42	77.38	2.8	NA	**28**	NA	Uncertainty
San Pedro River - On-Site Stable Riparian Soil and Surface Water													
Iron	9870	Max Detect	8.97	Max Detect	2.22	32.96	0.91	36.09	2.8	NA	**13**	NA	Uncertainty
San Pedro River - On-Site Untable Riparian Soil and Surface Water													
Iron	18000	Max Detect	8.97	Max Detect	4.05	60.10	0.91	65.06	2.8	NA	**23**	NA	Uncertainty
Upland Soils and Gila River Surface Water													
Arsenic	185.3	95UCL	0.009159	99UCL	0.37	0.37	0.0009	0.74	0.396	1.58	**1.9**	0.47	No Risk
Copper	37027	95UCL	0.1167	99UCL	6.53	49.45	0.01	55.99	11.7	15.14	**4.8**	**3.7**	**Possible Risk**
Iron	75892	95UCL	24	99UCL	17.09	253.40	2.42	272.92	2.8	NA	**97**	NA	Uncertainty
Lead	297.7	95UCL	0.1051	99UCL	0.34	0.26	0.01	0.61	0.92	4.7	0.67	0.13	No Risk
Molybdenum	648.7	95UCL	0.005126	99UCL	42.99	2.17	0.0005	45.15	0.26	2.6	**174**	**17**	**Possible Risk**
Selenium	14.63	95UCL	0.000845	95UCL	0.52	0.03	0.0001	0.55	0.2	0.33	**2.7**	**1.7**	**Possible Risk**
Vanadium	67.31	95UCL	0.02696	95UCL	0.02	0.22	0.0027	0.24	0.21	2.1	**1.2**	0.12	No Risk
Wash Soils and Gila River Surface Water													
Antimony	1.699	95UCL	0.0016	Max ND	0.003	0.01	0.0002	0.01	0.059	0.59	0.16	0.02	No Risk
Arsenic	28.34	95UCL	0.009159	99UCL	0.06	0.06	0.0009	0.11	0.396	1.58	0.29	0.07	No Risk
Copper	6848	95UCL	0.1167	99UCL	3.36	9.15	0.01	12.52	11.7	15.14	**1.1**	0.83	No Risk
Iron	70306	95UCL	24	99UCL	15.84	234.75	2.42	253.01	2.8	NA	**90**	NA	Uncertainty
Lead	95.83	95UCL	0.1051	99UCL	0.18	0.08	0.01	0.28	0.92	4.7	0.30	0.06	No Risk
Molybdenum	48.08	95UCL	0.005126	99UCL	3.19	0.16	0.0005	3.35	0.26	2.6	**13**	**1.3**	**Possible Risk**
Selenium	2.712	95UCL	0.000845	95UCL	0.08	0.01	0.0001	0.09	0.2	0.33	0.43	0.26	No Risk
Vanadium	54.86	95UCL	0.02696	95UCL	0.01	0.18	0.003	0.20	0.21	2.1	0.95	0.10	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further consideration.

[b] Exposure estimates by each pathway (e.g., terrestrial plant portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 100% plants was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro rivers. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level

TABLE 5-28
Refined Screening Evaluation for Desert Cottontail
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)						Hazard Quotients [c]		
Analytes [a]	**Soil EPC (mg/kg)**	**Soil EPC Basis**	**Water EPC (mg/L)**	**Water EPC Basis**	**Plant**	**Soil**	**Water**	**Total**	**NOAEL (mg/kg/d)**	**LOAEL (mg/kg/d)**	**NOAEL HQ**	**LOAEL HQ**	**Risk Conclusion**

mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mear
99 UCL = 99 percent upper confidence limit of the arithmetic mear

TABLE 5-29

Comparison of Estimated 95UCL Concentrations of Chemicals of Potential Ecological Concern in Small Mammal Tissue (Kidney and Liver) to Literature-based Benchmarks

Screening-level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Model Type	N	Soil EPC (mg/kg)	EPC Basis	Estimated Concentration in Tissue (mg/kg DW)	Threshold	Units	Hazard Quotient	Refined Screen Results
Upland - soil-to-kidney									
Lead	insectivore	26	297.7	95UCL	15.42	10	mg/kg DW	**1.5**	**Possible Risk**
Lead	herbivore	31	297.7	95UCL	11.46	10	mg/kg DW	**1.1**	**Possible Risk**
Upland - soil-to-liver									
Copper	insectivore	27	37027	95UCL	106.23	68	mg/kg WW	**1.6**	**Possible Risk**
Lead	insectivore	26	297.7	95UCL	4.88	5	mg/kg DW	0.98	No Risk
Wash - soil-to-kidney									
Lead	insectivore	26	95.83	95UCL	6.09	10	mg/kg DW	0.6	No Risk
Lead	herbivore	31	95.83	95UCL	7.36	10	mg/kg DW	0.7	No Risk
Wash - soil-to-liver									
Copper	insectivore	27	6848	95UCL	70.91	68	mg/kg WW	**1.0**	**Possible Risk**

Notes:

Highlight and bold represent HQ values equal to or greater than one

95UCL = 95th upper confidence limit of the arithmetic mean
DW = dry weight
EPC = exposure point concentration
mg/kg = milligram per kilogram
NA = not available
WW = wet weight

TABLE 5-30
Refined Screening Evaluation for Desert Shrew
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Soil EPC (mg/kg)	Soil EPC Basis	Water EPC (mg/L)	Water EPC Basis	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Risk Conclusion
					Soil Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]													
Copper	389.1	99UCL	0.1167	99UCL	40.08	4.05	0.02	44.14	11.7	15.14	**3.8**	**2.9**	**Possible Risk**
Cyanide	0.26	Max Detect	0.0061	Max Detect	0.05	0.01	0.001	0.06	0.15	0.5	0.40	0.12	No Risk
Mercury	0.0735	95UCL	0.00042	95UCL	0.09	0.0003	0.0001	0.09	0.032	0.16	**2.7**	0.54	No Risk
Molybdenum	2.33	95UCL	0.005126	99UCL	0.44	0.06	0.0009	0.51	0.26	2.6	**1.9**	0.19	No Risk
Selenium	0.67	Max Detect	0.000845	95UCL	0.14	0.01	0.0001	0.15	0.2	0.33	0.74	0.45	No Risk
Silver	0.466	95UCL	0.0000533	95UCL	0.19	0.01	0.00001	0.20	2.38	23.8	0.09	0.01	No Risk
Middle Gila River - On-Site Stable Riparian Soil and Surface Water													
Iron	17381	95UCL	24	99UCL	125.14	451.91	4.03	581.08	2.8	NA	**208**	NA	Uncertainty
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water													
Iron	21030	95UCL	24	99UCL	151.42	546.78	4.03	702.23	2.8	NA	**251**	NA	Uncertainty
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water													
Cyanide	0.34	Max Detect	0.01	Max ND	0.07	0.01	0.002	0.08	0.15	0.5	0.52	0.16	No Risk
Mercury	0.051	Max Detect	0.00042	95UCL	0.08	0.0002	0.0001	0.08	0.032	0.16	**2.4**	0.47	No Risk
Selenium	3.5	Max ND	0.000845	95UCL	0.46	0.05	0.0001	0.52	0.2	0.33	**2.6**	**1.6**	**Possible Risk**
Silver	0.24	Max Detect	0.00005	Max Detect	0.10	0.006	0.00001	0.10	2.38	23.8	0.04	0.004	No Risk
San Pedro River - On-Site Stable Riparian Soil and Surface Water													
Iron	9870	Max Detect	8.97	Max Detect	71.06	256.62	1.51	329.19	2.8	NA	**118**	NA	Uncertainty
San Pedro River - On-Site Untable Riparian Soil and Surface Water													
Iron	18000	Max Detect	8.97	Max Detect	129.60	468.00	1.51	599.11	2.8	NA	**214**	NA	Uncertainty
Upland Soils and Gila River Surface Water													
Antimony	5.65	95UCL	0.0016	Max ND	1.13	0.1469	0.0003	1.28	0.059	0.59	**22**	**2.2**	**Possible Risk**
Arsenic	185.3	95UCL	0.009159	99UCL	1.93	2.89	0.002	4.82	0.396	1.58	**12**	**3.1**	**Possible Risk**
Cadmium	65.83	95UCL	0.00069	95UCL	46.21	0.15	0.0001	46.37	0.77	1.42	**60**	**32.7**	**Possible Risk**
Chromium	43.15	95UCL	0.021	99UCL	2.64	1.12	0.004	3.77	3.28	13.14	**1.1**	0.29	No Risk
Cobalt	41.28	95UCL	0.02499	99UCL	1.01	1.07	0.004	2.08	5.45	10.9	0.38	0.19	No Risk
Copper	37027	95UCL	0.1167	99UCL	3813.78	385.08	0.02	4198.88	11.7	15.14	**359**	**277**	**Possible Risk**
Cyanide	2.5	Max ND	0.0061	Max Detect	0.50	0.07	0.00	0.57	0.15	0.5	**3.8**	**1.1**	**Possible Risk**
Iron	75892	95UCL	24	99UCL	546.42	1973.19	4.03	2523.65	2.8	NA	**901**	NA	Uncertainty
Lead	297.7	95UCL	0.1051	99UCL	15.95	2.03	0.02	17.99	0.92	4.7	**20**	**3.8**	**Possible Risk**
Mercury	0.36	95UCL	0.00042	95UCL	0.15	0.001	0.0001	0.15	0.032	0.16	**4.6**	0.92	No Risk
Molybdenum	648.7	95UCL	0.005126	99UCL	123.64	16.87	0.0009	140.51	0.26	2.6	**540**	**54**	**Possible Risk**
Nickel	30.64	95UCL	0.01931	99UCL	6.49	0.80	0.003	7.29	6.8	31.63	**1.1**	0.23	No Risk
Selenium	14.63	95UCL	0.000845	95UCL	1.33	0.23	0.0001	1.55	0.2	0.33	**7.8**	**4.7**	**Possible Risk**
Silver	15.63	95UCL	0.0000533	95UCL	6.39	0.41	0	6.80	2.38	23.8	**2.9**	0.29	No Risk
Vanadium	67.31	95UCL	0.02696	95UCL	0.57	1.75	0.005	2.32	0.21	2.1	**11**	**1.1**	**Possible Risk**
Zinc	5170	95UCL	0.1552	99UCL	282.64	67.21	0.03	349.87	160	320	**2.2**	**1.1**	**Possible Risk**
Wash Soils and Gila River Surface Water													
Antimony	1.699	95UCL	0.0016	Max ND	0.34	0.04	0.0003	0.38	0.059	0.59	**6.5**	0.65	No Risk
Arsenic	28.34	95UCL	0.009159	99UCL	0.51	0.44	0.002	0.96	0.396	1.58	**2.4**	0.60	No Risk
Cadmium	3.161	95UCL	0.000724	95UCL	4.14	0.007	0.0001	4.14	0.77	1.42	**5.4**	**2.9**	**Possible Risk**
Chromium	29.48	95UCL	0.021	99UCL	1.80	0.77	0.004	2.57	3.28	13.14	0.78	0.20	No Risk
Cobalt	29	95UCL	0.02499	99UCL	0.71	0.75	0.004	1.47	5.45	10.9	0.27	0.13	No Risk
Copper	6848	95UCL	0.1167	99UCL	705.34	71.22	0.02	776.58	11.7	15.14	**66**	**51**	**Possible Risk**
Cyanide	2.5	Max ND	0.0061	Max Detect	0.50	0.07	0.001	0.57	0.15	0.5	**3.8**	**1.1**	**Possible Risk**
Iron	70306	95UCL	24	99UCL	506.20	1827.96	4.03	2338.19	2.8	NA	**835**	NA	Uncertainty

TABLE 5-30
Refined Screening Evaluation for Desert Shrew
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analytes [a]	Soil EPC (mg/kg)	Soil EPC Basis	Water EPC (mg/L)	Water EPC Basis	Exposure Estimate by Pathway [b] (mg/kg/d)				NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients [c]		Risk Conclusion
					Soil Invertebrate	Soil	Water	Total			NOAEL HQ	LOAEL HQ	
Lead	95.83	95UCL	0.1051	99UCL	6.39	0.65	0.0177	7.06	0.92	4.7	**7.7**	**1.5**	**Possible Risk**
Mercury	0.0981	95UCL	0.00042	95UCL	0.09	0.0004	0.0001	0.09	0.032	0.16	**3.0**	0.59	No Risk
Molybdenum	48.08	95UCL	0.005126	99UCL	9.16	1.25	0.0009	10.41	0.26	2.6	**40**	**4.0**	**Possible Risk**
Nickel	34.97	95UCL	0.01931	99UCL	7.41	0.91	0.003	8.32	6.8	31.63	**1.2**	0.26	No Risk
Selenium	2.712	95UCL	0.000845	95UCL	0.39	0.04	0.0001	0.43	0.2	0.33	**2.1**	**1.3**	**Possible Risk**
Silver	3.678	95UCL	0.0000533	95UCL	1.50	0.10	0.00001	1.60	2.38	23.8	0.67	0.07	No Risk
Thallium	1.305	95UCL	0.000358	95UCL	0.01	0.03	0.0001	0.05	0.48	1.43	0.10	0.03	No Risk
Vanadium	54.86	95UCL	0.02696	95UCL	0.46	1.43	0.005	1.89	0.21	2.1	**9.0**	0.90	No Risk
Zinc	373.1	95UCL	0.1552	99UCL	119.33	4.85	0.03	124.21	160	320	0.78	0.39	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further

[b] Exposure estimates by each pathway (e.g., soil invertebrate portion of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 100% soil invertebrates was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro rivers. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mear
99 UCL = 99 percent upper confidence limit of the arithmetic mear

TABLE 5-31
Refined Screening Evaluation for Coyote
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

					Exposure Estimate by Pathway [b] (mg/kg/d)								Hazard Quotients [c]		
Analytes [a]	**Soil EPC (mg/kg)**	**Soil EPC Basis**	**Water EPC (mg/L)**	**Water EPC Basis**	**Plant**	**Invertebrate**	**Mammal**	**Soil**	**Water**	**Total**	**NOAEL (mg/kg/d)**	**LOAEL (mg/kg/d)**	**NOAEL HQ**	**LOAEL HQ**	**Risk Conclusion**
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water [d]															
Molybdenum	2.33	95UCL	0.005126	99UCL	0.03	0.0010	0.08	0.003	0.0004	0.11	0.26	2.6	0.43	0.04	No Risk
Middle Gila River - On-Site Stable Riparian Soil and Surface Water															
Iron	17381	95UCL	24	99UCL	0.81	0.28	8.29	21.41	1.87	32.66	2.8	NA	**12**	NA	Uncertainty
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water															
Iron	21030	95UCL	24	99UCL	0.98	0.33	9.29	25.91	1.87	38.39	2.8	NA	**14**	NA	Uncertainty
San Pedro River - On-Site Stable Riparian Soil and Surface Water															
Iron	9870	Max Detect	8.97	Max Detect	0.46	0.16	5.91	12.16	0.70	19.39	2.8	NA	**6.9**	NA	Uncertainty
San Pedro River - On-Site Untable Riparian Soil and Surface Water															
Iron	18000	Max Detect	8.97	Max Detect	0.84	0.29	8.46	22.18	0.70	32.47	2.8	NA	**12**	NA	Uncertainty
Upland Soils and Gila River Surface Water															
Arsenic	185.3	95UCL	0.009159	99UCL	0.08	0.004	0.02	0.14	0.0007	0.24	0.396	1.58	0.60	0.15	No Risk
Copper	37027	95UCL	0.1167	99UCL	1.35	8.39	1.15	18.25	0.009	29.15	11.7	15.14	**2.5**	**1.9**	**Possible Risk**
Iron	75892	95UCL	24	99UCL	3.55	1.20	19.98	93.50	1.87	120.10	2.8	NA	**43**	NA	Uncertainty
Lead	297.7	95UCL	0.1051	99UCL	0.07	0.04	0.44	0.10	0.008	0.65	0.92	4.7	0.70	0.14	No Risk
Molybdenum	648.7	95UCL	0.005126	99UCL	8.92	0.27	21.12	0.80	0.0004	31.12	0.26	2.6	**120**	**12**	**Possible Risk**
Wash Soils and Gila River Surface Water															
Copper	6848	95UCL	0.1167	99UCL	0.70	1.55	0.90	3.37	0.009	6.53	11.7	15.14	0.56	0.43	No Risk
Iron	70306	95UCL	24	99UCL	3.29	1.11	19.09	86.62	1.87	111.98	2.8	NA	**40**	NA	Uncertainty
Molybdenum	48.08	95UCL	0.005126	99UCL	0.66	0.02	1.57	0.06	0.0004	2.31	0.26	2.6	**8.9**	0.89	No Risk

Notes:

[a] Calcium, magnesium, potassium, and sodium are considered naturally occurring essential macronutrients and adverse effects to bird and mammal populations from these analytes are not expected. Therefore, they were dropped from further

[b] Exposure estimates by each pathway (e.g., plant, soil invertebrate, and small mammal portions of diet, soil ingestion, and water ingestion) were calculated using the exposure model presented in Section 3.1.4, bioaccumulation regression models presented in Tables 3-2 to 3-6 for aquatic invertebrate, fish, plants, terrestrial invertebrates (earthworms as surrogate), and small mammals, respectively, median bioaccumulation factors presented in Table 5-17, and receptor-specific life history parameters (body weight and food ingestion rate) presented in Table 3-1. A refined diet of 25% plants, 1% soil invertebrates, and 74% small mammals was used. Bioavailability values from Table 5-18 were applied as available. The values shown are exposure estimates and do not represent the concentration of the analyte in each pathway, but rather the dose (mg/kg/d) from each pathway.

[c] Hazard Quotients = total exposure estimate/ receptor-specific NOAEL or LOAEL

[d] Stable and unstable riparian soils were collected along the Gila and San Pedro rivers. Based on a statistical comparison of the results, analytes with concentrations that did not differ between the two soil types were considered a single dataset and termed "combined stable and unstable riparian soil". Analytes with statistical differences between the two soil types were evaluated separately as "stable riparian soil" and "unstable riparian soil".

Highlight and bold represent HQ values equal to or greater than one

EPC = Exposure point concentration
HQ = hazard quotient
LOAEL = Lowest observed adverse effect level
mg/kg = milligram per kilogram
mg/kg/d = milliigram per kilogram per day
mg/L = milligram per liter
NOAEL = No observed adverse effect level
95 UCL = 95 percent upper confidence limit of the arithmetic mear
99 UCL = 99 percent upper confidence limit of the arithmetic mean

TABLE 7-1
Summary of Refined Screening Evaluation for Aquatic Ecological Receptors
Screening-Level Ecological Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Aquatic Organisms [2]	Benthic Invertebrates	Swallows	Belted Kingfisher	Little Brown Bat	Mink
On-Site Gila River						
Aluminum	**r (Retain)**	r (N)	r (NU)	r (NU)	**r (L, pH)**	**r (L, pH)**
Antimony	d	d	u	u	r (N)	d
Arsenic	d	d	d	d	r (D)	d
Barium	**r (Retain)**	d	d	d	d	d
Beryllium	**r(ND/DET)**	u	u	u	**r (NU)**	d
Boron	**r (Retain)**	u	d	d	d	d
[1] Cadmium	r (ND/DET)	r (N)	r (D)	**r (L)**	d	r (D)
Calcium	r (FE low)	-	-	-	-	-
Chromium	d	d	d	d	d	d
Cobalt	r (FE low)	u	d	d	d	d
[1] Copper	r (FE low)	r (FE low)	r (D)	d	**r (L)**	d
Cyanide	**r (ND/DET)**	**r (ND, L)**	u	u	**r (ND, L)**	d
Iron	**r (Retain)**	d	**r (L)**	r (D)	**r (NU)**	**r (NU)**
[1] Lead	r (FE low)	d	r (N)	r (N)	r (D)	d
Manganese	**r (Retain)**	r (FE low)	r (D)	d	r (D)	d
[1] Mercury	**r (ND/DET)**	d	r (D)	**r (L)**	r (D)	**r (L)**
Molybdenum	d	u	d	d	r (N)	d
Nickel	d	r (N)	d	d	d	d
Selenium	r (FE low)	d	d	r (D)	r (D)	r (D)
Silver	r (FE low)	r (N)	r (D)	d	r (D)	d
Strontium	-	u	u	u	d	d
Thallium	d	u	r (N)	d	d	d
Vanadium	r (FE low)	u	r (D)	d	r (N)	d
Zinc	d	d	r (D)	r (N)	d	d
Total Dissolved Solids	r (FE low)	-	-	-	-	-
Ammonia as N	d	-	-	-	-	-
p,p'-DDE	-	r (N)	r (N)	d	d	d
On-Site San Pedro River						
Aluminum	**r (Retain)**	r (N)	r (NU)	r (NU)	**r (L, pH)**	**r (L, pH)**
Antimony	d	d	u	u	r (N)	d
Arsenic	d	d	d	d	r (D)	d
Barium	**r (Retain)**	d	d	d	d	d
Beryllium	**r (Retain)**	u	u	u	**r (NU)**	d
Boron	**r (Retain)**	u	d	d	d	d
[1] Cadmium	d	d	r (D)	**r (L)**	d	d
Calcium	**r (Retain)**	-	-	-	-	-
Chromium	d	d	d	d	d	d
Cobalt	d	u	d	d	d	d
[1] Copper	d	r (N)	r (D)	d	r (N)	d
Cyanide	**r (ND)**	**r (ND, L)**	u	u	**r (ND, L)**	d
Iron	**r (Retain)**	d	**r (L)**	d	**r (NU)**	**r (NU)**

TABLE 7-1

Summary of Refined Screening Evaluation for Aquatic Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Aquatic Organisms [2]	Benthic Invertebrates	Swallows	Belted Kingfisher	Little Brown Bat	Mink
[1] Lead	d	d	r (N)	d	r (D)	d
Manganese	**r (Retain)**	r (N)	r (D)	d	r (D)	d
[1] Mercury	**r (ND)**	d	d	r (N)	r (D)	r (D)
Molybdenum	d	u	d	d	r (N)	d
Nickel	d	d	d	d	d	d
Selenium	d	d	d	r (N)	d	d
Silver	d	d	r (D)	d	d	d
Strontium	-	u	u	u	d	d
Thallium	d	u	r (N)	d	d	d
Vanadium	**r (Retain)**	u	d	d	r (N)	d
Zinc	d	d	r (D)	d	d	d
Total Dissolved Solids	**r (Retain)**	-	-	-	-	-
Ammonia as N	d	-	-	-	-	-
p,p'-DDE	-	r (N)	r (N)	d	d	d

Notes:

[1] Dissolved fraction of some metals used for aquatic organism evaluation

[2] Site-specific fish monitoring data do not exclude or support potential for risk; column presents results of the initial assessment and the (refined assessment).

Initial Assessment

u = Uncertainty; no receptor screening value available

d = Dropped from further analysis. Exposure concentration did not exceed screening benchmarks

r = COPEC could not be excluded from presenting a potential risk to receptor and was evaluated further in the refinement

- = not evaluated

Refined Assessment

N = NOAEL/Low-TRV exceedance in refinement but not the LOAEL/High-TRV; determination of no unacceptable risks to populations or communities (as applicable).

L = LOAEL/High-TRV exceedance in refinement; possible risk to populations or communities (as applicable)

D = NOAEL not exceeded in the refinement; determination of no unacceptable risk

NU = NOAEL exceedance in refinement; a LOAEL was unavailable therefore, risk is uncertain

Retain = COPEC did not pass refined screening and could not be excluded as a risk driver

ND/Det = The maximum non-detected value exceeded the maximum detected value and both exceeded the screening benchmark; risk is possible but the spatial extent of risk is uncertain.

ND = Exceedances based on concentrations less than the detection limit. Risks are uncertain, but cannot be excluded.

FE Low = The frequency of screening value exceedances is low ($\leq$20%).The likelihood of adverse effects is low and was excluded.

pH = Although risks from exposure to aluminum were predicted, the pH in sediments at the Site are greater than 5.5. Therefore, aluminum is not expected to be bioavailable.

Bold results indicate that a contaminant could not be excluded, for various reasons (e.g. insufficient detection limits or lack of a LOAEL), from posing a risk.

Highlighted results indicate conclusion of possible risk.

TABLE 7-2

Summary of Refined Risk Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants[1]	Terrestrial Invertebrates[1]	Terrestrial Microbes[1]	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher[2]	Desert Cottontail	Desert Shrew	Coyote
Middle Gila River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water										
Antimony	d	d	u	u	u	u	u	d	r (B)	d
Arsenic	**d (Retain GW)**	d	d	d	d	d	d	r (B)	r (B)	d
Beryllium	d	d	u	u	u	u	u	d	d	d
Boron	**r (NB)**	u	**r (NB)**	r (D)	d	d	d	r (D)	d	d
Cadmium	d	d	d	d	r (B)	d	r (B)	d	r (B)	d
Chromium	r (B)	r (B)	r (B)	d	r (B)	d	r (B)	d	r (B)	d
Copper	**r (Retain)**	**r (Retain)**	**r (Retain)**	d	r (D)	d	**r (Poss)**	d	**r (L)**	d
Cyanide	u	u	u	u	u	u	u	d	r (D)	d
Lead	d	d	d	r (B)	r (B)	r (B)	r (B)	d	r (B)	d
Mercury	d	r (FE low)	d	d	r (D)	d	**r (Poss)**	d	r (N)	d
Molybdenum	**r (Retain)**	u	d	d	d	d	r (D)	r (D)	r (N)	r (D)
Selenium	**r (ND)**	d	d	d	r (D)	d	r (D)	d	r (D)	d
Silver	d	u	d	d	r (D)	d	r (D)	d	r (D)	d
Thallium	r (B)	u	u	r (B)	r (B)	r (B)	r (B)	d	d	d
Vanadium	r (B)	u	r (B)	d	d	d	d	r (B)	r (B)	d
Zinc	r (B)	r (B)	r (B)	d	r (B)	r (B)	r (B)	d	d	d
Middle Gila River - On-Site Stable Riparian Soil and Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Barium	d	d	d	d	d	d	d	d	d	d
Cobalt	d	u	d	d	d	d	d	d	d	d
Iron	**r (NB)**	u	**r (NB)**	**r (NB)**	**r (NB)**	r (N)	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Manganese	**r (NB, Retain GW)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d
Nickel	d	d	d	d	d	d	d	d	r (B)	d
Middle Gila River - On-Site Unstable Riparian Soil and Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Barium	d	d	d	d	d	d	d	d	d	d
Cobalt	r (FE low)	u	d	d	d	d	d	d	d	d
Iron	**r (NB)**	u	**r (NB)**	**r (NB)**	**r (NB)**	r (N)	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Manganese	**r (NB, Retain GW)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d
Nickel	d	d	d	d	d	d	d	d	r (B)	d

TABLE 7-2

Summary of Refined Risk Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants[1]	Terrestrial Invertebrates[1]	Terrestrial Microbes[1]	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher[2]	Desert Cottontail	Desert Shrew	Coyote
San Pedro River - On-Site Combined Stable and Unstable Riparian Soil and Surface Water										
Antimony	d	d	u	u	u	u	u	d	r (B)	d
Arsenic	d	d	d	d	d	d	d	d	d	d
Beryllium	d	d	u	u	u	u	u	d	d	d
Boron	**r (NB)**	u	d	d	d	d	d	d	d	d
Cadmium	d	d	d	d	r (B)	d	r (B)	d	r (B)	d
Chromium	r (B)	r (B)	r (B)	d	r (B)	d	r (B)	d	r (B)	d
Copper	r (B)	r (B)	r (B)	d	r (B)	d	r (B)	d	r (B)	d
Cyanide	u	u	u	u	u	u	u	d	r (D)	d
Lead	d	d	d	r (B)	r (B)	r (B)	r (B)	d	r (B)	d
Mercury	d	r (FE low)	d	d	r (D)	d	**r (Poss)**	d	r (N)	d
Molybdenum	r (B)	u	d	d	d	d	d	r (B)	r (B)	d
Selenium	**r (ND)**	d	d	d	r (D)	d	**r (Poss, ND)**	d	**r (L, ND)**	d
Silver	d	u	d	d	r (D)	d	r (D)	d	r (D)	d
Thallium	r (B)	u	u	r (B)	r (B)	r (B)	r (B)	d	d	d
Vanadium	r (B)	u	r (B)	d	d	d	d	d	r (B)	d
Zinc	r (B)	d	d	d	r (B)	r (B)	**r (B, MT)**	d	d	d
San Pedro River - On-Site Stable Riparian Soil and Surface Water										
Aluminum	d	d	d	d	r (pH)	d	r (pH)	r (pH)	r (pH)	r (pH)
Barium	d	d	d	d	d	d	d	d	d	d
Cobalt	d	u	d	d	d	d	d	d	d	d
Iron	**r (NB)**	u	**r (NB)**	**r (NB)**	**r (NB)**	r (N)	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Manganese	d	d	**r (NB)**	d	d	d	d	d	d	d
Nickel	d	d	d	d	d	d	d	d	r (B)	d
San Pedro River - On-Site Untable Riparian Soil and Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Barium	d	d	d	d	d	d	d	d	d	d
Cobalt	d	u	d	d	d	d	d	d	d	d
Iron	**r (NB)**	u	**r (NB)**	**r (NB)**	**r (NB)**	r (N)	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Manganese	**r (NB)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d
Nickel	d	d	d	d	d	d	d	d	r (B)	d

TABLE 7-2

Summary of Refined Risk Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants[1]	Terrestrial Invertebrates[1]	Terrestrial Microbes[1]	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher[2]	Desert Cottontail	Desert Shrew	Coyote
Upland Soils and Gila River Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Antimony	r (FE low)	d	u	u	u	u	u	d	**r (L)**	d
Arsenic	**r (Retain)**	**r (Retain)**	r (FE low)	r (D)	d	d	d	r (N)	**r (L)**	r (D)
Barium	d	d	d	d	d	d	d	d	d	d
Beryllium	d	d	u	u	u	u	u	d	d	d
Boron	**r (NB)**	u	d	d	d	d	d	d	d	d
Cadmium	r (FE low)	d	r (FE low)	**r (L)**	**r (L)**	r (N)	**r (Prob)**	d	**r (L)**	d
Chromium	r (BC low)	r (BC low)	r (BC low)	r (D)	r (N)	d	**r (Poss)**	d	r (N)	d
Cobalt	**r (Retain)**	u	d	d	r (D)	d	r (D)	d	r (D)	d
Copper	**r (Retain)**	**r (Retain)**	**r (Retain)**	**r (L)**	**r (L)**	d	**r (Prob)**	**r (L)**	**r (L, T)**	**r (L)**
Cyanide	u	u	u	u	u	u	u	d	**r (L, ND)**	d
Iron	r (FE low)	u	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Lead	**r (Retain)**	d	d	**r (L)**	**r (L)**	**r (L)**	**r (Prob)**	**r (D, T)**	**r (L, T)**	r (D)
Manganese	**r (NB)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d
Mercury	r (FE low)	**r (Retain)**	d	d	r (N)	d	**r (Poss)**	d	r (N)	d
Molybdenum	**r (Retain)**	u	r (FE low)	**r (L)**	**r (L)**	**r (L)**	**r (Prob)**	**r (L)**	**r (L)**	**r (L)**
Nickel	r (FE low)	d	d	d	d	d	d	d	r (N)	d
Selenium	**r (Retain)**	d	d	**r (L)**	**r (L)**	d	**r (Prob)**	**r (L)**	**r (L)**	d
Silver	d	u	d	d	**r (L)**	r (D)	**r (Prob)**	d	r (N)	d
Thallium	r (FE low)	u	u	r (N)	r (N)	r (N)	**r (Poss)**	d	d	d
Vanadium	**r (Retain)**	u	**r (Retain)**	d	d	d	d	r (N)	**r (L)**	d
Zinc	**r (Retain)**	**r (Retain)**	**r (Retain)**	r (N)	**r (L)**	r (N)	**r (Prob, MT)**	d	**r (L)**	d
Wash Soils and Gila River Surface Water										
Aluminum	d	d	d	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)	r (pH)
Antimony	r (FE low)	d	u	u	u	u	u	r (D)	r (N)	d
Arsenic	**r (Retain)**	r (FE low)	d	d	d	d	d	r (D)	r (N)	d
Barium	d	d	d	d	d	d	d	d	d	d
Beryllium	d	d	u	u	u	u	u	d	d	d
Boron	**r (NB)**	u	d	d	d	d	d	d	d	d
Cadmium	d	d	d	r (N)	**r (L)**	d	**r (Prob)**	d	**r (L)**	d
Chromium	r (BC low)	r (BC low)	r (BC low)	r (D)	r (N)	r (D)	**r (Poss)**	d	r (D)	d
Cobalt	**r (Retain)**	u	d	d	r (D)	d	r (D)	d	r (D)	d
Copper	**r (Retain)**	**r (Retain)**	**r (Retain)**	r (D)	**r (L)**	d	**r (Prob)**	r (N)	**r (L, T)**	r (D)
Cyanide	u	u	u	u	u	u	u	d	**r (L, ND)**	d
Iron	**r (NB)**	u	r (B)	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB)**	**r (NB, NU)**	**r (NB, NU)**	**r (NB, NU)**
Lead	r (FE low)	d	d	r (N)	**r (L)**	r (N)	**r (Prob)**	r (D)	**r (L)**	d
Manganese	**r (NB)**	**r (NB)**	**r (NB)**	d	d	d	d	d	d	d

TABLE 7-2

Summary of Refined Risk Evaluation for Terrestrial Ecological Receptors

Screening-Level Ecological Risk Assessment

ASARCO LLC Hayden Plant Site, Hayden, Arizona

Analyte	Terrestrial Plants[1]	Terrestrial Invertebrates[1]	Terrestrial Microbes[1]	Mourning Dove	Curve-billed Thrasher	Red-tailed Hawk	Southwestern Willow Flycatcher[2]	Desert Cottontail	Desert Shrew	Coyote
Mercury	r (FE low)	r (FE low)	d	d	r (N)	d	**r (Poss)**	d	r (N)	d
Molybdenum	**r (Retain)**	u	d	r (N)	r (N)	r (N)	**r (Poss)**	**r (L)**	**r (L)**	r (N)
Nickel	r (FE low)	d	d	d	d	d	r (D)	d	r (N)	d
Selenium	**r (Retain)**	d	d	r (D)	r (D)	d	**r (Poss)**	r (D)	**r (L)**	d
Silver	d	u	d	d	r (N)	r (D)	**r (Poss)**	d	r (D)	d
Thallium	**r (Retain)**	u	u	r (N)	r (N)	r (N)	**r (Poss)**	d	r (D)	d
Vanadium	**r (Retain)**	u	**r (Retain)**	d	d	d	d	r (D)	r (N)	d
Zinc	**r (Retain)**	**r (Retain)**	**r (Retain)**	r (N)	r (N)	r (N)	**r (Prob)**	d	r (D)	d

Notes:

Column presents results of the initial assessment and the (refined assessment).

[1] Potential effects only from direct contact with Site soils were evaluated for non-wildlife receptors.

[2] Special Status Species. Evaluated at the individual level. Population studies of southwestern willow flycatchers in the vicinity of the Site do not exclude or support potential for risk.

Initial Assessment

- = not evaluated

u = Uncertainty; no receptor screening value available

d = Dropped from further analysis. Exposure concentration did not exceed low-screening value

r = COPEC could not be excluded from presenting a potential risk to receptor and was evaluated further in the refinement

Refined Assessment

B = Did not differ from background concentrations and is not a site-associated contaminant

N = NOAEL exceedance in refinement but not the LOAEL; determination of no unacceptable risks to populations or communities (as applicable)

L = LOAEL exceedance in refinement; possible risk populations or communities (as applicable)

D = NOAEL not exceeded in the refinement; determination of no unacceptable risks.

Retain = COPEC did not pass refined screening and could not be excluded as a risk driver

Retain GW = Groundwater concentrations exceeded the screening benchmark; considered to pose a possible risk, even if soil data predicted no risk or if onsite soil concentrations were similar to background.

Poss = NOAEL exceedance in refinement but not the LOAEL; possible risk to individuals.

Prob = LOAEL exceedance in refinement; probable risk to individuals

MT = Measured egg tissue concentrations exceeded toxicity threshold; therefore, possible risk. (Note: Egg was collected near San Pedro River, so results were applied to the San Pedro River riparian soils and to the upland soils.)

BC Low = Confidence in the screening benchmark is low (e.g., a highly bioavailable form was used in the toxicity testing). This low confidence coupled with a low number of samples that exceed the background upper t

NB = No site-specific background data were available, but maximum concentrations were within ranges typically reported for background. Risks are uncertain, but cannot be excluded.

NU = NOAEL exceedance in refinement; a LOAEL was unavailable therefore, risk is uncertain

ND = Exceedances based on concentrations less than the detection limit. Risks are uncertain, but cannot be excluded.

FE Low = The frequency of screening value exceedances is low (≤20%).The likelihood of adverse effects is low and was excluded.

T = Estimated tissue concentrations (either kidney or liver, or both) exceeded toxicity thresholds; therefore, possible risk.

Bold results indicate that a contaminant could not be excluded, for various reasons (e.g. insufficient detection limits or lack of a LOAEL), from posing a risk.

Highlighted results indicate conclusion of possible (or probable) risk.